AVIATION WEEK

JUNE 9, 1952

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NEWS DIGEST

Domestic

Air Coordinating Committee has approved CAB-requested priorities for production of 40 more transports ordered in the last quarter: UAL—25 Douglas DC-7s and 10 Convair 340s; PAA—3 DC-6As; Panagra—2 DC-6Bs (Panagra now has four DC-6Bs on order). This brings total airliner orders to 424 planes for delivery in the next 30 months.

Airlines restored cut schedules June 2 following a month of curtailment resulting from oil strikes. All the figures aren't in on resultant losses, but PAA, for example, estimates that cancelations during last two weeks in May cost it about $800,000.

Promotions to four-star rank of Lt. Gen. Lauris Norstad, commanding USAF in Europe, and Otto P. Weyland, commanding Far East Air Forces, Tokyo, have been recommended by President Truman.

Alma Quisenberry, most recently administrative assistant in BuAer's Office of Public Information, retired May 31 after 34 years' association with Naval Aviation. In 1946 she received the Navy Civilian Meritorious Award.

J. E. Warren is new deputy chief of Petroleum Administration for Defense, succeeding Bruce K. Brown. Warren has 30 years of experience in oil production.

High school course steering students toward technical aviation careers is being promoted by CAA. Administrator Charles Horne cites industry need for electronics and aeronautical engineers.

Harry M. Chase, president of Harry M. Chase, Inc., operator of Executive Aircraft Service, Dallas, died May 21 in Denton, Tex. Chase was active in aviation for 23 years.

Utility Airplane Council is new title of Aircraft Industry Assn.'s Personal Aircraft Council. AIA feels new name better describes today's non-transport plane trend, will also have more impact in dealing with government agencies.

Official federal certification has been given TWA's ten Lockheed Super Constellations. They differ from previously certified Super Connies ordered by Eastern Air Lines in getting 8% more power from C18-CB Wright engines, 327 mph. cruising speed, additional 730-gal. fuel tank in wing center section, long-range navigation equipment and Hughes terrain warning indicator.

TINY STUNTPLANE with wingspan of but 7 ft. 2 in. and length of 9 ft. 10 in. is examined by designer-builders Ray Stits (left) and Bob Starr prior to first flight May 26 at Palm Springs Airport, Calif. Powered by an 85-hp. Continental, souped up to 112 hp. the plane hit 145 mph. on flight. It took a year to build, cost was $2,800.

Andrew Berding, former Associated Press bureau chief in Rome and later Special Assistant on Public Relations to the Director of Mutual Security Agency in Washington, is slated to become Director of Public Relations, Department of Defense, replacing Clayton Fritchey, who vacated that post last week to become Special Assistant to President Truman. Fritchey said his assignment would not overlap activities of Press Secretary Joseph Short. Lt. Col. F. Clarke Newlon, USAF, until recently military deputy to Fritchey, has been given a European assignment.

Financial

Jack & Heintz, Inc., Cleveland, had $3 million in billings during April. Backlog is now $52 million.

Garrett Corp., Los Angeles, has declared a 40-cent quarterly dividend payable June 25 to holders of record on June 10.

Flying Tiger Line reports gross revenues of $16,281,589 for the nine-month period ending Mar. 31, a 48% gain over last year. Net profit after taxes was $1,174,395.

International

John Paul Barringer, director of the U. S. State Dept.'s Office of Transport and Communications Policy, has been elected president of the sixth assembly of the International Civil Aviation Organization. Vice presidents elected were Col. B. M. Amarante of Brazil, A. Kofoed-Hansen of Iceland, Dr. R. Sugoto of Indonesia and E. Bisang, Switzerland.

Two delta-wing trainers reportedly are being built by A. V. Roe & Co., Ltd. They apparently are based on the Gloster G.A. 5 twin-Sapphire all-weather fighter. Avro has delivered 11,020th and final Anson, production of which began in 1935.

Ansett Airways, Australia, was scheduled to start flying boat service May 31 using two Short Sandringhams and several Convair Catalinas.

European aircoach service will begin in the spring, 1953, if governments concerned ratify agreements concluded at a Buenos Aires meeting of the International Air Transport Assn. Service will operate between points in Belgium, The Netherlands, France, Switzerland, Germany, Italy, Austria and the United Kingdom. Daytime coach rates will be 20-25% cheaper than first-class rates, night rates will be 33-38% cheaper.

Canadian Dept. of Defense Production has placed orders for $3,029,000 with Canadian firms for aircraft parts, spares, and overhaul work during period Mar. 16-Apr. 15. Bristol Aeroplane Engines (Eastern) Ltd., Montreal, received largest single contract, covering engine maintenance and overhaul.

AVIATION CALENDAR

June 9-13—National Fire Protection Assn. annual meeting, aviation seminar on June 10, Hotel Statler, New York.

June 15-19—American Society of Mechanical Engineers, semi-annual meeting, Sheraton-Gibson Hotel, Cincinnati.

June 16-17—Aviation Distributors and Manufacturers Assn., mid-year meeting, The Grand Hotel, Mackinac Is., Michigan.

June 17-19—Aircraft Trade Shows international exhibit of aircraft parts and equipment, Hotel Park Sheraton, New York.

June 19-21—American Society of Mechanical Engineers symposium on shock and vibration instrumentation, Pennsylvania State College, Pa.

June 23-27—American Society for Testing Materials 50th anniversary meeting, Statler and New Yorker Hotels, New York.

June 24-26—Ignition and engine analyzer conference, sponsored by Scintilla Magneto division, Bendix Aviation Corp., Sydney, N. Y.

July 1-3—American Meteorological Society national meeting, including joint session with the Institute of the Aeronautical Sciences, Hotel Statler, Buffalo, N. Y.

July 2-5—Northeastern States Soaring Meet, Elmira, N. Y.

July 4-9—Ninety-Nines all-woman transcontinental air race from Santa Ana, Calif., to Teterboro, N. J.

July 8-12—Aviation Writers Assn. annual convention, Ambassador Hotel, Los Angeles.

July 14—Regional air safety forum sponsored by Corporation Aircraft Owners Assn. (St. Louis div.) and CAA, topic to be "Weather Flying"; Kratz Airport, St. Louis.

July 16-18—Institute of the Aeronautical Sciences annual summer meeting, IAS Western Headquarters Building, Los Angeles.

July 18-20—Woman Flyers of America national convention, Chattanooga, Tenn.

July 25-26—Silver anniversary celebration, Parks College of Aeronautical Technology, Parks Airport, East St. Louis, Ill.

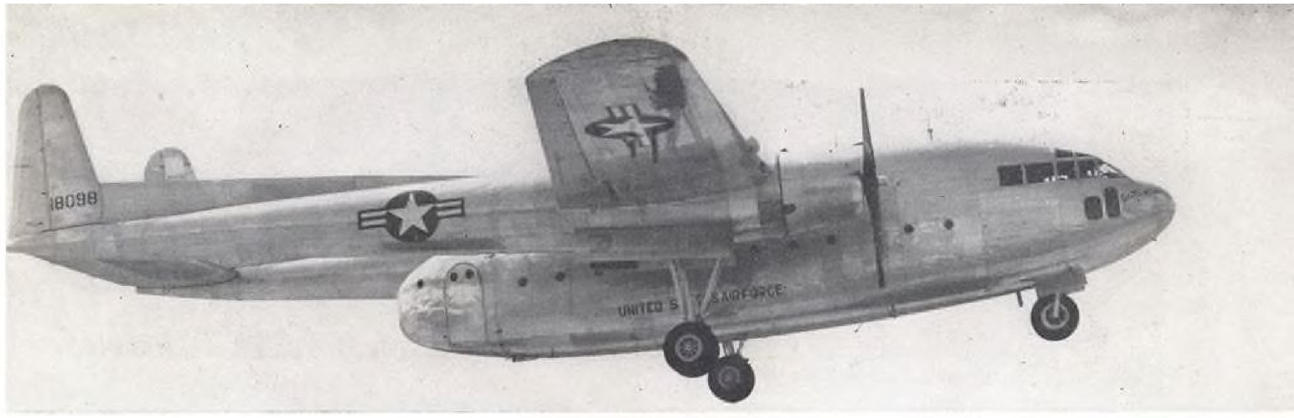
July 30-31—University Aviation Assn. fifth annual meeting, Ball State Teachers College, Muncie, Ind.

Sept. 1-7—Society of British Aircraft Constructors annual display, Farnborough, England.

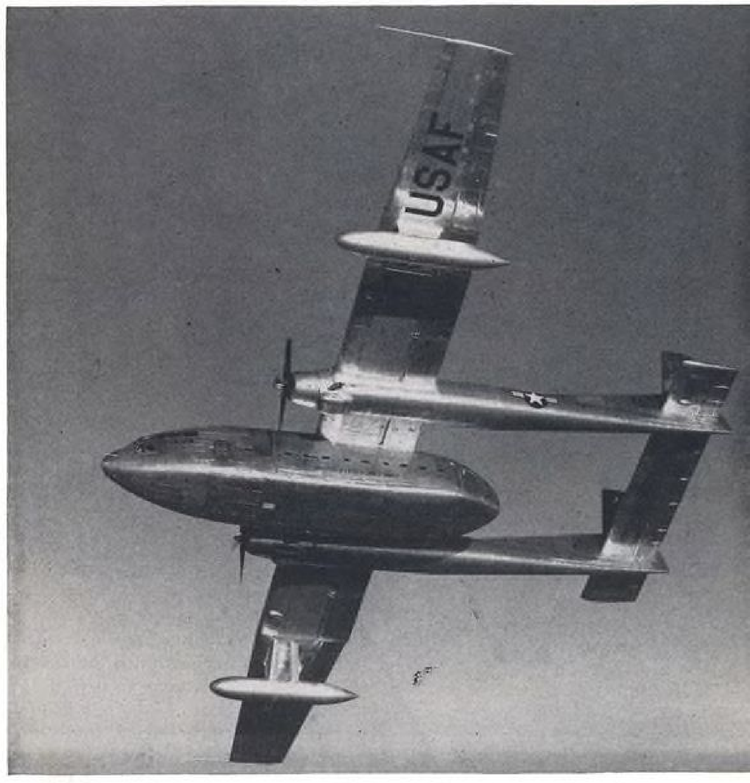
Sept. 15-19—International Air Transport Assn., eighth annual general meeting, Geneva, Switzerland.

PICTURE CREDITS

7—Los Angeles Times; 9—(top) Kaiser-Frazer; (center) Fairchild; (bottom) Hughes Aircraft; 16—McGraw-Hill World News; 17—Howard Levy; 21, 22, 24—USN-BuAer; 25—Levy-Hansen; 41—(top, right) Bell Telephone Labs., Inc.; 54—USN; 58, 60—Trane Co.

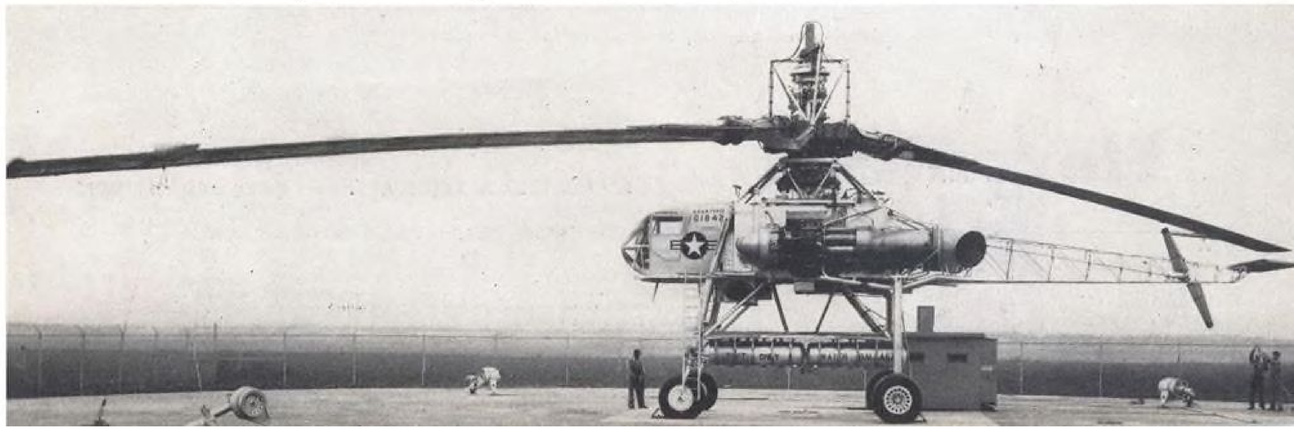


U. S. Aircraft In the News



KNOW YOUR PACKETS—First flight view of the new Fairchild C-119H (right) affords an interesting comparison with the Kaiser-Frazer-built C-119F (above), shown after takeoff from Willow Run. Although the two have a common forebear, the C-119H is virtually a new airplane, with larger wing, new tail and landing gear, and Wright R3350-30W compound engines. Span is 148 ft. compared with the C's 109 ft. All fuel is carried in the large, external underwing pods. It has greater cargo capacity (27,200 lb. vs. 10,000 lb.).

HUGHES "FLYING CRANE" READY FOR TRIALS—World's largest known helicopter, the Hughes XH-17, is shown after rollout at Culver City, Calif. Now complete, including tailboom with anti-torque rotor, the XH-17 will undergo tiedown trials before flight. Two General Electric turbojets feed thrust through the rotor shaft and out along the 100-ft.-diameter blades to the tips.



WHO'S WHERE

In the Front Office

Donald A. Duff has joined Wisconsin Central Airlines as executive vice president-general manager. Duff, who has held a number of executive airline positions, previously was with Colonial Airlines.

Donald O. Severson has resigned as vice president-manager of operations for L. Bamberger & Co., Newark, N. J., to accept a vice presidency with R. M. Hollingshead Corp., Camden, N. J., where he will direct sales and merchandising.

Carl C. Nelson has been named vice president in charge of manufacturing, purchasing and engineering for Meletron Corp., Los Angeles, makers of instruments for aircraft powerplants and equipment. He previously was a design engineer for Westinghouse. **H. C. Stolee** has been appointed assistant to the president of the Meletron organization.

Changes

Lewis P. Brown has been named manager of Air Associates Aviation Supplies division's Miami branch.

Dr. T. J. Jaramillo has returned to the Engineering Mechanics division of Armour Research Foundation of Illinois Institute of Technology as senior scientist.

G. J. (Gerry) McCaul has been promoted to general contracts manager for Simmonds Aerocessories, Inc., Tarrytown, N. Y.

Robert Lang has been made contracts administrator for Western Sky Industries, Oakland.

Emmett (Zeke) Evans has been named director of interline development for Central Airlines. **Richard T. Dominiak** has been promoted to director of sales for the carrier, replacing **W. Robert England**, resigned.

Gilbert C. Philiba has been designated airfreight representative in New York by Swissair.

What They're Doing

Christopher Dykes, formerly chief engineer (development) of BOAC, has established himself as a consulting aviation engineer specializing in air transport problems such as those involving selection of new equipment.

William S. Holloway is resigning June 13 as manager of Honolulu International Airport.

Honors and Elections

John A. Cunningham, Mid-Continent Airlines vice president-operations, has been elected president of the operations conference of the Air Transport Assn.

Edmond M. Hanrahan has been elected a director of Colonial Airlines. He is a partner of the law firm, Sullivan, Donovan, Heenehan and Hanrahan.

Arthur E. A. Mueller, Wisconsin industrialist, has been named chairman of the board of Wisconsin Central Airlines.

INDUSTRY OBSERVER

► **USAF is testing a new machine gun which can fire up to 5,000 rounds per minute. Weapon is for use on bombers to give a much needed increase in firepower. The gun was developed by private industry under Army Ordnance contract and tests to date indicate it is extremely rugged and reliable.**

► Beech Aircraft Corp. plans to get into production of its Model 50 Twin Bonanza six-place executive plane about the first of next year, with initial rate of three planes a month being stepped up to about 15 a month by the end of 1953. Earlier planned production has been delayed due to tooling and other production difficulties.

► **Fact that two of USAF's hottest test pilots flew the Chance Vought Navy F7U-1 this spring at Dallas has given additional credence to reports that AF is interested in buying some of the later F7U-3 Cutlass planes for ground support missions. Air Force pilots who wrung out the F7U-1 were Col. F. J. Ascani and Lt. Col. R. H. Johnson, both world speed record holders in North American F-86 Sabres.**

► North American's F-86D interceptor is using the new General Electric electronic engine controls. These automatically regulate the nozzles, pressure and temperatures of the J47-17 engine and afterburner for maximum thrust and acceleration at any altitude and speed, relieving the pilot of monitoring many engine instruments.

► **Despite Air Force insistence that it fully favors jet transport development, the Air Force has pulled the two twin GE-J47 jet pods from under the Chase C-123A. Reason released by USAF was that the $500,000 plane had developed a fuel leak. Company officials are still unable to find the leak.**

► Pratt & Whitney commercial sales prospects for the R4360 Wasp Major are picking up with new consideration being given for its use in Douglas DC-7 by United Air Lines and other DC-7 prospective buyers. It is being marketed against the Wright Turbo-Cyclone R3350, with a sales argument that the Wasp Major is now delivering 3,500 hp. for takeoff and 1,800 hp. for cruising, which is what the compound Wright engine is designed to do. Either engine requires a major modification of the nacelle from that used for the present DC-6 powerplants, Pratt & Whitney R2800s.

► **While versions of the Pratt & Whitney turboprop T34 engine being purchased for installation in Navy's turboprop Super Constellation and USAF's turboprop are rated at 5,500 eshp., Navy spokesmen have forecast that eventually the engine will go up as high as 8,000 eshp. Initial engine ran at 5,700 eshp. and some versions now are rated at 6,000 eshp.**

► Hiller Helicopter has lightened its ramjet helicopter by installing skid landing gear in place of the original Hornet gear, and can operate it as a two-placer for short duration flights with the increased payload.

► **Recent reports brought back from Korea indicate North American F-86 Sabre fighters equipped with a new radar gunsight were knocking down eight times as many MiGs as other F-86s in their squadrons which were not yet so equipped. The radar automatically provides target range information to the gunsight computer (Aviation Week Feb. 25, p. 65).**

► Production prospects for Boeing's four-engine B-47C jet bomber are not bright. The first plane of the four-jet B-47 version has been ready for its engines at Wichita for quite some time, but still hasn't received them. And recently the Air Force quietly issued a "suspend" order on further expenditures on the four-jet plane. It still is on the long-term USAF program, but whether it will remain there depends on whether Air Force gets additional funds beyond the pared-down 1953 budget proposed by the House. Chances are good that USAF will forego the gains of range, etc., predicted for the B-47C and stick with the six-jet B-47s exclusively.

Washington Roundup

Steam Under Air Power

Outlook for air power funds is brightening because: **Secretary for Air Thomas Finletter,** taking the offensive, is spelling out to congressmen just what cuts in funds mean in planes and striking air power. He's baring the record of the Administration's hold-down of Air Force expansion, heretofore kept "within the family," as well as protesting additional reductions in the USAF program by the House.

Elder Statesman Bernard Baruch, is actively campaigning to put the 143-wing USAF program back on an urgency basis and have it in being by the Joint Chiefs of Staff's target date—mid-1954. Administration program would put it off until 1955; House cuts, to 1956 or 1957. Determined, Baruch isn't leaving off with a public presentation to senators: Behind-the-scenes, he is putting spurs to Pentagon's top officialdom, inclined to accept stoically the slowdown in the air program. He reports: "I haven't left many of them unprotested."

Senate Appropriations Committee, heavily weighted with advocates of a quick buildup to a dominant air strength, is maneuvering to stave off cuts in air power funds on the Senate floor when the 1953 fiscal year military budget comes up for action in the near future.

Chairman of the Military Appropriations Subcommittee, Sen. Joseph O'Mahoney, is requesting that all cut proposals be submitted to his group for consideration. Reason cut proposals, pulled out of the hat at the last minute and offered on the Senate floor, succeeded last year was largely because the opposition, led by O'Mahoney, wasn't prepared effectively to refute them.

House leadership, which allowed the economizers to hold the reins in the House's field days of fund-slashing when the 1953 military budget was up, is now actively lining up the membership to support money for the 143-wing USAF program—if it is restored by the Senate, as expected.

Majority leader, Rep. John McCormack, warned on the House floor: "There is grave doubt as to whether this nation is in a position to control the air. Some believe that as a practical matter air superiority has actually passed to the Soviet Union. . . . The very existence of this doubt argues that we proceed with all the energy and resolution at our command to raise our air strength to a point where American primacy in the air will be re-established beyond peradventure of doubt."

But the opposition hasn't vanished and there's still a fight ahead for air funds:

Economy bloc in the House is blaming Air Force bungling—not lack of money—for U.S.'s decline over the postwar years in air dominance.

Hitting at USAF's early failure to recognize huge extrusion and forging presses as the "master key" to mass production of metal aircraft, Rep. H. R. Gross puts it:

"Production by this method is much faster, perhaps 25% or more, and much less expensive—an estimated billion dollars per 500 planes. But the great brains of the Pentagon did absolutely nothing about this key to production, which the Germans left for them on a silver platter and which the Russians quickly grasped to their bosoms, until the summer of 1951.

"The major reason the U.S. stands degraded as an air power is that the brass hats in the Pentagon permitted the U. S. to lose the battle of aircraft production in one of the most sickening exhibitions of inertia on record. It seems impossible, but it happened—in spite of the $52 billion appropriated by Congress for USAF since 1945, including $1.5 billion for research and development."

