AVIATION WEEK

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NEWS DIGEST

Domestic

Gen. O. P. Weyland, U. S. Far East Air Force commander, says Russia and Communist China have a combined force of at least 7,000 combat planes in the Orient—"greatly outnumbering" American aircraft. The Soviet Union's known force of 4,500 planes includes medium bombers capable of striking at any city in Japan, Weyland says.

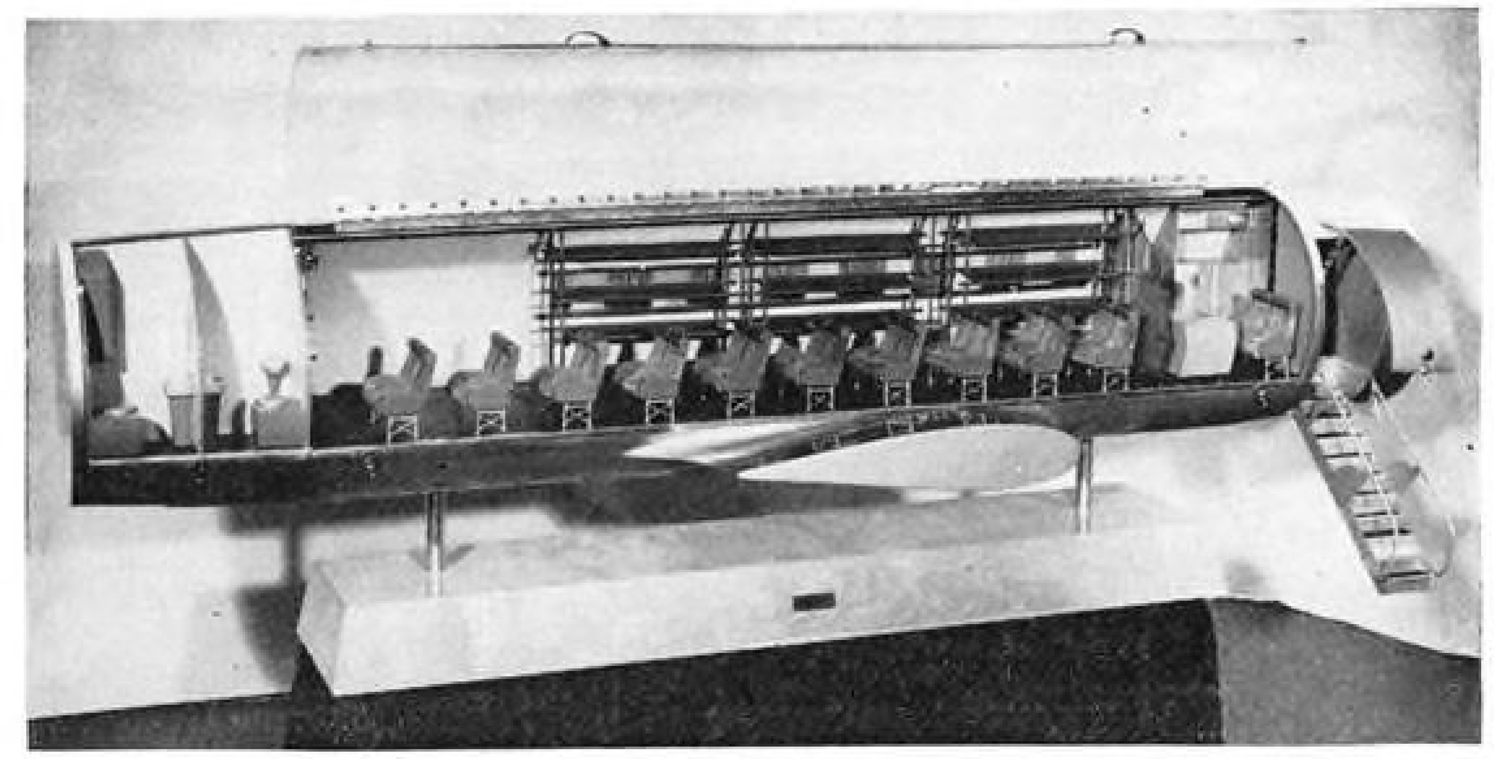
Love Field, largest commercial airport in Dallas, will be expanded and improved through a $12.5-million tax bond issue approved during a city election. The Dallas development program also includes conversion of small Red Bird Airport into an industrial airfield.

Reynolds Metals will build a $7.5-million addition to its McCook, Ill., plant for production of aluminum tapered sheet and plate used in the manufacture of Navy aircraft.

Flight Safety Foundation, Inc., New York, has formed a new Division of Aircraft Service and Equipment to coordinate activities with industry ground-safety departments. The division is headed by Joseph M. Chase, former aviation manager of Lumbermen's Mutual Casualty Co.

Manufacturers Aircraft Assn. has reelected William E. Valk of Curtiss-Wright Corp. as organization president. Vice presidents for this year: Robert E. Gross, Lockheed Aircraft Corp.; J. H. Kindelberger, North American Aviation, Inc.; W. T. Piper, Piper Aircraft Corp.; Charles H. Chatfield, United Aircraft Corp.; Horace G. Hitchcock of Chadbourne, Parke, Whiteside, Wolff & Brophy, New York, and John A. Sanborn, MAA general manager. Reelected: James P. Murray, Boeing Airplane Co., secretary, and Charles Kingsley, Grumman Aircraft Engineering Corp., treasurer.

Society of Automotive Engineers has named Robert Cass, White Motor Co., Cleveland, as 1953 president. Vice presidents include: Air Transport—O. E. Kirchner, American Airlines; Aircraft—T. T. Neill, National Advisory Committee for Aeronautics; Aircraft Powerplant—E. G. Haven, General Electric Co.; Engineering Materials—G. C. Riegel, Caterpillar Tractor Co.; Fuels and Lubricants—F. A. Suess, Continental Oil Co.; Production—P. Petersen, Canadian Acme Screw & Gear, Ltd., and Transportation and Maintenance—O. A. Brouer, Swift & Co.



INTERIOR DETAILS of new Convair C-131A Samaritan transport (military CV-240) are highlighted in this cutway model of craft's interior. Note the rearward-facing seating arrangement and provision for litters against the opposite wall. A large door on the left side of the fuselage facilitates litter loading, and there is a collapsible stairway on the right side for ambulatory passengers. Deliveries will begin in 1954.

Bell Aircraft Corp. says 6,631 test flights were made by its Helicopter Division last year without damage to aircraft or injury to personnel.

Bendix Aviation will handle sales and field service of distance measuring equipment (DME) developed and manufactured by Hazeltine Electronics Corp., Little Neck, N. Y.

Ryan Aeronautical Co., San Diego, reports a new two-stage parachute recovery system has been used successfully in landing jet-propelled Ryan Q-2 pilotless target planes during tests at Holloman Air Development Center, Alamogordo, N. M.

Atomic Energy Commission has postponed to Feb. 17 opening of bids on construction of ground testing facilities for prototype aircraft propulsion reactor at the National Reactor Testing Station, Idaho Falls, Idaho.

Trans World Airlines began through service this month to the island dominion of Ceylon on through flights via Great Britain, Europe, the Middle East and Bombay.

Aircraft Consulting Service, Washington, D. C., will go out of business effective Feb. 15, director H. E. Weihmiller has announced.

Financial

Continental Motors Corp., Detroit, reports record sales of $264,219,009 during fiscal 1952, the corporation's 50th year of operation. Net earnings totaled $6,126,021 after taxes, boosting Continental's net working capital to $29,382,330.

International Air Transport Assn. interline transactions of $17,234,000 in November were 16% higher than 1951. Total 11-month volume last year was $200,725,000, a 31% increase over the same period in the preceding year.

Convair reports a net income of $10,426,476 for fiscal 1952 after taxes, compared with $7,750,524 in 1951. Net sales last year totaled $390,997,843, topping the 1951 total of $322 million.

Flying Tiger Line's airfreight traffic in 1952 produced revenues estimated at $7 million, compared with $4,570,000 in the preceding year.

Bendix Aviation Corp. reports postwar peak sales of $507.7 million in fiscal 1952, producing a reported net income of $15,295,159. This compares with sales of $340.5 million and net income of $11,818 for 1951.

International

British transport plane with 39 persons aboard crashed last week in the North Atlantic, 359 mi. east-southeast of Gander, Newfoundland. The plane was a four-engine York, operated by Skyways, Ltd., London.

British Commonwealth Pacific Airlines has purchased three de Havilland Comet 2 jet airliners for trans-Pacific service between Australia, New Zealand and North America.

AVIATION CALENDAR

Feb. 10—Second seminar on industrial lubrication engineering, American Society of Lubrication Engineers, Bellevue-Stratford Hotel, Philadelphia.
Feb. 12-13—National Aviation Education Council annual meeting, Atlantic City, N. J.
Feb. 18—New York Section of the Instrument Society of America, Hotel Statler, New York, N. Y.
Feb. 18-19—Eighth Annual Conference of the Society of Plastics Industry, Reinforced Plastics Division, Shoreham Hotel, Washington, D. C.
Feb. 22-24—Texas' Second Agricultural Aviation Conference, Texas A & M College, College Station, Tex.
Feb. 28-Mar. 1—Seventh annual Pacific Coast Mid-Winter Soaring Meet, Torrey Pines Glider Port, San Diego, Calif.
Mar. 10-11—Eleventh Annual Conference, Society of the Plastics Industry Canada, Inc., General Brock Hotel, Niagara Falls, Canada.
Mar. 17-20—21st Annual Meeting American Society of Tool Engineers, Hotel Statler, Detroit.
Mar. 23-25—Third Midwestern Conference on Fluid Mechanics, University of Minnesota, Minneapolis.
Mar. 23-26—Institute of Radio Engineers National Convention, Waldorf-Astoria and Grand Central Palace, New York, N. Y.
Mar. 23-27—Eighth Western Metal Exposition and Congress, Pan-Pacific Auditorium, Los Angeles.
Mar. 23-28—Congress of Civil Aviation Conference, a joint meeting of trade organizations; theme: 50 years of aviation progress. American Association of Airport Executives is holding annual meeting simultaneously, Kansas City, Mo. Contact convention manager, Ross C. Roach, P. O. Box 315, Kansas City 41, Mo.
Mar. 25-27—National Production Forum of the SAE, Hotel Statler, Cleveland, O.
Mar. 31-Apr. 2—First International Magnesium Exposition, National Guard Armory, Washington, D. C.
Apr. 4-12—Second Annual International Motor Sports Show, Grand Central Palace, New York, N. Y.
Apr. 20-23—Aeronautic Production Forum, National Aeronautic Meeting and Aircraft Engineering display (SAE), Hotel Governor Clinton and Hotel Statler, New York, N. Y.
Apr. 20-May 2—Annual Conference of Technical Committee, International Air Transport Assn., Caribe Hilton Hotel, San Juan, Puerto Rico. Helicopter Symposium will be a principal feature.
Apr. 29-May 1—1953 Electronics Components Symposium (AIEE-IRE), Shakespeare Club, Pasadena, Calif.

PICTURE CREDITS

7—Convair; 13—(top) Douglas Aircraft; 14—McGraw-Hill World News; 15—CAA; 17—Kaiser-Frazer; 18—Bell Aircraft; 21—Wide World; 24—American Airlines; 69—Thompson Starrett Co.; 75—CAB; 76—Lockheed.

PRODUCTION F2H-3—Initial photos of production McDonnell F2H-3 Banshee in new "silver" finish (left and below) show the craft's numerous external changes over earlier models, notably the new nose and tail. The planes are coming off the line in conventional dark blue Navy warpaint also; this craft is one of a group that will test durability of the light anodized finish aboard carriers. The new tail has horizontal surfaces set considerably lower and to the rear of position occupied on earlier models and they have noticeable dihedral. The F2H-3 is powered by two Westinghouse J34 axial-flow turbojets, one in each wingroot.

New Planes In the Air

UNDER THE BANSHEE—A striking view (right), of the F2H-3 detailing its ordnance fittings. Note the large nose radome. Among the F2H-3's new features are improved electronics equipment (compared with previous Banshees), more powerful armament and increased internal fuel capacity. The fuselage bulges around the cockpit just behind the gun ports.

1953 BONANZA DISPLAYED—Here is the latest Beech D35 Bonanza four-place business plane, 25 of which were scheduled to leave Wichita, Kans., Jan. 31. Company has firm orders for approximately 60 more D35s, which list at $18,990 (FAF). Plane has 2,725-lb. gross weight compared with last year's 2,700 lb., upping useful loads 22 lb. to 1,075 lb. Some 3,400 Bonanzas have been built.

WHO'S WHERE

In the Front Office

E. Allan Williford has been elected president of Link Aviation, Inc., Binghamton, N. Y. He succeeds **Edwin A. Link,** company founder who will continue as chairman of the board and director of research.

J. E. Ashman has been named president and a director of Air Associates, Inc., Teterboro, N. J. Ashman formerly was executive vice president of Rockwell Manufacturing Co.

Julian K. Sprague has been elected president of Sprague Electric Co., North Adams, Mass., succeeding his brother, **Robert C. Sprague,** slated to be new Air Force Undersecretary.

G. Robert Henry has been appointed executive vice president of Bonanza Air Lines.

D. Morris Pratt has been elected a vice president of Marbon Corp., a subsidiary of Borg-Warner Corp. **Ray P. Johnson,** a director of Borg-Warner and vice president of Borg-Warner International, has been appointed director sales research. The corporation also named **Alonzo B. Knight** as administrative assistant to the president.

Changes

Sidney W. Souers has been elected to the board of directors of McDonnell Aircraft Corp., St. Louis. A former director of the U. S. Central Intelligence Agency, Souers served until last month as a special consultant on military and foreign affairs to former President Truman and was executive secretary of the National Security Council from 1947-50.

William N. Porter, president of Chemical Construction Corp., has been elected a director of Ultrasonic Corp., Cambridge, Mass., electronics manufacturer.

George P. MacNichol III has been named operating supervisor of Electrapane (new aircraft glass) production at Libbey-Owens-Ford Glass Co., Toledo.

Matthew T. Lebenbaum is supervisor of a newly formed applied electronics section of Airborne Instruments Laboratory's Research and Engineering Division, Mineola, N. Y.

Leon Shloss has been named assistant director of public relations for Republic Aviation Corp., succeeding **Louis W. Davis,** who has resigned, according to a company announcement.

Ed A. Leden is the new administrative engineer for Aeronca Manufacturing Corp., Middletown, Ohio.

Franklin G. Pater has been appointed staff representative for the Aeronautical Industries section of the National Safety Council, succeeding **Howard H. Warzyn** of NSC's Air Transport section.

James Hodge, British jet engine expert, is conducting special graduate courses in gas turbines at Columbia University's School of Engineering, New York. He is on leave from Power Jet, Ltd.

Edward H. Hughes has been named director of industrial relations at G. M. Giannini & Co., Inc., Pasadena, Calif., manufacturers

(*Continued on page 88*)

INDUSTRY OBSERVER

▶First tests of anti-aircraft guided missiles against actual aircraft have been made by Army Ordnance at the White Sands, N. M., proving ground. Douglas-built Nike missiles have been fired at remotely controlled B-17 bombers, with better than 50% accuracy record reported in hitting the aircraft. One hit from a Nike is enough to knock a B-17 out of the sky. Army also is training troops in operational field use of both the Douglas-built Nike and the Corporal E missiles.

▶North American Aviation's first F-86H fighter bomber version of the famed Sabre series is now at Edwards AFB and should be making initial flight tests before the end of February. The F-86H is powered by the General Electric J73 axial turbojet.

▶Lord Hives, managing director of Rolls-Royce Ltd., and his chief engineer have been touring U. S. airframe plants in an effort to sell American manufacturers the Conway bypass engine for use in commercial jet transports. The Conway is expected to be used in the de Havilland Series 4 Comet. Rolls expects to be producing the Conway by 1958 and is offering U. S. manufacturers a version producing 11,500 lb. static thrust with a specific fuel consumption of .7 lb. of fuel per pound of thrust per hour.

▶Martin P5M1 Marlin has completed in 639 hr. Navy accelerated service that normally requires 1,000 hr. of flying time. The anti-submarine patrol bomber powered by two Wright R3350 Turbo-Compound engines remained air or waterborne for periods up to four days.

▶Lockheed, Douglas and Boeing are putting strong pressure on engine manufacturers for development of reverse thrust jet braking devices for use in commercial jet transports. Fred B. Lee, deputy CAA administrator, has warned that CAA considers a "thoroughly reliable means of decelerating a jet transport regardless of runway surface condition" as an operational must.

▶One of the most pressing military problems is to find a means of enabling an airplane to spot moving ground targets, such as tanks, at night. Moving target indication (MTI) which removes stationary objects from a ground surveillance radar scope won't do the job in an airborne radar because both the ground and the ground target are moving at high speeds relative to the airplane. Navy spokesman says the government would be willing to spend millions of dollars to develop a promising solution.

▶Although Bell's new anti-submarine XHSL-1 helicopter has too small a fuselage in its Navy shipboard version for use as a transport, other military services have been considering possible procurement of a stretched-out version of the helicopter, using a fuselage insert at the center of gravity like the Super Constellation and DC-6B. With its R2800 powerplant, the new Bell has a good weight-lifting potential, but needs a larger fuselage to carry cargo other than concentrated anti-submarine equipment.

▶Hiller Helicopters has moved far beyond the little Hiller Hornet in jet-tipped rotor planning and has a portfolio full of designs for large jet-tipped rotor flying cranes and transports. Some of these Hiller proposals utilize interesting new concepts in fuselage design.

▶Army Transportation Corps is asking U. S. helicopter manufacturers to consider radically different concepts in copter design that are not necessarily bound by the traditional aerodynamic streamlining associated with airplanes. For shorthaul and relatively low speeds, Army wants more attention to cargo loads and handling in fuselage design. Basically the Army wants box-like fuselages and ground level loading arrangements, the same things it has been pleading for several years to be incorporated in fixed-wing cargo aircraft.

Washington Roundup

Eisenhower on Defense

President Eisenhower, in his State of the Union message to Congress, made these observations indicating the course the new Administration will follow on defense matters:

• **Reorganize Defense Department.** "Because of the complex technical nature of our military organization and because of the security reasons involved, the Secretary of Defense must take the initiative and assume the responsibility for developing plans to give our nation maximum safety at minimum cost. Accordingly, the new Secretary of Defense and his civilian and military associates will, in the future, recommend such changes in present laws affecting our defense activities as may be necessary to clarify responsibilities and improve the total effectiveness of our defense effort."

• **Augment the role of the National Security Council,** composed of the President, Vice President, Secretaries of State and Defense, and the chairman of the National Security Resources Board, plus other government officials as may be designated by the President.

"The statutory function of the National Security Council is to assist the President in the formulation and coordination of significant domestic, foreign and military policies required for the security of the nation. In these days of tension, it is essential that this central body have the vitality to perform effectively its statutory role. I propose to see that it does so."

• **Stress economy.** "Our problem is to achieve adequate military strength within the limits of endurable strain upon our economy. To amass military power without regard to our economic capacity would be to defend ourselves against one kind of disaster by inviting another."

• **Push unification.** "Both military and economic objectives demand a single national military policy, proper coordination of our armed services, and effective consolidation of certain logistics activities.

"We must eliminate waste and duplication of effort in the armed services.

"We must realize clearly that size alone is not sufficient. The biggest force is not necessarily the best—and we want the best.

"We must not let traditions or habits of the past stand in the way of developing an efficient military force. All members of our forces must be ever mindful that they serve under a single flag and for a single cause."

Aircraft Money Picture

Spending by USAF and Navy for aircraft and related procurement continues to lag. Their big backlog of unexpended funds is only being chipped away.

However, contract letting by USAF has been at a high rate. There will be a letup, since USAF already has obligated most of its available funds.

Navy contract letting, which got off to a slow start in July, is accelerating.

Some details:

• USAF and Navy spent less than \$3.7 billion on aircraft and related procurement during the first six months of fiscal 1953, July through December. This is less than a third of the \$11.5-billion expenditure planned under the program submitted to Congress a year ago. Unspent funds now on hand: USAF, \$24.1 billion; Navy \$8.9 billion.

• USAF obligated \$7.5 billion July through December, leaving only \$4.5 billion for obligation over the next six months of the year.

• Navy obligated \$1.7 billion, leaving \$1.8 billion for obligation during the last half of the year.

Defense Money Men

House Appropriations Subcommittee on Defense, headed by Rep. Richard Wigglesworth, has completed organization, is ready to move forward on the 1954 fiscal year money bill.

Probably the most significant factor in its composition: Of the eight incumbents on the nine-member group, five are opposed to clamping a ceiling on defense spending. It is questionable, however, that they will prevail over Wigglesworth and Chairman John Taber of the full Appropriations Committee, who favor the ceiling. They didn't last year.

The subcommittee is broken into a trio of three-member working groups.

• **Air Force group** is headed by Rep. Errett Scrivner, a World War I Army artilleryman, with an inclination toward the Army position. He is skeptical of USAF's program for fast jets for ground support and thinks consideration ought to be given to less speedy and less expensive aircraft. Scrivner also is critical of Marine encroachment into Army's ground fighting mission and opposed expansion of the Corps to three divisions and three air wings last year.

Other members of the group: Rep. Roman Hruska, a Republican newcomer from the Nebraska district including Strategic Air Command Headquarters, and Rep. George Mahon, a moderate supporter of land-based aviation.

• **Navy group** includes two firm Navy supporters: Wigglesworth and Rep. Harry Sheppard. Wigglesworth raises the point that with developments in refueling, Navy attack bombers might be able to take over missions now assigned to more expensive USAF bombers of longer range. Sheppard has been a leading proponent in Congress of Navy's carrier program. Third member of the group, Rep. Harold Ostertag, a World War I Army officer, is a new member of the Appropriations Committee.

• **Army group** includes Rep. Gerald Ford, chairman; Rep. Edward Miller; Rep. Robert Sikes.

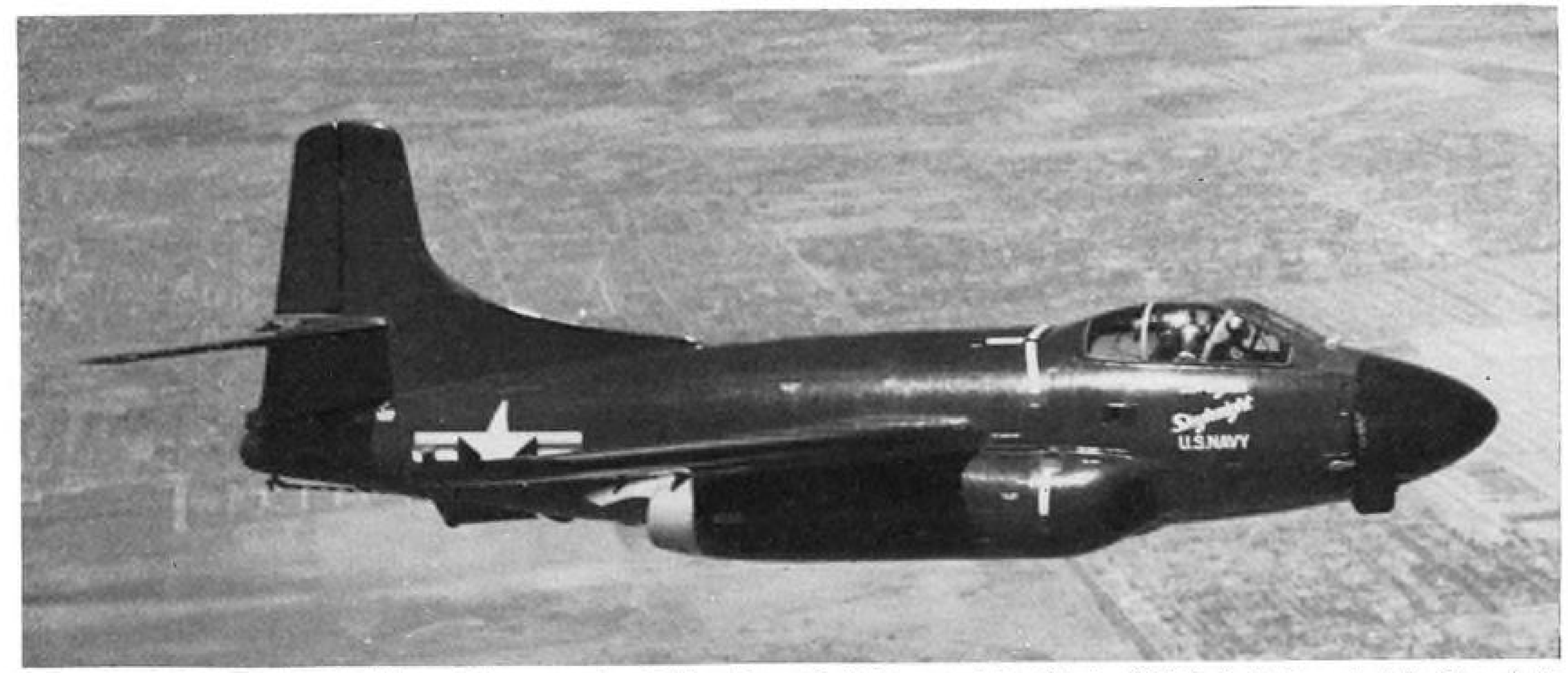
CAA, CAB Money Men

• **House Appropriations Subcommittee** that will review CAA and CAB money requests is headed by Rep. Cliff Cleavinger, with Rep. Frederic Coudert as ranking member. Strong for economy, this pair can be expected to aim for deep cuts. Top Democrat on the group is Rep. John Rooney, with a long record of off-and-on antagonism toward CAA and CAB.

• **Senate Appropriations Subcommittee** on CAA and CAB also is headed by an outstanding exponent for economy, Sen. Styles Bridges. Top Democrat is Sen. Pat McCarran, a veteran supporter of aviation on the hill. His antagonism toward CAA, over the past year, largely directed at administrator Charles Horne, may subside when appointment of a new administrator has been made.

—Katherine Johnsen

AVIATION WEEK VOL. 58, NO. 6 FEBRUARY 9, 1953



DOUGLAS F3D SKYKNIGHTS are flying cover for B-29 night raids in Korea to fight off intensified Red attacks against the Superforts.

F3Ds Outfly Red Night Fighters in Korea

- **Marine Skyknights down six Communist fighters.**
- **Douglas twin-jets defend Superforts in MiG Alley.**

By Robert Hotz

Marine pilots patrolling MiG Alley at night in Douglas F3D twin-jet Skyknights have shot down at least six Communist night fighters, including the Russian-built MiG-15.

The Marine victories are believed to be the first clash between jet fighters at night and were scored during a period of rapidly increasing Communist night attacks against USAF Boeing B-29 Superforts bombing targets south of the Yalu River. Five B-29s have been shot down by Red night fighters during the past few months.

First Marine kill was made by a night-fighter team consisting of Maj. William Stratton, pilot, and Master Sgt. Hans Hoagland, radar operator, early in November. Allied ground radar tracking an enemy target vectored Maj. Stratton's plane into range of the Skyknight's airborne radar, allowing Sgt. Hoagland to guide his pilot onto the tail of the enemy jet. Stratton was able to make visual contact on the glow of the enemy's tailpipe and fired his first burst of 20-mm. cannon shells into the Communist's wing.

TWIN-JET F3Ds have shot down six Red fighters in night battles over MiG Alley.

▶ **Score Hit**—The second burst hit the enemy's engine, causing an explosion and fire. Maj. Stratton reported flying through debris from the enemy fighter which burned and crashed. Stratton, a reservist, is now on inactive duty, working for the Hughes Aircraft Co. in Culver City, Calif.

A few nights later the team of Capt. Oliver Davis and Warrant Officer Dramus Fesler maneuvered by radar onto the tail of a MiG-15 and destroyed it with a burst of 20-mm. cannon fire into the tailpipe. The MiG was hit while in a tight turn, apparently trying to escape the Skyknight's cannon shells.

Another Marine Skyknight, piloted by Lieut. A. J. Corvey, shot down three piston-powered Communist fighters in a single night mission over MiG Alley. Lieut. Corvey's victims were believed to have been Russian Yak 9 fighters.

▶ **Other Red Victims**—Since then, the

OBSOLESCING B-29 BOMBERS taking off for bombing raids over Korea now are escorted by Marine F3Ds on night forays.

Skyknights have continued to operate successfully against the assortment of Communist fighters being thrown into the recently intensified night attacks against Allied bombers. At last report, at least two more Russian-type jets had been destroyed, although details are lacking. The Skyknights also have been used as fighter escort for B-29s on night missions over North Korea. B-29s have shot down three Red fighters recently.

The Marine pilots are from the Flying Nightmares, a night-fighter squadron originally trained in Skyknights at El Toro. They have been in Korea since last summer. Other types of night fighters in operational use in Korea include the Chance Vought F4U-5N Corsair, the Grumman F7F Tigercat and the Lockheed F-94 Starfire, but there have been no reports of their successfully engaging enemy fighters at night. The piston-powered Corsairs and Tigercats have been used primarily for attacking enemy truck convoys and supply trains at night.

► **Variety of Red Fighters**—Allied bomber pilots have been encountering a variety of Communist fighter types at night for more than a year, including both piston- and jet-powered types, but until recently their attacks were uncoordinated and relatively ineffective. Lately, however, the Communist night fighters have been working closely with ground radar and searchlights to spot and attack B-29 and B-26 bombers operating against the vital supply lines stretching south into Korea from the Yalu River.

USAF reported that one B-29 shot down the night of Jan. 13 was attacked by 12 enemy jet fighters that obviously were being vectored onto their target by ground radar. There is no evidence to date that the Communists are using any night fighters equipped with airborne radar, although there is a radar-equipped model of the MiG-15 in service with the Russian air force. Nor is there any evidence of the use of air-to-air rockets over Korea, although the Communists have been using ground-to-air rockets against night bombers for some time.

Damage to returning B-29s indicates the standard range of Communist fighter armament, from machine guns to 37-mm. cannon, is being used by enemy night fighters.

► **Attacks Increase**—The increasing scale of night attacks against the B-29s raises the question of how much longer Far Eastern Air Forces can continue to use this obsolescent equipment against the growing strength and expanding defensive capability of the Communist air forces based in Manchuria.

Aggressive attacks by substantial quantities of Russian-built MiG-15 jet fighters drove the B-29s out of the daylight skies over North Korea late in 1951 and although military losses have not yet become prohibitive, military observers wonder if USAF will soon be forced to use more modern bombers to keep up the weight of its 'round-the-clock attack on North Korean targets. USAF recently has noted the appearance of more than a hundred Russian-built twin-jet IL-28-type bombers in Manchuria, with several hundred more in adjoining maritime provinces of Siberia.

The Skyknight was built by the El Segundo Division of Douglas Aircraft Co. It is powered by two Westinghouse J34 axial turbojets of 3,600 lb. thrust each and carries a Westinghouse APG-35 airborne radar. Armament consists of four 20-mm. cannon. Pilot and radar operator sit side-by-side in the cockpit. Plans to develop a sweptwing version of the Skyknight powered by later model Westinghouse engines were abandoned by the Navy about a year ago. Navy officers have publicly testified that the Skyknight successfully intercepted other jet night fighters in darkness above 40,000 ft. in operational tests over Patuxent River, Md., three years ago.

Korea Air Losses

A total of 1,172 Air Force, Navy and Marine aircraft have been lost to enemy action in the 30 months of the Korean war, according to official Defense Department statistics. Of this total, USAF losses were 701 planes, while the Navy and Marines lost 471 planes in action.

The Navy has also announced its operational losses incurred in Korea and surrounding waters as an additional 562 planes. USAF does not announce its operational losses. Operational losses include all aircraft lost from all other causes except enemy action over enemy territory. They are generally equal to or slightly higher than combat losses.

Unofficial estimates place the total Korean combat and operational losses of all services at about 2,400 aircraft.

Comet Problem

- **Complications develop as U. S. approval is sought.**
- **CAA may insist on own Series 3 test program.**

BRITISH-U. S. representatives at Washington meeting on certification of jet transports (seated left to right): H. C. Black, R. H. Warde, J. G. M. Pardoe and R. E. Hardingham of British Air Registration Board; Charles F. Horne, CAA administrator; John Chamberlain, director, CAB Bureau of Safety Regulation; George Haldeman, CAA jet team chairman; (standing left to right): Henry T. Snowdown, State Department; F. W. Austin, British ARB; F. B. Lee, CAA deputy administrator; W. E. Koneczny, chief, CAB Airworthiness Division; E. S. Hensley, director, CAA Office of Aviation Safety, and Omer Welling, acting chief, CAA Aircraft Engineering Division.

Serious complications were developing in Washington last week over the British problem of getting the de Havilland Comet 3 jet transport certificated by the U.S. so Pan American World Airways can operate the Comets it has ordered (AVIATION WEEK Oct. 27, p. 13).

After a week's preliminary skirmishing between U. S. Civil Aeronautics Administration and the British Air Registration Board representatives in a Washington conference, the situation appeared to resolve itself into a virtual stalemate on this point:

Will the U. S. accept the British certification of Comet 3 tests as meeting American transport requirements, or will CAA decide to make independent flight tests of the Comet and render its own final verdict?

Some unofficial U. S. observers forecast an unfavorable outcome of the Comet case would have a lasting effect that may set back progress in the International Civil Aviation Organization as much as five years.

► **British Position**—The four-man British delegation, which is headed by Robert Hardingham, secretary of the British ARB, came to Washington with a request for a CAA statement on U. S. requirements for certification of the Comet 3. Basically, the British said:

Here are the requirements for British certification of the Comet 3; now, you tell us in detail what else CAA wants the Comet to do to get U. S. certification and we'll get this done within reason, and certify that it has been done.

CAA administrator Charles F. Horne told AVIATION WEEK that CAA has not yet determined whether or not it would insist on its own flight tests of the Comet 3, in addition to British tests to U. S. standards. He said that as far as he could tell no controversy existed between the two delegations, adding, "It could not exist until the British make a proposal and we reject it. This has not happened."

British objections to any CAA policy requiring U. S. flight tests of the Comet 3 in addition to British certification to U. S. standards, appear to be that it denies the competency of the ARB to make such tests and strikes a serious blow at the international air principle of reciprocal registration. There also is apprehension, informed sources tell AVIATION WEEK, that CAA flight tests, if made, may call for additional requirements for changes. Such changes, if not anticipated in the building of the airplane, could result in costly additional modifications.

► **Comet Changes**—There are several changes that CAA already has indicated it probably wants in the Comet 3 before certification:

- Double-glass enclosures of windows for additional safety.
- Rating engine power less than engines could deliver when new to allow for deterioration in service.
- British landing requirements provide for landing within 70% of runway length, while U. S. requirements provide for landing within 60%. This is expected to be adjusted to U. S. standards.

► **U. S. Jet Policy**—In addition to these, there is a long list of tentative U. S. policies on turbine-powered transports that is under continuing revision. The last statements of CAA policy on airworthiness requirements for certification of turbine-powered transports was issued a year ago, and a new revision is now in process.

Some aviation analysts point out that if CAA insists on its own testing program on the Comet 3, it may bounce back when U. S. jet transports come up for British certification. British acceptance of some current American piston-powered transports on the basis of U. S. certification, despite failure to meet entirely all British requirements, also is cited as a precedent for jet reciprocity.

► **Performance Requirements**—Behind the conflict over what flight test shall be accepted is a continuing international debate over standards for performance, which has kept an international performance committee in session at six-month intervals under ICAO leadership for several years.

U. S. standard of flight performance is based generally on an engineering formula relating stall speed of an airplane to its forward velocity. European performance standards are based generally on past experience of what have proved to be safe speeds in various flight conditions.

The 15-year-old American standard has produced safe airplanes in performance, and the CAA technical staff is not prepared to relinquish it without indications of an improved standard that will permit at least equivalent safety.

► **Jet Transport Problems**—Based on the unrevised 1952 jet transport policies, here are some problems CAA believes need investigation:

- Turbojet aircraft, as compared with propeller aircraft, will not have slipstream over the wing—a difference that will show up in takeoff requirements.
- Performance of turbine aircraft is more critically affected by temperature changes than propeller aircraft.
- Absence of reverse propeller thrust and propeller drag will mean greater reliance on brakes, auxiliary drag and reverse thrust turbines for jet aircraft.
- Longitudinal control at high jet speeds presents problems that need attention in whatever range and altitude the airplane is to be certificated.
- Differences in structural characteristics—such as thick skins, swept wings and structural deformations—mean new structural testing requirements.
- Design requirements must take into account new high and low temperatures encountered in jet operations.
- Hydraulic, pneumatic or electrical control systems, which are replacing mechanical systems, entail the problem of requiring standby alternate systems in the event of failure.

► **Conference Continues**—Washington forecasts are that the British-U. S. sessions will continue for another week.

Participating with Hardingham are

British specialists R. H. Warde, powerplants; H. C. Black, flight tests, and J. G. M. Pardoe, structures.

U. S. conferees are headed by George W. Haldeman, chairman of the recently named CAA Jet Transport Evaluation Committee. Other members of this committee and CAA technical representatives, called in on special subjects, attended the conference.

Ray Meloy, CAA flight test chief, heads the U. S. committee on performance requirements, which is going to Paris in May for another ICAO session on this problem. —A. McS.

Mooney Aircraft Moves to Texas

Mooney Aircraft Co. moved its entire factory last week from Wichita to Kerrville, Tex., in an effort to increase production of the single-place Model 18 and speed development of the new four-place Model 20.

Expansion of facilities and increased employment of skilled personnel, made possible by the move to Kerrville, will permit test flights of the Model 20 within 60 days, executive vice president Al Mooney says. The new single-engine plane is scheduled for marketing by mid-summer.

Charles G. Yankey, Mooney president, says the decision to move the aircraft plant was based on inadequate facilities and shortage of aircraft technicians and production workers at Wichita.

Employment will be tripled to 150 persons, Yankey says.

The company's field in Wichita was located adjacent to the Air Force B-47 flight training base, limiting expansion of aircraft factory and test programs.

Review of Aviation Policies Under Way

The congressional session moved forward last week with these developments affecting aviation:

• **Senate Interstate and Foreign Commerce Committee's** chairman Charles Tobey reported plans to give early consideration to airmail subsidy separation legislation and later look into British advances in jet air transportation. Sen. Edwin Johnson and Sen. John Kennedy have drafted subsidy separation bills.

• **House Interstate and Foreign Commerce Committee** is making general review of all agencies under its jurisdiction. Chairman Charles Wolverton plans to call Civil Aeronautics Board and Civil Aeronautics Administration officials to appear before the committee for progress reports and education of new members.

• **House Armed Services Committee**

VICKERS JET TRANSPORT (in model), may carry 150 passengers, have 2,000-mi. range.

Britain Announces New Jet Liner

By Nat McKitterick
(McGraw-Hill World News)

London—Great Britain's fourth turbine-type transport was unveiled last week with announcement of the Vickers 1000, prototype of which has been ordered for the Royal Air Force Transport Command.

At the same time, Vickers announced a civil version of the transport, the VC-7, now in the design stage. Both projects were designed by George Edwards, Vickers' chief designer and creator of the Valiant and Viscount.

► **BEA Interest**—The Vickers 1000 will be the first project to utilize Rolls-Royce bypass jets. With four Conways, claiming some 30% saving on fuel costs (consumption figures for engine already are down around .5 lb./lb./hr.), Vickers claims the VC-7 will have equal use on short continental hops as on very long trans-Atlantic hops. British European Airways is reported highly interested in the development.

No performance figures have been released, but last November Air Minister Lord de L'Isle and Dudley foresaw a jet troop carrier this way:

"We can now conceive an aircraft leaving England at noon, climbing to 45,000 or 50,000 feet, and delivering its load of 150 passengers in Egypt by tea time."

That spells a speed in excess of 500 mph. and a range in excess of 2,000 miles.

► **Specifications**—The Vickers project is Britain's biggest jet liner venture to date. Fuselage length will be 146 ft., as against 110 ft. for the Comet 3. Wingspan is 140 ft., or about 20 ft. wider than the Comet 3 and the Valiant bomber. Height is set at 38 ft., 6 in.

Wingform is superficially like the compound sweep of the Valiant, except that wingtips are tapered instead of square. All external resemblance to the Valiant ends there.

Tailplane is swept and flush with low main wing. Present conventional British characteristics of low wing-loading, with engines buried in wingroots, are followed in the new Vickers project.

Given development and testing time, the earliest Transport Command can expect its first Vickers 1000 will be 1957. No production orders for either type have been placed.

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has voted to continue an investigating subcommittee to watch the defense program.

• **Senate's Preparedness Subcommittee**, headed last year by Sen. Lyndon Johnson, probably will be continued with a Republican leader.

• **Post Office and Civil Service Committee** of the Senate plans a thorough investigation of the postal service, including airmail postal rates, revenues and expenditures for airmail service, and subsidies to airlines. A resolution authorizing the investigation has been introduced by Chairman Frank Carlson and Sen. Olin Johnston, ranking Democrat on the committee.

Bills which have been introduced include:

• **Prototype development:** A measure

proposed by Rep. Carl Hinshaw would authorize government loans to aircraft manufacturers up to $15 million to finance 75% of the developmental cost of jet transport aircraft.

• **Aviation training:** Another Hinshaw measure would authorize CAA to finance 75% of the cost of training aircraft and engine mechanics, instrument and electronics technicians, pilots and other flight and ground personnel.

• **Interservice transfer** of military officers, recommended by Defense Department, is provided for in a Hinshaw bill. Approval of the officer and the Secretaries of the two departments concerned would be required.

• **Independent air safety board** of five members is proposed in legislation introduced by Sen. Pat McCarran.

• **Customs expense:** Air carriers would be exempted from the requirement to pay overtime compensation of customs employes by another bill offered by Hinshaw.

Engine Trouble Found

Oil dilution as an airline maintenance practice for cold weather starting was blamed for R4360 Wasp Major engine trouble in BOAC's Boeing Stratocruisers, as the first six of the 10-plane fleet were returned to service last week. Of 15 engines torn down for examination, 11 showed evidences of over-dilution of engine oil with aviation gasoline, CAA sources report.

Other difficulties disclosed in the teardown of Pratt & Whitney R4360s included piston pin plug failures, two knuckle pin failures, one cam lobe and one master rod cap.

BOAC Stratocruisers were grounded last month after reports of piston "seizing" (Aviation Week Feb. 2 p. 17).

Plane Fastener Fight Nears End

Military may accept Camloc quick-release type in settlement of 14-year standardization controversy.

By Alexander McSurely

A million-dollar technical standardization controversy over a 30-cent quick-release fastener for aircraft assembly appears to be on its way to settlement following an industry-armed forces conference at Wright Air Development Center, Dayton, Ohio.

It is too early to predict how the controversy will end, but U.S. aircraft manufacturers who have been pushing for the settlement say thorough airing of the problem at the conference is a healthy preliminary sign.

The controversy involves two types of fasteners. One was made to a military specification ordered by the Air Force and Navy, designated MIL F-5591. The other, a fastener built by the Camloc Fastener Corp., recently was designated NAS 499 by the National Aircraft Standards Committee of Aircraft Industries Assn.

► **Possible Outcome**—Final outcome may be admission of both specifications as standard, eliminating expensive and time-wasting special deviation orders. A second alternative to drop the military specification and standardize only NAS 499 is what many airframe manufacturers would like to have accomplished ultimately.