Sen. Paul Douglas will lead the Senate drive for cutting military funds. Since "Who is the most for the most air power?" has become a presidential campaign issue, it isn't likely that moves specifically to cut back the 143-wing USAF program will carry in the Senate.

Expert Confusion

Conflicting official reports continue to bolster congressional feeling that the defense experts really don't know what the score is on air power—but tailor the facts to suit the occasion. Example:

John D. Small, chairman of the Munitions Board: "We are still far behind Russia" in current warplane production, particularly of jet aircraft.

Manly Fleischmann, outgoing Defense Production Administrator: The production rate of jets "will catch up with the Russian effort by early 1953 and go ahead."

An informed estimate:

• **Jet fighters:** Russia has attained an annual rate of 6,000 of MiG-15 or improved types; U. S. F-86 production will approach 1,000 a year by the end of 1952.

• **Medium jet bombers:** Russia's annual rate approximates 750; 300 B-47's will come off the lines in 1953.

Guns vs. Facilities

Skepticism is growing generally in Washington toward the emphasis on plant expansion in the Administration's mobilization program instead of guns, planes and tanks.

It was given a prod by Baruch, focusing attention on these points:

• If war were to break out, even obsolescent planes would be of some value. But no aggressor was ever stopped with blueprints for super planes and standby facilities.

• In a war with Russia, the volume, as well as the quality, of planes and weapons would hold the key to victory.

Defense's Inconsistency

Senators, who for years have unsuccessfully urged and pleaded with the military to support a government-financed commercial prototype program, raised evebrows at this official report on the matter by acting Defense Secretary William Foster:

"The Department of Defense has long recognized the necessity that the U.S. retain its position of leadership in the field of civil aviation and has consistently supported efforts to achieve such leadership. In keeping with that thought the department has supported and will continue the support of all programs established for that purpose."

It doesn't jibe with the January, 1950, report of ex-Secretary for Air Stuart Symington:

"Legislation providing for the expenditure of government funds for the development of prototype transport aircraft is not in accord with the program of the President. For this reason, the Department of Defense will not seek adoption of its program (for development of two low-cost, long-range cargo or transport aircraft) by the Congress and will not support any other bill which provides for prototype development at government expense."

—Katherine Johnsen

AVIATION WEEK VOL. 56, NO. 23 JUNE 9, 1952

Three Plants Push Supersonic Bombers

- **New plane designs figure in heavy bomber study.**
- **And latest crash of B-36 may boost mediums.**

By Ben S. Lee

Designs of supersonic bombers, already well underway at Boeing, Douglas and Convair, plus mounting uneasiness over B-36 crashes, are spurring new studies of the size and type of USAF strategic bombers.

Arrival of the first bomber with a speed well over Mach 1.0 and altitude high above 50,000 ft. is still far away—the three companies hope their planes will be flying by 1958. But Convair and Boeing both are reported to be well along in adaptation of atomic engines to aircraft.

Latest crash of a Strategic Air Command Convair B-36 late last month once again cast a shadow over the giant bomber policy which has been the backbone of SAC since the days of World War II.

► **Large vs. Medium**—Air Force sources say the latest crash, which brought the loss toll to nine planes valued at more than $30 million and the death toll to 71, has resulted in renewed demands in Congress for a re-examination of the SAC mission and, more specifically, the relative merits of the intercontinental bomber vs. the smaller, shorter-ranged, but faster, medium B-47-type jet bombers and their attendant refuelers.

There has long been disagreement among informed quarters as to the ultimate combat value of the giant B-36 bomber. At the same time, there are few who deny that the B-36, with its 10,000-mi. range and 10,000-lb. bomb capacity, has had a definite deterring effect on any plans Russia may have.

► **Becoming Obsolete**—Many military strategists, however, feel that combat potential of this big bomber is dwindling rapidly as speeds and combat altitudes of jet (and soon-to-come rocket) interceptors continue to rise. In light of performance data of our own fighter types now in production and soon to be in production, the B-36 is rapidly becoming obsolete.

According to some advanced military thinking, even the latest experimental very-heavy jet bombers—the Convair YB-60 and the Boeing B-52—are being outdated before a firm first production contract is awarded to either manufacturer. Currently, Air Force thinking favors the B-52 over the sweptwing design progression of the B-36 to B-60 configuration, despite the fact both planes possess approximately the same performance specifications.

Probable reason for favorable consideration of the B-52 over the B-60 is that the B-52 is considered an "all-new" aircraft design and its speed and altitude performance may be increased with the introduction of later jet engines with higher and more economical thrust ratings than the Pratt & Whitney J57 engine now installed. The B-60, although its wings and tail have been swept, is still essentially the B-36 and its speed potential has peaked in this latest configuration with the use of J57 engines.

► **Decision Later**—A final decision will not be reached until later this month. But the expected victory of the B-52 will be short-lived, both industry and Air Force sources believe. Most informed quarters say that the present contemplated contracts will be finalized with Boeing being given a production contract of slightly more than 30 B-52s as indicated on Munitions Board schedule A-16. Additionally there is some consideration being given to con-

B-36 Crash Summary

1952

May 28—Crashed and exploded at Carswell AFB, Tex. when right landing gear failed on landing run. Seven of 17 personnel aboard killed.

April 15—Crashed and exploded near Fairchild AFB, Spokane, Wash. Probably as a result of power failure of one or more right engines on takeoff. 15 of 17 personnel aboard killed.

March 6—Crashed and burned at Carswell AFB., Tex., on landing run when No. 2 engine caught fire. All but rear section of plane completely destroyed. 14 crewmen escaped unharmed.

Jan. 29—Crashed and burned at Fairchild AFB, Spokane, Wash., when plane undershot runway, belly-landed, and skidded into snowbank. Crew of 12 escaped unharmed.

1951

May 6—Crashed and burned at Kirtland AFB, N. M., when right wing tip touched ground during GCA landing in high gusty winds of blinding sandstorm. Pilot attempting to pull up in course correction resulted in damage to right jet engine pod and No. 6 and possibly No. 5 engine when wing touched down. All 23 crewmen aboard killed.

April 27—Vicinity of Carney, Okla., in-flight collision of B-36 and F-51 fighter on gunnery mission. Accident unavoidable on part of B-36. Findings indicate error in judgment of fighter pilot. Four B-36 crewmen parachuted to safety; 13 killed. Fighter pilot killed.

1950

Nov. 22—Crashed and burned near Cleburne, Tex., cause laid to failure of electronic control system of B-36 regulator operating fuel mixture to supercharger, spark gaps, etc. Finding indicated equipment operable but that power system controlling equipment failed. Two fatalities.

Feb. 14—Crashed at sea off coast of British Columbia. Findings indicated severe carburetor chamber icing that resulted in backfire and fire in two engines. Twelve of 17 crewmen aboard escaped uninjured by parachute. Five were killed.

1949

Sept. 15—Crashed into Lake Worth on takeoff from Carswell AFB, Tex. Cause listed as "due to inexplicable reversing of two engine propellers." Exact findings for reversing of props is still classified. Plane completely destroyed. Five crewmen killed.

Fewer Accidents . . . More Serious Results

Plagued by queries as to whether aircraft accident rates are climbing and as to whether latest planes in use are too complex with their myriads of electronic controls and weapon devices, Air Force is faced with questions it can answer only in generalities because of security. But the Air Force's safety director had some interesting statistics.

Maj. Gen. Victor Bertrandias, USAF Director of Flying Safety, said in an interview, "When we release other (specific) statistical information relative to our aircraft accidents, we are placing in the hands of the enemy tools which, with other information he has available, enable him to ascertain our attrition, readiness, state of training, status of maintenance and support effort, status of facilities or our capacity to sustain operations. These facts, which within themselves may seem unimportant, when placed with others, reveal highly classified information."

► **Crashes in General**—As a result, he pointed out, he was unable to discuss specifically the accident rate of the B-36 bomber. Discussing Air Force accident rates generally, however, he said:

"During the period 1947 through 1951, the Air Force has consistently experienced a decline in the rate of occurrence of major aircraft accidents (number of accidents per 100,000 flying hr.). During this same period, the occurrence of fatalities per 100,000 flying hr. has also declined—but not in proportion to the decline in the rate of major accidents.

"Although the frequency of fatal accidents per hour of flight has decreased, the result of any single major accident is apt to be more serious today than it ever was before. This is because of the fact that, with high-performance aircraft, impact speeds are greater. Also, the use of larger aircraft is becoming more extensive and greater numbers of passengers and crew members are exposed to injury when an accident occurs.

"During the period 1947 through 1951, the rate of occurrence of major aircraft accidents has declined 25%. During this same period, the number of major accidents experienced by the Air Force has increased 40%. However, the number of hours flown has increased 89%, which indicates that the accident hazard per hour of flight has decreased substantially."

► **Rate Decline**—"The fatality rate," Bertrandias continued, "declined 12% during the period 1947 through 1951. This decline has not been consistent during the period stated. In fact, the fatality rate for 1951 increased over 1949, although it decreased slightly from 1950 to 1951. The number of fatalities from 1947 to 1951 has increased by 74%. At the same time, the proportion of fatalities which occur in relation to the number of major accidents has increased. In 1947, there were 38 fatalities for every 100 major accidents. In 1951, there were 46 fatalities for every 100 major accidents.

"The rate of occurrence of fatal accidents (accidents in which there are one or more fatalities) has remained essentially constant during this period. The rates for both 1947 and 1951 were six fatal accidents for every 100,000 flying hours. However, the proportion of major accidents that result in death is approximately 30% higher today than five years ago. In 1947, 13 in every 100 major accidents involved a fatality or fatalities. In 1951, 17 of every 100 major accidents involved a fatality or fatalities.

"In short," he declared, "it is apparent that the vulnerability to aircraft accidents is lower today than it has ever been. However, if an individual is involved in a major accident, the probability of his being killed is greater today than in prior years."

version of the remaining B-36 aircraft on order to B-60 configuration.

Such a decision would be logical because the B-60 could be phased in sooner due to less stringent production and tooling problems. The B-52 would phase in as the B-60 contract phases out.

► **B-47 Importance**—Meanwhile, the Boeing B-47 program continues to grow in importance to Strategic Air Command.

With more than 1,000 B-47 aircraft on order, the complex problem of providing them with in-flight refueling mother ships becomes increasingly important. Air Force, faced with an eventual problem of providing considerable numbers of aerial refuelers for these fast B-47s, are considering still another plan for converting B-36 bombers as they are replaced in SAC combat wings by B-52s and/or B-60s and B-47s to refueling tankers.

PanAm's DC-6As

The three all-cargo DC-6As bought by Pan American for trans-Atlantic service will carry payloads of 25,000 lb. on the long-range hop. PanAm says they are similar to its 82-passenger aircoach DC-6Bs, called "Super-Six" by PAA. They will make the crossing in 13½ hr.

Cargo doors are hydraulically operated; rear door is 78 x 124 in., and forward door 67 x 94 in.

CAA Prop Reversal Recommendations

The CAA Aircraft Engineering division has come up with recommendations for airline modifications to prevent unwanted propeller reversal on Hamilton Standard propeller systems, following a two-month industry-wide study.

Chief proposals CAA now asks industry comment on before making them mandatory modifications are:

- **Direct shut-off control** to prevent reversal at any time except when wanted. This is the pilot-proposed system described in detail in AVIATION WEEK Apr. 14, p 84.
- **Isolation of reversing solenoid circuit** throughout the system. The circuit already has been isolated forward of the firewall only, following a CAA emergency order last February.
- **Throttle control quadrant warning** flag modification to warn pilot quicker and more positively when reverse segment of the quadrant is not fully locked.

Airline installation of the manual shut-off control must await Ham Standard test and CAA approval of its design and finally manufacture of the item.

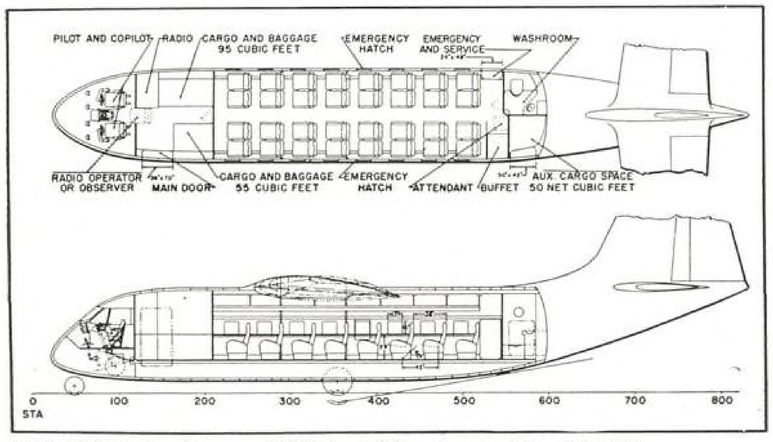
Pakistan Cadets Train in U.S.

A new class of 30 Royal Pakistan Air Force cadets is getting fighter plane instruction at Hawthorne Flying Service's Craig Field, Jacksonville, Fla.

The RPAF students will receive about 160 hours of flight training in North American T-6 trainers and an additional 60 hours on North American F-51 and Republic F-47 piston-engine fighters. They will also have more than 200 hours ground school work and approximately 15 hours on the Link or other simulators.

Hawthorne's Jacksonville base graduated 19 out of the first class of 22 RPAF cadets in 1949.

CL-21 DESIGN would put Canadair in the local service aircraft picture with . . .



32-SEATER designed to carry 7,000 lb. at 220 mph. and sell for $450,000.

Canadair Plans DC-3 Replacement

Montreal—The latest bid to put a feederline plane on the worldwide market as a replacement for the veteran Douglas DC-3 comes from Canadair Ltd., largest airframe builder in Canada, and wholly owned subsidiary of General Dynamics Corp. (formerly Electric Boat Co.), New York.

In existence but a short 10 years, the plant has until now manufactured aircraft under license. It is building F-86Es (North American Aviation) and will soon be turning out T-33s (Lockheed) and T-36s (Beech). It built the DC-4M under a Douglas license.

► **CL-21 Project**—Now the company wants to establish itself as a self-reliant segment of Canada's aircraft industry. Its projected transport—the CL-21—seems its best bet (AVIATION WEEK June 2, p. 68).

Designed for local-service-operator short-range routes, the plane's characteristics are intended to fit it for medium-range service as well. Design details of the plane are still undergoing refinement, but the general configuration and internal arrangements are shown in the accompanying artist's version and sectional drawing.

► **Seats 32**—Preliminary estimates indicate that the craft will cruise at 220 mph. with a payload of 7,000 lb. Cabin pressurization will maintain sea level conditions up to 5,000 ft. and an 8,000-ft. altitude at 15,000 ft. Seats are arranged four abreast in eight rows. Each two-seat unit spans 42½ in. with aisle width of 17 in. There is a total of 200 cu. ft. of cargo and baggage space.

► **Dimensions**—The plane is basically designed around the Wright Cyclone 9HE piston engine, but Pratt & Whitney and British engines are being considered for application. Props are reversible, constant-speed, full-feathering units. Dual wheels will be used on the tricycle landing gear.

Preliminary design studies have fixed the fuselage length at 67½ ft., wing span at 90 ft. and wing area at 900 sq. ft. Height to top of tail is 25¾ ft. Greatest fuselage depth is 9¼ ft.

► **Estimated Performance**—Takeoff and landing gross weight is pegged at 32,000 lb. CAR takeoff field length at sea level (with auto feathering) is 3,500 ft.; landing field length at sea level (no reverse thrust or flap retraction) is 3,330 ft.; one-engine-out ceiling is 12,500 ft. Stall speed, landing flap setting, is 75 mph. Disposable load of 7,085 lb. includes 32 passengers (5,280 lb.) and baggage and cargo (1,805 lb.).

Price of the CL-21 will be approximately $450,000 at the factory. If a worldwide sales survey now underway indicates a good market for the plane, prototype production probably will begin this fall, with production deliveries materializing late in 1954.—IS.

Italy Set to Buy Training Planes

(McGraw-Hill World News)

Rome—The Italian Defense Ministry has laid out a policy for assuring adequate numbers and types of training planes to carry through expansion of the Italian Air Force.

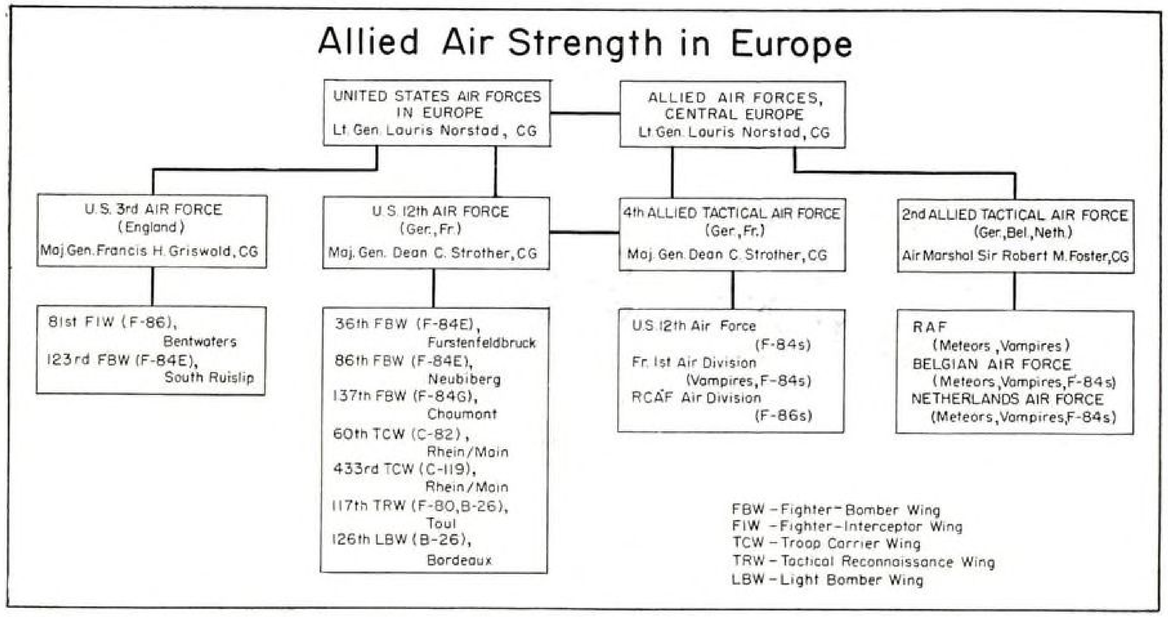
Funds are earmarked for procurement of 600 primary and 800 basic trainers and an unspecified but fairly large number of jet planes. Of the latter, 80 Fiat-built DH Vampires and 10 Fiat G.80s have already been ordered. The G.80 is a two-seater powered by an imported DH Goblin 35 engine. (An all-weather fighter version of this plane—the G.81—powered by a more powerful DH Ghost turbojet is in the works.)

► **Trainer Orders**—Orders have been placed for 240 Macchi 416s and 75 Piaggio P. 148 primary trainers. The former is a Fokker-designed trainer built under license. It is possible that the Macchi order will be cut back and additional planes ordered from Piaggio if the latter speeds its delivery rate.

The basic trainer to be selected under the new program is now under consideration—Macchi, Fiat and Piaggio having submitted bids covering their M.B. 323, P. 150 and G. 49, respectively. All three types are now being flight tested.

They were all designed to an Air Ministry spec which required that the planes be two-place, equipped with Pratt & Whitney R1340-AN-1 engines (the G. 49 is offered with an alternative engine, the British Alvis Leonides radial), having day-and-night instrumentation and VHF radio and directional finder.

Provisions were to be made for installation of armament, auxiliary tankage, cameras and oxygen equipment.



Little Fuel, Many MiGs Worry USAFE

By William Kroger

Wiesbaden—Fuel supply, not the number of planes on each side, is the real gauge of superiority between the Allied and Communist air forces facing each other across the tension-wracked border between East and West Germany.

Last week, as actions east of the border became ever more menacing in the wake of the signing of the West German peace contracts, Communist air forces in East Germany and Poland still vastly outnumbered the Allied Air Forces of Central Europe. As many as 2,500 MiG-15s may oppose as few as 1,000 AAFCE planes, few of which can fly as high and as fast as the MiGs.

If the opposing forces are thrown into action against each other, availability of fuel may become the great leveler.

► **A New Problem**—The mighty air forces in Europe during World War II never had the problem of AAFCE, which by World War II standards is still a tiny force. For in AAFCE, turbojet planes predominate.

One German-based 75-plane F-84 wing on routine missions burns 100,000 gal. of fuel per day, the equivalent of 10 U. S.-size tank cars, Air Force logistics planners say. Normally, these days, the F-84s fly 35 hours per month. During the recent fuel strike in the States, this had to be cut to 20 hours per month to avoid dipping into the strategic reserve of fuel.

There are sufficient roads and railroads in France and West Germany to furnish fuel links to the ports. But there are neither enough tank cars nor fuel trucks. Whether there are even enough tankers to haul sufficient fuel across the ocean to the ports, planners here won't guess.

► **Across the Border**—Looking across the border between East and West Germany, the Allied planners suspect but can't be sure that fuel is just as vulnerable an item for the Communists. That gives them hope that they have time for AAFCE to grow and reduce their numerical inferiority.