Charges and countercharges in the 14-year-old controversy boil down to this:

Camloc refused to change its fastener design when the military authorities set up the MIL F-5991 specification, while other companies went along with service procuring agencies to build the fastener they specified.

Things would have been different, if the U.S. aircraft manufacturers had been satisfied with the military specification fastener. Instead, they prefer the Camloc fastener. It stays fastened better, they say.

► **Manufacturer and Airline Preference**—Last month the NAS committee reported to the Air Force and Navy that 12 of the principal manufacturing plants producing military aircraft are using the NAS 499 (Camloc-type) fastener in their work.

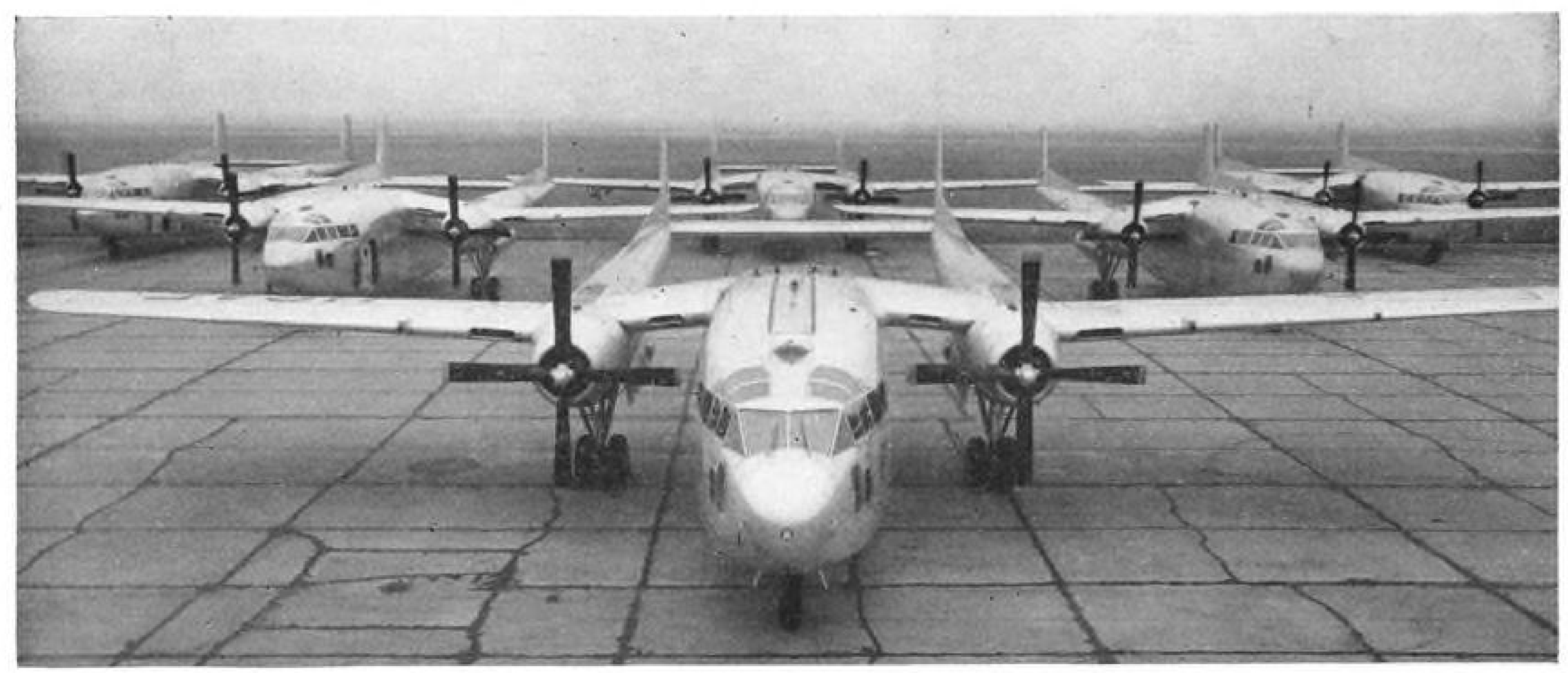
Representatives of nine of the companies attended the Dayton session to decide which fastener to use. At the meetings were representatives of Boeing-Wichita, Boeing-Seattle, Chance Vought, Convair-San Diego, Douglas-El Segundo, Hughes Aircraft, Piasecki and Republic.

Other plants using the fastener include Douglas-Santa Monica, Convair-Ft. Worth, all Lockheed plants, Ryan, and Sikorsky. Hughes, Kaman, and Northrop use the Camloc-type fasteners on experimental contracts.

It also was reported that the NAS fastener is being used by a majority of the principal airlines.

Presiding at the Wright Air Development Center meeting was Lt. Col. E. M. Huntington of the Munitions Board Aircraft Standards Group. Seven other officers and 13 civilian engineers representing USAF and Navy Bureau of Aeronautics attended.

Presenting aspects of the problem



THE LARGEST SINGLE DELIVERY of Kaiser-Frazer-built C-119F Packets lined up at Willow Run, Mich., awaiting weather clearance for flight to Mitchel AFB, L. I., N. Y. These planes are assigned to the 514th Troop Carrier Wing.

were representatives of the following fastener companies: Amloc, Dzus, Lion, Monadnock, Packmayer, Scovill, Shakesproof, and United Carr.

►**Camloc Advantages**—A list of technical advantages of the NAS 499 type fastener over the MIL F-5591 presented by the Aircraft Standards Committee was considered at the meeting.

Among other points, it was reported that plus-minus range of torque and tensile requirements for the NAS 499 fastener permits standardization on one-third the number of studs that would be required if the MIL F-5591 fastener were used.

Strength requirements also permit use of one NAS fastener size, where two sizes of the military fastener would be required.

These combined factors make it possible to use a stock inventory of approximately one-sixth the number of stud lengths with the NAS 499 fastener.

►**Million-Dollar Costs**—Estimates of million-dollar costs involved in the controversy refer to the number of engineering changes that have been required in various airplanes, deviations required to permit use of the NAS 499 fastener as replacement for the MIL F-5991 fastener, engineering manhours consumed on conferences, and number of parts numbers that have been set up and changed.

Aircraft manufacturers say a fastener that will "button up" engine cowls, plates, doors and accessory equipment of today's high-speed aircraft is up against a job far tougher than the one contemplated when the original military specification was set up.

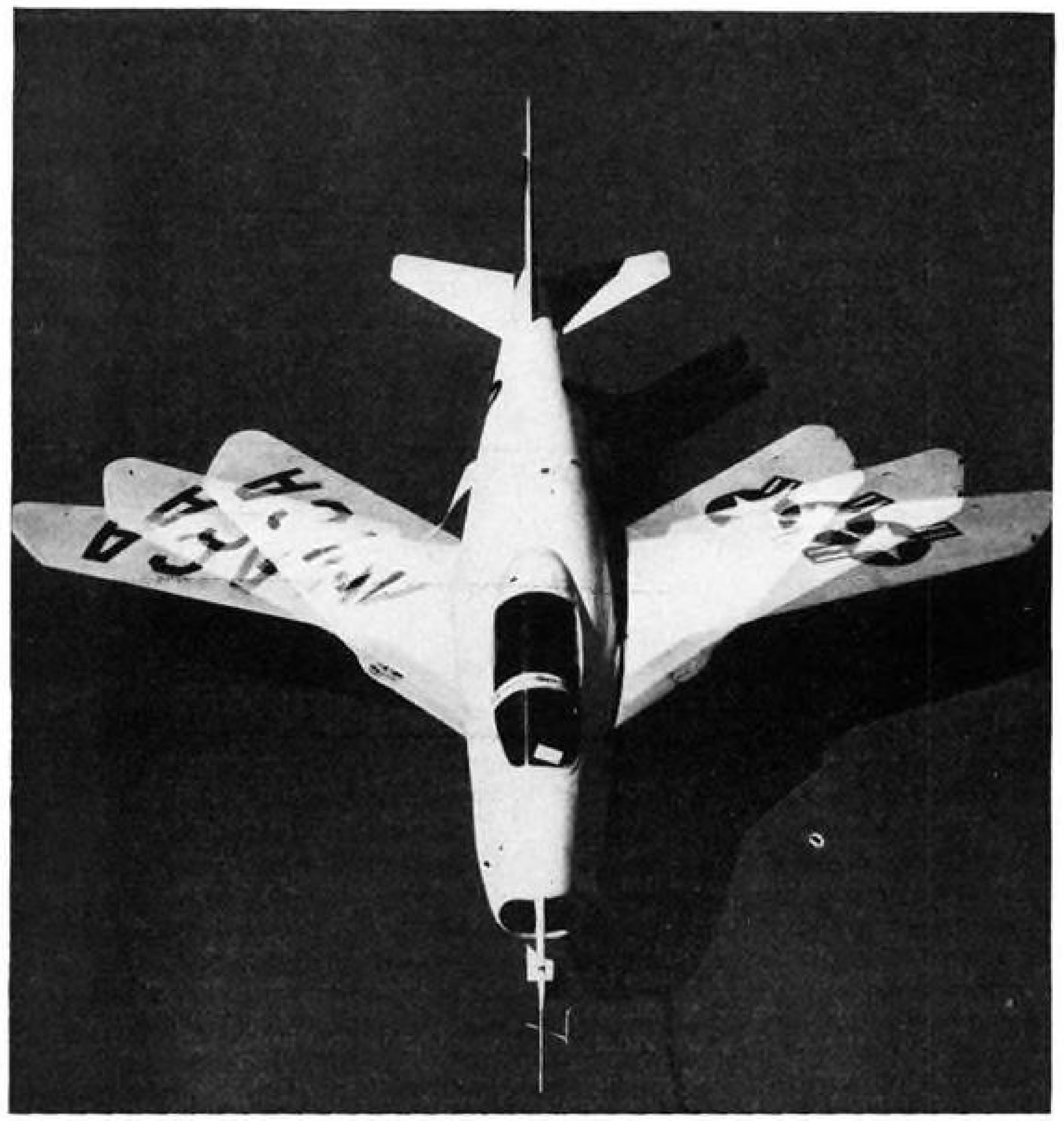
►**C-124 Story**—One illustration of the fastener controversy centers on the huge Douglas C-124 four-engine transport. At the time the USAF's 6-8-9 inspection board arrived to pass judgment on the Globemaster, its engine cowlings were locked with the military specification fastener. When Douglas opened the cowlings, the engineers couldn't get them to fasten shut again.

The board was forced to wait until an aircraft laboratory specialist was called from Dayton to issue a deviation order necessary for substitution of the Camloc fastener.

►**Firm Military Stand**—What is behind the military refusal to accept the apparent industry preference on the merits of the two specifications?

Some industry observers say it is a military stubbornness against retreating after a position has been taken. But another factor is the positive attitude of fastener companies who complied with the military specification. They have a united front against the Camloc fastener to support continued use of present military specifications, some aircraft manufacturers say.

Although the controversy seems out of proportion to the value of an individual item, the widespread use of fasteners in today's aircraft and missile programs makes the problem important. Several hundred fasteners may be used on a small aircraft and as many as 3,000 on one big bomber. Multiply the number of fasteners per airplane by the thousands of aircraft in USAF and Navy programs, the thousands of missiles just entering production, the replacement and spares programs for all of these, and the fastener dollar volume mounts rapidly to big business.



X-5'S CHANGING WING SWEEP

How the Bell X-5's wings can be swept while in flight is graphically shown in this multiple-exposure ground shot. As the wingtips move back, the wingroot portions move forward. More than 60 flights have been made with the X-5 research plane by Bell, USAF and NACA pilots at Edwards AFB, Calif. The craft is making possible accumulation of data on high subsonic speed flight as well as variable sweepback.

BuAer Speeds Up Contracting System

Navy's Bureau of Aeronautics signed the first of a series of basic agreements with airframe manufacturers last week by which it expects to save time and trouble in setting up future contracts with its major contractors.

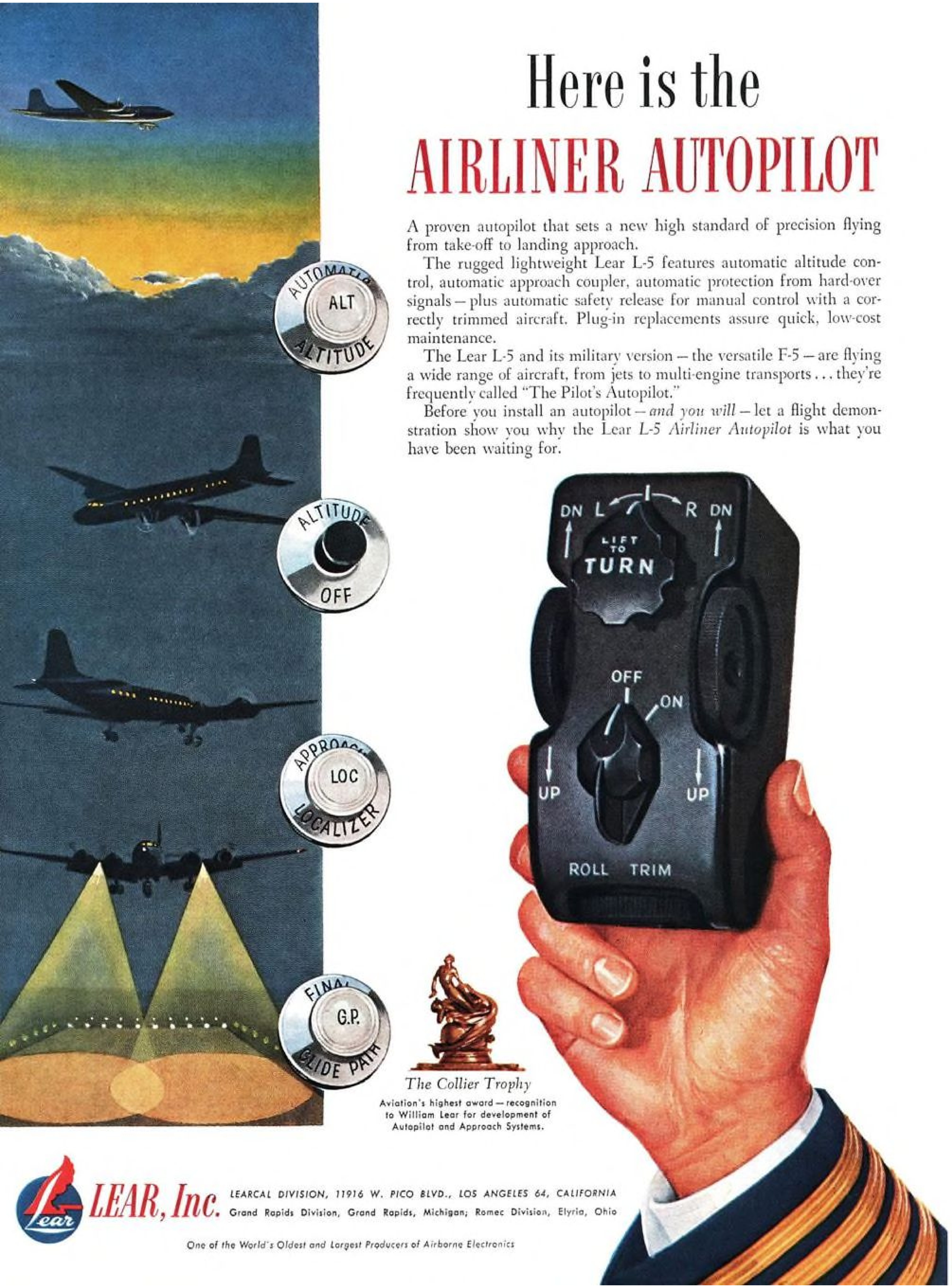
The new agreement was signed with Lockheed Aircraft Corp. by Rear Adm. T. S. Combs, Chief of the Bureau of Aeronautics, and Courtlandt Gross, executive vice president of Lockheed. Other agreements will follow, Navy reveals, with about 15 contractors. (USAF has been using this procedure several years.)

The Lockheed agreement, signed for one year, will apply to all contracts drawn up by the Navy through 1953. So far, four production contracts are planned for negotiation with Lockheed this year.

A basic agreement sets up the general conditions under which all future contracts will be written. The language of clauses is definitely established to save argument over the general provisions of future contracts. Thus contracts can be negotiated more quickly.

In writing a contract, details of quantities, prices, specifications, delivery and other specific conditions will be set forth in full. General provisions in the basic agreement merely will be referred to in the contract.

"Although we have contacted the airframe manufacturers first," Adm. Combs said, "we hope to work out similar agreements with component manufacturers."



Big Bell Stock Sale Reported by SEC

Purchase of 427,876 shares of Bell Aircraft Corp. common stock by Equity Corp. from First York Corp. in merger is reported in the latest Securities and Exchange Report.

Other aviation stock transactions reported:

Air Associates, Inc.: Earl M. Newlin, director, sale of 13,520 common shares, total holding, and sale of 1,598 common shares in trusts, leaving a total holding of 1,396 shares; Earl M. Newlin, sale of 300 preferred shares in trusts, total holding.

Airfleets, Inc.: George Lusk, officer, purchase of 100 common shares, making a total holding of 607 shares.

All-American Airways: Robert M. Love, officer and director, sale of 3,345 common shares, leaving a total holding of 48,000 shares.

Allis-Chalmers Mfg. Co.: J. L. Singleton, officer and director, purchase of 200 common shares, making a total holding of 260 shares.

Capital Airlines, Inc.: J. H. Carmichael, officer, sale of 137 common shares, leaving a total holding of 3,000 shares.

Colonial Airlines, Inc.: Francis Hartley, Jr., director, sale of 2,000 common shares, leaving a total holding of 3,804 shares.

Consolidated Vultee Aircraft: Floyd B. Odlum, director, purchase of 5,000 common shares, total holding.

Continental Air Lines: Lawrence C. Ames, director, purchase of 100 common shares, making a total holding of 300 shares.

Fairchild Engine and Airplane Corp.: Paul J. Frizzell, officer, purchase of 100 common shares, total holding.

Flying Tiger Line, Inc.: Wm. E. Bartling, officer, sale of 200 preferred shares, total holding.

Glenn L. Martin Co.: Wm. Barclay Harding, director, purchase of 200 common shares, total holding.

Minneapolis-Honeywell Regulator Co.: C. B. Sweatt, officer and director, sale of 2,000 common shares, leaving a total holding of 44,505 shares; sale of 2,530 common shares in trusts, leaving a total holding of 7,345 shares; Harold W. Sweatt, officer and director, sale of 2,530 common shares in trusts, leaving a total holding of 2,000 shares; A. M. Wilson, officer, sale of 200 common shares in trusts, total holding; P. B. Wishart, officer, purchase of 100 common shares, making a total holding of 680 shares.

National Airlines, Inc.: J. C. Brawner, officer and director, purchase of 100 common shares, making a total holding of 160 shares.

Northwest Airlines, Inc.: Alonzo Petteys, director, purchase of 500 preferred shares, making a total holding of 2,000 shares.

Ryan Aeronautical Co.: Melvin H. Lockett, director, purchase of 1,000 common shares, making a total holding of 2,000 shares; T. Claude Ryan, officer, director, beneficial owner, purchase of 119 common shares, making a total holding of 49,200 shares.

Seaboard & Western Airlines, Inc.: Harold Montee, officer, purchase of 300 common shares, making a total holding of 400 shares.

Solar Aircraft Co.: E. Franklin Hatch, director, purchase of 300 common shares, making a total holding of 400 shares.

Sperry Corp.: Thomas B. Doe, director, purchase of 2,500 common shares, making a total holding of 2,700 shares.

Trans World Airlines: George H. Clay, officer, purchase of 200 common shares, making a total holding of 600 shares; E. O. Cocke, officer and director, purchase of 443 common shares, making a total holding of 1,143 shares; John A. Collings, officer, purchase of 400 common shares, making a total holding of 1,101 shares; Ralph S. Damon, officer and director, purchase of 700 common shares, making a total holding of 3,300 shares; Warren Lee Pierson, director, purchase of 600 common shares, making a total holding of 3,460 shares.

United Aircraft Corp.: Joseph P. Ripley, director, purchase of 500 common shares, making a total holding of 1,000 shares.

United Aircraft Products, Inc.: John M. Meyers, officer and director, purchase of 500 common shares, making a total holding of 4,500 shares.

New African Aircoach

(McGraw-Hill World News)

Johannesburg–All major carriers on the London-Johannesburg run are expected to add tourist flights to their services next year. The move is planned for after Oct. 1, when first-class fares go up approximately $14 to $500. Tourist tariff will be about $375 one way and $680 roundtrip.

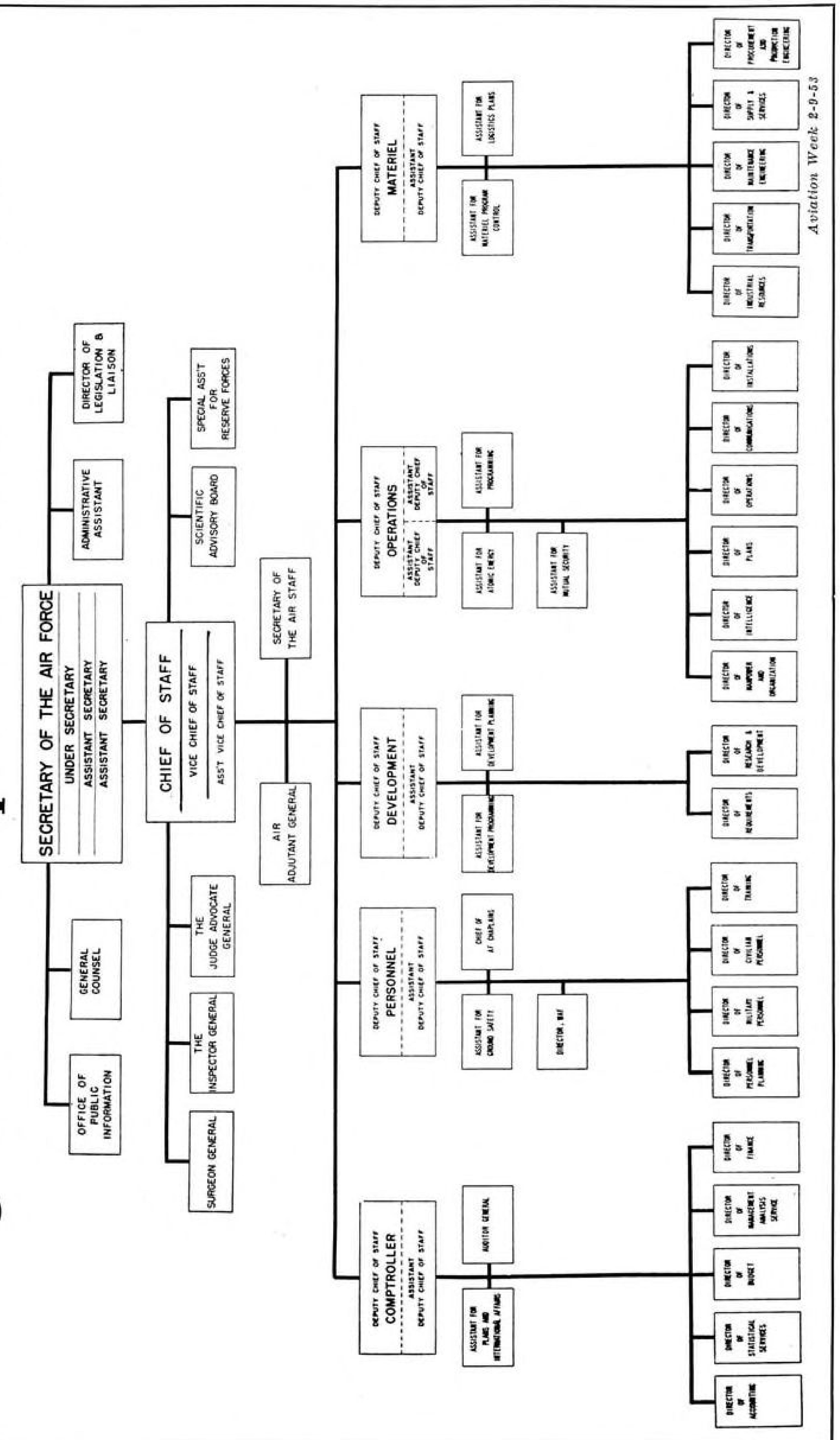
South African Airways is converting its Constellations to seat 60. BOAC and Central African Airways will open low-cost flights between London and the Rhodesias this month.

ROTOR BLADE ICING RESEARCH

Heating equipment is shown being installed on rotor hub of a Piasecki HUP helicopter stationed atop Mt. Washington, N. H., for study of icing conditions on rotor blades. The severe conditions on the peak of the 6,288-ft. mountain make it a natural laboratory for aviation studies. The copter is secured to a large trailer.

FACTS FOR FILING

Organization of Department of the Air Force



About Littlewood

William Littlewood, vice-president engineering of American Airlines, is internationally recognized for his contribution to the development of the modern airliner. His first aviation connection was with Fairchild Engine Co., of which he became general manager. There he helped develop and produce several important aircraft engines.

In 1930 he came to American Airways (predecessor of American Airlines) and was made chief engineer three years later. He was elected vice president-engineering of American Airlines in 1937, and named to the corresponding post for American Overseas Airlines in 1945.

He received the 1935 Wright Brothers award for "outstanding contribution to aviation."

The DC-3, to which he points in this picture, was built to Littlewood's specifications by Douglas Aircraft Co. for American, which put it into service in 1936. Littlewood was also important in the development of the Convair 240 and Douglas DC-6 airline transports.

Littlewood delivered the 16th Annual Wright Brothers Lecture in Washington this past year, laying down a broad guide that the designers of tomorrow's transports could follow. This talk is also being presented before various technical and industry groups in the country by Otto E. Kirchner, director-operational engineering, American Airlines.

A news story about Littlewood's speech was carried in Aviation Week, Dec. 22, p. 17. But in view of its importance to industry circles, we are printing extensive excerpts from it. The first of two parts appears below.

Littlewood Analyzes Transport Trends

- **In the past, aircraft size and capabilities have risen steadily, but largely as a matter of expediency.**
- **For the future, likely direction of growth as well as immediate needs should figure in plane design.**

There has been a constant development with time of larger and larger transport units with obviously longer-range capacities and applications. There has also been an underlying development with some increase in size of essentially shorthaul transports.

Today, of course, the longhaul airplanes are typified by the Lockheed Constellation, the Douglas DC-6 and the Boeing Stratocruiser, varying from approximately 100,000 to 150,000 lb. in gross weight. The shorthaul airplanes are typified by the Consolidated Vultee 240 and 340 and the Martin 4-0-4, ranging from 40,000 to 50,000 lb. gross weight. . . .

▶ **How They've Grown**—Wing span has shown a significant average growth in 25 years from about 50 feet to more than double that value (Fig. 1). Fuselage length . . . shows a significant increase at a more rapid rate from an average of about 30 to a modern value of more than three times that amount.

The rate of increase of fuselage length to wing span ratio is rather interesting in that it indicates some change in aerodynamic proportioning, and shows the method by which air transport capacity has been most logically increased—namely, by increases of fuselage length. The Lockheed Constellation has had some 18 feet added to its initial length, and the Douglas DC-7 will have had some 12 feet added. This seems to be a significant thing to keep in mind with respect to future transports.

One requirement of a modern contract and specification should be the advanced determination and agreement of a definite plan for capacity growth as powerplants of increased size become available in the future. Growth of any individual model in the past has been largely a matter of expediency. Since high performance aircraft of the future will be limited by Mach drag-rise design characteristics, the direction of growth will probably be least in speed and mostly in range and/or capacity.

If the airplane is initially planned for a defined operation, the range requirements will be built in from the beginning. Therefore, the normal direction of growth, with increased power or thrust available, will be in the direction of increased capacity. Plans for such a growth program should be incorporated in the initial model so that it can be accomplished with the least expense and trouble. . . .

▶ **Crew Size**—Early crews were one man. The common problem of physiological and psychological reliability of the human being, as well as the parallel question of reliability of a single powerplant, brought about almost simultaneously the early transition to a minimum flight crew of two, as well as a minimum powerplant arrangement of the same number. . . .

Crew growth thereafter was in consideration of additional segregated functions to be performed. As the needs of the passengers became evident, cabin crews were added, and as the needs of the cockpits and their manifold equipment became apparent in the larger airplanes, flight engineers were added. For the very largest airplanes multiple cabin crews are necessary to perform the quantity of tasks required, and for some uses of the airplane, particularly long-range, over-water operations, some

Littlewood's Guideposts for Designers

- Low-wing all-metal monoplane has the economic and safety edge over other types.
- Seat design and arrangement must permit occupants to survive 25G crash.
- Further study of exit locations, standardized and improved design of hinges, latches, etc., is needed.
- Proper marking of aircraft structure is desirable, so mechanics do not drill blind holes into vital equipment or wiring.
- Safety engineering set-up is a must within every aircraft engineering organization.
- Noise is lost energy. Efficiency gains, reduced prop tip speeds, reflective and absorptive baffles may ease this problem.
- Drag creators, such as external avionic equipment, deicer boots, etc., must be eliminated.
- Wide latitude of approach and climb-out speeds is needed to accommodate planes to maximum-traffic-frequency patterns at wide variety of airports and runways.
- Reverse-thrust-producing mechanism for jet aircraft is necessary.
- Collision prevention or warning means, whether lights, radar, cockpit indications and/or more precisely controlled flight paths, must be designed and improved for tomorrow's transports.

arrangements of equipment and functions indicated the need for radio operators and navigators. For those flights planned to exceed desirable or legal time limits, partial or total reserve crews are carried.

The crew number factor, of course, has shown a rising indication with the years, but determinations for the future should depend entirely on functional analysis of the over-all number of segregated jobs to be performed, and proper considerations of the relationship of flight time to the physical and mental fatigue of the tasks involved. Obviously, it is a prime duty of design and airline engineers to continuously simplify the tasks so that more can be accomplished with less total effort and with improved safety and efficiency.

▶ **Demand for Capacity**—The time curves of passenger seats, cargo and the total of all loads, show the accelerating upsweep of required capacities with time. This is interesting in its indication of the exponential growth of the industry. I think it is generally agreed that at any given time and under any given set of operating conditions, an operator would be wise to keep his airplanes a little on the small side of maximum required capacity.

A study and report prepared in 1930, using the sum total of available statistics from the extremely diversified American Airways operations of that time, indicated that with the then scattered demand and unreliability of operation, more than 90% of the business could have been accomplished with aircraft of less than half the average size of those then operated.

The indications led one of the most thoughtful and intelligent leaders of air transportation of that time to a conclusion that a 50% load factor was the most that air transportation could ever hope for. How untrue this was, has been demonstrated conclusively as air transportation achieved adequate utility and reliability. However, to contemplate that the very high load factors of today can be continuously maintained for future periods of possibly greater economic stringency, would appear to be on the side of recklessness.

This period has recently seen the development of the so-called coach or air tourist services—with somewhat reduced and simplified accommodations handling more passengers per airplane at lowered rates—made possible by the flexible nature of the equipment.

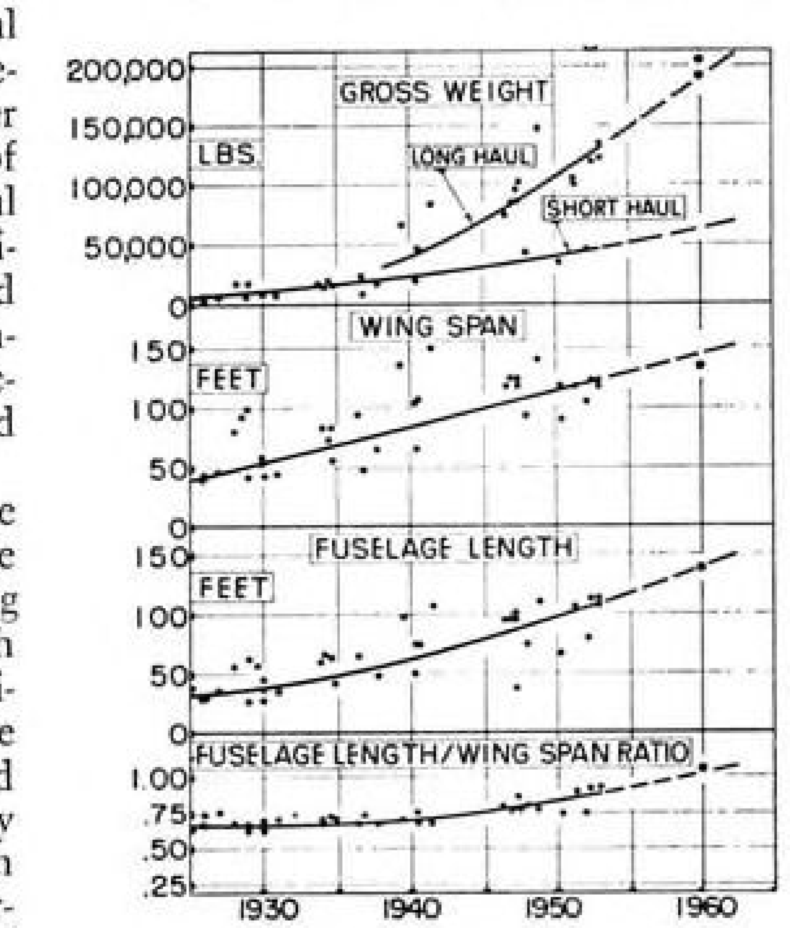


Fig. 1

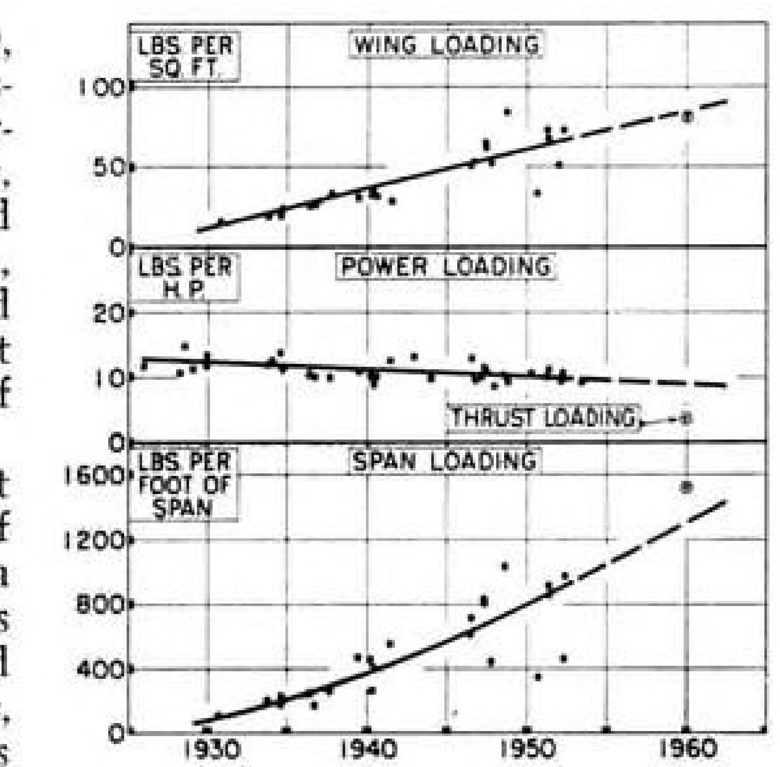


Fig. 2

▶ **Economic Factors**—With the relative inflexibility of the larger-size, high-performance transport units of the future, it would appear desirable to arrive at a basic determination of a satisfactory and fully acceptable standard of service, and to determine at what rate such services can be sold to develop the maximum economic possibilities of that type of airplane.

If there is economic justification for airplanes of such sizes and performances in a sufficient number of services, they will be built and successfully operated. If not, the industry would be well advised to move slowly into the high-performance possibilities of the future.

There is no reason to be pessimistic about the situation, for studies, to date, appear to establish that such airplanes can be developed in sizes fully consistent with anticipated capacity requirements, and that in such sizes they can operate at reasonable load factors and give the desired high performances with economic success.

Speed has many values, both direct and indirect, for which some compensation could be reasonably expected. To design these future aircraft, however, without taking full advantage of the economic possibilities and without planning the future growth programs of the aircraft, would be inexcusable in view of the tremendous risks in development and capital investment required.

The curves of wing loading, power loading and span loading (Fig. 2) with time show the principal reasons for continually improved economic weight factors, performances and efficiencies. Coincident with the developments of high-lift devices, the increased wing and span loadings and lowered power loadings have made possible the

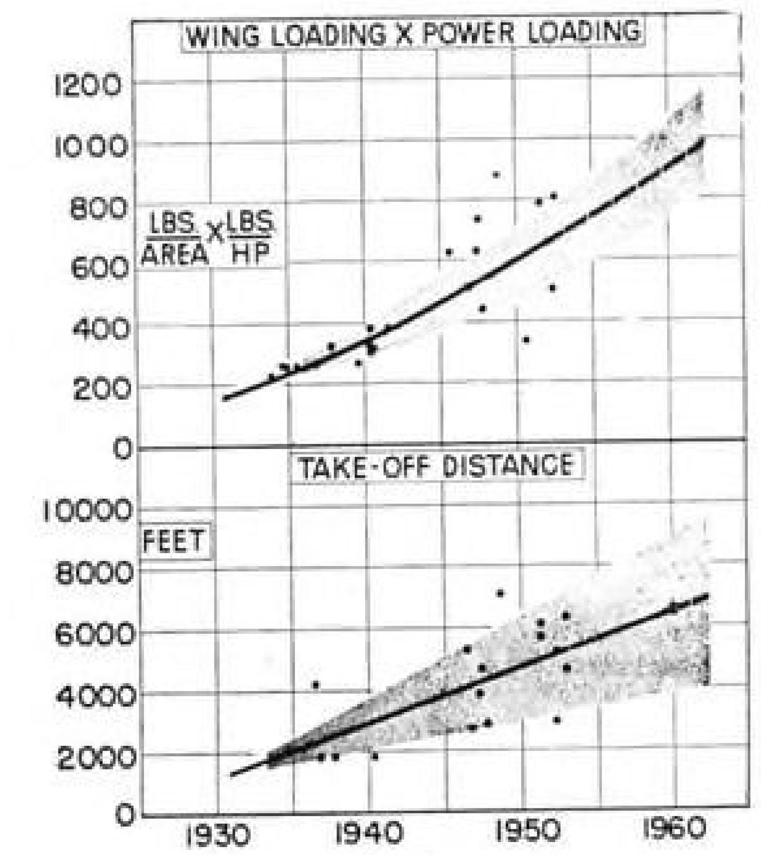


Fig. 3

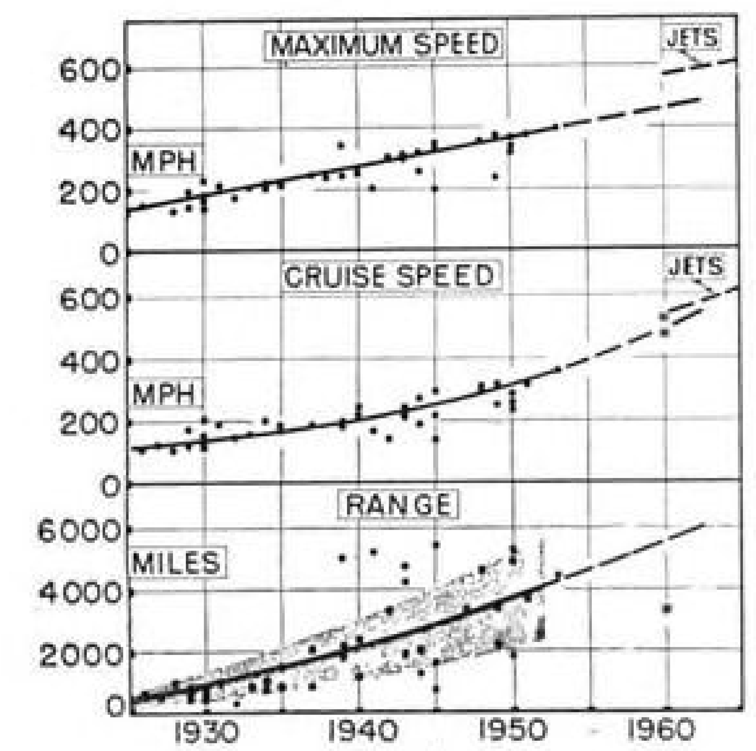


Fig. 4

economically efficient transports of today. The earlier removal of the arbitrary 80-mph. stall speed limitation cleared the path for achieving the benefits of these technical developments.

. . . The product of (Wing loading x Power loading) against time (Fig. 3) serves as a basis for the significant curve of Runway length requirement with time.

. . . The maximum speed increase has been almost constant with time since the beginning of powered flight (Fig. 4). It has been frequently pointed out that until the advent of the jet, maximum military speeds had increased at almost a flat rate of 14 mph. per year, while transport top speeds were going up at about half that rate. . . . Cruising speed increases have tended to increase a little more rapidly with time, primarily, I believe, due to the development of engine reliability and the ability to use higher percentages of cruising power.

The service ceiling scatter of points is naturally wide and merely shows an indication of the increasing altitude capacities of powerplants and the tendency toward lower power loadings with the higher wing loadings, and the incorporation of more adequate power

An impressive concentration of top aviation engineers and electronic specialists was recently assigned to the new Westinghouse Air Arm Division in Baltimore. The huge plant, occupying 75 acres next to the Baltimore Friendship Airport, has space to integrate all Westinghouse air-borne electronic engineering, testing and production facilities into one operation . . . with the opportunity for both air-borne and environmental testing.

Already this division has designed, tested and put into production some outstanding developments. One is the Westinghouse Autopilot, the first automatic pilot to utilize three "non-tumbling" gyroscopes and to provide unlimited maneuverability. Also of great value to our nation's military needs are the tremendous advances made on complete fire-control systems and guided missile systems.