Here in this ancient German resort town, the headquarters of the United States Air Forces in Europe, the problems of growth and logistics are under constant study. USAFE now is smaller than the British Royal Air Force in Germany; but eventually it likely will be the largest national air force in Europe. It furnishes logistical support for all U. S. Air Force planes in Europe and, in various ways, for much of AAFCE.

GEN. STROTHER: We're eight minutes away, too.

Organization

USAFE's commander is Lt. Gen. Lauris Norstad. He also is commander of AAFCE, headquarters of which is Fontainebleau, France. So in effect, day-to-day commander of USAFE is Maj. Gen. Truman H. Landon, deputy commander and chief of staff, whose office is here.

USAFE units are scattered from Germany to England and from France to North Africa. It gives logistic support to the Strategic Air Command's 7th Air Division in England (although it has no operational control over SAC units). It operates two huge supply depots, one in France and one in North Africa, which support not only USAFE planes, but U. S.-built planes of other NATO countries. And USAFE directly controls the two U. S. air striking forces in Europe—the 3rd Air Force in England and the 12th Air Force in France and Germany.

► **Functions**—The Third's main function is to support SAC's 7th Air Division. It is small now, one F-86 wing and one F-84E wing (soon to be moved to the Continent), with immediate growth possibilities limited. The emphasis for some time to come will be on strengthening the 12th Air Force, the USAFE unit which would feel the first blow in war and the unit which is the backbone of the 4th Allied Tactical Air Force.

Wearing two hats as boss of both the 12th AF and the 4th ATAF is a tall, pipe-smoking Kansan, Maj. Gen. Dean C. Strother. As commander of the 4th ATAF, Gen. Strother has under him the 1st French Air Division and a unit of the Royal Canadian Air Force, in addition to the 12th AF.

The RCAF unit flies Canadian-built F-86s. The French use some British-built de Havilland Vampires. All other fighter planes in Gen. Strother's command are Republic F-84s. Only the 137th Fighter-Bomber Wing, newly arrived at Chaumont, France, has F-84Gs, the others being Es.

► **Need Faster Planes**—In the 12th AF, Gen. Strother has four F-84 wings (including the 123rd FBW which will move from England to France), soon to be increased to five. Adding in the F-84s of the French, Gen. Strother has between 450 and 500 of these fighter-bombers.

These are the planes that may be pitted against the Russian-built MiG in a defense of Europe. Gen. Strother and USAFE officers would be the first to acknowledge they could well use later, faster fighters (they are eager to get F-84Fs, for instance). But right now they also would be the last to write off the F-84E and G.

The F-84, in the opinion of USAFE people, is faster than most Allied planes in Europe (the Vampire may have a slight speed edge). It is rugged, packs a heavy bomb/rocket load, is dependable, and has a longer range than any other jet fighter in Europe.

Planes & Support

The Twelfth has had trouble with the F-84, but it currently boasts an in-commission rate of 90-95%, which, Gen. Strother says, is higher than the average World War II fighter plane rate. It is so high he didn't believe it himself until he checked the records personally.

Strother and other high-ranking officers strike a common chord: the jet engine is still very new and they learn new things about it every day. One officer in charge of operations puts it this way: "That engine in the F-84 gives you about 7,500 lb. static thrust. Say you cruise at 6,000 lb. thrust. At 550 mph., that's 12,000 hp., more than we ever dreamed of. We don't know anything about that kind of power. No wonder we have trouble."

► **Troubles**—As if to prove the point, most of the trouble has been non-recurrent. First, there was an engine shortage, but that eased off. Then, for a long time, there was a run of in-flight fires. USAFE thinks that hazard has been licked.

The clue to the fire cause came one day when an F-84 was wrecked by an explosion in flight. The pilot was able to land, and reported that the explosion seemed to be right behind him, where the radio compartment was located. The engineers scoffed at his claim because there was nothing in the compartment to explode.

But one of the younger officers decided to run some tests. He poured green ink in the overflow vent of an F-84 and flew the plane. When he landed the radio compartment was filled with a green mist. The vent was directly under the radio compartment; back pressure forced in gas fumes, which were ignited, it was assumed, by a spark when one of the radio circuits was actuated.

► **Engine Overhaul**—Since then, says the operations officer, there have been no more unexplained explosions in flight with the 12th AF's F-84s.

Engine overhaul has been, and still is a major worry to USAFE. Avion Dieppe, a Dutch firm at Schiphol Airport, Amsterdam, is doing some minor overhaul on F-84 engines, and USAFE's huge base at Chateauroux, France, when completed will ease the problem considerably. Pending arrangements with Italian firms also will open new sources of spare parts for both F-84 airframes and engines. But as of now, F-84 engines are sent all the way back to Tinker AFB, Oklahoma City, for major overhaul.

That makes a long pipeline—as long and as worrisome as the fuel pipeline.

But in conversations in West Germany, even the importance of logistics pales beside the threat of the thousand or more MiGs pointed toward the 12th Air Force.

Plans & Tactics

► **Eight Minutes Away**—From where Gen. Strother sits at his desk in Wiesbaden's "Little Pentagon" (a former Luftwaffe staff building), the MiGs are "eight minutes away." Two of his F-84 wings, the 36th FBW and the 86th FBW are at Furstenfeldbruck in Germany. That's too close, all admit. Even some Army units are farther away from the East German border than they are.

When the 36th and 86th as well as USAFE headquarters will be able to pull back into France is a political problem, Gen. Strother says. The French have to furnish bases, which is their political problem, and whether—if USAFE pulled back—the Germans would think the U. S. was deserting them is a political problem for U. S. civilian officials in Germany.

Meanwhile, Strother makes his plans and weighs his chances of success as best he can.

The Twelfth has been following carefully intelligence reports of the war against the MiGs in Korea. It has as yet no high-ranking officers who have actually had Korean battle experience against the MiGs. It has recently sent a unit to Korea and expects it to return in a few months with such practical experience.

► **Impressions**—No one in the Twelfth or in AAFCE, of course, will publicly disclose planned strategy or tactics in case military action follows the present Communist moves. But an observer, talking to key officers, gets certain firm impressions.

Gen. Strother makes the point, for instance, that in the last war after D-Day in Europe "99% of U. S. troops never saw an enemy plane" and can't appreciate what it is like to be bombed and strafed in sustained attacks. You also get the feeling that the F-84s would not be used primarily for troop support, but would take advantage of

PARAPLANE PRODUCTION PLANNED

Latest Lanier Paraplane in flight shows the redesigned tail, new 25% chord flaps and longer nose. The Paraplane II is designed to take off in less than 130 ft. in soft sod (under 100 ft. from hardtop) and climb 1,225 fpm. The spinproof craft is slated to go into production this year in a new factory in Pennsylvania. First planes will cost under $5,000.

their long legs to strike behind enemy lines at airfields and fuel dumps.

The overall impression of an observer is that at least in the early stages of a war the U. S. Army in Germany would take a terriffic beating from enemy air. A big question is whether the same would be true of our Air Force.

The F-84s of the Twelfth are on constant alert, armed and fueled. Their commanders cannot forget that the MiG swarm is only eight minutes away. Gen. Strother finds it a serious situation, but not hopeless.

► **A Parallel**—"You remember the story about Gen. Nathan Bedford Forrest?" he asks. "He was fighting the battle of Shiloh and had to hold a bridge. A soldier runs up and says, 'General, they're attacking on our left flank,' and Forrest tells him to go back there and fight them. Pretty soon another soldier comes up and says 'General, they're on our right flank.' Forrest sends him back to fight. Then another soldier runs up and says 'General, they're on our rear,' Forrest said, 'We're on their'n, ain't we?' "

The general pulls on his pipe and delivers his punch line: "We're only eight minutes away from them, too."

Braniff, MCA May Be First to Merge

If stockholders approve, Braniff Airways will be the first domestic line to purchase another airline since Western bought Inland back in 1944. CAB has approved the Braniff-Mid-Continent deal wherein Braniff would buy MCA by giving shareholders one share Braniff for every 1½ shares which Mid-Continent held.

But the Board conditioned its approval on Braniff's signing adequate guarantees of employe protection.

This is record time for a merger to get approval of CAB—four months to a day from the original application Jan. 24. Other merger proposals have had rougher going: Northwest minority stockholders blocked merger with Capital and NWA withdrew its merger application; Colonial minority holders stopped a deal with National; Delta-Northeast merger proposal hit a snag—no connecting route; Delta-C&S is a new proposal.

Increased NACA Program Is Out

National Advisory Committee for Aeronautics' plans for a stepped-up program over the coming year are out.

The question now is whether NACA operations can continue at this year's level—or must be reduced.

The $64.2-million appropriation allowed by the House for the 1953 fiscal year, which would require NACA to curtail its staff starting July 1, has been upped by the Senate Appropriations Committee to $68.3 million to permit a continuation of activities at the present level. NACA requested a $78.5-million budget. Conferees of the two houses will decide between the House and Senate figures.

Both House and Senate Appropriations Committees earmarked $17.7 million of the total for construction—$3 million less than the $20.7 million asked by NACA.

The construction money ($1 million is to liquidate existing contracts) will go for: conversion of the 19-ft. pressure tunnel for dynamic model testing and a high-temperature structural research laboratory at Langley AFB, $11.1 million; high pressure air supply and distribution system and expansion of air facilities for full-scale jet engine research at Lewis Laboratory, $5.6 million.

Intensive Missile Research Need Cited

The United States must go all-out in the research, development and production of guided missiles if this nation and its way of life are to survive, according to J. H. "Dutch" Kindelberger, North American Aviation chairman.

In an address before the Economic Club of Detroit, Kindelberger declared: "Flying machines are rapidly approaching capabilities that are penalized rather than aided by the presence of a human pilot." So complex and so fast have present-day aircraft become, he said, that aircraft manufacturers now have to provide extravagantly not only for the pilot's comfort but his life. The pilot's body has to be cooled, warmed and must be kept comfortable by an artificial atmosphere.

► **Pilot Problems**—Because the pilot's senses are not sufficiently acute and his reaction time not sufficiently fast enough to enable him to guide the machine in all the split-second phases of its military mission, devices must be installed which not only control the plane automatically but waste weight and space informing the pilot what the machine already has been told.

"Accordingly, we are being forced closer and closer to the concept of leaving the pilot out, a concept that has been fundamental to another line of development that started in Germany and has been vigorously carried forward since in the U. S. and, we may reasonably assume, in Russia. In these converging lines of development there is clearly discernable the ultimate shape of air power (the guided missile)."

► **Development Needs**—Kindelberger indicated that we already have the "know-how" to make very-high-powered rocket engines, but that guidance for the missiles is not so far along.

BIGGEST FRENCH AIRLINER STARTS SERVICE

SE-2010 Armagnac, decked out in the colors of Transports Aeriens Intercontinentaux, has started in Paris-Casablanca-Paris service. Powered by four P&W R4360 engines, the SE-2010 can seat over 100 passengers and grosses over 165,000 lb., making it the largest civilian transport in the world. Top speed is approximately 300 mph. The air-flow "dams" were not in the prototype.

Rocket Model Does Work of Windtunnel

- **Telemetered missile gives accurate data.**
- **And because it's cheap, method shows promise.**

By George L. Christian

North Hollywood, Calif.—A rocket-powered vehicle carrying a scale-model wing of one of Navy's latest tail-less delta-type craft is being used as an inexpensive and effective means of obtaining various types of flight information. The model carries instrumentation and telemetering equipment designed and built by Bendix Aviation Corp.'s Pacific division.

Although space in the model is cramped, it provides data on eight channels, and this can be increased to 12, Bendix says.

► **Model Advantages**—The model system should soon gain wider acceptance in solving supersonic aircraft problems, Bendix believes. Here are some of the reasons, as outlined by R. G. Hoof, the company's aircraft sales manager:

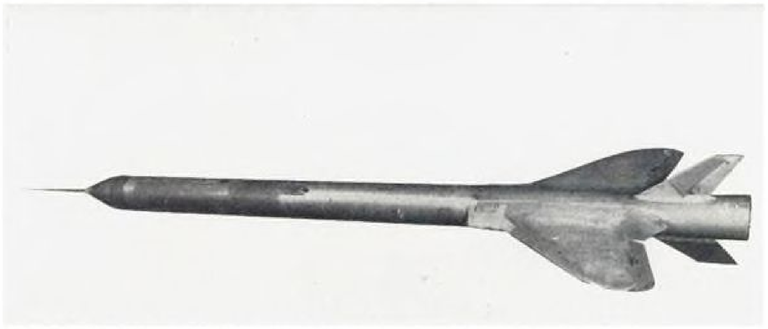
• **No windtunnels.** The model consists of a standard 5-in. military rocket with the scale-model wing of the plane under study attached near the tail. The rocket is fired and telemeters desired data back to the ground, eliminating the need for windtunnel tests.

Implications of this new method are exciting. It will be possible to expand the procurement of flight data without erecting additional expensive and complicated supersonic windtunnels. Capacity of present tunnels, with their heavy backlog of work, will not be further strained.

The model method of performance is not so expensive as is that of operating a windtunnel, and gives more accurate data, Bendix says, because tunnel choking effects tend to distort true performance criteria. The free-flight model gives a near-perfect reflection of flight characteristics of the surface under test.

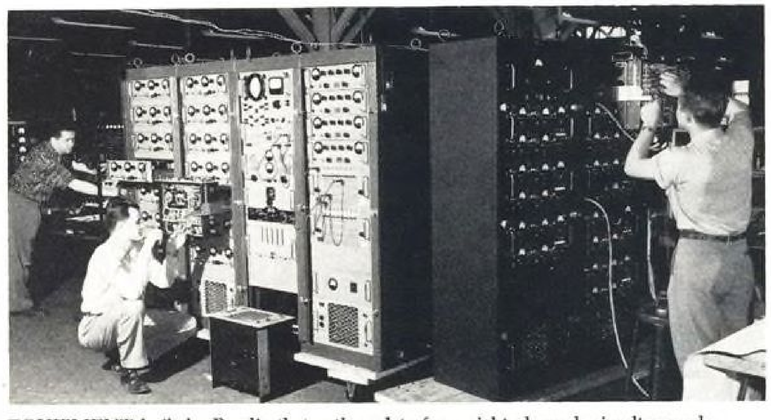
• **Inexpensive body.** Standard military rockets provide the body of the vehicle, and these are relatively inexpensive and easy to obtain.

• **Variable trajectory.** Trajectory of the model's flight may be varied at the launching platform. This, Hoof points out, is a distinct advantage of the self-powered model over drop-type models. Trajectory of drop models results in low

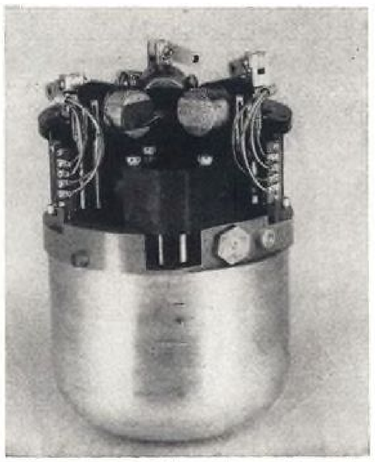


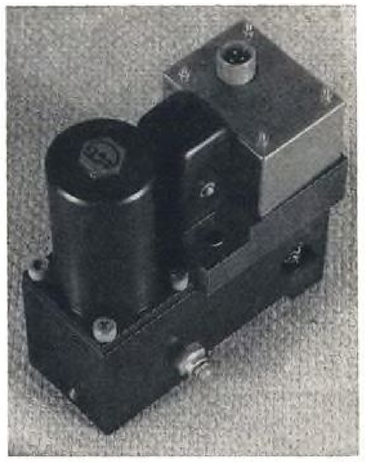
SCALE-MODEL WING of delta fighter is fixed near tail of 5-in. rocket for . . .

FLIGHT TESTS which are telemetered to these ground receiver trailers using . . .



EQUIPMENT built by Bendix that gathers data from eight channels simultaneously.





BENDIX-PACIFIC'S equipment line includes packaged hydraulic system (left) for guided missiles and electro-hydraulic power unit (right) for engine brakes.

speeds at high altitudes and high speeds at low altitudes, usually the opposite of operating conditions.

• **Variable flight path.** Timer-operated programming control moves surfaces in flight to alter the model's path. Although the model cannot be controlled from the ground, the programmer is inexpensive, expendable, easy to obtain, and light compared to radio control.

► **Speedy Solutions**—Speed in solving particular flight problems as they develop on the actual aircraft is a major advantage of the model method. Hoof says a model to test a specific aircraft characteristic can be built, instrumented and fired within four to six weeks from the time the project is started. As he puts it: "You could have checked your fourth problem by the time a wind-tunnel became available." And, the need for large numbers of highly skilled personnel is reduced considerably.

Here are the measurements continuously telemetered back to earth by the Bendix-Pacific equipment:

• **Ram air pressure.**

• **Longitudinal acceleration and deceleration.**

• **Yaw and pitch accelerations.**

• **Amplitude and frequency** of wing and elevon vibration. (Different models have different flutter and vibration configurations.)

► **Bendix Pickups**—To make telemetering on such relatively small-size models practical, Bendix had to subminiaturize already miniature components, according to R. J. Krause, aircraft sales engineer.

The North Hollywood manufacturer developed two pickups used in the model which are contributing materially to the practicality of the vehicle's test program.

• **Barium titanate crystal** vibration pickup. The tiny component, in the wing and fin tips, measures only ¼ in. in diameter and is 1 in. long. Weight is less than 1 oz. Output of 5 millivolts per G is amplified to readable proportions by an amplifier.

• **Miniature potentiometer.** Used to measure elevon (or other surface control) deflection, the measuring device's dimensions are: ½x½x⅝ in. Weight is ¾ oz. Bendix engineers say that this potentiometer is an exclusive development of theirs.

► **Telemetering Piloted Flights**—Bendix spokesmen see expanding use for telemetering—one of their principal products.

A new and interesting application promises notable savings in prototype aircraft flight time with corollary economies in cost, effort and analyses of flight data.

Telemetering in-flight information from piloted prototype planes could cut test flying time by one-third, Bendix engineers estimate.

In the current method of photo-recording flight performance with cameras in the airplane, the craft is put through certain prescribed maneuvers. A month may elapse before the records

Model Data

- Weight, loaded...Approx. 150 lb.
- Span .....3-4 ft.
- Length .....12 ft.
- Propulsion..Standard, 5-in. solid-propellant rocket.
- Acceleration..30-35 G maximum.
- Rated speed....Reached in about 2 sec.
- Max. speed..Slightly over Mach 1.
- Flight time.....20 sec. average.
- Distance of flight.....4-5 mi.
- Cost of Bendix equipment..Approx. $2,000 per model.

have been studied and more advanced flight maneuvers are undertaken. The process may be repeated several times before the aircraft's maximum performance is realized—a very time-consuming process.

Telemetering the large mass of flight performance data during flight would enable all engineers interested in the many various phases of the operation to study the telemetered information visually on the ground as the aircraft is put through its paces. If all goes well with the initial phases of the test, the pilot may be told to step up speed, wing loadings and other factors without having to land. Thus, two or more programs of test flying may be compressed into one intensive evaluation. Savings in time, pilot strain, wear and tear on very expensive aircraft are self-evident.

With current telemetering equipment, Bendix engineers say that the aircraft may maneuver within a 125-mi. line of sight radius of the ground telemetering pickup stations. There is no limit on altitude.

► **Aviation First**—Principal endeavors of Bendix' Pacific division are in avionic instrumentaton, guidance and control equipment for pilotless aircraft and missiles. Wrapped up in these efforts is the development and construction of attendant servo-mechanisms, including complete, self-contained hydraulic systems.

Pacific division is now becoming seriously entrenched in the field of airborne radar. The firm is starting production of the APS-42 set for the services. To help expedite this project, a large radar testing tower was recently erected at the plant. Control room at the top is completely furnished with all required test equipment.

Among the products made here for the aviation industry are:

• **Hydraulic actuating cylinders.** In this line, Bendix claims to be making one of the most complex units used on aircraft. On the Chance Vought Cutlass the cylinder not only retracts the landing gear, but also acts as a drag strut and shifts the position of the main gear with respect to the airplane "to improve takeoff and landing characteristics." In the hydraulic field, Bendix also makes brake valves, de-boost and solenoid valves. Boeing's "Flying Boom" air refueling system contains many Bendix-Pacific actuating mechanisms.

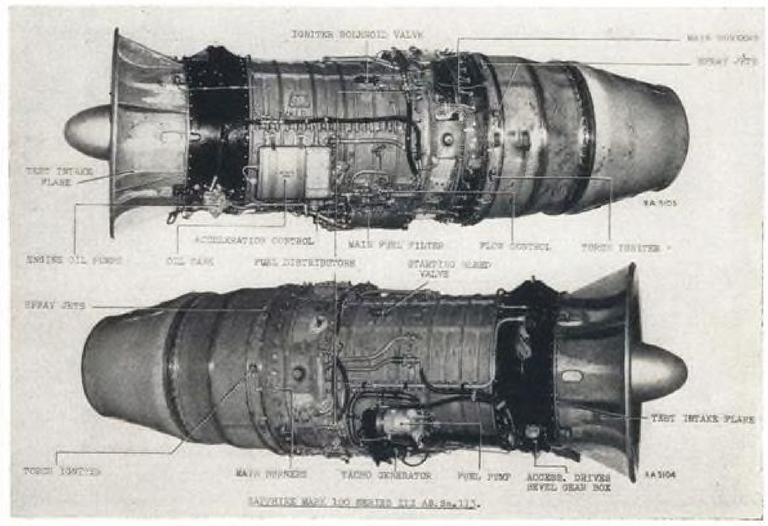
• **Geneva-Loc positive positioning** electric actuators. This series of actuators has found many applications in modern aircraft.

Among the features of these units: motor comes up to speed under no-load condition; positive control of output shaft movement—shaft is automatically locked in all stops and is independent of motor over-travel and temperature variations; clutches, torque limiters, brakes and limit switches are eliminated, giving the unit simple, trouble-free action; cutout switches operate at no load motor current, allowing them maximum life; whole assemblies are readily replaced simply by indexing drive shafts.

Geneva-Loc applications include operation of hydraulic and fuel selector valves, engine control actuators, auxiliary engine throttle actuators, etc.

The division also makes non-aviation products, including "Fish Finders," commercial development of Navy sonar depth recorders, which enable fishermen to locate schools of fish; and hydraulic equipment for automobiles and tractors.

Bendix-Pacific's new plant in the Los Angeles area adds 60,000 sq. ft. of factory space to an existing 180,000 sq. ft. Much of the new plant's capacity will be devoted to avionic, sonar and guided missile instrumentation work.



WHAT MAKES SAPPHIRE TICK

The Armstrong Siddeley Sapphire AS.Sa. 6, British turbojet currently rated at 8,300 lb. static thrust with 25 to 50% gain from afterburning, is shown here in the first detailed pictures released of the engine. Wright Aero will built it as the J65.

THRUST & DRAG

There's a tremendous interest in vintage airplanes in this country and abroad, and it's assuming the proportions of the current preoccupation with old automobiles. A large number of these ancient aircraft have been rebuilt or refurbished for display and flight.

Most recent to come to our attention is a replica of a 1909 Danish plane designed by J. C. Ellehammer, which is now a feature attraction in an air circus touring the Continent. Ellehammer's original design had his own 60-hp.

radial engine, and the pilot shifted his chair around to operate the controls. The rebuilt plane has an 80-hp. Blackburn Cirrus III and conventional controls as a safety concession, but is otherwise the spit-and-image of the 1909 job. The craft grosses 975 lb., has a top speed of 55 mph. and lands at 35 mph.

Ellehammer, who cooperated in the reconstruction of the airplane, is one of the early pioneers in aviation. He first flew a two-seater of his own design in September, 1906, in Denmark, and six years later made limited vertical flights in his own helicopter.

* * *

Taxes and drogue parachutes apparently have little in common except that one pays for the other. But have you ever stopped to think what it means in terms of your tax money to stop an aircraft like the B-47 after touchdown on a runway? In Aviation Week *Apr. 14, 1952, there is an item that the USAF ordered 4,300 drogue parachutes from Pioneer Parachute Co. at a cost of $6 million-plus. These chutes are to brake the landing run of the B-47; expected life is 15 landings per chute and cost per landing works out to be about $100. Not much per landing, is it? But the*

total contract amount is an interesting reflection on the high cost of aircraft today.

The largest portion of income tax returns are in the $3,000 to $3,500 income bracket. If you split this and assume the near-national average family of man, wife and one child, that typical family in a typical income bracket pays about $225 in taxes. Thus one family underwrites about 2¼ B-47 landings.

To pay for the complete parachute contract would take 27,413 such families or a hypothetical city of 82,239 population. This is somewhat larger than Burbank, Calif., or Springfield, Ill., and a little smaller than East St. Louis, Mo. And there is every prospect that there will be more contracts to replace these parachutes when they are worn. Suppose you took the $6 million and studied a built-in way to slow down the B-47—wouldn't it probably be more economical over the years? —DAA

Aluminum Plate at Room Temperature

A new practical process for electrodepositing aluminum at room temperature has been worked out by the National Bureau of Standards. Application is expected to be in the electroforming of articles with close inside tolerances, such as wave guides, and for providing various types of equipment with a thin protective coating of aluminum.

Already, dense, ductile deposits of the metal are being obtained at the Bureau from an organic plating bath consisting of an ether solution of aluminum chloride and a metal hydride. The procedure was developed at NBS by D. E. Couch and Abner Brenner.

The study is being extended to develop methods for depositing in good physical form such metals as molybdenum, tungsten, titanium, and zirconium.

Steel Not Weakened By New Chrome Plate

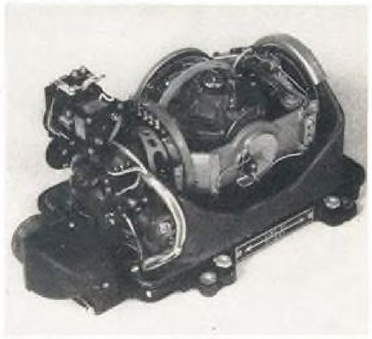
Chrome-plated steel parts subjected to fatigue loads have been designed conservatively in the past because of the known reduction in fatigue strength due to plating. But a recently developed plating solution (Unichrome SRHS CR-110) promises to eliminate much of the need for overstrength design.

Typical example of saving: If a part were to be plated with 0.001 in. of chromium from ordinary solutions, the stress section area would be increased about 35% to account for the weakening by plating. If plating is done with the new solution, stress area increase is only about 8%.

These conclusions were reached from

tests made at the University of Michigan by Prof. M. J. Sinnot. Samples of aircraft quality SAE 4130 steel were heat-treated to a hardness of Rockwell C40-41 and tensile strength of 185,000 psi. One set was fatigue-tested directly to serve as control specimens. The other sets were chrome-plated in different solutions and then tested.

Information about the tests or the Unichrome solution is available from United Chromium, Inc., 100 E. 42 St., New York 17.



This Gyro Knows Which End Was Up

Some gyros can't remember which end was up, but the new cageable vertical gyro developed by Minneapolis-Honeywell Regulator Co. does.

The gyro, now at the start of a $2¼-million production order for the Navy's Bureau of Aeronautics, will re-establish a vertical axis within two seconds after violent maneuvering of the aircraft has ceased. Some of the current crop of gyros, says M-H, take as much as 20 minutes to remember which end was up.

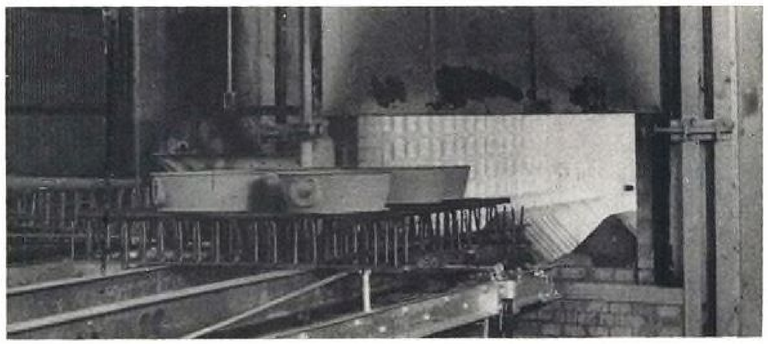
Secret of the new gyro performance is a special tumbling pin which lets the gyro rotate without limit around its outer axis and up to 85-deg. rotation about the inner axis. Thus the gyro can spin freely as the pilot flings the airplane around the sky, instead of jamming or locking. Many of today's gyros jam 10 or 15 deg. off center, says John V. Sigford, M-H's chief aero planning engineer, and it takes about one minute of time per degree to come back to normal after maneuvers.

With the M-H gyro the pilot flicks a switch after completing his aerobatics, and in two seconds the gyro is functioning again for guidance.

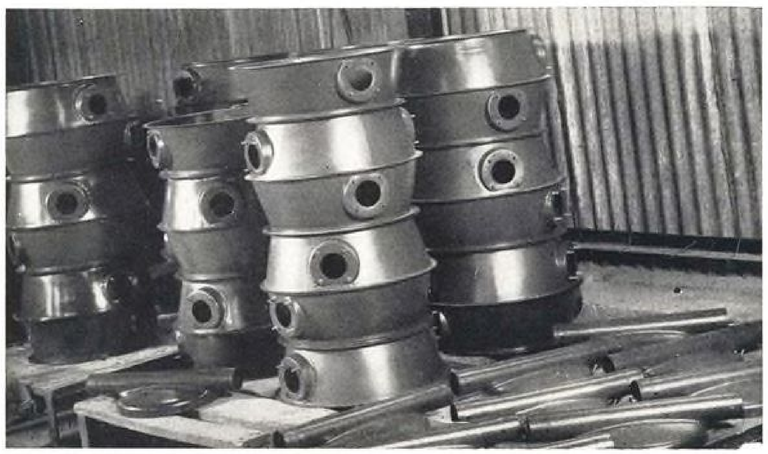
Sigford says that the new unit can be used for missile guidance (obviously not by itself) and stabilization of radar scanning in addition to the normal aircraft autopilot use. With modifications, it can also serve as a directional gyro.

Ceramics for Jet Use Put into Production

SPRAYED ceramic coats turbosupercharger exhaust hood (other methods of application are dipping and hand-brushing), preparing part to be . . .



FIRED at temperature of 1,875F. The high heat fuses frit, clay and metallic oxide ingredients of coat to the hood. After firing, parts are . . .



STACKED awaiting inspection and shipment. These turbosupercharger assemblies were part of the first production run through Bettinger's new plant.

- **As yet it's a painstaking, intricate operation.**
- **But it extends life of parts two to six times.**

High-temperature ceramic coatings have left the laboratory and can now be applied on a production-line basis, says the Bettinger Corp., Waltham, Mass.

The firm's new facility, claimed to be the first production plant in this country devoted exclusively to these new coatings, is set up to apply any of the current ceramic coverings to any metal requiring protection.

Prime advantage of ceramic coatings is to extend the useful life of metal parts in a high-temperature environment. Life expectancy of a coated metal part is from two to six times that of an uncoated piece .

There's a secondary advantage—for a given design requirement of life or strength at high temperature, ceramic coatings let you use a lower grade metal, saving on top-grade critical alloys.

▶ **Current Use**—Ceramic coatings are currently protecting aircraft exhaust systems, turbosupercharger parts and combustion chamber liners in turbojets. Turbojet afterburners and tailcone assemblies are being coated. Turbine blades have been coated experimentally in lots of several hundred. Ahead lie possible applications to rocket and ramjet engines.

Paradoxically, the ceramics which protect today's high-temperature systems are among the most ancient materials used by man. For centuries artisans have protected pottery or cooking dishes with a fired coating of ceramic material which stood up under intense heat.

Within recent years there has been increased research and development work pointing the way toward efficiency increases in turbojet and piston-engine systems. A large part of that research has been directed toward the development and evaluation of ceramic coatings as distinct from ceramic parts.

Ceramic coatings are attractive for immediate use. They are expected to extend the usefulness of alloys, with few, if any, design changes required for their use (Aviation Week Mar. 13, 1950, p. 21), from a paper by W. H. Duckworth and I. E. Campbell, as-

sistant supervisors of Battelle Memorial Institute).

► **Coatings Defined**—A typical ceramic coating applied by Bettinger is a refractory glassy material fused to the surface of the part to be protected. Small pieces of glass (called "frit"), clay, metallic oxides and other substances make up the coating. Fusion of coating to the metal surface takes place in a furnace at 1,875F.

Together these coatings—about 0.001 in. thick—have the same coefficient of expansion as the base metal. They resist high temperatures, protecting the base metal and extending its life. They protect static or moving parts equally well, and grow with centrifugal or other forces on parts such as turbine blades. They withstand thermal shock.

As a result of research and applied development, two general classes of ceramic coatings are most common now. One is the A 418 and Solaramic series, used for coating special alloys such as Inconel, Nimonic 75 and Hastelloy B. The second is the A 19 series, used for coating mild steel and the lower-grade alloys.

► **Criteria**—There are many tricks of the ceramic coating trade, starting with the initial choice of material and going through final inspection.

Which material you select for coating depends on three things:

• **Degree of protection,** defined by operating temperatures, strength requirements and life expectancy.

• **Material to be coated.** For example, requirements for coating of low-carbon steels and the high-strength alloys are diametrically opposed. In low-carbon steels, the coating must fuse early in the heating cycle to seal off oxygen and prevent too much oxidation of the metal. On high-strength alloys, fusion must be delayed until sufficient metal oxide is formed to guarantee good adhesion.

• **Conditions of operation,** defined by the heating cycle or the motion of the part. The coatings must match the expansion of the base metals, show heat stability and have a slow rate of solvent action on the metal.

► **Into the Lab**—The inherent abilities of these coatings have been discovered through specimen tests and experimental applications typified in the extensive work of Solar Aircraft Corp., as well as others in the aircraft field.

Bettinger also maintains laboratories where a large amount of development work is done for a number of customers, and where primary control and test experiments are made. Test pieces have been heated to 1,875F and plunged into cold water time after time to check thermal shock resistance. Only after many repeated trials is there any sign of failure in the ceramic coating.

Other test specimens have been

heated briefly and rapidly at temperatures as high as 3,000F (about maximum flame temperature in jet engines) and have taken the strain. Trials of ceramic-coated turbine blades have underlined the ability of the coatings to take blade growth at high temperatures.

► **Out of the Lab**—A production plant for coating is considerably different from an experimental setup. Bettinger needed both additional space and versatile equipment. In the space of six weeks and at a cost of about $100,000 Bettinger erected and put into operation a completely separate factory near its main Waltham plant, with specialized equipment particularly developed for high-temperature coatings.

Now Bettinger is set for full-scale production. Bulk of the firm's current work is development and experimentation; there is no huge backlog of unfilled orders. Thus a customer would not have to wait very long to start receiving deliveries of coated parts. Says the company: "We can take steady flow and deliver steady flow. Once they get pipe lines filled they can get daily or hourly deliveries if necessary."

Parts which enter the plant for coating go through a standardized production routine. As some indication of the processing time involved, you can consider that a single group of parts could be cycled in a single eight-hour day. The time for processing varies with the type of part and quantity, and make-ready time is a definite factor in some work.

► **Production Pattern**—The full pattern of production routine on a part is like this:

- **Scaling**, a cleaning process at a temperature of 1,800F.
- **Pickling**, running the parts through an acid bath, a high-pressure water spray, a drying period and a second acid bath.
- **Burning off**, a few-minute exposure to 1,875F temperature to burn the acids off the piece.
- **Sandblasting**, for preparation of the surface.
- **Application** of coating, either by dipping or spraying. Where a part must be coated by both techniques, dipping comes first. Before the spraying all excess coating from the dip is brushed of.
- **Firing** of the coating, done in furnaces at 1,857F.
- **Inspection**, which is over and above the continuous in-process inspections. A further word about inspection: It is based on visual standards and experience with the places that go wrong. During processing there is almost continual inspection of parts and coating composition. The parts are subjected to spot checks for thermal and mechanical shock. Bettinger cycles a flow of test pieces through routine processing as

controls for production. The composition of the coating is sampled and checked periodically.

If parts are unsatisfactory, they can be reworked by stripping the ceramic and reprocessing. But only one rework is allowed, because of the possibility that the recycling will harm the base metal.

►**Field Repair?**—It is possible to machine or grind parts after they have been coated; most of Bettinger's current production is so treated. Because of this workability after treating, there is some indication that these coatings can be repaired in the field. This would not apply to large areas of complicated pieces, but to small spots with signs of wear or damage. In practice the part can be cleaned locally and the healing coating applied.

Bettinger is performing some interesting current research on the number of times a part can be recoated after use. The job involves coating new parts, running them and recoating them. The cycle is repeated until there is evidence of failure or that nothing will be gained by further recoating.

It is more difficult to coat metals which have been used without coating. This is because of the action of combustion or heat on the surface structure of the metal parts. Preparing the surface is time-consuming, but Bettinger says that it is an economy to do the work involved if it means saving the piece or extending its useful life.

So it seems that both new and old parts stand to be improved through the use of ceramic coatings. And in these days of accent on non-critical materials, Bettinger's new production facility can mean the saving of pounds of cobalt, columbium, tungsten, molybdenum and nickel. —DAA

Airframe Workers Double Pre-Korea

Airframe manufacturing plant employment has more than doubled since Korea—latest figures from the Dept. of Labor show the work force as of February totaled 378,000, compared with the pre-Korea figure of 170,000.

But the industry has been leveling out its employment rate because of the decision to stretch out defense production. Hiring in January was below the level of the preceding 18 months, although highly skilled workers, draftsmen and engineers still were short.

Rate of military separations of factory workers from their jobs has decreased by about one-third over the past year. This reflects reductions in the manpower requirements of the armed forces following rapid buildup in military strength in the first year after the Korean outbreak.

Multi-Use Grinder Tilts, Turns

A grinding machine displaying some design wrinkles not seen before in this type equipment and claimed to be the "most versatile on the market today," has been introduced by George F. Grant Co., Inc.

The novel grinder has a single belt, but can be used for sanding and polishing, too. It "combines more . . . features than any three . . ." grinders now commonly used, Grant claims.

Several contact points on the unit for different kinds of work are located at intervals around the circumference of the belt, making it possible for more than one operator to use it at the same time.

The belt can be tilted at various angles and rotated a full 360 deg. on a horizontal plane, locked at 90 deg. intervals. It can be moved from horizontal to vertical to perpendicular—so that an operator doesn't have to go to another machine to complete a particular job. Special attachments—abrasive sleeves—permit small parts to be ground internally from $\frac{5}{8}$ to 2 in. i.d.

The machine incorporates some of the latest developments in the grinding field, among them the serrated contact wheel introduced not long ago to increase belt life and raise grinding efficiency. New adjustable tension control compensates for variations in belt length that might result from stretching, atmospheric conditions and other causes. This control gives smoother cutting and prevents belt breakage under heavy loads, the company says.

At one end of the belt, the operator can carry out contact wheel grinding, at the other, radius grinding from $\frac{1}{4}$ to $\frac{1}{2}$ in. A flat plate astride the belt ends permits flat grinding. Work on convex and concave surfaces can be done at another point. The machine is ruggedly built, using heavy castings and oversize bearings for maximum rigidity.

George F. Grant Co., Inc., West Newton 65, Mass.

Certificates Of Necessity

Accelerated tax amortization for manufacturers expanding their defense facilities is granted by the government in the forms of certificates of necessity.

In the following list of recent certificates, company name is given, followed by product of service, cost of construction deemed necessary for defense expansion but of no likely civilian use after the emergency, and the percentage of the expansion cost allowed for fast tax write-off. Fast write-off permits property to be depreciated in five years.