These rapid strides were possible because of unmatched resources, such as: a Flight Engineering Department with hangar and company-owned planes . . . an REAC Analog Computer with flight simulator equipment . . . environmental test facilities, such as the one illustrated below . . . and a large staff of trained service engineers. All these Westinghouse facilities under one roof for one purpose—*advancing tomorrow's pushbutton aviation.* Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-91004

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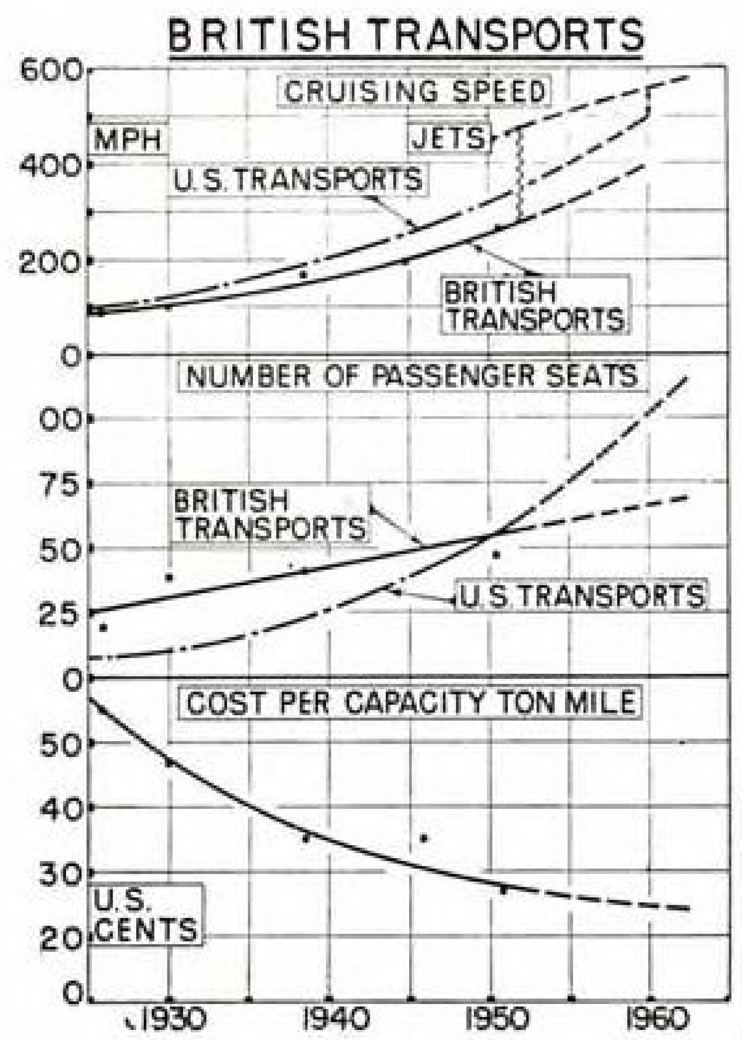


Fig. 5

performance reserves with time.

In the future, as increasing emphasis is laid on speed and since the speed must be attained at high altitude and by the use of relatively large powers or thrusts, service ceilings will, I am sure, continue to increase. . . .

▶ **Range Considerations**—Ranges are a function of the service pattern requirements of the operator and a measure of the ability of the design engineers to meet the desired figures. High aerodynamic efficiencies and low specific fuel consumptions are, of course, the basic requirements for maximum ranges. Both these factors have played an important part in the rising trend shown in Fig. 4 (p. 27).

There is, of course, for every airplane a minimum range below which its space capacity makes the airplane inefficient because it does not use its full weight ability. There is, also, at the other end of the scale, a maximum range where the combination of fuel and payload uses up all the weight capacity of the airplane and beyond which its economic efficiency deteriorates with extreme rapidity.

It is foolish to contemplate that this maximum range, as normally stated for a new airplane, is a realistic value. The inevitable service increases of empty weight—always a maximum in the early period of operation and happily decreasing with time—demand a sensible correction factor to determine the realistic maximum range for practical operation.

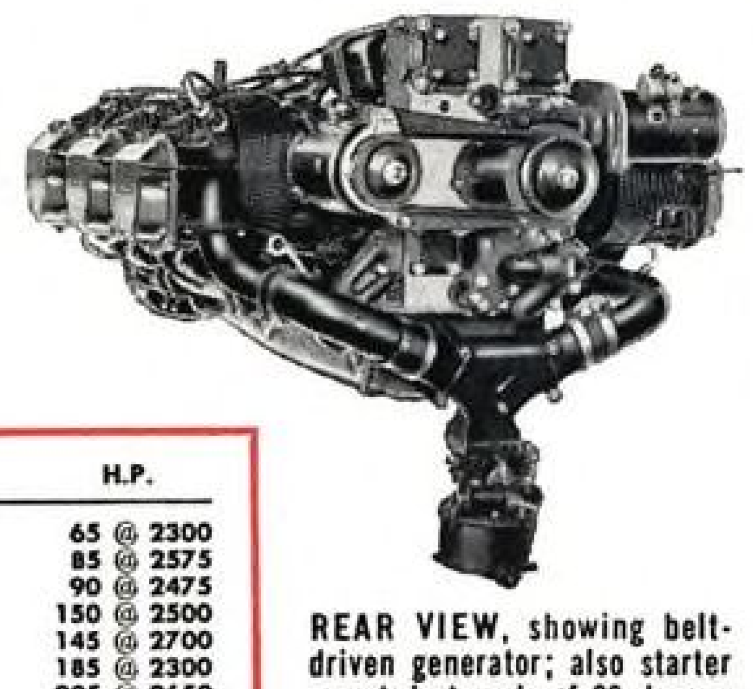
There is also a tendency on the part of design engineers to minimize the operational reserve fuel requirements and other essential factors which cut into range payload. The powerplant manufacturers have often been unduly optimistic with respect to the fuel consumptions to be realized in operation, which has a most significant bearing on range capacities.

In the past, there have also been significant variants with respect to realized speed performances due to a disregard of the drag penalties invoked by the necessary application of external antenna, radomes, de-icer boots and similar parasites. Most fortunately and with increasing urgency as speeds increase, much is being done to provide satisfactory antenna arrangements completely submerged within the contours of the airplane.

Many problems of satisfactory functional performance still remain, and new icing problems of unknown magnitude will be introduced. These include possible losses in transmission and receiving efficiencies, and may give beam distortion and problems of lightning strikes, which with non-conductive areas, give some reason for concern. Possible losses of structural strength in flush antenna areas may also aggravate problems of bird or hail strikes.

▶ **British Trends**—As an interesting comparison, I would like to show, at this time, a plot of British trends in transport operation for the past 25 years (Fig. 5), prepared from data taken from Mr. Peter Masefield's Brancker Memorial Lecture of 1951.

Cruising speeds in 1925 started at

about the same value—100 mph. or slightly below—but by 1952, American cruising speeds were well above 300 mph. with 360 mph. promised for 1953, while the British with conventional engines have stayed at a conservative 260 mph. with an indicated projection to 275 mph. or thereabouts by 1953.

It would appear that in the past the British have not been nearly as interested in speed as have we Americans, which seems natural in consideration of the shorter BEA cruising distances involved. The benefits to be achieved in block speed made good are so much a function of range that speed greatly loses its significance in the shorter range operations. Mr. Masefield pointed out that while London-Paris (about 200 miles) cruising speeds had increased some 225% in 20 years, only about 35% increase in station-to-station effective speed was realized.

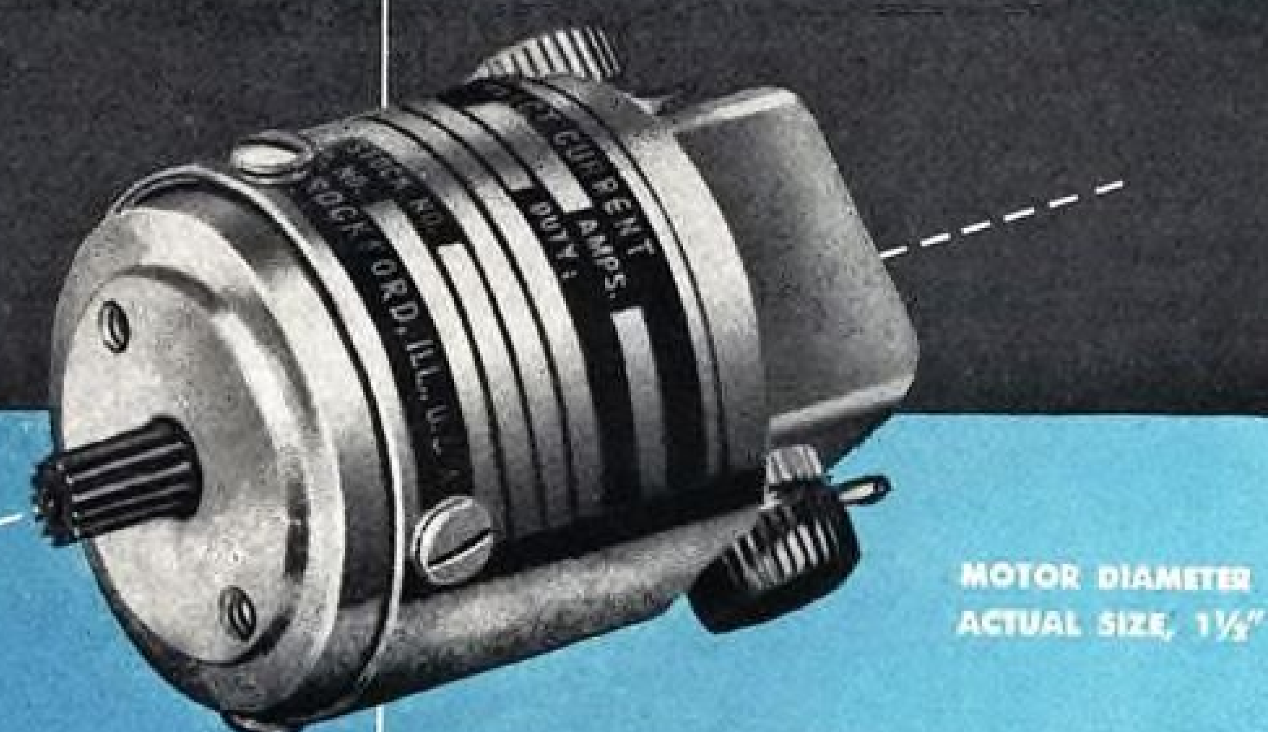
This consideration must be kept prominently in mind by local operators evaluating the questionable benefits of substantial speed increases in short-range operations. Of course, in 1952 the British have made a cruising speed jump to some 450 mph. or better by the introduction of the Comet jet operations, and will proceed to do much better in the future as larger power-plants are applied.

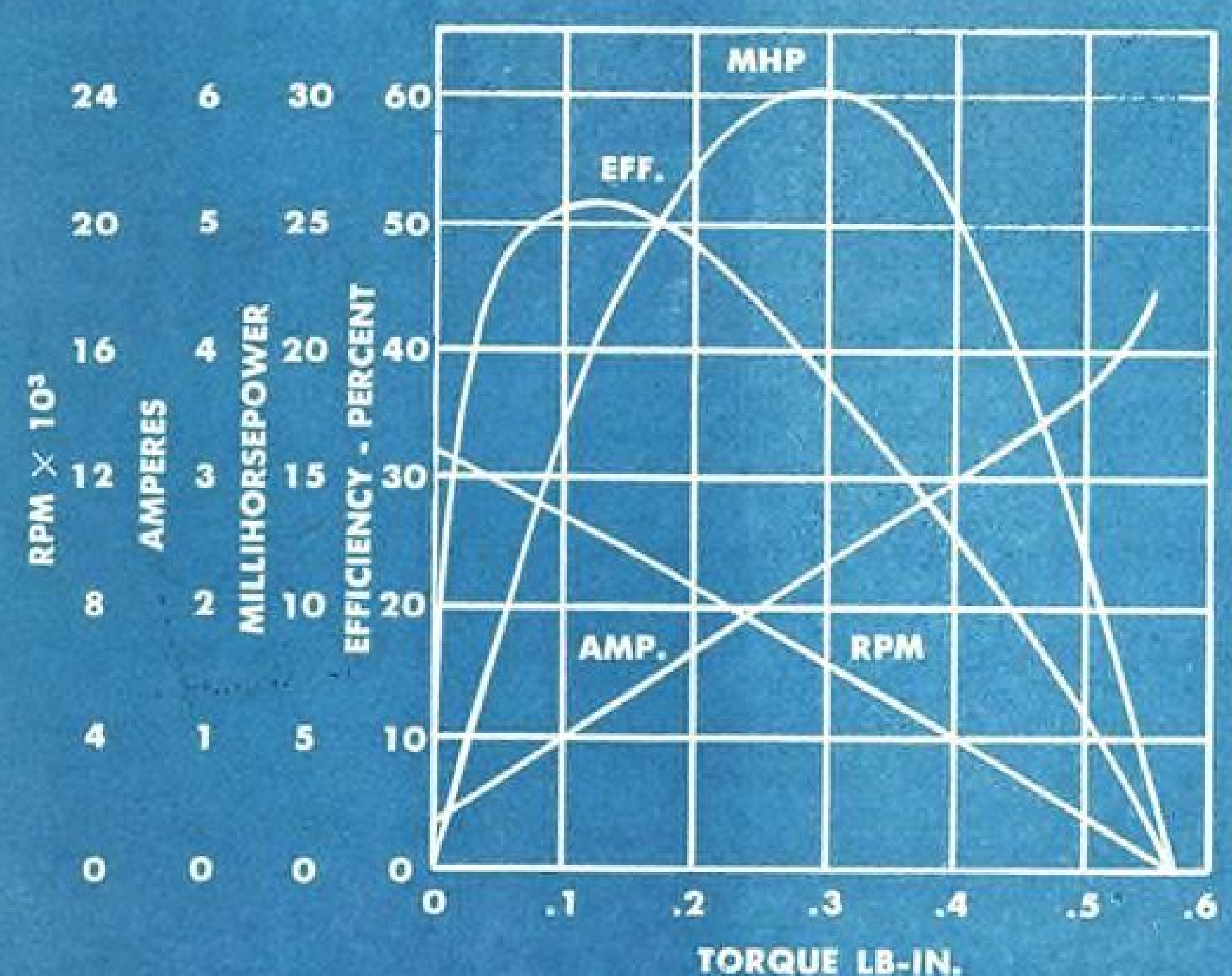
The BEA curve of average transport passenger seat capacities is also interesting in comparison with the American trend. Starting with very nearly the same values in 1925, the British capacities rose very rapidly and then flattened off by 1952 to an average maximum of some 47 seats, while the American curve has increased at an accelerated rate to a comparable average of about 65 in 1952.

The cost curve of British operation has had a very healthy downswing through the years, although it is difficult to attribute too much significance to the absolute values since the numerous reorganizations and somewhat uncertain conditions with respect to subsidies have made determinations of cost rather indefinite.

The same may well be said of the determinations of American costs in the past, which have been greatly confused by ill-defined and variable accounting systems, and by considerable uncertainty as to the nature of rewards in the subsidy and compensatory classes. . . .

▶ **Around-the-Clock Study**—In 1938 when American Airlines was operating DC-3s for all types of service—long, medium and short, to the extent of their range capacities—we made quite well distributed use of the airplanes with the most airplanes in the air during the daylight hours of maximum traffic consumption—namely, late afternoon. . . . In 1946, we had a sub-





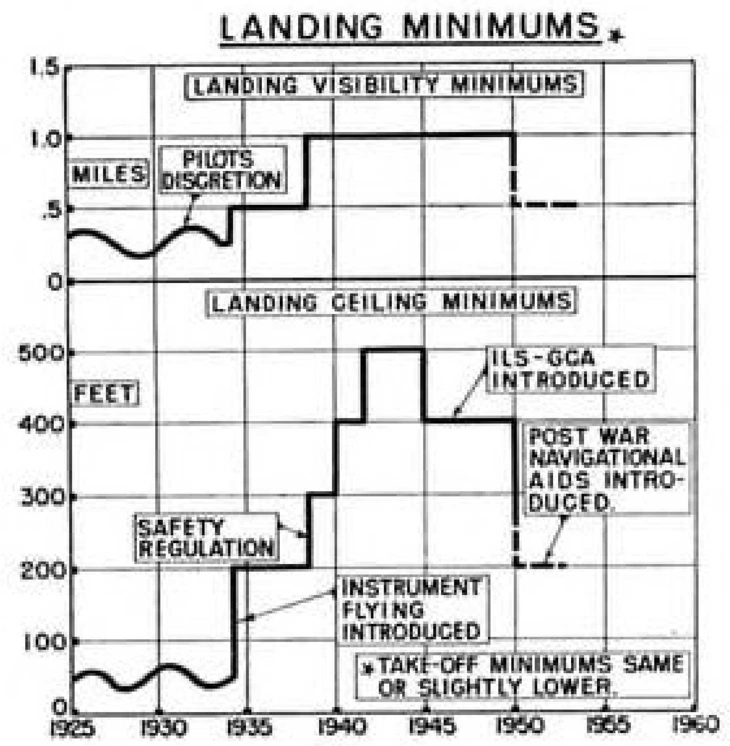


Fig. 6

stantially greater fleet composed of DC-3s and DC-4s. The average range of operation had gone up by the inclusion of the larger DC-4 airplanes, but we still showed the same maximum activity throughout daylight hours, somewhat leveled off during this period with a substantial relative decline during the very early morning hours.

Now, if you will look at the present American Airlines' fleet of 78 Convairs and 66 DC-6s, you will note that the type of operation has been segregated into essentially long-range operations for the DC-6s and short-range for the Convairs. The DC-6 curve, by this specialized application, has very substantially leveled out throughout the entire 24 hours—a most efficient utilization of equipment in that respect, and probably one of the very substantial reason why DC-6 costs per unit mile show such a favorable value.

On the other hand, the Convair, assigned primarily to short ranges of operation in local services, has a very high utilization throughout the daylight hours, but falls to very low values and even to zero for one time in the early morning hours. The fleet required to perform the daylight services is, obviously, large, but an equal number of airplanes are sitting on the ground unused for a portion of the night. This is one of the factors which contributes greatly to the apparently high unit operating costs of the short-range units of such a fleet. . . .

You may also be interested in a corelation between landing minimums and time (Fig. 6) affected throughout the period by numerous influences and fortunately showing marked and continuous improvement since 1945. This is one of the essential factors in the ambitious objective of some day achieving 100% operating factor. It is, I think, a pretty good confirmation of my earlier statement, that as a type of vehicle the airplane will eventually accommodate itself better to adverse weather conditions than any other type of transportation.

. . . Take a glance at the interesting increases in airline engine overhaul times from 1939 to date. If we were to project this curve further back, we would find a starting very close to 100 hours per overhaul in 1930. This experience should not be dissimilar to that which will in the future probably be achieved by jet and turboprop powerplants. It is a history—the progressive improvement of engineering design, materials, testing and operating techniques which have always accompanied the development of powerplants. There seems no reason for a change in principle in the future. Let us be reasonably optimistic. . . .

▶ **Uniform Product**—With the tremendously diversified background which we have been discussing, it seems strange that we have come to this point in air transportation with an almost firmly established type of aircraft and with startling similarities between powerplants, cockpits and installations of all kinds.

The reasons for this, of course, include the concentration of basic information in nationally available laboratories, notably the NACA; and the centralization of procurement in the Navy and the Air Force—the two largest customers for aviation development projects; and the establishment of uniform regulations and supervision for the design, construction, testing and operation of commercial aircraft under the CAA and the CAB.

Within these influences, there has been a very substantial latitude of development, but they have contributed greatly to the bringing about of a fairly uniform air transport product. I would mention modestly that airline engineers have, to some extent, played a part in the same program in determining and emphasizing the important technical needs of their industry.

▶ **Today's Transport**—There are, of course, substantial variations in size, speed, range, number and rating of powerplants, weight and space capacities and many other features, but if we were to define the modern American air transport, it does not appear to be dissimilar from many of the good transports developed and used abroad alongside of the American products.

- It would be a low-wing, all-metal, internally braced, smooth stressed-skin structure with two or four conventional engines driving constant-speed, full-feathering, reversible propellers.
- It would be fitted with retractable tricycle landing gear with various numbers of wheels and brakes dependent on the size of the airplane.
- The streamlined engine housings or nacelles would in flight effect complete closure over the retracted main wheels.
- The airplane would have slotted flaps, and the ailerons and tail control surfaces would probably be tab-trimmed or controlled and would be metal-covered.
- The cockpit would be fitted for a minimum crew of two, with at least one more for the large four-engine types, would contain somewhat standardized communication, navigation and control equipment of many types.
- For the medium and longer ranges, the entire fuselage would be pressurized; tended by a suitable cabin crew, and fitted with comfortable reclining seats, lavatories and suitable food accommodations.
- The airplane, powerplants and propellers, etc., would be fitted with ice protection, generally of the heat type.

Numerous details, quite standardized in nature, could be appended to this list, but the above would describe, in general terms, any and all of the current brood of operating transport airplanes.

▶ **Much to be Done**—But with all this indicated standardization and excellence, there remains much to be accomplished in the engineering field, in addition to the pleasant contemplation of such fundamental changes as those to turboprop or turbojet types, and greatly enhanced performance characteristics.

I sincerely hope the future holds no

threat of change in basic type from the essentially low-wing, all-metal monoplane. Innumerable studies have been made, and from time to time proposals offered suggesting high-wing transport designs . . . but their value does not begin to balance against the safety and economic advantages of the low-wing type.

Every thoroughly honest, comparative study with which I am familiar has shown some weight advantage in favor of the low wing, primarily because of the shortened landing gear and the elimination of keel and supplementary structure necessary to achieve the minimum required strength forward.

But, the irrefutable advantage of low-wing design lies in the area of safety. . . . The disposition of live load, if we may refer so casually to our passengers, between the mass concentration of engine, wing and fuel weight and the probable point of impact with the ground in the event of a crash landing, is almost certain to result in aggravated casualties. . . .

▶ **Impact Protection**—It is apparent that one of the best ways to absorb the energy of impact is to permit the destruction of structure. How much better it is to have that structure, not the fuselage in which the passengers are housed, but rather the wings and engine installations. One only needs to recall the repeated experiences of the war to emphasize this and the great difficulty, if not impossibility, of executing satisfactory ditching operations with a high-wing type of airplane.

May I, therefore, repeat my sincere hope that this great step forward in safety be recognized as an established trend, and no retreat from it be made.

Another most significant factor in crash survival is the engineering of proper arrangement and detail with respect to the passenger- and crew-occupied areas. A great deal of work has been done in this field to determine the nature of the loads and their significance with respect to personal injury. It does not seem too ambitious to expect that a well-designed and fitted airplane would readily permit its human occupants to survive a 25G crash, probably more than can normally be taken in other forms of vehicles without serious injury or death.

It seems to me that the basic approach to the problem should be from the point of view of the capacity of the human body to endure stress when properly supported, without serious injury or death.

Investigation has shown that distributed stress has permitted up to 100G in numerous cases of accidental or suicidal falls without fatality. Innumerable tests have been conducted of properly supported subjects at 30 to 40G decelerations without injury. These, then, should be ultimate design objectives for safety in aviation crashes.