- **American Airlines,** New York, air transportation, (indeterminate), 80%.
- **Eastern Air Lines,** New York, air transportation, $74,125,731, 80%.
- **Efficient Screw Products Corp.,** Cleveland, aircraft products, $54,348, 50%.
- **Whirlpool Corp.,** St. Joseph, Mich., aircraft and ordnance parts, $103,068, 70%.
- **General Fireproofing Co.,** Youngstown, Ohio, aircraft parts, $653,418, 65%.
- **Wolverine Diesel Power Co.,** Detroit, engine generator for aircraft, $70,555, 65%.
- **United Aircraft Products, Inc.,** Dayton, aircraft parts, $50,515, 80%.
- **Andrews-Alderfer Processing Co.,** Akron, aircraft parts, $18,895, 65%.
- **Victor De Francesco,** Cincinnati, aircraft products, $15,413, 70%.
- **Enterprize Tool and Gear Corp.,** Detroit, precision gears for aircraft, $70,724, 70%.
- **Ripley Mfg. Co.,** Croswell, Mich., aircraft parts, $83,000, 70%.
- **Bemco Co.,** Columbus, Ohio, aircraft parts, $18,940, 70%.
- **Research Welding and Engineering Co.,** South Gate, Calif., aircraft parts, $11,343, 65%.
- **Marquardt Aircraft Co.,** Van Nuys, Calif., aircraft parts, $695,000, 65%.
- **Industrial Refrigeration Co. of Calif.,** Los Angeles, aircraft testing equipment, $23,350, 70%.
- **Airdraulics,** Pasadena, Calif., aircraft parts, $42,866, 70%.
- **Almac Mfg. Co.,** El Monte, Calif., aircraft parts, $23,485, 70%.
- **Roy J. Heyne Mach. Co.,** Phoenix, aircraft parts, $71,703, 70%.
- **Moorles Mfg. Co.,** Los Angeles, aircraft parts, $36,775, 70%.
- **Emsco Derrick and Equip. Co.,** Los Angeles, aircraft parts, $81,300, 70%.
- **Interstate Engineering Corp.,** El Segundo, Calif., aircraft parts, $19,293, 75%.
- **Pacific Airmotive Corp.,** Burbank, Calif., aircraft engines, $88,203, 65%.
- **General Metals Corp.,** Burbank, Calif., aircraft parts, $107,800, 65%.
- **National Screw and Mfg. Co.,** Los Angeles, aircraft parts, $189,117, 50%.
- **Diversified Metal Products Co.,** Los Angeles, aircraft parts, $173,792, 70%.
- **CIA-VAL Co.,** Alhambra, Calif., aircraft parts, $65,179, 70%.
- **Axelson Mfg. Co.,** Vernon, Calif., aircraft landing gears, $123,479, 65%.
- **Vendorlator Mfg. Co.,** Fresno, Calif., aircraft parts, $58,243, 75%.
- **Castle Industries Inc.,** Everett, Wash., aircraft metal parts, $53,307, 65%.
- **Revenna Metal Products Corp.,** Seattle, aircraft parts, $198,564, 75%
- **Raytheon Mfg. Co.,** Waltham, Mass., electronic tubes, $222,985, 65%.
- **Verney Corp.,** W. Peterboro, N. H., fabrics for parachutes, $122,559, 40%.
- **United Aircraft Corp.,** East Hartford, Conn., aircraft engines and parts, $2,573,-984, 65%.
- **Connecticut Filter Corp.,** Stafford Springs, Conn., aircraft parts, $182,485, 50%.
- **Kenick Mfg. Co.,** Lynbrook, N. Y., aircraft components, $11,450, 80%.
- **G. M. Giannini and Co., Inc.,** Springfield, N. J., aircraft parts, $4,142, 65%.
- **Heritage Co.,** Huntington, L. I., N. Y., aircraft parts, $37,300, 65%.
- **American Standard Corp.,** Trevose, Pa., aircraft parts, $34,864, 70%.
- **Federal Screw Works,** Chelsea, Mich., aircraft engine parts, $367,582, 50%.
- **J. Lenkart Machine Co., Inc.,** Columbus, Ohio, aircraft parts, $163,236, 70%.
- **American Tool and Engineering Co.,** aircraft parts, $107,300, 80%.
- **D. L. Auld Co.,** Columbus, Ohio, aluminum forgings for aircraft, $45,424, 65%.
- **Aluminum Company of America,** Cleveland, aluminum forgings for aircraft, $182,-000, 65%.
- **Sunbeam Corp.,** Chicago, aircraft parts, $114,610, 65%.
- **Lakeside Aluminum Co.,** Minneapolis, aircraft parts, $79,431, 70%.
- **Solar Aircraft Co.,** Des Moines, aircraft parts, $127,039, 65%.
- **Northrop Aircraft, Inc.,** Hawthorne, Calif., aircraft, $57,741, 65%.
- **Bill Jack Scientific Instrument Co.,** Solana Beach, Calif., aerial reconnaissance cameras, $35,583, 65%; $21,109, 65%.
- **Zahnter Mfg. and Machine Co.,** Compton, Calif., aircraft parts, $54,627, 65%.
- **Domanco Corp.,** Torrance, Calif., components for aircraft, $191,443, 65%.
- **Bloomfield Tool Corp.,** Bloomfield, N. J., aircraft parts, $110,927, 80%.
- **Bendix Aviation Corp.,** Teterboro, N. J., aircraft accessories, $109,396, 65%.
- **Janney Cylinder Co.,** Philadelphia, aircraft parts, $73,983, 75%.
- **American Ron-Gran Bronze Co.,** Berwyn, Pa., aircraft parts, $22,631, 70%.
- **Topflight Tool Co., Inc.,** York, Pa., aircraft tools and ordnance, $294,089, 65%.
- **Hetherington, Inc.,** Sharon Hill, Pa., aircraft parts, $5,451, 65%.
- **J. Zagora Machine and Gear Co.,** Charlotte, N. C., aircraft parts, $97,583, 70%.
- **Fairchild Engine and Airplane Corp.,** Hagerstown, Md., cargo airplanes, $114,180, 65%.
- **International Nickel Co.,** Huntington, W. Va., nickel alloy tubing for aircraft, $218,200, 50%.
- **Robertshaw-Fulton Controls Co.,** Knoxville, Tenn., aircraft parts, $100,615, 50%.
- **Willard Bronze Co.,** Cincinnati, aircraft parts, $124,442, 65%.
- **Springfield Tent & Awning Co.,** Springfield, Ohio, canvas aircraft shelters, $40,000, 50%.
- **Continental Aviation and Eng. Corp.,** Detroit, aircraft engines, $140,722, 65%.

Transistors, Mag-Amps in IRE Spotlight

- **Military studying use of new avionic devices.**
- **They point to improved reliability, economy.**

By Philip Klass

Dayton—The Air Force is analyzing its existing avionics equipment to see how it can take advantage of the space and weight saving and increased reliability transistors can offer over vacuum tubes; meanwhile magnetic amplifiers have already begun to make serious inroads on vacuum tubes.

This evidence comes from papers given recently at the Institute of Radio Engineers-sponsored conference on airborne electronics in Dayton.

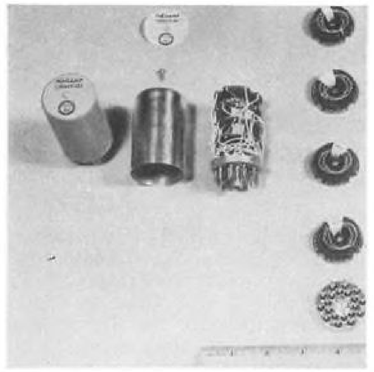
One paper described an analysis which indicated that existing transistors could replace vacuum tube stages in 54% of the USAF's avionics equipment. Other papers described servo systems and a voltage regulator in which magnetic amplifiers have partially or completely displaced vacuum tubes.

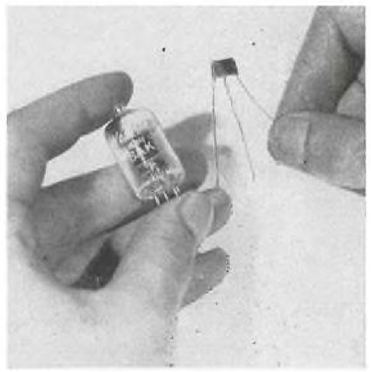
"Reliability" was a much-used word throughout the conference. Engineers also described new techniques for packaging avionics equipment to improve its reliability, reduce its size, and ease maintenance.

► **Transistors**—Today's tiny transistors have a life expectancy of at least 70,000 hours and can withstand shocks of 20,000 G and vibrations of 100 G, Dr. O. M. Stuetzer of the USAF's Wright Air Development Center told the IRE audience. Stuetzer is research facilities chief of WADC's electronics lab. He said that the new junction-type transistors should do still better.

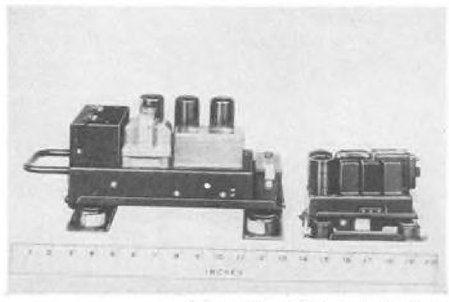
Even more encouraging, transistor manufacturers can now produce transistors with impedance variations of ±30% or less, Dr. Stuetzer said. However, he played down the size and weight reduction which can be achieved today by "transistorizing" avionics equipment. This is because transistors cannot replace vacuum tubes in many avionics applications.

Transistors can only be used at present in low-power level applications and at frequencies below 30-40 mc, Dr. Stuetzer said. He also pointed to their present top operating temperature of about 60-70C; above 80C, they cease to function.





RELIABILITY of avionic equipment will be increased by devices such as rugged Westinghouse plug-in magnetic amplifier (left) and junction transistor (right) which should last 70-100 times as long as the "miniature" tube shown with it.



ECONOMY of size and weight are being improved. First panel shows two vacuum tube amplifiers of identical performance, but newer one (right) is 70% smaller, 50% lighter. Right panel shows complete two-stage voltage amplifier plug-in unit.

► **Size and Weight Saving**—Stuetzer described the results of a WADC analysis of USAF communications and navigation, fire control, and radar equipments to determine where transistors could replace vacuum tube stages and how much size and weight saving would result. Five to ten equipments of each type were considered.

Dr. Stuetzer said that 72% of the tube stages in USAF fire control equipment could be replaced with today's transistors, but only 40% of the radars could be transistorized. The weighted average for all types of equipment was 54%.

In some instances it isn't practical to transistorize even though it is technically possible, Dr. Stuetzer said. The increased circuit complexity cannot be justified. On this basis, he said, it would be feasible to transistorize only 40% (weighted average) of the vacuum tube stages.

Using this 40% figure, Stuetzer gave the following size and weight reductions resulting from transistorizing, broken down by the size-type of vacuum tube now used.

	Weight	Size
• Standard stages	35%	38%
• Miniature stages	30%	33%
• Subminiature stages	22%	30%
• Weighted average	28%	33%

Overall equipment size and weight saving would be further reduced to 20% and 25%, respectively, because equipment cases, cables, blowers, etc., are relatively unaffected by transistorizing, Dr. Stuetzer said. If these percentages seem small compared to early glowing predictions, it should be remembered that they are based on equipment which is only 40% transistorized.

► **Some Power Loss**—Acknowledging that transistors eliminate the need for heater or filament power required by vacuum tubes, Dr. Stuetzer reminded

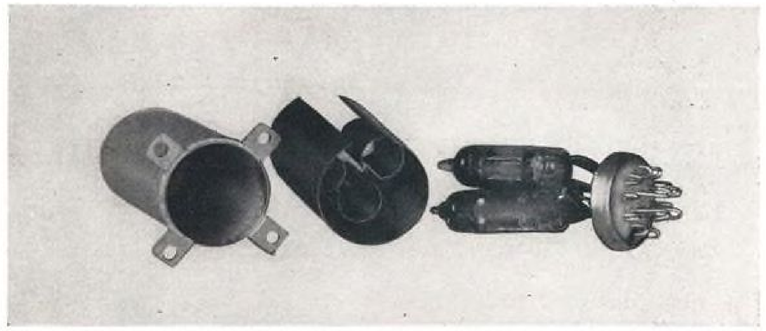
his audience that transistors waste power in the form of constant current biasing needed for the transistor emitter.

Dr. Stuetzer estimates transistor power consumption at 0.2 watts per stage, compared to an average of 3.0 watts for a typical standard tube stage, or 2.5 watts for an average miniature tube stage. By transistorizing, he estimates that 2.5 watts per stage can be saved.

► **Gain in Reliability**—With an in-flight transistor service life of 70 to 100 times that of a miniature vacuum tube, Dr. Stuetzer thinks the transistor's biggest contribution will come from increased equipment reliability. He believes that transistorizing 40% of today's avionics equipment would reduce equipment failures almost 40%.

► **Silicon Transistors?**—To achieve higher operating temperatures, transistors may some day be made of silicon instead of germanium, Dr. J. P. Jordan of General Electric predicted. At the moment, less is known about the properties and characteristics of silicon, and it may have other drawbacks.

Jordan said that existing junction-type germanium transistors can handle powers of 100 milliwatts, and if cooling is used, up to two watts. However Jordan said that he feels that increased transistor power capacity should come from a larger transistor working area rather than from added cooling.



TUBE-GENERATED HEAT is conducted in thermal shields to assembly base and then to chassis for efficient dissipation in this Minneapolis-Honeywell assembly.

Long-lived transistors should extend the life of resistors and condensers in computer applications, according to J. H. Felker of Bell Telephone Labs. Resistors and condensers will operate at lower voltages and currents, thereby increasing their life.

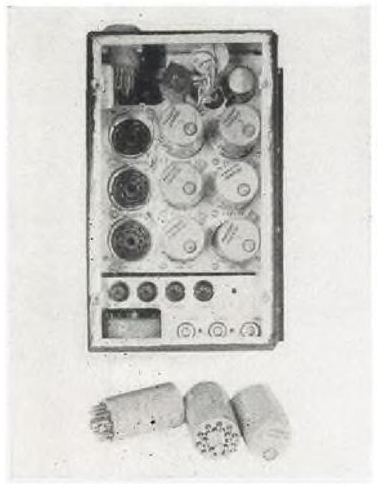
► **Magnetic Amplifiers**—The magnetic amplifier hasn't received the publicity given the transistor, but the mag-amp (as it is sometimes called) is a fast growing threat to vacuum tubes. The mag-amp will complement rather than compete with the transistor. The transistor is presently limited to low-power uses; the mag-amp is well suited to high-power uses.

Fundamentally the mag-amp is a saturable reactor and as such has been long known. The Germans and Swedes dug it up during the last war to cover their vacuum tube shortage and advanced the art considerably. Engineers in this country are rapidly turning to the mag-amp because it promises a much longer, more reliable service life than vacuum tubes.

Engineers from four major companies told of their magnetic amplifier activities at the IRE conference.

• **Westinghouse**—An autopilot servo amplifier; all magnetic.

• **Minneapolis-Honeywell**—A remote positioning system servo amplifier; all magnetic.



AUTOPILOT AMPLIFIER built by Westinghouse contains no vacuum tubes. Plug-in magnetic amplifiers are used throughout the assembly. Chassis which is shown above contains three separate autopilot channels.

• **Bell Laboratories**—An instrument-type servo system for computers; magnetic amplifier output stage.

• **W. L. Maxson Co.**—Voltage and frequency regulator for 400-cycle inverter; using mostly magnetic amplifiers.

► **Mag-Amp Attraction**—According to the IRE speakers, here's what makes the magnetic amplifier so attractive for avionics equipment.

• **Reliability and long life** due to rugged transformer-type construction.

• **No filament heater** required, hence no warm-up time.

• **Reduced power consumption** and heat dissipation problems because of no filament heater and because mag-amp functions as variable reactance device instead of variable resistance device (a pure reactance consumes no power). D. B. Kleason of M-H cited comparative figures for a mag-amp and tube amplifier designed for the same job. The mag-amp's standby power was 1/5, and full-load was ½, of tube amplifier power consumption.

• **Lighter weight** for power outputs greater than 5 w., possibly for powers as low as 1 w., according to Kleason.

► **Mag-Amp Drawbacks**—On the other side of the ledger, there are two drawbacks to magnetic amplifiers. One may be licked in time; the other is inherent.

• **Temperature limits.** The dry-plate rectifiers used in mag-amp circuits are presently limited to a maximum temperature of about 160F. Higher temperature rectifiers are presumably under development.

• **Poorer frequency response.** Response time of a mag-amp has a theoretical

minimum of one cycle of the supply frequency. (1/400 sec. for a 400-cps. supply). If relatively high gains are desired, response time gets longer. (At low servo-system frequencies, a vacuum tube is considered to have zero response time.)

► **Autopilot Amplifier**—The Westinghouse all-magnetic servo amplifier is designed for use on their new E-9 autopilot. It contains three separate channels (rudder, aileron, elevator) each of which uses three plug-in type reactor units measuring 3¼ x 1½ in. dia. The output of each channel is 10 w., according to F. S. Malick who described the unit.

The amplifier output excites a solenoid-valve which in turn ports fluid to a hydraulic servo; a separate valve and servo, presumably, is used for each control surface.

Malick predicted that the size of low-power-level mag-amps could be reduced to match miniature tube size. For further reductions he suggested using a higher a.c. supply source frequency or internal frequency multipliers.

Malick said that new types of low-impedance synchros are needed as signal sources for low-impedance mag-amps. The control current required by mag-amps makes present high-impedance synchros unsuitable. He suggested the use of a variable reactance pickoff using a permanent magnet rotor.

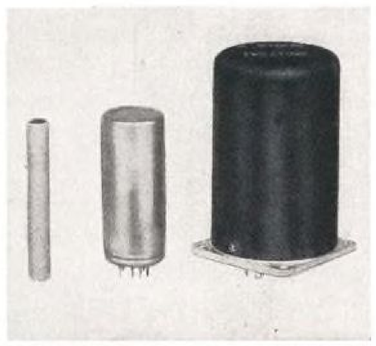
► **Remote Positioning**—"Watt for watt, and with gains required for most remote positioning systems, magnetic amplifiers can compete in size and weight with electronic (amplifiers)," D. B. Kleason of M-H said. The generally low-input impedance of mag-amps is a big advantage where noise pickup in the signal circuit is a problem. For example, mag-amps are ideally suited for use with highly sensitive thermocouples.

Mag-amps make natural d.c. amplifiers, Kleason said, permitting the use of a d.c. signal circuit without "choppers" or other means of converting d.c. to a.c. If a.c. signal circuits must be used, he recommended a small demodulator consisting of a toroidal transformer and rectifier.

Kleason later demonstrated an all-magnetic two-stage Class "A" magnetic amplifier operating a 40-in. lb. inertia load. He cited figures for the system showing that frequency response is down 3 db. at 1.4 cps.; the 90-deg. phase shift occurs at 1.2 cps.

The demonstrator reportedly had a 50:1 modulation range with a null shift of less than 5%. Kleason said linearity was good from zero to full 20 w. output.

Mag-amps' extreme reliability and ability to withstand shock should permit mounting them in inaccessible air-



"CHOPPER" or synchronous vibrator has long defied miniaturization. Now Minneapolis-Honeywell has come up with a small 400-cycle vibrator (center), not much larger than a cigarette. Older unit is shown at right.

plane locations, Kleason predicted.

► **Instrument Servos**—Instrument-type servo systems for computers, which combine vacuum tube driver stages with mag-amp output stages, were described by H. A. Helm and L. W. Stammerjohn of Bell Labs. Bell has designed a family of three amplifiers using identical driver stages with mag-amp output stages of different ratings.

Each vacuum-tube driver consists of an a.c. amplifier, phase detector, and phase inverter; the complete amplifier is then placed in a potted plug-in assembly.

Helm cautioned engineers that unless care is taken to match the impedance of the mag-amp and its 2-phase a.c. motor, the motor may develop torque and rotate when only its fixed phase is excited.

The Maxson mag-amp regulator, developed for a Jack and Heintz inverter will hold voltage within ±1 volt and frequency within ±2 cps. C. B. Grady said.

► **System Reliability**—"It (reliability) must be built in, designed for, checked for . . . from idea to hardware, manufacturing techniques and test procedures—these all contribute," Irving Mirman of USAF's Rome Air Development Center told IRE members. He urged engineers to devote more time and money to reliability during initial equipment design to save maintenance costs later.

Mirman emphasized that a small decrease in reliability of individual circuit elements results in a much larger decrease in overall system reliability. To illustrate this point, Mirman considered three hypothetical systems containing 500, 1,000, and 2,000 vacuum tubes respectively. He further assumed that each system must be operable for 23 hours per day, with a one-hour shutdown for repairs; also, that only two faulty tubes could be located and re-

placed during this one-hour shutdown.

Here are the results Mirman presented:

Reliability of Each Tube	System Reliability 500	1,000	2,000
1.000	1.000	1.000	1.000
0.998	0.910	0.705	0.291
0.996	0.680	0.191	0.003

The table shows, for example, that if the reliability of each tube is 0.998 (2 tubes out of 1,000 will fail), the 500-tube system will have a reliability of about 0.9.

In other words, it can be expected the system will operate nine days out of every ten before it has more tube failures than can be located and fixed in the daily one-hour shutdown. The 1,000-tube system can be expected to operate only seven days out of ten; the 2,000-tube system can be expected to operate only three days out of ten without system failure.

If individual tube reliability goes down to 0.996, the 2,000-tube system could be expected to be operative only 3 out of every 1,000 days.

► **The Solution**—To improve system reliability, Mirman urged engineers to:

• **Reduce the number of tubes** wherever possible. (Each tube, on the average, he said, requires five resistors and four capacitors.)

• **Use conservative design** of vacuum tube circuits in order that tubes will operate below their maximum rating. (This would appear to be partially at odds with his previous admonition.)

• **Build in test equipment** to check operation of equipment and its major assemblies.

• **Make least reliable elements** most accessible for replacement.

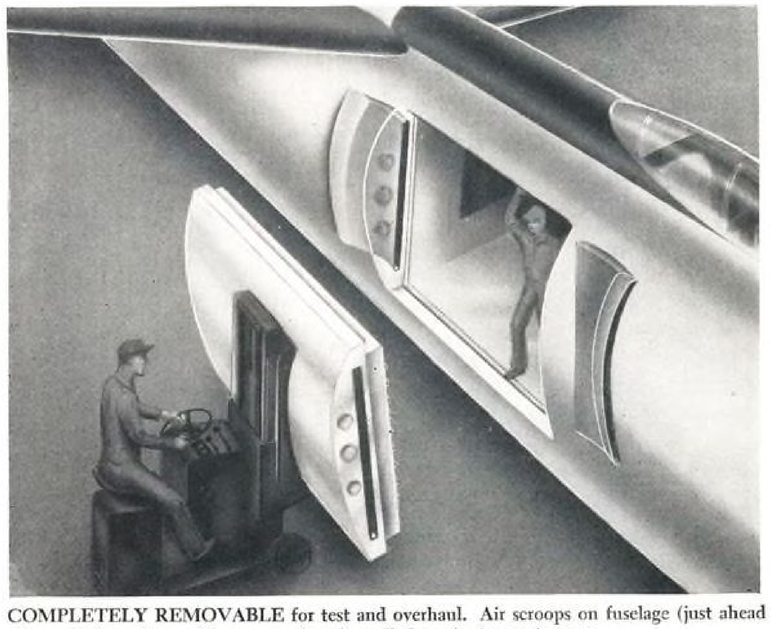
► **Miniaturized Construction**—Unless miniaturized avionic construction is "unitized," it becomes "a 'rat's nest' of components, completely unserviceable to even the most highly skilled technician," D. G. Heitert of Emerson Electric Mfg. Co. warned. The answer, he said, is to break circuits down into small circuit segments each of which performs a definite function and is separately packaged, usually as a plug-in assembly.

Heitert urged the use of plastic embedment (potting) for small units. These, he said, should be scrapped, not repaired, when they fail. Potting prevents unauthorized tampering with circuits, which he called an important by-product advantage.

He told of portions of an airborne computer circuit which were experimentally built in both potted and standard forms for comparison. The potted unit compared favorably with the standard construction circuit in terms of performance, except for gain which was a maximum of 10% lower. However, the potted units had heating problems; power densities were 8-12 times higher than the standard construction, running as high as 2,540 watts/cu.ft.

To dissipate internal heat, Heitert talked of fortifying the potting compound with heat-conducting fillers. This could provide thermal conductivity equal to twice that of still air but which still can't compare with standard construction using forced air cooling, he said.

LARGE PANELS, containing all the plane's avionics built into modular-type cases with provision for turbulent cooling, have been suggested. They would be . . .



COMPLETELY REMOVABLE for test and overhaul. Air scroops on fuselage (just ahead of opening) would provide means of cooling all the avionics equipment.

► **Cooling Problems**—Inadequate heat removal is a major cause of avionics equipment failure, J. P. Welsh, Cornell Aeronautical Lab, told the IRE. Excessive heat shortens tube life by releasing gas in the tube and by cutting down emission.

High heat also causes decomposition and dielectric failure in capacitors, resistors and insulating materials and in-

stability and shift in component values, Welsh said.

He called the vacuum tube itself the principle heat generator, abetted by resistors and reactors. Subminiature tubes can be cooled by using extra-heavy electrical conductors to the tube terminals which will also serve as thermal conductors. Tight-fitting tube shields with low thermal impedance conductors connecting them to the chassis are another solution. However, Welsh said, present submin tube shield design needs to be improved thermally.

Vacuum tube life goes down as bulb temperature rises above 150C, Welsh said. Although the industry recognizes the need for derating avionics components when they are used at elevated temperatures, Welsh said that little is known about how much derating is necessary to maintain normal low-temperature life.

► **Empirical Art**—There are so many unknown variables and such a scarcity of data that it is almost impossible to solve thermal design problems in avionics equipment by mathematical treatment, Welsh said. As an alternative he suggested using simulated models to determine expected temperature gradients.

Welsh urged that avionics equipment be given a thermal analysis, in addition to its customary electrical and mechanical design analysis. This is necessary, he warned, if miniaturized avionics equipment is to give long reliable service life.

► **Turbulent Air Cooling**—A radically new approach to cooling avionics equipment which utilizes a base cooling plate (heat sink) through which air is forced at a velocity sufficient to give turbulent flow, was described by Leonhard Katz of Raytheon Mfg. Co.

A description of this new technique was published in AVIATION WEEK Mar. 17, 1952, p. 41. Refinements in technique and component design since Katz gave the original paper this spring include:

- **Optimum air pressure** differential for operation of this method is now believed to be ½ psi.
- **Lighter cooling plate** and chassis for housing avionics components. This results from use of fabricated sheet metal construction instead of castings.
- **Detachable avionics turbulent cooling package.** Giving his imagination free rein, Katz showed an artist's conception of a large turbulent air cooling plate containing modular receptacles into which a variety of avionics equipment would fit. The entire package (resembling the cargo door of a military transport) would be installed to form a structural part of the plane, including skin. An air scoop slightly forward of the "avionics package" would provide cooling air to the single cooling plate. Sev-

eral such centralized avionics packages might be located in various parts of the airplane. The use of such packages, Katz said, would solve the cooling and shock mounting problems of individual avionics equipment manufacturers.

► **Submin Servo Amplifiers**—Subminiaturization techniques, previously used in low-power-level circuits, are being applied to servo systems. Minneapolis-Honeywell has designed a miniaturized power unit for their capacitance-type fuel gage which cuts the weight of its previous amplifier by 50% and size by 70%.

A. C. Smith of M-H described another servo amplifier designed for operation at an ambient temperature of 200F. The tubes—a submin triode, rectifier and pentode—are housed in a small hermetically sealed unit. Each tube is surrounded by a metal clamp which acts as thermal conductor to the outside case and amplifier chassis. Smith also described a complete two-stage amplifier which is housed in a potted plug-in unit which is the size of miniature tube.

► **Smaller Power Supply**—To reduce the size of power supplies, Smith suggested the use of lower-than-normal plate voltages in servo systems where some distortion and non-linearity can be tolerated. This permits the use of capacitors rated at 200 volts instead of 450- or 600-v. units. Smith also suggested using auto-transformers wherever possible to save size and weight.

► **Subminiature Tubes**—M-H is swinging over to subminiature tubes in all new designs, Smith said. The only exception is output tubes where the miniature twin-triode is still used. However Smith said that newly developed submin triodes of increased power rating may permit the use of two submin tubes to replace one miniature-type output tube.

Smith reported that at least one tube manufacturer is supplying premium submin tubes with hard glass envelopes to withstand higher operating temperatures. These have a maximum bulb temperature rating of 482F.

M-H's work on subminiaturization, Smith said, is directed toward improved reliability, reduced size, and designs which can find wide-spread use in a variety of M-H avionics systems. He said M-H is also studying the use of transistors and of hybrid electronic-magnetic amplifiers.

► **New Building Blocks**—New and improved resistors, capacitors, and inductors, the basic building blocks of avionics equipment, are on the way, C. E. Doyle of WADC promised. He predicted that film-type resistors will eventually replace practically all wire-wound resistors.

The Battelle Memorial Institute,

IRE Quotes

"Engineers (designing avionics equipment) must be shocked into 'Reliability consciousness' " . . . Cmdr. M. A. Mason, head of BuAer's radar section describing Navy's problems in keeping avionics equipment operating.

"A rapidly changing boresight shift . . . (by poor radar radome construction) can severely test the response of the missile servo system or aircraft computers, resulting in instability and oscillation." . . . Martin H. Paiss, U. S. Naval Air Development Center, emphasizing the importance of radome design.

"Until the component manufacturer (resistors, capacitors, tubes, etc.) can establish sufficient controls to guarantee the desired characteristic, the equipment manufacturer is obligated to instigate quality control (procedures) or sacrifice performance and reliability." . . . J. J. Beck, Raymond Rosen Engineering Products, Inc.

"Range performance (of the newly announced AN/APS-42 transport radar) on land masses out to 195 miles over water is common, with range and azimuth bearings within . . . ± 1 deg. in azimuth and ± 1 mile in range." . . . F. G. Suffield, Radio Corporation of America.

under USAF contract, has found that nitrides and silicides of various metals can be used for form resistive films with zero temperature coefficient. They show no appreciable permanent change in resistance when operated at ambients up to 250C, Doyle said.

Doyle predicted a bright future for several new avionics elements; some of which are potential substitutes for vacuum tubes:

- **Thermistors,** Elements whose resistance varies with temperature, hence with current.
- **Varistors,** Elements whose resistance varies with voltage or polarity.
- **Transistors.**
- **Dielectric amplifiers.** Certain ceramic dielectrics have a voltage coefficient of capacitance. This non-linear characteristic could permit its use as an amplifying device. Their high-impedance characteristics could complement the low-impedance characteristics of the magnetic amplifier.
- **Non-linear magnetics.** These include magnetic amplifiers, ferro-resonant transformers, magnetic modulators and pulse generators.

▶ **New Basis for Overhaul**—The Navy Bureau of Aeronautics may soon have factual data on the actual number of hours their avionics equipment operates before failure. From this, they can establish suitable intervals for pulling avionics equipment out of service for preventive maintenance or overhaul. The source of the information will come from tiny (1¾ dia. x 3 in.) elapsed-time indicators weighing only 7 oz.

Cmdr. M. A. Mason, head of BuAer's radar section, said that elapsed-time indicators will be required in new avionics equipment developed for BuAer. Eventually an indicator may be used in each major component of complex systems. Mason thinks the equipment designer will benefit too, by learning what kind of service life his equipment is giving.

ELAPSED-TIME INDICATOR will be mandatory on future BuAer avionics equipment, where it should help Navy in search for reliability. Unit is about the size of a cigarette lighter.

At present the elapsed-time indicators are available for operation only from 115 v., 400 cps. However, BuAer expects to develop indicators for d.c., and other a.c. frequencies.

▶ **Vital Statistics**—Over 1,600 engineers and technicians from all parts of the U. S., and from England and Canada attended the IRE conference. A total of 80 technical papers were presented plus two symposiums on air navigation and traffic control progress and problems. Fifty-five exhibitors displayed their wares on three floors of the Hotel Biltmore, scene of the IRE conference.

WHAT'S NEW

Telling the Market

Handy Guide for Specifying Aircraft Rivets is a ready reference with design charts and simple-to-use tables of sizes, weights and quantities. Copies available from Milford Rivet & Machine Co., Milford, Conn. . . . Data on industrial **rubber hose assemblies** for all types of aviation equipment is obtainable by writing Carlyle Rubber Co., Dept. L-1, 64 Park Place, New York 7, N. Y. . . . **Small Cutting Tools of Extreme Precision** is an 18-page catalog describing 20 small units made by Woodruff & Stokes Co., Inc., Building 38, 349 Lincoln St., Hingham, Mass.

Practical Nickel Plating is a 44-page publication for the designer, specifying engineer and user giving data on electroplating and details of nickel plating and its practices. Write International Nickel Co., Inc., Dept. EZ, New York 5. . . . Handbook gives information on **variable-area meters, tubes and floats** and comparison with variable-head meters. Calibration prediction data is included. Write Fischer & Porter Co., Hatboro, Pa.

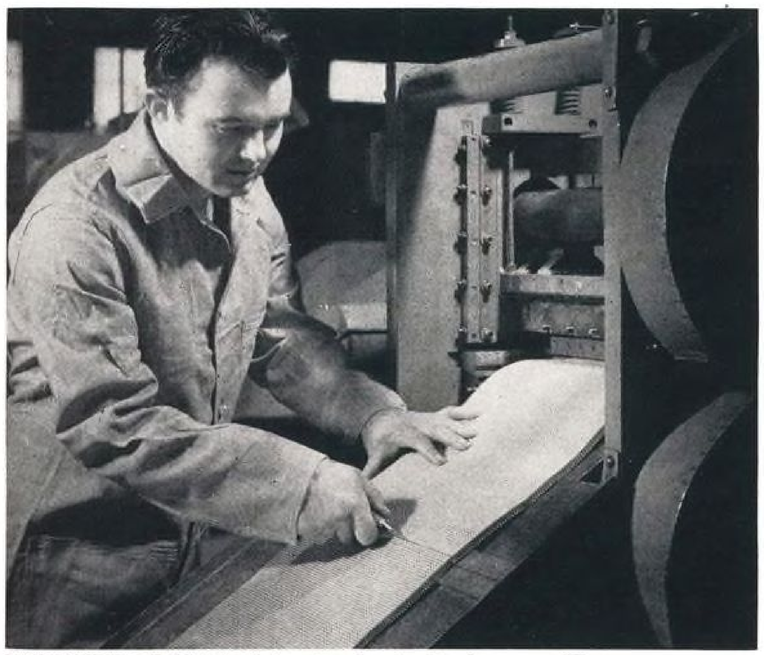
Operating principles, design, advantages, applications of **Nylined bearings** for rotation and reciprocation are detailed in bulletin issued by Thomson Industries, Inc., Manhasset, N. Y. . . . **Free template kits** covering the 20 most popular bellows sizes are available to designers and draftsmen by Clifford Mfg. Co., Waltham, Mass. Templates show standard dimensions of most common and readily available bellows within limits of true scale.

Aimed at design and methods engineers is 16-page booklet, **Static and Dynamic Balancing**, reprinted from Section 89 of the first edition of the Tool Engineers Handbook. Data is also supplied on the Gisholt Balancing School. Write Gisholt Machine Co., Madison 10, Wis. . . . Technical and practical data bulletins on the nature and applications of **FO line of solvents, cleaners and emulsions** are available from Fine Organics, Inc., Aviation-Industrial Chemicals div., 211 E. 19th St., New York 3.

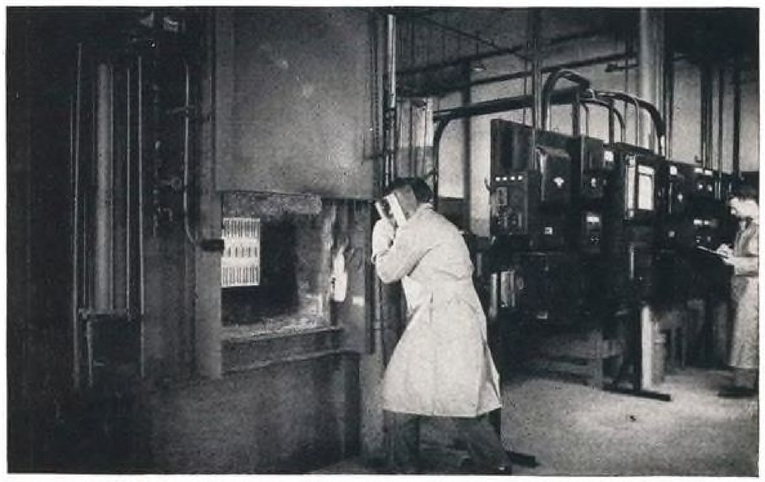
Publications Received

History of Marine Corps Aviation in World War II, by Robert Sherrod, published by Combat Forces Press, Washington, D. C., 1952, $6.50. Robert Sherrod, Time and Life correspondent, has written the story of the Marine aviators from the earliest days (1912) to the beginning of the war in Korea in June, 1950.

EQUIPMENT



CRIMPED ALUMINUM strip is cut to size after forming on special press.

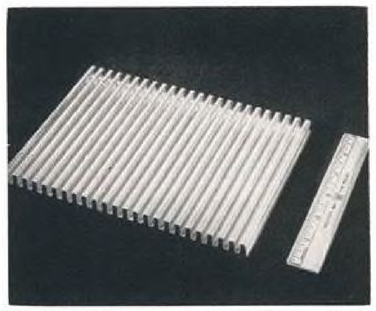


ASSEMBLED CORE is brazed in furnace after carefully controlled preheat.

Jet Heat Exchangers Made Lighter

Trane Co. is producing special aluminum heat exchangers in various configurations to fill a wide range of gas-to-gas, liquid-to-liquid and gas-liquid heat transfer needs in jet aircraft and other applications.

The heat exchanger cores are made by the La Crosse, Wis., manufacturer by special methods in a choice of corrugated, serrated, perforated, or herringbone patterns, depending on performance requirements. Exchangers with simple straight-fin corrugated cores, for example, correlate closely in performance with the familiar round tube cores long seen in aircraft and



INTERCOOLER gets final Trane check.

STRAIGHT FIN is equal to round tube in heat exchanger properties.

made by other firms, Trane says. Round tubes are similar in heat transfer coefficients, volume, velocity and pressure drop characteristics for fluid flowing over the surface, Trane engineers say.

►**Saved 500 lb.**—Heat exchanger core elements are bonded into an integral assembly by a flux-brazing method developed by Trane in World War II. The process is difficult, Trane says, but pays off in compact, lightweight and efficient intercoolers, radiators and other equipment.

In one case, the development was responsible for a 500-lb. reduction in weight in a single-engine fighter plane, according to Trane.

►**Production Steps**—First step in making the cores is processing aluminum strip stock into corrugated, serrated or other patterns desired. This is done on special crimping machines. The stock is coated with a brazing alloy and silicones on one or both sides.

The core elements next are combined with flat sheets spaced between, and other sections necessary to make a complete assembly, and the unit pre-heated to a point just below the melting point of the silicone coating on the surfaces.

The payoff in the process comes when the entire assembly is plunged into a cherry red bath of flux heated close to the melting point of the aluminum itself. This is hot enough to make the silicone coating run so that it bonds the flat sheets and corrugated fins into a rigid structure, capable of withstanding test pressures of 300 to 600 psi. and operating pressures ranging from 100 to 300 psi.

Very accurate control of pre-heating, flux bath temperature (so near the melting point of the aluminum assembly) and cooling is necessary to success of the flux brazing process, the company says.

NEW AVIATION PRODUCTS

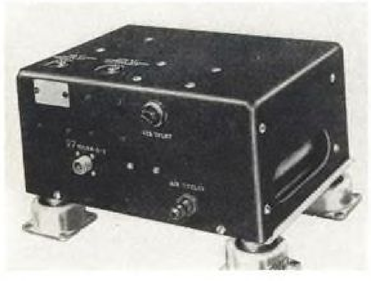
Aluminum Etch

A material for etching aluminum prior to spotwelding, said to "far outperform any aluminum etch on the market today," has been developed by the Jackson Chemical Co. of Calif., Inc.

The product can be used hot or cold, will etch the toughest alloys, including 61S, the firm says. Micron readings of spotwelded aluminum etched with the material are much lower than heretofore, it claims.

The firm notes that a proper etch is somewhat dependent on proper cleaning prior to the etch and for this reason has introduced as a companion product, X-10 Alkaline Hot Tank Cleaner. But even with other cleaning materials, the new etch still is better than others now available, the company claims.

Jackson Chemical Co. of Calif., Inc., 6920 S. Stanford Ave., Los Angeles 1.



Jet Air for Radar

A new pressurizing kit for airborne radar which obtains its air supply from the compressor section of the jet engine has been developed by the Romec division of Lear, Inc.

The kit delivers air at a uniform 20 psi., regardless of inlet pressures from the engine, or altitude factors up to 50,000 ft. If air pressure from the jet is excessive it is dumped, through automatic regulation within the kit. This is provided by an absolute pressure switch and solenoid valves.

Inlet air, before it reaches the built-in dehydrator which cleans and dries the air, is kept at a pressure lower than required (for control reasons), then built up accurately to required pressure by means of an air compressor also included in the kit. Final regulation of air pressure before it leaves the pressurizer is by pressure switch-solenoid control similar to that in the inlet side of the unit.

The kit operates at rated performance through temperatures from −67F to 160F, produces 300 cu. in. of air/min., uses 27 v. d.c. current, draws 3.7 amp., and weighs 13.9 lb.

Romec division, Lear, Inc, Elyria, Ohio.

Steam Cleaner

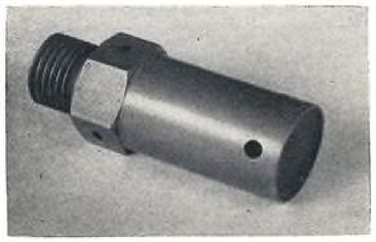
A new steam cleaner to save money, time and labor in cleaning aircraft engine nacelles, props, wings and landing gear has been introduced by Acroil Products Co., Inc.

Acroil calls its development the Auto-Steam, built it especially to meet aviation needs. It can be used both in factory and field and is particularly useful at airports, according to the firm.

The unit can be operated for as little as 50¢ hourly. One filling of the compound tank is sufficient for 8 hr. of continuous operation.

A wide variety of chemicals may be used in the device without requiring pre-mixing, and 100 lb. of steam pressure can be generated in about 90 sec. It is centrally controlled from a completely visible panel, the firm points out. Cleaner automatically stops when water supply fails.

Aeroil Products Co., Inc., S. Hackensack, N. J.



Gears Protected

A new breather vent for aircraft gear cases that meets helicopter requirements has been developed by Technical Development Co. for tropic and arctic service.

The unit makes up for pressure differentials created within gear cases from changes in altitude or temperature. It permits air to pass freely in and out of the case, but prevents entry of grit from the outside and escape of oil from the inside, the company says.

Equalization of pressure is essential to prevent damage to oil seals and formation of air pockets or oil leakage in the lubrication system. The unit weighs .04 lb., is made of heat-treated aluminum alloy to military specifications.

Technical Development Co., 22 Meredith Rd., Philadelphia 31.

ALSO ON THE MARKET

Roto-Stepper (stepping positioner drive) weighing .8 lb, and rotabable 360 deg. left or right is suitable for driving various low-torque mechanisms such as indicators, potentiometers, selsyns, synchros and similar equipment. Device is solenoid-operated, normally rotating in 2-deg. increments. G. M. Giannini Co., Pasadena, Calif.

New flush latch for aircraft is designed for a variety of applications and is simply installed. The only exposed parts are fingertip-operated flush trigger button and close buttons. It is made in various metals, weighs 0.7 to 2 oz., according to material. Hartwell Aviation Supply Co., 9035 Venice Blvd., Los Angeles 34.

FINANCIAL

PAA Gross Reaches All-Time Peak

Net profits also were higher than ever before, but taxes kept them from surpassing 1945 high mark.

An all-time gross revenue peak of more than $188.5 million was reported by Pan American World Airways for 1951. This compares with a total gross of $153.8 million in 1950.

While 1951 net profits, before taxes, of $11,836,197 were also at an all-time high, net income after taxes, $6,546,197, fell short of the record $7,565,580 established in 1945. Earnings per common share aggregated $1.06 in 1951 compared to 66 cents in 1950 and the previous peak of $1.23 in 1945.

A total of 50 cents a share, or $3,065,522 was paid to shareholders during 1951. This represented the eleventh consecutive year in which dividends were paid. The same rate was paid in all years, excepting 1946 through 1949, when only 25 cents a share was paid.

▶ **Mail Effect**—Pan American's statements for 1951 and 1950, are far less qualified than the accounts for prior years which included in gross revenues company estimates for additional mail pay not yet awarded by the Civil Aeronautics Board. Nevertheless, financial results for 1951 still contain a tenuous note in view of pending mail rate proceedings which may ultimately serve to increase or decrease reported results for last year.

The same qualifications apply in varying degree to the published earnings of recent periods as well. Permanent mail rates for the Atlantic division have yet to be established in various aspects from Jan. 1, 1946. A permanent rate is pending for the Latin American services covering the period from Apr. 1, 1948. (Last year saw the establishment of permanent rates for the company's trans-Pacific and Alaskan operations.)

It is significant that in 1951 PAA's total mail revenues—U. S. and foreign combined—aggregated but 20.4% of the carrier's total gross revenues.