The basic nature of aircraft structure is such that by its very destruction, substantial impact energy can be absorbed. With reasonable energy-absorbing seat mountings, chair structures and seat belts, and the elimination of extraneous hazards which result from personal impacts against hard or sharp objects, or damage from flying missiles, it is not difficult to see many ways in which aircraft crash safety can be made superior to any other.

It seems appropriate to comment that static strength requirements of chairs, even with a recognition of the need for strength tests of varying amounts in all directions, could be met by an airplane chair designed and built of a brittle material such as glass. The inappropriateness of such action hardly needs comment, but the inadequacy of the requirements as an expression of the needs to meet the impact loading anticipated, is evident.

A reasonable deflection of seat structure under severe impact load must be permitted. On the other hand, to develop serious distortion, or display inadequate retention to the basic airplane structure will result in a very unsafe cabin condition due to the interferences with emergency evacuation. These hazards are recognized and methods of solution have been proposed. There does not seem to be much reason why suitable engineering action should not be taken.

► Doors and Exits—Another most significant aspect of passenger cabin safety is that associated with the provisions for ingress and egress—most important in event of emergency. Undue emphasis, by regulation, on the aft location of major emergency exits does not appear to be a suitable recognition of the overall picture. A very insufficient amount of statistical data does not justify a conclusion, contradicted by actual experiences, that airplanes always terminate crash landings facing forward. Actually, they end up with their axes at all angles with the line of initial impact from zero to 180 degrees.

The substantial evidence to that effect seems to emphasize the essentiality of treating the airplane, right and left, and fore and aft, with due regard to required locations of standard and emergency exits. It is the writer's strong opinion that the normal entry door or doors to the cabin rate many times the value of any other exit in emergency, because of familiarity as to location and use. It is true that the aft end of the fuselage is often the least damaged in a crash, but this is not so to an extent that justifies an abnormal or exclusive emphasis on that location for emergency exit purposes.

It is also unfortunate that consideration of emergency exit locations has placed undue emphasis on the forward inertia and pressure ejection of fuel from ruptured tanks. With the variable final position of the aircraft axis as one factor, the existence of reasonably strong prevailing winds may completely nullify the effects of any forward jettisoning action of the fuel. Even if the airplane proceeds in a straight line as the fuel spills from the ruptured tanks, the nose of the airplane frequently passes over and beyond any fuel, which may end up under the rear of the fuselage, or on either side.

The plea, then, is for a complete adequacy and universality of treatment in this respect.

I would also like to open the strong case for standardized and improved locations, designs, directions of openings and hinging, and types of latches, handles and operating instructions for passenger doors of all descriptions. In my opinion, this factor is as fundamental to evacuation safety as any other consideration. . . .

► Thoughtless Designing—Engineering thinking must also recognize the impossibility of service mechanics, no matter how intelligent, coping adequately with the unknown. It cannot be assumed that a service mechanic always has at his elbow a maintenance manual, even

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At the end of the war, the Corsair was the only piston-engine fighter whose performance for the Allies was advanced enough to warrant continued development on an uninterrupted post-war production schedule.

That's why it was ready for use by United Nations forces at the beginning of the Korean conflict in June 1950, and soon was accounting for 82% of all close air support sorties flown by Navy and Marine pilots against targets assigned by air support controllers in Korea.

Since the Corsair was first wheeled from the production lines, more than 12,000 of the gull-winged craft have been built, including a large order for the French Navy just completed. During the years many engineering and production changes have been made—but it is still basically the same stout-hearted fighter it proved itself at Guadalcanal a decade ago.

The Corsair has been in continuous production longer than any other military airplane. And *still* this great veteran goes on making aviation history!

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if it were complete in all details, nor does he have the time, nor inclination, to look up every subject which may be remotely related to his particular problem.

There have been many instances of mechanics unwittingly drilling through a blind floor or bulkhead into a congested mass of unprotected electrical cables or conduit. A little forethought would indicate that the airplane should be marked in such a way that, without reference to a manual, the mechanic would know that behind any critical location on a floor or bulkhead there were items of equipment or installations which made it inadvisable, at least, to drill through. This type of advance engineering thinking is the only guaranteed preventive of innumerable accidents and mishaps.

All too often, details of thoughtless design or installation engineering are discovered as the causes of incidents and accidents, both minor and serious—sometimes inadequate designs which you would expect to find in a child's toy rather than in a million-dollar product like a transport airplane: Hinge pins that fall out, latches that become inoperative and unlatch, leading-edge covers that hinge on the wrong side and come dangerously loose in flight; and in the less dangerous but equally annoying and expensive area: Faucets that will not shut off, outboard drains that freeze, valves and controls that lock from low temperatures, equipment items that come loose in turbulence and make dangerous missiles. . . .

▶ **Safety Engineering**—This leads directly to a thought I would like to express concerning the place and importance of safety engineering in an aircraft engineering organization. Some feel that safety is of such universal concern that its principles should be taught and inculcated in all aircraft engineers—and that is all. Others feel that safety should be a separate engineering function responsible to a rather high executive in the organization—something like Inspection, or to a lesser degree Weight Control. I think both are of the utmost importance.

There is no equivalent to continuously conceived and originally built-in safety design features. But, recognizing the effects of continuously present pressures which are adverse to a quiet and thorough contemplation of safety in design, there is also no substitute for a constructively critical review of all design from the safety expert's point of view. We have not done it adequately—let's do it!

▶ **Jets and Turboprops**—Now assuming that we have defined our modern transport type and by imaginative, analytical engineering have improved its quality, let us examine a few of the problems which face the next series of high-per-

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SWOOPING DOWN to land on the carrier deck, there is no "guesswork" for the pilot of Chance Vought's Cutlass as to whether his landing gear is down . . . he knows. Up or down, the position of his landing gear is unfailingly signalled to the cockpit by MICRO precision switches.

Small size, light weight and *absolute dependability* of these precise snap-action switches dictated their selection for this and other important functions by Chance Vought's design engineers.

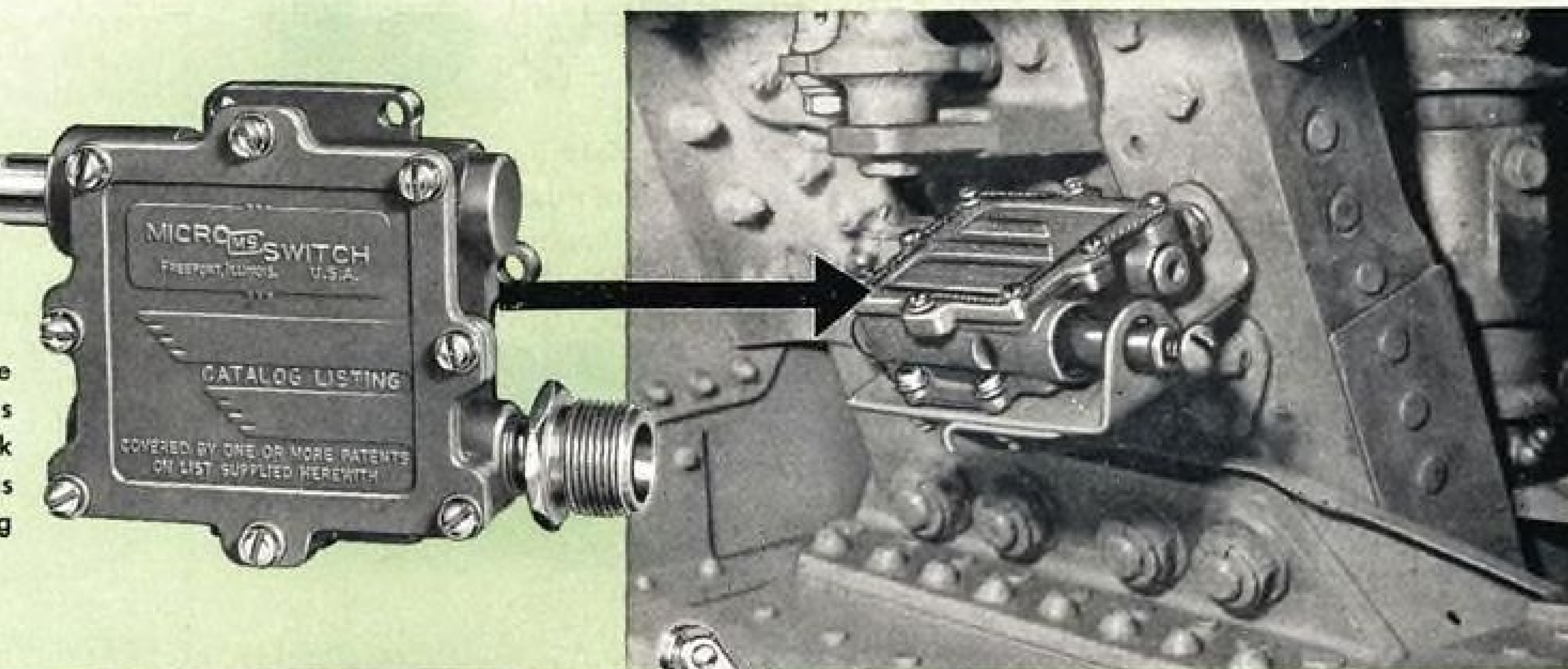
These factors, plus the ability of MICRO engineering to supply the widely varying switch characteristics to meet exacting aircraft requirements, have made MICRO switches first choice in the industry for components to protect both planes and pilots and enhance aircraft performance.

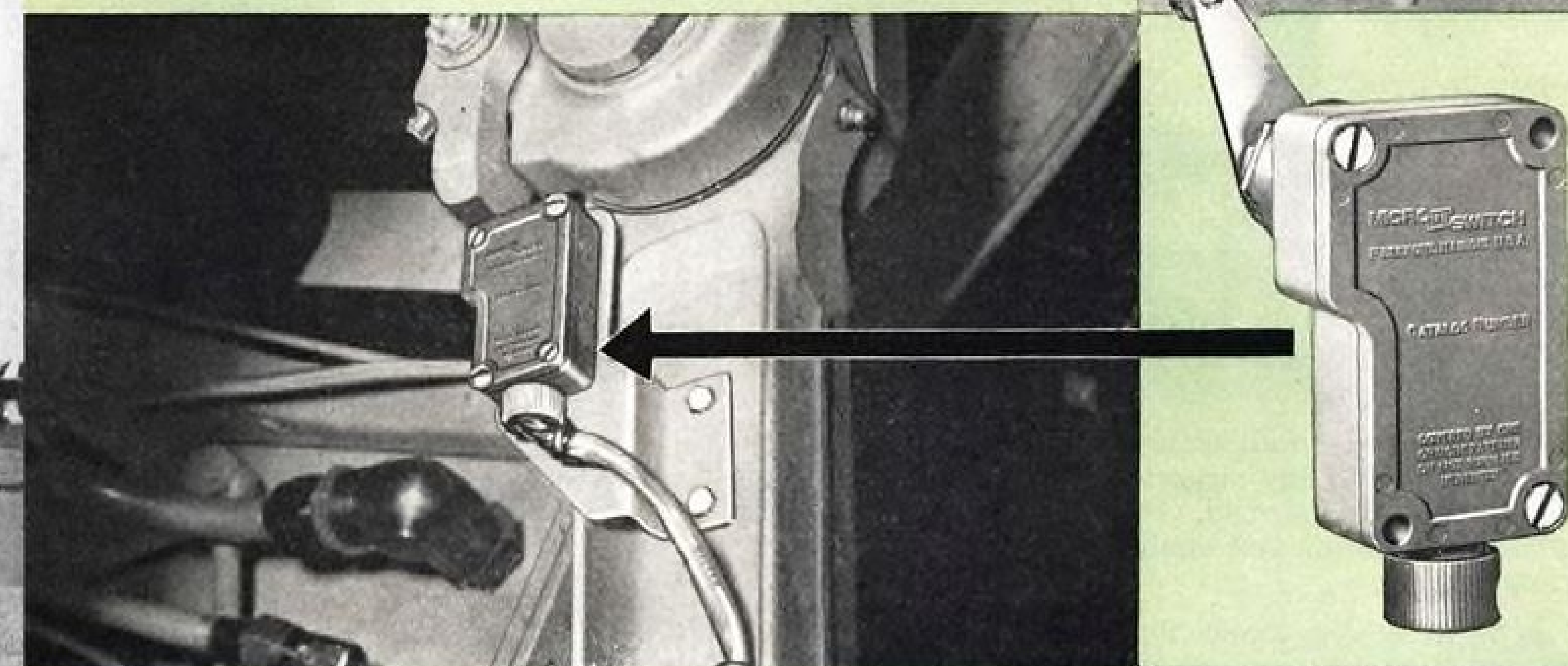
MICRO units are daily meeting the utmost requirements of both commercial and military aircraft not only as landing gear limits and signals but also as: screw jack limits, wing fold limits, flap limits, cockpit lighting controls, fire control masking, door interlocks, fire-fighting apparatus, barometric pressure devices, wing lock indicators, throttle warnings, propeller controls . . . and other uses.

This wide experience in serving the rapidly expanding needs of the aircraft industry has made MICRO a headquarters for switch engineering cooperation, consultation and development. MICRO field engineers are located near you. We invite you to contact your nearest MICRO branch office.

Is the landing gear up?

This is one of the MICRO "LA" Series landing gear uplock switches which signals the pilot when landing gear is retracted.



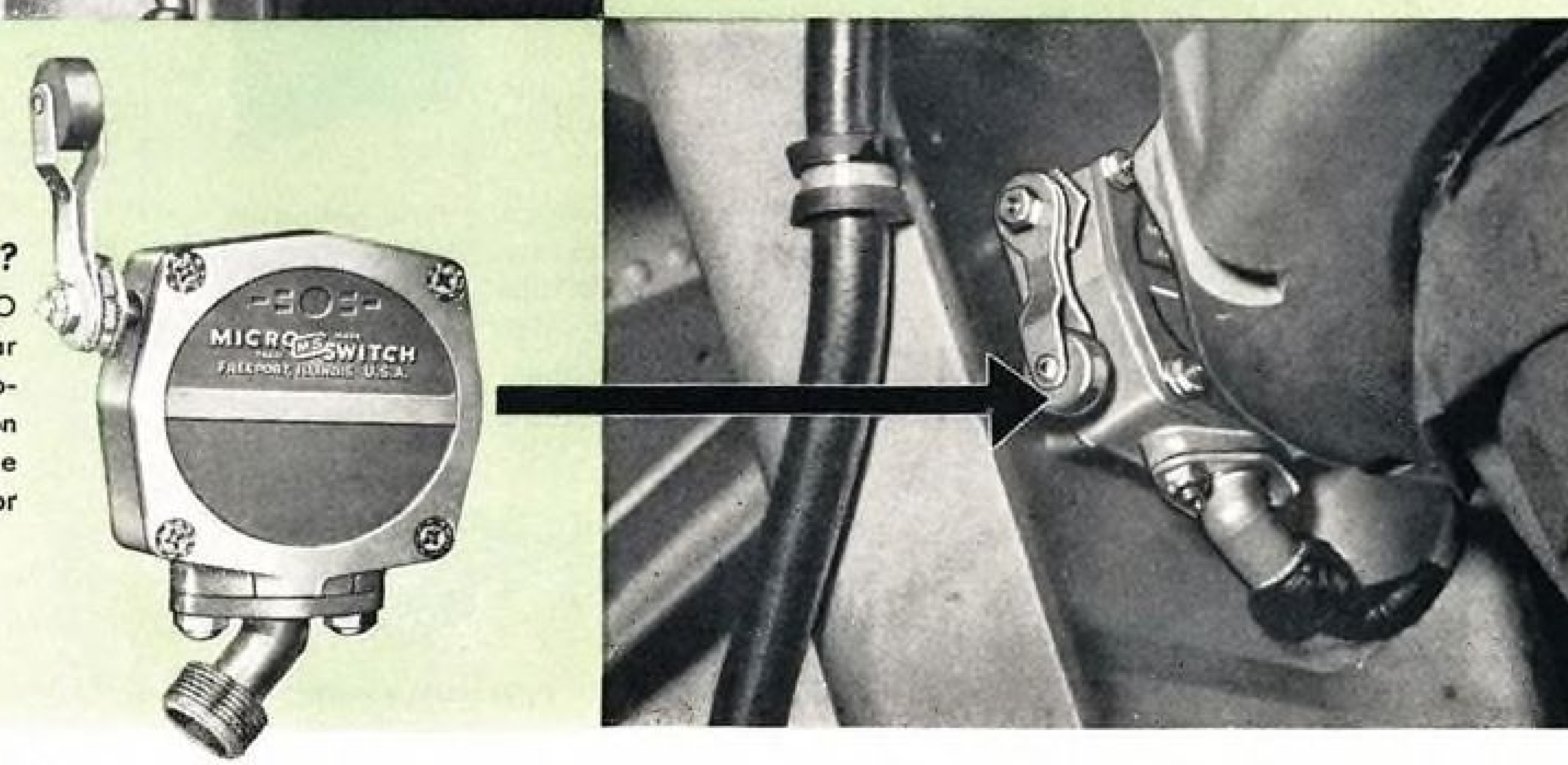


Is the landing gear down and locked?

This is one of the MICRO "VA" Series down lock switches which signals the pilot when the landing gear is extended and locked in position.

Is accidental retraction impossible?

This is one of the MICRO "LMR" Series main gear strut extensions which prohibits accidental retraction of the landing gear while ship is sitting on ground or carrier.



formance aircraft when they come into being. It does not seem improper to conclude that the industry would prefer to tread on the firmer ground of relatively conservative increases in performance and size, not achievable in the larger transports with any reciprocating engines which are planned or likely, but certainly attainable with many advantages by the use of proper size and efficient turbo-propeller type powerplants when available. However, it is obvious that there are many technical problems in such a satisfactory development, even beyond those incidental to the early satisfactory operation of jets.

The great emphasis which the military program has placed on jet development will unquestionably bring that simpler type of powerplant to an adequately satisfactory and reliable condition long before we can hope to have turbo-propeller operations.

There appears to be in the American domestic picture a bracket of required ranges—roughly from 500 to 2,500 miles—and appropriate sizes of well-developed jets to give a reasonable and efficient transport airplane of quite high performance and satisfactory economy. Below these bracketed ranges and above them, there would still appear to be an eventual great need for the application of turbo-propeller powerplants.

From the point of view of any airline, even the largest, it is obviously undesirable to operate any more models of aircraft than are necessary to perform the required services. The smaller airlines may well hope to continue to do all their work with one model. However, in the domestic industry as a whole, and particularly among the larger airlines, it seems that a minimum of two models will be required, continuing the trends of the indicated split in developmental types and characteristics which originated some 15 years ago in America with the concept of the DC-4E.

► **Copter Problems**—Encroaching on the absolute minimum of aviation ranges, the helicopter will eventually find its economical niche. It is my opinion, however, that the inherent mechanical complexity of this type of flying machine, despite its apparently desirable characteristics for short-range operation in congested areas, and its basic principle which requires such a large proportion of its power for sustaining it in flight, will continue to make the units very expensive in first cost, relatively expensive in operating costs per unit mile, and fraught with problems of dependability.

Furthermore, if they are to be operated in the congested areas proposed, we must not forget that they are just as dependent on powerplant reliability as an airplane, and have many unsolved problems of stability and controllability, particularly under instrument conditions. The single-engine, single-pilot transport airplane went out of vogue many years ago, and we must question the safety factors of such a helicopter operation. Any evidence to the contrary is based on a very limited operational experience.

Yet, we blithely accept the idea that helicopters can safely operate over congested, built-up areas. There is nothing in the above to disparage the usefulness or eventual promise of the helicopter as a lifting and carrying device, but it must be properly applied just as must the airplane.

▶ DC-3 Successor—There is much discussion in the local operations field concerning the specifications for a desirable and efficient small transport airplane, which will presumably improve vastly on the economy of the DC-3. . . . It might be expected to operate with a little less field requirement, and might be expected to have somewhat better single-engine performance and reserve. It might have somewhat better flying qualities. It would need little, if any, more in the way of speed or altitude performance to accomplish its intended purposes, but it must do all these things and be much more economic per unit-mile.

The approach appears to be a suggested increase in capacity, which with a constant assumed load factor, indicates at the same or slightly decreased costs per airplane-mile, greatly decreased costs per unit-mile. The fallacy of this appears to be in the assumption that local operators can establish and maintain a high load factor. The engineering economic study I made for American Airways in 1930 emphasized the startling conclusion that about 90% of our then business could have been accomplished with airplanes less than half the size were were operating.

There does not seem to be too much difference in many of the characteristics of local operations today and tomorrow compared with the scattered operations of American Airways in 1930, and if that comparison be in any sense legitimate, it would seem to emphasize that the cost per airplane-mile is a much more important factor than cost per unit load-mile achieved by increased size and the possibly excess capacity.

It would be interesting to consider the results that might be obtained if it were physically possible to expand the width of a DC-3 airplane the necessary foot or so required to provide it with a satisfactory additional row of seats raising its capacity from some 24 to 32. The changes, if efficiently accomplished and accompanied by some supplementary cleaning up of the airplane as a whole would, I am sure, have a relatively small effect on the performance or cost per mile of the airplane.

In its effective results, it would become the approximate equivalent of airplanes proposed for local operations. It might or might not achieve a substantial increase in passengers carried, and if it did not, it would achieve no economic benefit. I think increased scheduled services and improved dependability are much more important factors. I doubt if pressurization is necessary or economically justifiable.

▶ **Turboprop Picture Hazy**—In the larger domestic airline picture it appears highly desirable to endeavor to perform the services needed with a continuation of reasonable growth in the two general types now in use—exemplified on the one hand by the Stratocruiser, Constellation and DC-6 in medium- to long-range operations, and on the other hand, by the Convair 240 and 340 and Martin 4-0-4 for the shorter ranges of operation.