In 1950 this ratio amounted to 23.8%. Almost 31% came from this source in 1949. Ten years ago and earlier, reported mail revenues accounted for anywhere from 50% to 80% of the total gross revenues.

▶ **Passenger Effect**—This is nothing more than a reflection of the increasing importance of non-mail revenues, particularly from passenger development. Revenue passenger miles reached a new high of 1.57 billion, an increase of 25% over 1950. Passenger revenues aggregated more than $108.6 million in 1951 for a new high, up from the $87.8 million of 1950 and surpassing the previous peak of $94.4 million in 1947.

The company's tourist-type service is credited with much of this gain, as 20% of the total revenue passenger miles last year came from this source.

Net operating income before non-operating adjustments amounted to $10,260,677 for 1951, three times as great as the $3,392,300 reported for 1950. Non-operating income for 1951 was less: $3,495,429 as compared to $4,882,073, the main difference being accounted for by a decline in the net gain on the disposition of property from $3,356,344 in 1950 to $1,817,769.

▶ **Financial Position**—An improving financial position is also reflected by the 1951 report. A bank credit totaling $59 million was made available to the company on Sept. 25, 1950. A portion of this credit was utilized to finance the purchase of American Overseas Airlines for $17,450,000 in 1950. Total borrowings, which stood at $52,750,000 on Dec. 31, 1950, were reduced to $40,250,000 a year later. With a payment of $6,250,000 on Mar. 31, 1952, total loans were down to $34 million as of that date. Repayments are scheduled to continue semi-annually to Sept. 30, 1955.

At Dec. 31, 1951, Pan American had total commitments approximating $44.5 million for airplanes, against which advance payments of $5,650,000 had been made. This capital requirement is represented by the order for 39 DC-6Bs (Pan American labels them Super-6 Clippers). These commitments are expected to require cash of $21.3 million in 1952. The company had other commitments for parts, materials, and services totaling $11.5 million.

With 1952 depreciation charges expected to exceed the $16.7 million shown for 1951, a considerable cash throw-off should be available from this source to help meet these capital requirements. Debt retirement will entail another $6,250,000 on Sept. 1, 1952 and $14 million during 1953. Net working capital aggregated almost $17.5 million at Dec. 31, 1951, down from the $22.2 million at the 1950 year-end. Earnings and new borrowings, if necessary, may be expected to provide the additional funds.

▶ **Atlantic Coach**—Continued traffic gains are anticipated during 1952 largely as a result of the new tourist service across the Atlantic. This may well make for further increases in passenger revenues.

While mail revenues are declining in relative importance, they bulk importantly in permitting profitable operations. A major mail rate determination is scheduled for September with a proceeding designed to establish a permanent rate for the trans-Atlantic service of both Pan American and TWA.

Recently the CAB made final a temporary rate for TWA reducing that carrier's international mail revenue from $9 million to about $3,307,000 annually. The Board held that this temporary rate is designed to fix mail pay at a break-even need or less, but never more. TWA asserts that on the basis of this temporary rate, its mail compensation for the year ended Sept. 30, 1951 averaged 82 cents a ton mile while Pan American received an average of $2.63 during the same period under temporary rates in effect for that carrier. Presumably CAB may be expected to clarify any prevailing rate disparities in establishing permanent rates for the two carriers.

—Selig Altschul

U. S. Aviation Switches to Knots July 1

- **Airlines are ready, but join others in protest.**
- **Speed will be in knots, distance nautical miles.**

By F. Lee Moore

"The aviation industry's going knots and nautical miles" next month despite the fact all natural navigation markers and obstructions of the country—land sections, roads, mountains and 1,000-ft. TV towers—are located in terms of statute miles and are habitually approached in terms of mph. by all Americans but seamen and Navy pilots.

That is how one aviation industry representative summed up results of the recent Civil Aeronautics Board hearing on the proposed July 1 switch-over of official speed measure from mph. to knots and distance measure from statute to nautical miles.

Seven mph. are six knots and seven statute miles are six nautical miles. Navy and Air Force wanted to standardize on the nautical measure to avoid confusion. CAB consented.

► **Industry Attack**—But at the CAB hearing, spokesmen of every phase of civil aviation launched strong but probably fruitless attacks on the CAB regulation.

What most disturbed industry spokesmen, especially the airline representatives, and two of the three CAB members present (Oswald Ryan and Joseph Adams) was the fact that CAB had been committed to the change-over administratively, without consulting the industry. This, they said, made the hearing a sham concession to procedural tradition and law.

Gen. Milton Arnold, operation and engineering vice president of the airlines' ATA, put it this way: CAA and CAB told the airlines last October at their Denver operation convention, in effect, that they had better start converting instruments, manuals and procedures to knots and nautical miles now, because there would be a switch to those units July 1. The airlines complied.

Gen. Arnold told the Board at the hearing that the airlines had put such heavy investment into the change that a Board reversal now would be worse than going through with the original administrative decision.

Knots, Nautical Miles, MPH

The July 1 switch-over of U. S. official air navigation units to nautical miles and knots demands only one legally required change in pilot procedure. Pilots (except private fliers on visual contact VFR flights who may ask CAA personnel to convert for them) must communicate with CAA in terms of nautical miles and knots.

To make the conversion simpler, airlines and their pilots plan eventually to make these changes:

• **Air speed indicators** will be removed and their dials changed to knot indications.

• **Navigation computers,** mostly the Dalton, will be modified to read in knots only; most Daltons in use now require one extra step to get the answer in nautical miles and knots.

• **Flight manual,** especially runway limitations on aircraft gross weight and aircraft performance data, must be converted. Some airlines plan first to insert conversion tables, later change the basic data.

• **Rulers** and other navigation utensils marked in statute miles only will need replacement. But most of them have long carried both statute and nautical units.

• **Chart maps** published by Coast & Geodetic Survey are coming out with nautical mile measures now; most have for some time, approach charts are now. Jepson approach plates have been converted.

► **What is a knot?**—Here are basic conversion data for statute to nautical distance-speed units:

• **One statute mile** is 5,280 ft.

• **One nautical mile** is 6,080 ft., or 1.15 times one statute mile, or one minute of latitude (one degree of latitude of any great circle course equals 60 nautical miles).

• **One knot** is equal to 1.15 mph.

► **Urge Action**—Thus the airlines, while deploring the regulation, urged its immediate implementation.

The problem first arose Apr. 5, 1950, when CAB Chairman Joseph J. O'Connell signed a unanimous civil-military Air Coordinating Committee policy directive, setting the date for total switch-over to knots on or before Jan. 1, 1954. O'Connell says he heard the objections of airlines and private fliers groups before making the decision. National defense was one reason for going ahead. Then last year, CAA and CAB decided that the sooner the change-over was made the better it would be for the industry.

Bound by the high-policy finality of the ACC decision and CAA and CAB firmness about the date, the airlines got to work converting. Now, Gen. Arnold says, the airlines are ready but CAA and CAB aren't. Regulations, cross-wind and tail-wind components, and all statistics used by airlines and their pilots are still in statute miles—and "they couldn't be converted within a year if the CAA and CAB started now," Arnold told AVIATION WEEK.

► **General Aviation Opposition**—All representatives of general aviation testified in strong opposition to the switch-over.

• **Utility Airplane Council.** Joseph Geuting, Jr., said there is no need for the hundreds of thousands of local fliers in this country to adopt an alien international standard. Nautical miles are only useful in spherical, great circle navigation, he added. He cited the fact that the land section layout of the central U. S. is a visual map in statute miles. You can't change that, he pointed out. And you can't change the normal civilian's habit of thinking of mph. and regular miles in his daily life, he added.

"We suggest," Geuting said, "that the international and military operators, use the nautical, but that CAB and CAA let the domestic civil industry use the statute mile." The utility fliers also suggested that to make this work smoothly, CAA furnish their traffic controllers with quick-reference conversion tables.

• **State Aviation Officials.** Representing the NASAO, Col. A. B. McMullen said in answer to the proponents of a "common system" that "there always has been only one standard in the U. S.—the statute mile." He added that he's recently been working on the problem of formulas for safer location of tall TV

antennas. The TV tower locations are being measured in miles "and the aviation industry's going knots," he quipped.

• **Indiana Groups.** Representing the Indiana Air Committee and the Indiana Flying Farmers, Clarence Cornish said the non-professional pilot thinks in miles, and he frequently navigates by mile-long section lines. Conversion of his thinking from the statute mile habit would be "one more natural obstacle," he said.

• **Aircraft Owners.** Speaking for thousands of members of the Aircraft Owners and Pilots Assn., Merril Armour and J. B. Hartranft, Jr., backed up the general aviation opposition to the knot.

▶ **Airlines Going Ahead**—Gen. Arnold said the airlines will probably be ready equipment-wise on July 1, and the mental change-over shouldn't trouble the pilots much. Arnold's chief criticism was the way in which CAB and the ACC decision was made. He remembers, and the minutes of the ACC bear him out, he said, that there was never a systematic evaluation of the desirability and the technical problem of making the conversion.

Air Line Pilots Assn. did not participate in the hearing. Two years ago, the ALPA executive board approved the switch-over policy determination by the ACC.

▶ **Military Position**—Air Force Col. Johnson backed the CAB regulation—said problems under the present double standard would be especially great in case of mobilization. He cited troubles of coordinating joint Navy-Air Force operations in World War II, when Army Air Force was still on statute miles. He cited the problem of integrating the Civil Air Patrol in search and rescue, when they were on mph. and statute miles and the military on knots and nautical miles.

And he cited the problem of reserve pilots and trainees switching from civil flying to military and back again. Finally, he noted the need for standardization of transport planes of airlines and Military Air Transport Service.

Pressed by CAB Chairman Donald Nyrop, Col. Johnson couldn't detail AF plans to fit its large number of old planes still instrumented for mph. and statute miles. It appeared that the airlines are way ahead of the Air Force on actual unification and standardization. The colonel did say, however, that all AF planes built since 1946 have been delivered in the nautical configuration.

▶ **CAA Argument**—CAA defended the decision to change all airline and instrument flight operations to nautical units July 1.

The standardization coordinator of the CAA planning staff—Bart S. Spano—outlined CAA's position, making two main points:

• **Cost is less** on a one-time change-over than the long-range cost of a dual system, one military and the other civil.

• **Safety risk is less** on a one-time adjustment than a long-term double standard.

Three Firms Build ATA Omni Models

Avionics manufacturers are swinging into production and sales activity in record time on the low-cost terminal omnirange facility developed by Air Transport Assn. technicians.

ATA completed evaluation tests on this navigation and instrument approach aid only two months ago (AVIATION WEEK May 5, p. 68).

Maryland Electronic Co. is running a prototype model through its plant now—hopes to have it ready for airline inspection late this month. Maryland believes its model is just the version the airlines want, but plans to demonstrate it and get some firm orders before producing in quantity.

▶ **Other Types**—Wilcox Electric Co. is talking of going into full production without waiting for firm orders, may build 50.

Collins Radio Co. is building a prototype at Dallas.

Despite this manufacturer activity so soon after the birth of a new commercial product, Pan American World Airways couldn't wait. PanAm already has started building one dual unit for installation at Roberts Field, Liberia.

Robinson Airlines plans to lease the ATA development model for installation at Ithaca, N. Y.

Other airlines eager to get models soon: All-American, Southwest and American Airlines (for its Mexican route).

▶ **Costs**—Maryland will produce a more expensive model than Wilcox. Maryland estimates cost of its model at about $10,000 complete with monitor—says this model is up to CAA specifications, doesn't look like a "commercial" product at all. Wilcox is sticking to rock-bottom cost consistent with reliability—along the lines of the ATA development model (under $7,500). ATA developed the inexpensive terminal omni to meet local service airlines requirements, mostly. But reports are that the international market may be the biggest.

Locations will be unusual. Where no other aids are available for positive fix during landing approach, a compass locator also may be needed so airlines can make straight-in instrument approaches on the omnirange. But where other aids are nearby, the omni may be all that is needed to lower an airport's weather minimum as well as improve navigation in the area.

Cabotage Privileges In Germany Continue

Gerald W. Schroder
(McGraw-Hill World News)

Frankfurt—Foreign carriers supplying airline service between cities in West Germany still have a long time before their cabotage privileges will end, despite the peace contracts which end the Allied occupation of the Federal German Republic.

The peace contracts provide that Germany will permit air carriers of any state to continue their operations, including cabotage, on a basis no less favorable than that enjoyed by them at the time the peace contracts take effect (after ratification by the national legislatures of Britain, France, the U. S. and the German Republic).

Further, it is agreed that this permission will not be withdrawn for at least one year after the effective date of the peace contracts, unless the new German state meanwhile signs an air transport agreement with the country whose airline has the cabotage rights.

▶ **Other Possibility**—There is one other possible—but not probable—way to end the cabotage rights sooner. Under the peace contracts, Germany may withdraw the privilege when its own airline is able to provide adequate internal service. This is not probable within a year.

(Airlines with most at stake in the present cabotage arrangement are Air France, British European Airways, Pan American, Sabena, Swissair and KLM.)

The peace contracts also provide:

• Germany will abide by the terms of the International Civil Aviation Organization and as soon as possible will join ICAO.

• Aircraft of foreign countries will be extended same rights and privileges in use of air navigation and other facilities as Germany extends to its own aircraft.

• Air traffic to Berlin will continue to be regulated by the U. S., Britain and France.

• Not later than Mar. 31, 1953, Germany will take full responsibility for various air traffic services, navigational aids and accident investigation in the field of civil aviation.

Bahamas Line Reorganizes

After three years of increasing financial losses, Bahamas Airways, Nassau, one of BOAC's smallest associated companies, has reorganized and will operate an entirely domestic service under management separate from the big British carrier.

BOAC is taking over the small carrier's international service, including the 200-mi. run from Nassau to Palm Beach, Fla., suspended recently.

Airline Mobilization Plans for Emergency Reserve

	Original program	New plan considered*
Boeing Stratocruisers	35	35
Douglas DC-65	88	123
Lockheed Constellations	57	82
Douglas DC-4s	182	60
Total planes	362	300

* Approximate numbers estimated by Aviation Week from information supplied by Defense Air Transport Administration and Air Force officials.

Note: Airlift capacity of both fleet plans is about the same, with DC-6 and Connie figured at about twice the ton-miles per day capacity of a DC-4.

AF Transport Reserve Program

First contracts to airlines for modifying planes are expected this month; full details still undecided.

By the end of this month the airlines may have their first Air Force contracts to modify half their four-engine fleets as an airlift mobilization reserve.

But Air Force and Defense Air Transport Administration still haven't decided on how many of each type planes to modify first, despite two years' planning since start of the Pacific airlift.

Eventually, Air Force plans call for modification of all four-engine airliners to readiness for long-range airlift duty. But Air Force wants to get going on the first half of the modification program for early readiness—with the rest later as budget allocation permits.

▶ **Revised Plan**—The DC-4, originally slated as the emergency fleet's backbone, may be pushed back to second-line reserve status, except for about 60 long-range DC-4s needing little modification for airlift duty.

An Air Force official says AF has asked the civilian mobilizers at DATA to substitute longer-range DC-6s and Connies for the short- and medium-range DC-4s originally slated for modification to emergency airlift readiness. But a DATA spokesman says it's quite the opposite—AF hasn't made up its mind what it wants.

At any rate, modification of a bare minimum of about 80 Stratocruisers, DC-6s and Constellations is slated to start about July 1. Then when Air Force and DATA can get together on what to do about the DC-4s, modification of those planes will start.

When the DC-4 contribution is settled, allocation of the remaining airlift capacity demanded by Air Force will go ahead. Indications are that the latter will be in the ratio of about two-thirds DC-6s and one-third Constellations.

▶ **Estimates**—Through conversations with both DATA and Air Force personnel, AVIATION WEEK has estimated the approximate fleet composition wanted now by Air Force (see box).

However, it's still not decided. Here are relative merits of the old plan, featuring modification of DC-4s vs. the new plan featuring fewer DC-4s and more modern passenger planes.

• **DC-4 advantages,** if modified now, include its better adaptability for cargo; and the fact that if Air Force needs more than the first- and second-line reserve it will need the DC-4s anyway. They take the longest time and the most equipment to bring up to long-range over-ocean navigation standards.

• **DC-6 and Connie advantages,** if modified first: they can be modified sooner; they require less than half as much government-furnished equipment per plane for a given airlift capacity; they are faster, bigger and more efficient; they are becoming more and more the airline standard as new deliveries continue, and, finally, Air Force wonders about the advisability of modifying obsolescent airliners (DC-4s) that will later be sold to foreign countries as U. S. lines replace them with more modern planes.

Indications are that Air Force and DATA already have decided to substitute modern transports for the short-range DC-4s of 1,800-gal. fuel capacity. Main question now is: What about the medium-range DC-4s of less than 3,200-gal. capacity?

Airlines to Continue Family Fare Plan

Despite recent pleas of domestic airlines for higher fares, they're holding onto the half-fare "family plan" voluntarily. Only trunkline failing to renew the plan for another year is Northwest, which says it wasn't used much on Northwest routes except for the Stratocruiser service, which doesn't need that promotion anyway.

The family fare plan promotes travel on normally weak days of Monday, Tuesday and Wednesday.

Under the arrangement, a husband or wife buying one full-fare ticket can bring spouse and children (no matter how many) along at half-fare. American Airlines pioneered the plan; it worked so well in smoothing out the week's travel load that virtually all airlines have used it since.

Local circumstances sometimes change airlines' use of the plan, however. United Air Lines recently proposed raising the family rate to three-quarters fare—had to retract when competitors didn't go along. New York State local Robinson Airlines dropped the plan this summer. Trans-Canada drops it every summer, resumes in the winter. Northeast Airlines dropped the plan temporarily this month because the fuel shortage cut schedules heavily, but plans to resume it when the shortage is over.

Civil Aeronautics Board started a "general fare investigation" in April, after permitting a dollar-fare increase but denying the airlines' plea for elimination of the 5% round trip discount. Pre-hearing conference hasn't been held.

Robinson Presents Case for Renewal

Robinson Airlines, first local line recommended by a Civil Aeronautics Board examiner for 10-yr. renewal of its certificate, presented a strong case for CAB adoption of that renewal recommendation at the recent Board hearing.

Vice president and general counsel John Carver noted that in the month of October, last year, Robinson was tied with Pioneer for the highest number of revenue passengers carried per mile—12 passengers, compared with 10 for Southwest and Piedmont and an average of only 8½ for all DC-3-operating locals.

Robinson's October traffic density, measured in passengers generated per route mile, was 16, compared with nine for Piedmont, Southwest and Pioneer and an industry average of only six passengers.

And on the key index of money volume, passenger revenue per revenue mile flown, Robinson again led with 68 cents per mile, compared with Pioneer's 62 cents, Piedmont's 61 cents and Southwest's 57 cents.

However, due to rising expenses this year Robinson has asked the Board to raise its presently-effective final mail

rate of about 40 cents a mile. Last year, Robinson received mail pay of 80 cents a mile, totaling $1,150,000 for the year.

CAB Sets Causes In Braniff Accident

Immediate cause of the Braniff Airways DC-4 accident at Hugoton, Kan., Mar. 26 in which all aboard escaped when the plane burned in a field beyond the airport has been narrowed down by CAB investigators to either a burned-out generator or vacuum pump.

Basic cause of the engine fire that led to the crash is believed to have been in the wiring and tubing installation on Braniff's DC-4s. CAB investigators said the "plumbing" needed cleaning up. Braniff since has separated "hot" wires and fuel and hydraulic lines and anchored them with Adel clamps.

The accident occurred en route from Colorado Springs to Oklahoma City. Fire broke out in the No. 3 engine. Pilot couldn't see what part the fire was in, so ducked into the small airport at Hugoton.

The burning engine fell off just before landing. With the hydraulic system out, flaps and brakes failed. He landed long and overshot the runway end, coming to rest in an open field. Although the plane was destroyed, no one was injured.

UAL to Modernize Terminal Operations

San Francisco—A two-year research program to mechanize and streamline United Air Lines' terminal operations was outlined here recently by UAL President W. A. Patterson.

Patterson told a meeting of Security Analysts here that airline terminal operations are a "complete disgrace," that millions of dollars annually are spent unnecessarily to operate in the present "cumbersome fashion."

As an example, he said that when a DC-6 lands ground crews "charge at it from all directions—you'd think the Queen Mary was docking. We're going to spend the next two years in finding and developing mechanical equipment that will stop this comedy."

United plans to turn one of its line stations, probably Denver, into a laboratory to attempt to iron out the terminal problem.

Big Pay Connie

- **Lockheed compares new version with competitors.**
- **Company now has 85 firm orders from airlines.**

Lockheed Aircraft's sales engineers say that their Super Constellations are "longer by $366,000" than their nearest competitors.

What Lockheed means is the Super Connie cabin is 80 in. longer than the Douglas DC-7 cabin, so the Connie can seat eight more standard-fare passengers or 10 more coach passengers.

Here's how Lockheed computes the extra $366,000 annual revenue potential of the eight extra seats: 2,920 hr. average flying time per year times 280 mph average cruising speed equals 817,600 miles; that times 5.6 cents revenue per seat mile is $45,785.60 per year per seat; multiply by eight seats and you have $366,284.80. This assumes the seats are full, of course.

► **Douglas View**—A Douglas Aircraft spokesman says its true the Super Connie is bigger, but it costs more to operate and it is slower. Lockheed claims cruising speed of 340-350 mph for the compound-engine Super Connie compared with Douglas' claim of 364 mph. for the DC-7 with the same power—four Wright 3350 engines rated at 3,250 hp. each.