Since with the shorter-range aircraft, the field requirements are so important and the benefits of altitude and speed cannot be effectively realized, it would appear that a logical development would lie eventually in the turboprop type.

This picture is so hazy because of the unavailability of adequately proven or suitable powerplants and associated units, that we cannot discuss it sensibly except to point out that the same general engineering design comments to be referred to later apply equally to eventual developments in this field.

▶ **Designing the Jet Transport**—With respect to the medium- and long-range domestic aircraft, however, it is fairly clear that reasonable increases of size, coupled with the economic benefits to be achieved from high-altitude, high-speed operation, can permit the reasonably early development of such transports built around adequately proven and efficient jet powerplants.

As in the past, the design starts around an acceptable number—in this case four—powerplants of an adequately efficient and reliable type, with suitable horsepower or thrust-producing ratings. From this platform one can entertain variables in range, capacity and speed. Ranges are, of course, dependent on the minimum and maximum desirable or required distance characteristics of the operating airline. Capacities and speeds thereupon become the principal variables, coupled of course, with innumerable concepts of arrangement and functional characteristics.

With jet-type powerplants the necessity for performance at reasonably high altitudes and high subsonic Mach numbers becomes apparent. Drag-rise characteristics (dictating maximum speeds) directly influence the selection of wing thickness ratios and sweepback, and with the basic selection of powerplant location and arrangement, the airplane begins to take form.

Rather intricate studies involving assumed variations of performance and capacity lead eventually to a determination of the best compromises and a firm definition of the airplane. Frankly, this is the process which has been going on for many months—the final determination is, of course, the analysis of operating costs based, to some extent, on first costs including development, and leading to a decision both on the part of the manufacturer and his prospective customers as to whether the project should proceed.

▶ **What About Noise?**—Many other considerations are involved in such a decision. We are currently faced with a serious transport noise problem. It is not that which has affected the relationship with the occupants of the airplane fuselage, which has been reasonably solved to date and can certainly be handled in the future by known techniques, even with the disturbing noises emanating from jets.

The so-called noise problem of today is that which lies between the powerplants and equipment on or in the vicinity of the ground, and the people in the vicinity. The problem is being tackled on many fronts, and practical improvements have already been made in the nature of operational controls as to directions and altitudes of takeoffs, climbouts, approaches and landings. Baffles and directional reflectors and absorbers are coming into use to control some fixed ground run-up problems.

It has become quite evident that the problem is not strictly one of noise, but has substantial elements of individual and mass reactions to fear and various annoyances. People have indicated their great concern about noise and low flying in general, and have registered innumerable specific complaints of interruption of sleep, fear of crashes, annoying vibrations and rattling of dishes, interruptions of radio and TV programs, interruptions of telephone conversations and concern about frightened children. We can certainly not deny the existence, nor legitimacy, of this most serious problem.

While we are gravely concerned about the generation with large reciprocating engines of over-all maximum sound intensities of 100 to 105 db., and with conventional propellers of 115 to 120 db., we must look forward with even greater concern to the possible development with supersonic propellers of sound intensities approaching 130 db., and with unaugmented turbojets, of 125 db., rising to perhaps 140 db. with afterburners. These values are well beyond acceptable levels and threaten to reach proportions that we cannot hope to control satisfactorily by the simple expedient of operational restrictions.

It is absurd to suggest that a reasonable solution would be the relocation of airports or time limitations on their use. The penalties and depreciation of military and commercial values attendant on such a solution would work a totally unjustifiable disservice to the national interest. We must, therefore, consider the problem one of the most difficult but inspiring challenges which has been thrown at the scientists, engineers and operators of the country. It has been disappointing to find the degree of pessimism which prevails among the scientists and engineers on this subject. . . .

▶ **Noise Is Lost Energy**—It has been stated that noise is an unavoidable accompaniment of the generation of power or thrust and its application in the atmosphere. Nevertheless, we have such contradictory observations as that of two jets, the larger of which develops the lesser noise and apparently evokes the fewest complaints.

We, also, have the encouraging thought that sound represents lost energy even though it be small in percentage and magnitude. Efficiency gains, in some cases, can accompany sound reductions, and that hope should give an added stimulation to the program.

We know that the harnessing of exhaust energy by the operation of exhaust turbines, as in a compound engine, will make a reduction in the exhaust noise.

We also know that reduction of propeller tip speeds, with negligible loss of efficiency, although involving some weight penalties, produces marked benefits in noise reduction.

We know further that turboprop installations such as the British Bristol Britannia with Proteus engines have an encouragingly low sound level. In some installations, intake designs give annoying noises where in others they do not.

We know that precipitation and suitable ground cover are very helpful in promoting attenuation.

We are not sure of the reflective or sound directional control possibilities with jet exhaust. We know that some designs of exhaust jet are notably quieter than others. We know that on the ground reflective and absorptive baffles and sound shields can be provided.

All in all, I find no cause for pessimism, and feel that a wholehearted, intelligent and vigorous attack on all facets of the problem will bring it to a most gratifying conclusion.

▶ **Takeoff-Landing Performance**—Our somewhat larger, longer-range, high-altitude, highspeed transports must be injected into the increasingly crowded traffic patterns at existing airports. Obviously, such aircraft will find their primary use in connection with the larger centers of population, and the runway lengths available do not seem to present any problem with respect to takeoff except as to accelerate-stop distance.

Power required to achieve the high-speed performances and the relatively low wing loadings required for efficient operation at the high altitudes, would appear to give very adequate unaugmented takeoff characteristics. There is, of course, some question of variations of takeoff performance with temperature, but with reasonable accountability, this does not appear serious.

On the other hand, we must examine most carefully the aircraft performance during approach and landing. It would be most desirable if all aircraft could have a wide latitude of satisfactory approach and climb-out speeds, such that maximum consistency and good flexibility of operation would be available during the approach and climb regimes to accommodate at any given airport or on any given runway, a maximum traffic frequency.

If this cannot be accomplished, the situation will, of course, be largely dependent upon the aircraft having the highest required approach speed and the aircraft having the lowest climb speed. Presumably, all other aircraft could, if necessary, speed up their approaches within reason, or with sacrifices of efficiency decrease their climb speeds for maximum traffic capacity.

Anticipating a fully satisfactory climb performance for our future transport, we must then look to a satisfactorily low approach speed and adequate control to insure airport efficiency. The existing requirement of approximately 10% residual thrust on approach to provide prompt acceleration, if needed, gives us a difficult problem.

▶ **Reverse Thrust**—The other portion of this problem is, of course, the landing

"Olson, if you don't like my design, I wish you'd come right out and say so. . . ."

Douglas Airview News

deceleration. With a clean jet-type airplane without reverse-thrust provisions, we are very dependent on a super-efficient landing technique and the existence of very satisfactory runway characteristics and airplane braking qualities.

We can, of course, look to dive brakes and other high drag devices for aerodynamic deceleration during the initial landing run. We might even look to drag chutes for such assistance on emergency fields, or in cases of slippery runways or over-shoots. However, the effectiveness of such devices rapidly diminishes with loss of speed, and they cannot be considered, in any sense, the equivalent of a reverse-thrust-producing mechanism for landing safety under all conditions. I look forward confidently to the development of satisfactory reverse-thrust mechanisms for jets.

► **Collision Problem**—In the field of operation, itself, we must look forward with increasing concern to the possibilities of collision with terrain, with other aircraft, as well as the adverse effects of rain, hail and turbulence. We cannot deny that increased speeds make these problems more difficult, and the adverse effects more important to avoid.

The "see-and-be-seen" principle is already obsolescent in consideration of increasing speeds and air traffic densities in the vicinity of major terminals. The interim provision of high-intensity flashing lights to help in the air-to-air collision problem is, of course, a worthwhile contribution. But, as speeds and traffic densities further increase, such devices do not alleviate the confusion.

It is evident that satisfactory airborne radar can be very beneficial as a defense against terrain collision, and can function as a supplementary navigational device, and can help greatly to avoid the high turbulence associated with thunderstorms. As yet, we have no answers except the meteorological approaches to the complete avoidance of hail collision or clear air turbulence, nor can radar be considered a satisfactory device for the prevention of air-to-air collisions, due to the rapidity of the relative motions and the confusion of the information presented in this instance.

It would seem that the solution to this problem lies in the area of more precisely controlled flight paths and patterns with the hoped-for development of cockpit indications and warnings possibly operated on the Doppler principle.

As to unavoidable turbulence . . . it is hoped much more will be done in the direction of gust alleviation provisions in basic airplane designs.

(The second and concluding installment based on Littlewood's Wright Brothers Lecture will appear in AVIATION WEEK *next week.)*

IAS Summaries

Papers discussing the effects of friction at high speeds were among those presented at the Institute of the Aeronautical Sciences' recent 21st annual meeting in New York.

Summaries of four IAS papers are printed here, continuing publication begun last week (p. 36). Additional papers will appear in succeeding issues.

Aerodynamics

▶ **Survey of Friction Coefficients, Recovery Factors, and Heat-Transfer Coefficients for Supersonic Flow.** Joseph Kaye, Assoc. Prof. of Mechanical Engineering, Massachusetts Institute of Technology.

In the past four years, significant experimental and theoretical contributions have been made in the study of the laminar boundary layer up to Mach 3.

Small discrepancies between theory and experiment still exist in this range for friction coefficients and recovery factors. The amount of experimental data on heat-transfer coefficients in this range is still almost negligible compared to the wealth of such data on subsonic flows. The greatest need is to extend the experimental data beyond Mach 3 and to investigate the effects of pressure gradient, radiation, transition, surface curvature, etc.

In the past four years, significant contributions have been made in the theory of the turbulent boundary layer for supersonic flow, but the quantity of experimental work has not kept pace with the theoretical work, especially in the case of heat-transfer coefficients. Experimental data on friction coefficients and recovery factors have been extended to Mach 3 and a length Reynolds number of 20 million, and these data agree within 10% of the results predicted by several theories. The greatest need is to obtain reliable data on heat transfer coefficients for turbulent boundary layers, since, practically speaking, none is available.

▶ **Direct-Force Measurements of Turbulent Skin Friction on Cone-Cylinders at Subsonic and Supersonic Velocities.** Dean R. Chapman and Robert H. Kester, Ames Aeronautical Lab., NACA.

The principal results of a study of all known theories for calculating turbulent skin friction in compressible flow are briefly reviewed. These various theories, approximately 15 in number, predict widely different effects of Mach number on skin friction (and, hence, also on heat transfer), thus emphasizing the inadequacy of the present turbulent boundary-layer theory and the need for experimental measurements.

During the last two years, systematic experiments have been conducted in the Ames 1- by 3-ft. supersonic windtunnels No. 1 and No. 2 to determine turbulent skin friction on cone-cylinder bodies of revolution having fineness ratios of 10, 15, and 25. Data were obtained by using a direct-force method of measuring the overall skin friction. Boundary-layer surveys determined correction necessary to the force measurements in order that the final data represent fully developed turbulent flow.

Measurements made with different pressure distributions showed no significant effect on skin friction of moderate changes in pressure gradient. At both subsonic and supersonic velocities, the skin-friction coefficient was observed to depend only to a small extent on the body fineness ratio. For each fineness ratio, however, the effect of Mach number was found to be large, amounting to approximately a 50% reduction in skin-friction coefficient at Mach numbers near 4 compared to corresponding values measured at subsonic Mach numbers. This effect of Mach number did not depend significantly on Reynolds number or body fineness ratio and was found to be in good agreement with experimental measurements.

Four of the various published theories of turbulent skin friction agreed with each other and with the measurements to within about 5% at all Mach numbers investigated.

At Mach 10, these same theories will predict values of skin friction which differ from each other by approximately 100%, thereby indicating need for future skin-friction measurements at hypersonic Mach numbers.

Flight Propulsion

▶ **Propagation of Stall in Compressor Blade Rows.** Frank E. Marble, Asst. Prof., Guggenheim Jet Propulsion Center, California Institute of Technology.

The stall propagation speed, steady and oscillating blade forces are calculated for a single blade row. The analysis is extended to two adjacent blade rows in relative motion, such as a stator and rotor combination. The influence of mutual interference upon the speed of stall propagation, steady and fluctuating blade loads may be strong depending upon the geometry and velocity diagrams for the two rows. The process of approaching and entering the state of rotating stall is discussed for a compressor utilizing an external throttling mechanism.

The observations that a propagating stall may occur which involves only a portion of the blade height are examined on the basis of a three-dimensional cascade theory.

Aircraft Design

▶ **Military Air Cargo Carrier Trends.** Walter Tydon, Chief Engr., Aircraft Div., Fairchild Engine & Airplane Corp.

This paper deals basically with the operational trends as they affect component and system designs, where speed becomes only one factor, with other more important factors being turn-around-time and ability to deliver to final destination. The fuselage design, with its trend toward high wing, is being more and more influenced by larger units of cargo.

Advance base operation has also had a marked influence on cargo types with requirements for low take-off and landing distances, low-speed stability and control, rough field gear, simplified loading, and need for lower turnaround-time. With these have come such accepted features as cockpit emergency egress hatches; external fuel with its advantages of safety, wider CG. cargo range, ease of refueling, service, and repair; and structural requirements for crash landings.

NAVY CONTRACTS

The following contracts were announced recently by the Navy's Aviation Supply Office, 700 Robbins Ave., Philadelphia 11.

Aero Instrument Co., 5105 Denison Ave., Cleveland 2, tube, pitot, 3,392 ea., $35,616.

Solar Aircraft Co., 2200 Pacific Highway, San Diego 12, support assemblies, $49,096.

McDonnell Aircraft Corp., P. O. Box 516, St. Louis 3, parts for FH and F2H aircraft, $63,295.

Nash Engr. Co., Wilson Ave., South Norwalk, Conn., pump assembly, 95 ea., $105,009.

Fairchild Camera & Instr. Corp., 88-06 Van Wyck Blvd., Jamaica 1, N. Y., motor, 200 ea., $25,315.

Advance Gear & Mach. Corp., 5851 Holmes Ave., Los Angeles 1, gear box, 28 ea., $26,100.

Skinner Purifiers Div., Bendix Aviation Corp., 1500 Trombly Ave., Detroit, filter assembly, 1,740 ea., $49,132.

Air Associates, Inc., Teterboro, N. J., maintenance parts for AD aircraft, $94,385.

Douglas Aircraft Co., El Segundo, Calif., maintenance parts for aviation armament, $318,545.

International Packing, 712 American Bldg., Richmond, Va., water drinking, emergency, $88,924.

Anyx Oils & Resins, 95 Broad St., New York 4, raw tung oil, 108,000 lb., $36,720.

Weston Hydraulics, 10918 Burbank Blvd., North Hollywood, Calif., sleeve assembly, 855 ea., $30,780.

National Lead Co., 2607 E. Cumberland St., Philadelphia 25, pigment, 120,000 lb., $35,640.

Airborne Accessories, 1414 Chestnut Ave., Hillside 5, N. J., actuators, $115,334; maintenance parts for various aircraft, $141,117.

Holley Carburetor Co., 5930 Vancouver Ave., Detroit, fuel control, 50 ea., $149,500.

Douglas Aircraft Co., 3000 Ocean Park Blvd., Santa Monica, maintenance parts for R5D aircraft, $190,719.

Victory Apparel Mfg., 250 Passaic St., Newark 4, N. J., adult life preservers, $556,706.

B. F. Goodrich Co., 500 S. Main St., Akron 18, brake assembly, 171 ea., $192,026.

Pesco Products Div., Borg-Warner Corp., 24700 N. Miles Road, Bedford, Ohio, hydraulic pumps, $157,356.

Mine Safety Appliances, Braddock, Thomas & Meade Sts., Pittsburgh, mask, 2,955 ea., $58,302.

New Jersey Zinc Sales Co., Inc., pigment, 288,000 lb., $40,608.

Foote Bros. Gear & Machine Corp., 4545 S. Western Blvd., Chicago, actuators & boxes for various aircraft, $38,710.

Lockheed Aircraft, 2555 N. Hollywood Way, Burbank, hydraulic valves, $36,980.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., instruments for various aircraft, $27,907; air pump and spare parts, 843 ea., $502,540.

Welson Tool Co., 3000 Woodhill Road, Cleveland 4, pump assembly, 690 ea., $52,380.

Foote Bros. Gear & Mach. Corp., 4545 S. Western Blvd., Chicago, ball screw assembly, 200 ea., $62,794.

AiResearch Mfg. Co., div. of The Garret Co., 9851-9951 Sepulveda, Los Angeles 45, actuators, $94,860; parts for various aircraft, $65,248.

Adel Div., Gen. Metals, 10777 Van Owen St., Burbank, parts for various aircraft, $234,770.

Peterson Co., 350 Pennsylvania Ave., Freeport, N. Y., float, life, 185 ea., $26,659.

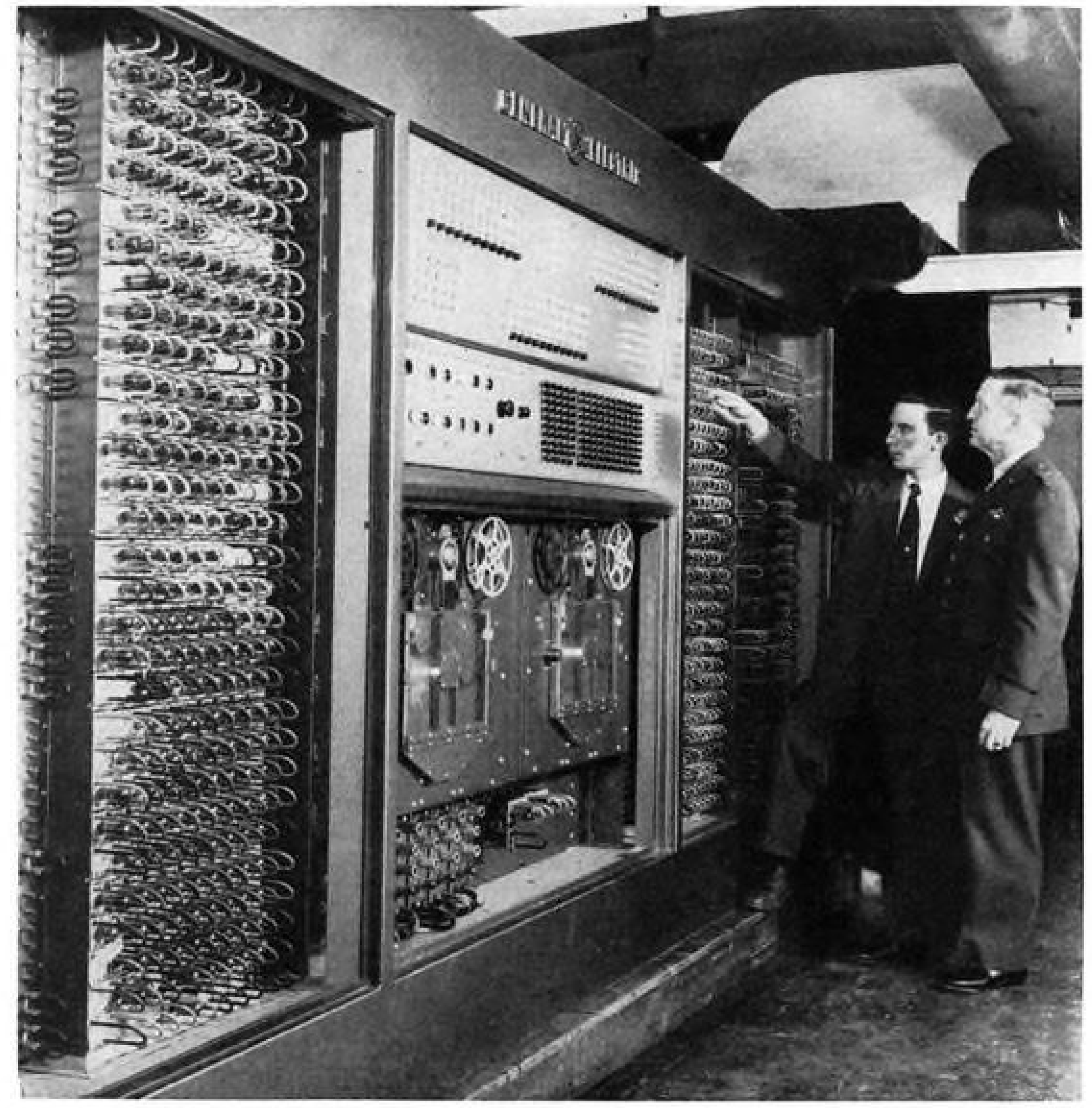
Garfield Electric Co., 68 E. 116th St., New York 29, clocks, 4,540 ea., $33,596.

Consolidated Vultee Aircraft Corp., Lindbergh Field, San Diego 12, parts for P4Y aircraft, $42,229.

Big Brain to Solve Aviation Problems

- Oarac memory can hold up to 10,000 'words.'
- First task: solving of 1,011-equation problem.

By Philip Klass



OARAC, GE-built automatic computer, will help speed development of new aircraft and equipment. Gen. L. I. Davis is seen inspecting USAF's new analytic tool.

Syracuse, N. Y.—Oarac, newest entry in the field of large electronic digital computers, is expected to save the Air Force and the aviation industry valuable research and development time, as well as much costly flight testing previously required in the development of complex aviation equipment.

Developed by General Electric's electronics division here, Oarac's claim to fame in automatic computer circles is its comparative simplicity and its very large internal memory.

A minor crisis in the Oarac program occurred when the Office of Air Research, for whom the computer was named, had its name changed to Flight Research Laboratory. Rather than change the computer's name to the unpronounceable Frlac, General Electric stuck to Oarac.