In building the Super Connie, Lockheed stretched the standard Connie by 18.4 ft, increasing the cabin by the equivalent of 22 standard seats or 27 coach seats. The Super Connie length Lockheed compares with the DC-7 is the distance from flight station to the aft pressure bulkhead.

The extreme range, size and payload of the Super Connie with compound engine should enable it to beat Britain's jet Comet at close to half the price. BOAC's scheduled jet Comet time London-Johannesburg is 24 hr., 40 min. with five stops en route. The compound Super Connie will do it in 20 hr. with one stop and carry 93 passengers—more than twice the payload of the present Comet.

The same plane will make New York-London in 10 hr., 35 min., Lockheed says, and turboprop power would cut that to about 9 hr.

► **First Flights**—First flight of a compound-engine Super Connie transport, Navy's R7V-1, is slated for some time this month. And the first flight of Navy's turboprop Super Connie prototype is planned for about the end of this year, engines permitting. The Douglas DC-7 is expected to fly early next year, with first delivery to American Airlines slated for June, 1953.

Lockheed Super Constellation orders now total $260 million backlog. That includes 85 airliners, 52 Navy transports, 19 Navy radar pickets and 10 Air Force transports—total orders, 166.

Airline orders announced to date: Eastern 30, KLM 10, TWA 10, Air France 10, Pakistan 3, Qantas (Australia) 3, Trans-Canada 5, Safe Braathens (Norway) 1, Air India 2, Seaboard & Western 5, Iberia 3 and Avianca (PAA affiliate in Colombia) 3.

Firm airline orders for the Douglas DC-7 total 33 so far: 25 for American, 4 for National and 4 for Delta. United is ordering 25.

NWA'S SHORTHAUL BUS SERVICE

When Wold-Chamberlain Airport, Minneapolis, began repairs on Northwest Airlines' loading ramp areas, the carrier was obliged to move these operations temporarily to a distant portion of the field. To save its passengers the inconvenience of walking the several hundred yards, the carrier pressed into service this open-air bus. It's estimated that it will be needed for approximately two months.

Israel Airport Plans Improvements

(McGraw-Hill World News)

Tel Aviv—Numerous improvements being made to Lod (formerly Lydda) Airport will soon make it one of the world's top-ranking commercial terminals.

Extensive lighting and navigational facilities are being put in. These include three directional beacons—a radar beacon with 100-mi. range, a high frequency direction finder capable of reaching Rome, and a very high frequency finder ranging 150 mi. A battery of 91 lamps of 160,000 watts each are to be installed along the main runway to aid landings during inclement weather.

The main runway has been extended to 7,770 ft. and another strip to approximately 5,900 ft. Both runways were widened to about 200 ft.

A large maintenance base is being put up by the government to be managed with the assistance of a group of U. S. experts.

The terminal building improvements include extensions and new building construction to handle simultaneous arrival of four transports, with more space available for airline offices, government departments and restaurants.

► **Rising Load**—The field continues to handle an increasing traffic load. During its 40 months of operation as an Israeli airport, 408,000 passengers used its facilities; 176,000 were residents and tourists, 24,000 transients and 208,000 immigrants.

There were also 75,000 air crew and 40,000 passengers on the internal Arika service to Elath on the Red Sea. More than 7,000 international planes landed and took off from the field, plus 1,600 aircraft on domestic service. International cargo loaded on and off at Lod totaled more than 13 million lb.

Employment at the field has reached 1,500.

Colonial Asks Bids In Sale Proposal

Colonial Airlines President B. T. Dykes has asked airlines interested in buying Colonial to submit sealed bids to be opened June 26.

The company "will determine which, if any, of the bids will be accepted and presented to the Civil Aeronautics Board and to the stockholders of the company for approval," the announcement states.

Invitations went direct to American, Capital, Eastern, National, Northwest, Northeast, Pan American, TWA and United.

"Since Delta Airlines, Inc., has indicated an interest in merging with or acquiring a carrier serving Colonial's area, it was also invited to bid," the announcement added. Delta has a merger application with Northeast pending CAB action.

SHORTLINES

► **Air Transport Assn.** says that by the end of February this year, U. S. commercial planes had hauled 350 million ton-miles to Korea, and that they "have accounted for more than 61% of the total tonnage carried to the war theater" by air.

► **All American Airways** moved its Pittsburgh base from Allegheny County Airport to new facilities at Greater Pittsburgh Airport June 3.

► **Capital Airlines** reports business volume received from other lines the first quarter this year was 25% over a year ago; cites schedule cooperation and the automatic sales system at off-airway airports as helping. Interline receivables were $2,025,436.

► **California Eastern Airways** has sold two DC-4s for $1,200,000—one to Carmas Supply Corp. and the other to Icelandic Airlines.

► **El Al Israel Airlines** says its all-coach trans-Atlantic service tripled business of the same route a year ago, when it was all luxury. . . . Has won rights for operation from Rome to N. Y., Athens and Vienna, and recently won similar freedom of operation through Paris.

► **International Air Transport Assn.** resolution to cut the 7½% travel agent commission to 6% on trans-Atlantic aircoach is recommended for CAB denial by Examiner F. M. Ruhlen. Agents would run at a loss, he estimates, and the $4 difference N. Y.-London fare could better be made up by a $4 fare increase.

► **International Italian Airlines** traffic totaled 6,820,000 ton-miles in 1951 compared with 5,245,000 the year before.

► **Local service airlines** do not plan on participation in buying "flight simulators" for pilot training, as they don't figure the President's (Doolittle) Airport Commission intended such recommendation for the relatively simple DC-3 cockpit.

► **Northwest Airlines** reports April load factor at 65%, compared with 57% a year ago; passenger miles increased 35% to 54,430,150.

► **Pan American-Grace Airways** 34,833,000 revenue passenger miles the first quarter increased 916,000 mi. over a year ago.

► **Pioneer Air Lines'** order for five Convair 340s was nullified by Civil Aeronautics Board, which refused to certify Pioneer's need for materials priorities from Defense Production Administration. Meanwhile, there's an intra-CAB conflict whether to approve increased mail pay to carry the nine Martin 2-0-2s already bought.

► **Trans-Australia Airlines'** five Convairs have logged over 300 million passenger miles without a fatality. One of them is the first Convair to fly over 10,000 hr. Average time on the 175 Convair 240s now in operation across the world is 6,000 hr.

► **United Air Lines** again has pressed CAB to allow airlines to drop the traditional 5% discount on roundtrip tickets. CAB plans an investigation on the subject.

SEARCHLIGHT SECTION

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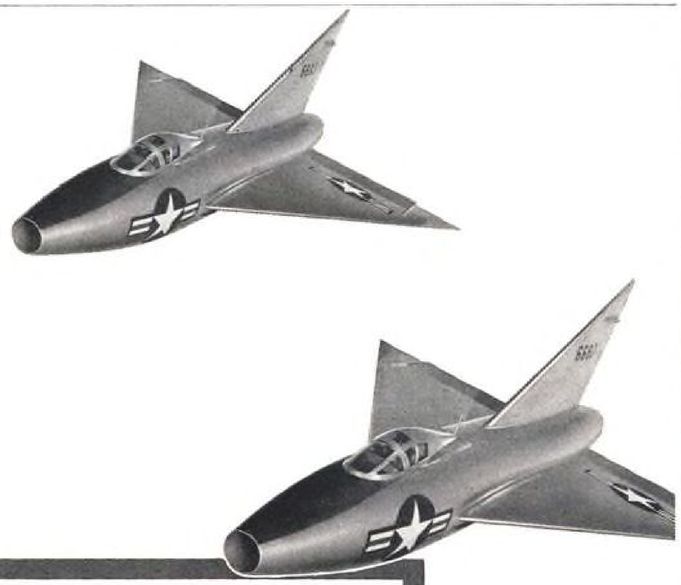

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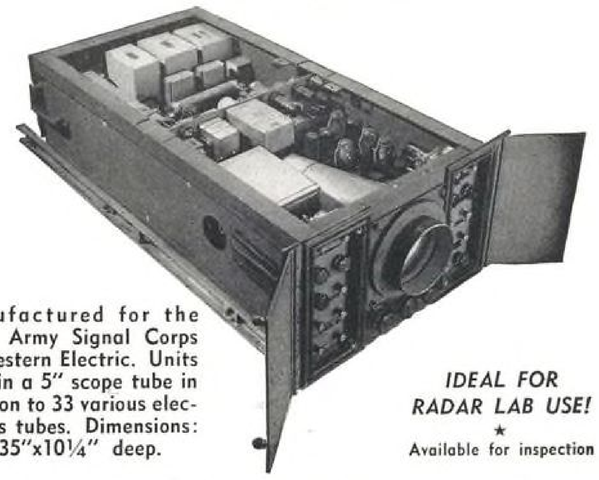

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175	48363	Shaft
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78	76236	Gear
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113	84487	Housing
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200	84083	Cylinder
100	84084	Cylinder
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700	TFD 8600	Thompson	Fuel Booster Pump
125	D7B18	Adel	Anti-icer Pump
250	AN4014	Erie Meter	Wobble (D-3) Pump
300	1H260-K & KA	Pesco	Hydraulic Pump
1000	AN5780-2	G. E.	Wheel & Flap Position Indicator
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83	A4934	Delco	Motor
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70	AN3213-1	Scintilla	Ignition Switch
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687	RS-2	Mallory	Selector Box
90	JH950-R	Jack & Heintz	Starter Motor
492	S-841 (94-32253)	Electronic Labs	Box
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188	EYLC-2334	Barber-Colman	Control
11	12086-1C	Eclipse	Amplifier
174	450-0	Skinner	Gasoline Filter
250	558-1A	Eclipse	Oil Separator
100	716-3A	Eclipse	Generator (NEA-3A)
37	117-47	Edison	Detector
89	318	Edwards	Horn
20	794-F	Stewart-Warner	Heater
230	921-B	Stewart-Warner	Heater (200000 BTU)
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97	6041H-146A	Cutler Hammer	Relay (B-12)
22	0655-D	Aro	Oxygen Regulator
148	PG20BAS1	Minn. Honeywell	Air Ramp Switch
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SO THEY TELL US

Capitol Hill

Airmen's training legislation, authorizing $18 million for CAA to train mechanics and pilots, has no chance. Budget Bureau is against it. This means that even in the unlikely event authorizing legislation goes through Congress, Budget Bureau will block funds to carry it out.

Post Office officials tell Congress that airmail in the coming 1953 fiscal year will run up a $29.3-million deficit. But if legislation separating mail pay from subsidy is enacted, so the department doesn't have to bear that subsidy, the service will almost break even. In the current year, deficit will be $34.5 million, P.O. officials say. Of this, $29.7 million is out-and-out airline subsidy, over and above service rates for mail carrying.

Military

USAF is determined to continue its contract with Aro, Inc., for operating Arnold Engineering Development Center. The House of Representatives banned use of USAF funds for Aro payments after July 1. Urging senators to lift the ban, Air Force's Brig. Gen. Marshall Roth said they could prevent serious delay of "an absolutely essential research center."

Reports of "flying saucers" continue to trickle into the USAF. The recent Life article increased them. We asked USAF information officers about radar units that have been reported tracking saucers and are told officially that inexplicable electrical disturbances sometimes cause "blips" on radar scopes that may be "tracked" for a time before they suddenly disappear.

A $64 question is whether Air Force & Navy will cut down the number of aircraft types. A civilian defense agency official says he thinks they will, based on current economy pressures from Capitol Hill.

Need for autopilots to improve helicopter stability is being recognized by both the military and by copter makers. Minneapolis-Honeywell has received a USAF contract to produce autopilots for the Piasecki YH-21, and Bell and Sikorsky are reported developing their own autopilots.

Heavy slashes in Air Force public relations budgets are causing many reshufflings in Pentagon jobs.

The vacancy in USAF secretariat left by resignation of Eugene Zuckert may be filled with an appointee who will supervise public and industry relations along with the other duties of an assistant secretary. This would fulfill a long-planned objective of Secretary Finletter—to set up a top civilian supervisor of public relations, as it was in the days of Steve Leo.

That Avro delta-wing bomber has not made its first flight, says an industry observer just back from England. This contradicts what a well-known French aviation figure told us in France the other day as a fact, and reported here May 26. Our latest information is that the Olympus engine is so far from flight stage that the first ship, at least, will be powered with the Avon. If the ship flies by fall, Avro will be fortunate, it's said.

Transport

A U. S. aircraft industry official says the Comet III is the version that will give American manufacturers real competition. It is set for first flight in 1953, with deliveries late in 1953 and early in 1954.

Pan American officials in Rio tell our Brazilian correspondent that the recent Stratocruiser accident may have been caused by some failure in No. 1 engine or propeller. They and the outer wing were never found. That the loss of engine was not immediate seems to be shown by the fact that investigators found evidence that "emergency descent" procedure had been set up before the crash.

Safety specialists say there is a definite trend toward moving gasoline tanks outboard of the motors in wings of upcoming transport types, and also into detachable wingtip tanks and pods. But it appears unlikely that these latter tanks can be made large enough to replace wing tanks completely.

Industry

We're told that despite strong industry rumors to the contrary, the rocket development work of Curtiss Propeller division is to continue at its present level, at least until June, 1953, under the terms of a recently signed Air Force contract. Under active consideration are other contracts which would extend the rocket work of the division over another five years. One of the Curtiss projects has been the throttling rocket motor for the Bell X-2.

STRICTLY PERSONAL

Robson the Gardener

Columnist Ace Robson answers our query on why he has written us so few columns lately.

"Due in part to house remodeling—dabblin' in plumbing, heating, wiring, carpentry and painting, for two months—while the typewriter gathered dust," says he.

* * *

EXTRA!

Casey Jones Tells How It Feels To Get a Letter From Truman!

(Strictly Personal wrote C. S. "Casey" Jones to ask him to tell us his story of his recent letter to President Truman and its acknowledgment. Here's his account.)

After listening to the President's broadcast (on the steel industry seizure) I tried to wire him, having jotted down a few questions I wanted to ask because I was not too happy about some of the things he said.

When I was advised that the telegraph operators were on strike I simply wrote him a letter on our farm stationery in longhand asking him the questions, and while I expected I might get some sort of an acknowledgment I, of course, never dreamed I would get a reply from the President.

As a consequence, when the White House 'phoned me a week ago Sunday, I was probably the most surprised person in Pennsylvania. Even after the letter was read to me over the 'phone I didn't realize what interest it would create.

Only about two hours later the Philadelphia Inquirer called up and advised that a flash had just come over the wire and they asked for confirmation as to whether I had written the letter. I think this was around 4:00 pm. and from then until midnight it was a series of 'phone calls, interviews, tape recording, etc., and I suspect I was probably the most unpopular guy on our party line where my 'phone rings four times anytime anyone calls me. I understand numerous complaints were received at the telephone office.

I realize that it was happenstance that the President answered my letter rather than many others of similar nature which he must have received. When the White House called me they made no attempt to check except that I had written the letter, but I expect they thought they were calling farmer Jones in Pennsylvania.

I have replied to the letter but have not made any announcement of it. I simply acknowledged it and made no attempt to continue with any discussion. I was not completely satisfied, however, with all of the answers and I did mention the fact that I was concerned about the interesting tendency to concentrate more power in the Executive Branch of the Federal Government. Naturally I have received many letters from all different kinds of people but the ones that have pleased me most were from old friends I had not heard from in years.

C. S. (Casey) Jones

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—JUNE 9, 1952

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EDITORIAL

The Air Force Finds Its Voice

Fortunately for the country, the Air Force shows signs of awakening, although belatedly, to the realization that its own timidity and secrecy have helped politicians slash our air power far beyond limits of safety.

The danger signals were flying first about a year ago with the first cut in funds.

Then the so-called stretchout was concocted and the Air Force again knuckled down to the Truman politicians. At first, the stretchout was presented merely as delayed deliveries; later it was conceded that important fighting aircraft had been eliminated from schedules completely. Some aircraft schedules had been unrealistic, it is true, but the stretchout did go beyond mere realistic readjustments.

The Air Force high command—both civilian and uniformed—bowed to the Administration, however. The courageous fighting tactics of a suave, informed Symington on Capitol Hill to sell the need for air power—with persuasive facts—were sadly missed.

The congressional economy wave followed the Administration's lead.

Now, quoting AVIATION WEEK's legislative reporter, Miss Katherine Johnsen, "Secretary for Air Finletter is taking the offensive in spelling out to congressmen just what cuts in funds mean in planes and striking air power." Why wasn't it done a year ago?

Now, Miss Johnsen says, Mr. Finletter is "baring the record of the Administration's hold-down of Air Force expansion, heretofore kept 'within the family,' as well as protesting reductions in the USAF program by the House."

A documented chronicle of how U. S. air power has been held back by White House and congressional slashes of funds, to the point where today's air power-in-being stands at 80 combat wings—about two-thirds of what is needed today—was finally laid before the Senate Armed Services Committee last week by Mr. Finletter.

It would be "highly desirable and not a case of over-insuring," he told the Senate committee at a hearing of its Preparedness Subcommittee, if the 126-combat wing Air Force, ultimate goal of present planning, were in being today.

First adverse blow at the USAF schedule to get a 143-wing Air Force, including 126 combat wings, by the end of fiscal 1954, came a year ago, with the failure to pass of a $5-billion national emergency fund congressional appropriation needed to start the buildup from the 95-wing strength previously authorized, Finletter recalled. Instead, a $1-billion appropriation was passed, of which USAF was allotted $667 million. This provided little more than a tenth of the funds sought, making possible a start on some of the long-lead items for the 143-wing force, but throwing the overall plan behind schedule.

In planning the 1953 budget request, the Secretary said, buildup to 143 wings (126 combat wings) authorized by Joint Chiefs of Staff, civilian secretaries of the Defense Department and President Truman, was "sought." Despite the previous failure of four-fifths of the national emergency fund, Air Force planners decided that with partial financing in the first part of calendar 1952 and enough funds in 1953 and subsequent years, the desired readiness date at the end of fiscal 1954 could be almost reached.

A three-point program was planned by Gen. Hoyt S. Vandenberg and Finletter to hold down expenditures.

First proposal of the air staff was for a $26.7-billion 1953 Air Force budget covering everything but public works (air bases).

By drastic reviews this was cut to $22.4 billion before submission to the Defense Department.

Further reviews by Secretary Lovett's office and the Bureau of the Budget personnel resulted in a reduction to $21.4 billion.

This figure was tentatively allotted as the USAF's part in an overall $55-billion 1953 budget recommended to the Bureau of the Budget and the White House by the Department of Defense.

Then the Bureau of the Budget did the expected cutting and recommended only a $44-billion budget, with $16.6 billion for Air Force.

Following a meeting at the White House Dec. 28, 1951, the President determined that combined expenditures for the Defense Department and military foreign aid should be held to less than $60 billion. To do this, Defense Department decided to stretch out the period in which the full strength would be obtained. This resulted in a $20.7-billion Air Force budget, meaning a stretchout of about a year in the date of readiness of the Air Force, to the end of fiscal 1955.

When the House got through with the proposed military budget, there were two kinds of cuts:

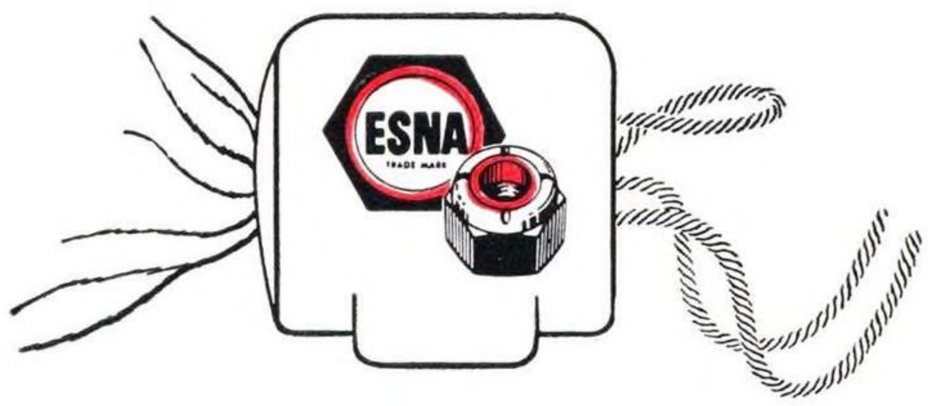
- **A budgetary cut of $1.67 billion,** which will reduce the number of modernized wings and delay the date of readiness of the 126-combat-wing force to about the end of fiscal year 1957.
- **A ceiling on the overall defense budget** of $46 billion which, when divided among the services, resulted in a limitation of $17.4 billion on the Air Force.

So, Mr. Finletter summarized, "It is of the utmost importance that we get the money to build as close as possible to the date of July, 1954—which I would estimate to be July 1, 1955, if Section 638 of H. R. 7391 and the House cuts are eliminated and if the Air Force gets its $20.7 billion of appropriations for fiscal year 1953, plus the necessary sums for public works in order that we may have the bases from which the planes are going to fly."

This lack of fight, and the ridiculous secrecy indulged in by the Air Force, resulted in supine surrender to politics. Because neither the people nor their elected representatives were told what these slashes would mean to our air strength.

If Congress and the people cannot depend on our top military authorities—with access to the most authentic information available—to tell us when danger threatens, how can Congress and the people be expected to decide how much money is needed for the national welfare?

—Robert H. Wood



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