Brig. Gen. L. I. Davis, director of armament at Air Research and Development Command headquarters in Baltimore recently accepted Oarac for the USAF and it is now on its way to the Flight Research Lab at Wright Air Development Center in Dayton. There it will soon be solving complex problems in avionics, physics, aerodynamics, ballistics, logistics, and even dietetics.

▶ **Avionics Problem First**—Oarac's large internal memory, capable of storing 10,000 "words" (a "word" is a 10-digit number, plus sign, or an operational instruction), equips it to handle problems like its first FRL assignment in magneto-ionic theory. The problem requires the solution of 1,011 simultaneous equations.

The object is to find the index of refraction, index of absorption, and polarization of low-frequency radio waves in an ionized medium in the presence of an external magnetic field.

If this problem were given to an experienced operator working with a conventional automatic desk calculator, he would need about 20 years to solve it; Oarac will provide the complete solution in about 200 working hours, GE says.

▶ **Technical Speaking**—In the language of computers, Oarac is a serial decimal, binary coded, single-address machine with magnetic tape input and output, and a magnetic drum internal memory.

"Decimal serial" means that the computer works with numbers in decimal form and that the "weight" of any digit in a number is determined by its position relative to other digits in the number. (In the number "88" for example, the first eight has 10 times the weight of the second eight, by virtue of its position.)

Each digit in a number is represented by a binary code or combination of four binary digits. The four binary digits are always stored and handled in parallel (simultaneously) for each decimal digit.

By "single address" is meant that a single command contains only the information on the location of information to be pulled out of the memory, or to be placed in the memory, but not both.

▶ **Not the Speediest**—By comparison with some electronic computers, Oarac appears to be "slow-witted." It can perform only 110 operations (additions, subtractions, etc.) per second. (Raydac, built by Raytheon Manufacturing Co. for Navy BuAer, reportedly operates 10 to 15 times faster.)

Actually Oarac could do better if it were not for delays involved in getting data out of its large internal memory. (Maximum access time to any "word" stored in the internal memory is 17 milliseconds.) Basic (counting) pulse repetition rate is 150,000 per second.

GE reasoned that super speed is not the most desirable feature in a computer. A medium-speed machine which has good reliability can turn out more work than a super-speed machine whose complexity is so great as to cause frequent failures. Even a "slow" electronic computer operates so rapidly that it is apt to run quickly through the available supply of complex problems worthy of its efforts. In most cases, it is the time required for human operators to set up

SOLUTIONS are recorded on magnetic tape for transcription by electric typewriter on output console. Problem is set up on tape for computer from similar console.

the problem, rather than computer speed, that limits a computer's useful output.

▶ **Simplicity the Goal**—To achieve maximum computer simplicity, GE engineers decided to:

• **Eliminate permanent programs.** Except where a few added components would save considerable work in programming a problem, GE eliminated the complexity of built-in (permanent) program operations. Instead, Oarac's large internal memory makes it feasible to store the complex programs or sequences on magnetic tape. Frequently encountered problems can be "taped," to form a library. Only the special boundry conditions peculiar to a particular problem need then be added to the tape.

• **Standardize circuits.** By what it calls "careful use of symbolic logic," GE was able to standardize on seven basic circuits. These are able, GE says, to perform all required storage, gating, choice, mixing, and regeneration functions. With fewer circuits, more engineering effort could be put into the design of each circuit.

▶ **Proof of the Pudding**—One example of Oarac's comparative simplicity is that it uses only 1,400 vacuum tubes and 7,000 germanium diodes. (Raydac, for example, uses 5,000 tubes and 18,000 diodes.) Even an infinitesimal percentage of tube failures can result in frequent computer shutdowns. To improve Oarac's tube life, tube filaments are operated at 90% rated voltage.

To facilitate maintenance, all the basic circuits are built on quick-disconnect, plug-in chassis (manufactured by Alden Products Co.). Chassis handles are color coded to identify each type of circuit. Each assembly is constructed to permit the flow of forced cooling air through the adjoining units on the computer rack.

▶ **Link With Outer World**—Like most computers, Oarac's line of communications with the human world comes through magnetic tape. A human operator, working at an "input console," types out the problem on a standard electric typewriter. The console automatically codes and records the information on magnetic tape. When the computer is available, the tape is inserted. Tape can provide the computer with data as fast as it can devour it.

Because the computer spews out its answers too quickly for an electric typewriter to keep pace, the solution is also "taped" on another magnetic tape. The tape is then removed, freeing the computer for another problem, and transcribed on the "output console" at a leisurely rate (96 "words" per minute) which an electric typewriter can handle.

Output console controls permit the answers to be typed out in any one of a variety of tabular forms.

▶ **Internal Memory**—Oarac's internal memory consists of a large cast aluminum alloy drum (22 in. diameter, 30 in. length) coated with a ferrous (magnetic) material and driven at a speed of about 3,400 rpm.

Because each decimal digit is represented by a four binary-digit code, four magnetic recording heads are needed to record each decimal digit on the memory drum. These four magnetic heads are mounted at 90-deg. intervals around

SEVEN BASIC UNITS, such as this, make up Oarac. They are mounted on plug-in chassis for easy maintenance.

the circumference of the memory drum and are referred to as a "parallel track."

Each track is capable of recording 200 decimal "words" (2,200 decimal digits, or 8,800 binary digits) around the circumference of the drum. There are a total of 50 such tracks, with recording heads, spaced along the length of the drum. This gives the drum a total capacity of 10,000 "words."

A single magnetic head is used both for recording and reading out information from the memory drum. This eliminates the head alignment problem existing when separate heads are used to perform the record-in and the read-out functions.

► **Self Checking**—Like many computers, Oarac has provisions for automatically checking its computations lest it show the human failing of making a mistake. One inherent self-checking feature arises from the use of the four binary-digit code to represent each decimal number. The four binary digits provide 16 possible combinations (2^4), but only 10 of these combinations are used to represent the ten decimal numbers from zero to nine.

If a computer malfunction causes any one of the six unused binary combinations to come up, the machine spots them as easily as a poker player would "call" his opponent if he laid down "five aces" when there was "nothing wild." When the computer spots such an impossible combination, it automatically stops and rings an alarm.

Oarac also has a "roll back" provision to check against faulty programming or a single transient failure.

The computer can be set up to make occasional accuracy checks by performing a given calculation in two different ways, and then comparing the results. If the results agree, Oarac automatically proceeds to go to work on its next operation.

If the results fail to agree, the computer returns to the previous check point and repeats the dual operation. If the answers still don't jibe after three checks, Oarac will "give up," and ring the alarm.

► **Eye to Automatic Factory**—GE's interest in digital computers appears to lie beyond building an occasional special-purpose mathematical wizard like Oarac. The Syracuse electronics division which built Oarac is also developing automatic factory-type machines for the Signal Corps. These are designed to produce electronics assemblies completely automatically (Aviation Week Nov. 17, 1952, p. 36).

Such machines will take their operating instructions in digital form from magnetic tapes—the same technique used in Oarac. GE sees a large potential market for digital control units for use in automatic factories in the electronic, chemical, and other manufacturing industries.

IATA Radio Meeting Transcript on Sale

The International Air Transport Assn. has published in book form a transcript of its three-day airborne radio symposium held last May in Copenhagen (Aviation Week June 23, 1952, p. 54).

The 252-page book gives a verbatim report of the ideas expressed by 150 representatives of 23 IATA airlines and 45 equipment manufacturers, government and research agencies. The IATA symposium, and its transcript, covered such subjects as HF, VHF and UHF radio communications, presentation of navigational information, aircraft antenna installation, and equipment design and installation. Several papers on single side-band transmission, secondary radar system, etc., are included in the book's appendix.

Transcript copies are available for $3.00 from IATA, International Aviation Bldg., Montreal 3, Quebec, Canada.

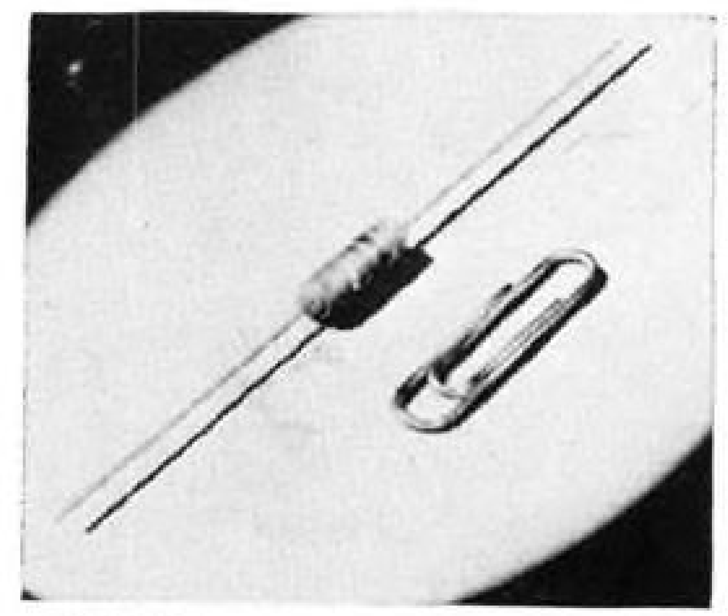
Oscilloscope Gives Precise Flight Checks

A lightweight precision cathode-ray oscilloscope available from Tektronix, Inc., gives a wide choice of time bases between one microsecond and 50 seconds. Its linearity permits waveform voltage to be read directly from the 3-in. screen in any one of nine calibrated ranges.

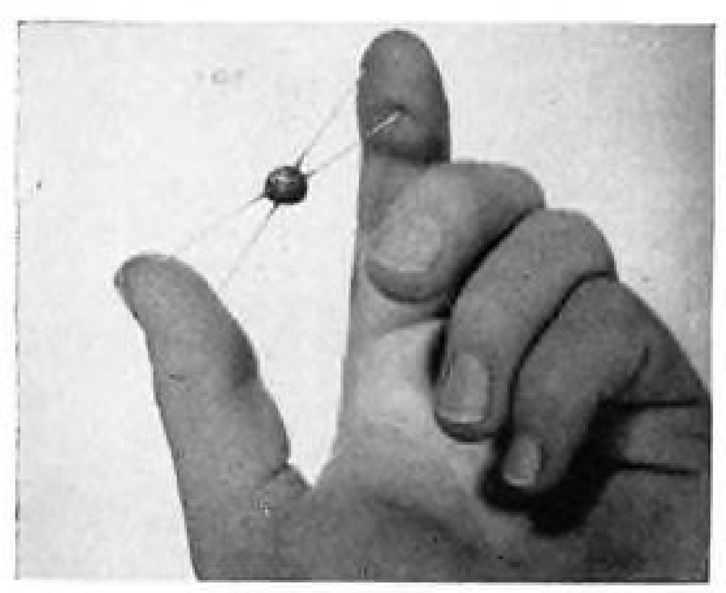
The new type 315D weighs only 35 lb. and operates from 115 v., 50- to 800-cycle power, so that it can be used aboard aircraft for radar or communication equipment checks. A 5X magnifier allows the time base to be expanded either side of center and a direct-coupled trigger amplitude discriminator permits trigger phasing on complex waveforms. (Tektronix, Inc., Post Office Box 831, Portland 7, Oregon.)

It's a Small World In Components

Two new avionics componets are called "the world's smallest" by their respective manufacturers. The devices are:



• **Molded paper capacitor,** only ⅝ in. long and 0.175 in. dia. It is reportedly designed for continuous operation at temperatures up to 125C. Designated Type 85P, the new capacitor is available with tolerances of 20%, 10%, or 5% if required. Added information is available in Bulletin 205E from Sprague Electric Co., 327 Marshall St., North Adams, Mass.



• **Pulse transformer** capable of providing a 0.1 microsecond pulse width with a rise time of less than 0.005 milli-microseconds, according to the manufacturer. Unit reportedly meets MIL-T-27 and can operate continuously at temperatures of −70 to 125C, or up to 150C for short periods. Designated MPT 101-0.1, the pea-sized transformer weighs 0.03 oz. and is hermetically sealed. It is made by PCA Electronics, Inc. 6368 De Longpre Ave., Hollywood 28, Calif.

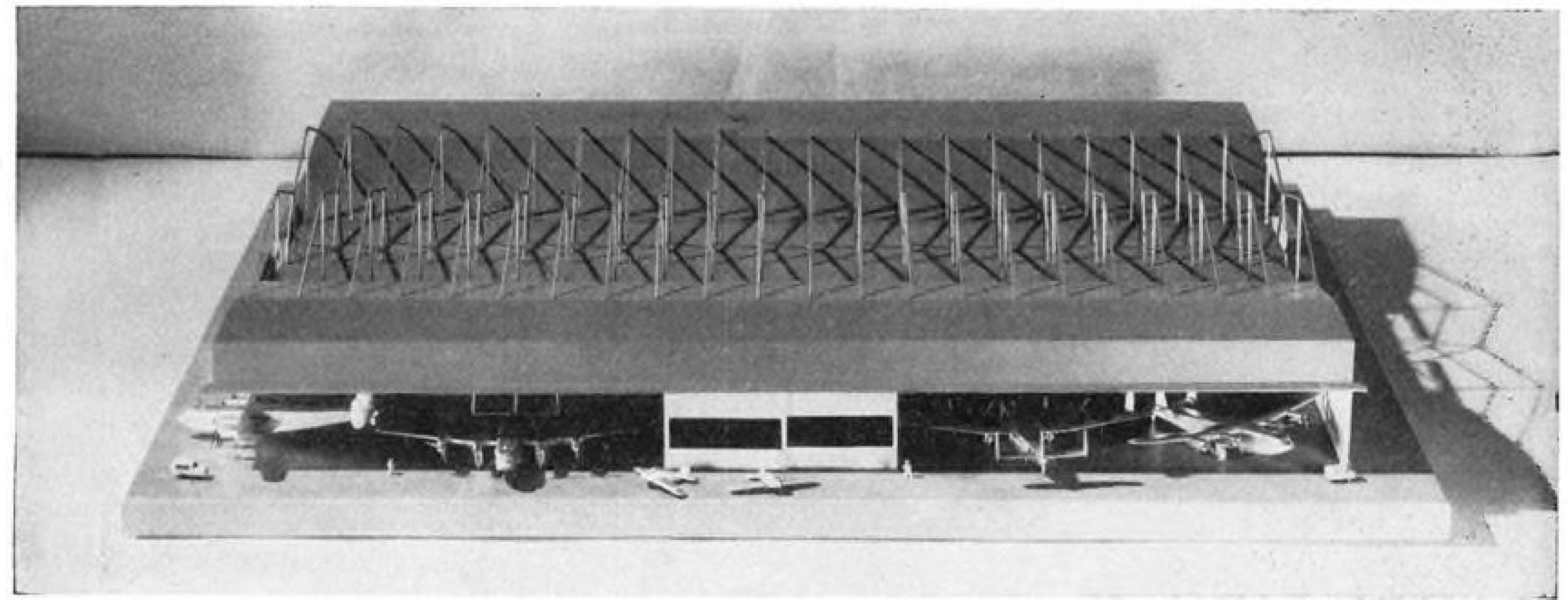
FILTER CENTER

► **McDonnell Buys Telereader**—McDonnell Aircraft Co. hopes to speed analysis of flight and windtunnel data by factor of 10 with its newly purchased Telereader and Telerecorder equipment. Made by Telecomputing Corp. of Burbank, Calif., the new equipment will be used in McDonnell's helicopter engineering division.

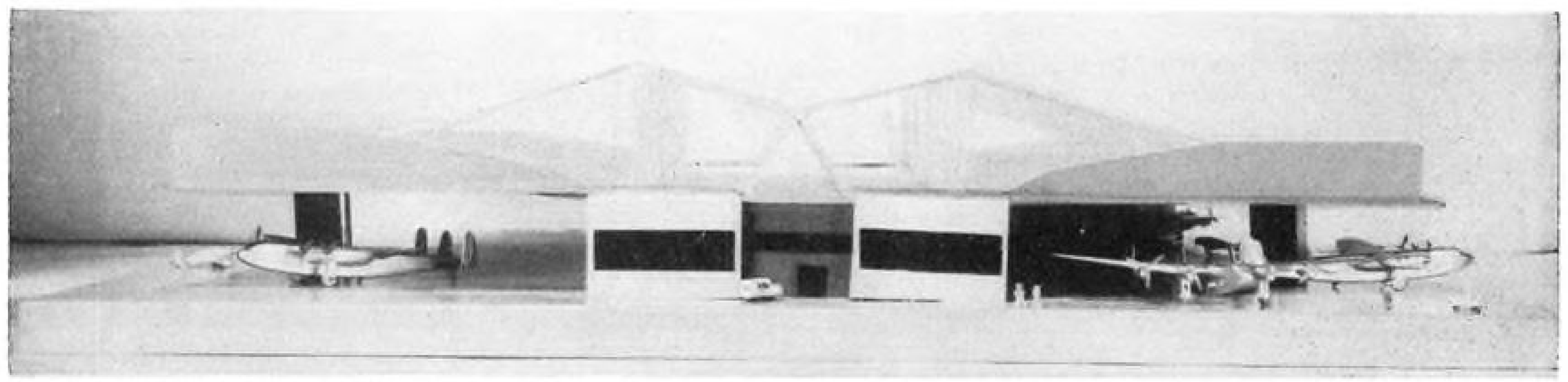
► **Simplified Assembly**—Westinghouse has cut assembly time of its aircraft d.c. voltage regulator by substituting a single-piece die-cast aluminum base for the 50-piece fabricated base previously used. Another saving is made in regulator frame. Previously fabricated from 140 separate pieces, Westinghouse now uses a single high-impact-strength molded plastic frame.

► **60-Kva. Alternator**—Latest and largest addition to Westinghouse Electric's line of aircraft alternators is a 3-phase, 400-cycle, 60-kva. machine for operation in the 5,400-to-6,600-rpm. speed range. Alternator which weighs 123 lb., can deliver 150% rated load for five minutes, 200% rated load for five seconds, Westinghouse says.

—PK



CANTILEVER-ROOF AIRCRAFT HANGAR (sliding doors in center) is new design offered to aircraft operators that affords . . .



UNOBSTRUCTED FLOOR SPACE which can be used for large-scale production overhauls. Double unit is pictured.

Expandable Hangar Features Clear Floor

By George L. Christian

A cantilever-roof aircraft hangar has been developed to give airline operators 100% unobstructed floor space and to allow simple expansion of the structure. The same type of construction could be adopted to manufacture of planes.

Designed by structural engineer Paul Rongved, and Cyril P. Erwin of Erwin-Newman Co., the hangar is built from an oblong office-and-shop lean-to that extends along one side and anchors cantilever girders supporting the roof. Sliding doors enclose the other three sides of the hangar but may be stored to give a maximum amount of floor space.

▶ **First Construction**—Thompson-Starrett Co., Inc., New York, is preparing to build the first cantilever-type hangar at Westchester County Airport in White Plains, N. Y., and lease it to Westair, Inc., a fixed-base operator.

Cost of the hangar will be "in excess of $1 million," Gerald Wilson, chief salesman at Thompson-Starrett, says. Proposed dimensions of the structure are: length 560 ft. and width 133 ft. The office and shop building will be two stories high and 67 ft. wide.

Advantages offered by the cantilever design are:

- **Cost.** Erwin and Rongved say construction expenses for their hangar will be comparable to the cost of conventional types.
- **Expansion.** Roof span of the hangar may be increased with special sections, the inner wall of the lean-to knocked out to house 40 x 67-ft. nose docks and pent houses built into the roof to accommodate aircraft fins and rudders of any height.
- **Increased Space.** The hangar is expected to house more aircraft per square foot than any other construction because of unobstructed floor space allowed by the cantilever roof and three open sides.
- **Versatility.** Possible uses of the hangar include any type of aircraft maintenance, overhaul, assembly-line manufacturing overhaul techniques and modification work.

▶ **Production Unit**—If built as a double unit, the hangar could be adapted to disassemble-reassemble production-line overhaul practices used by many large airlines.

Planes would enter one end of the hangar, with engines and accessories removed at successive stations and passed laterally to the lean-to for service. Aircraft would swing around at a covered end of the double hangar, and overhauled components would be reinstalled as the planes moved through assembly stations on the second side.

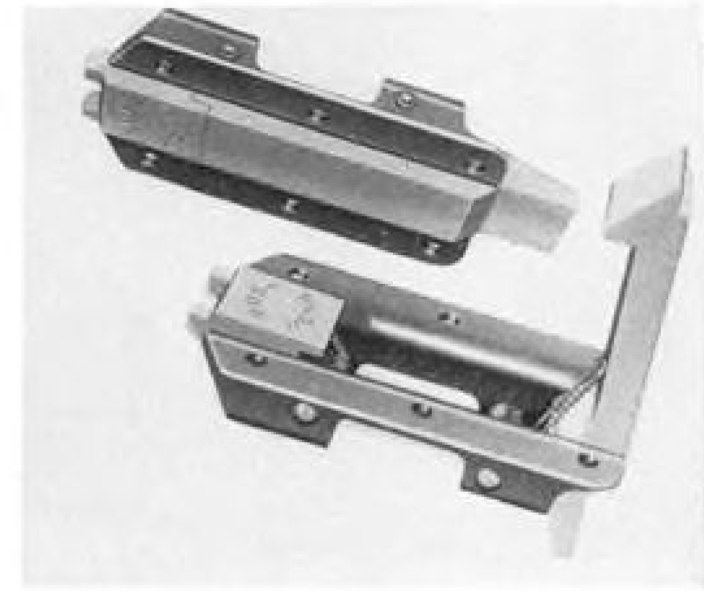
Free space of the cantilever type would reduce assembly-line stoppage, allowing immediate removal of a unit bogging down the line without disrupting the flow of aircraft through the hangar.

The hangar floor is designed to incorporate radiant heat, which Erwin and Rongved say will reduce heating cost by 6 cents per square foot and improve personal comfort.

Erwin-Newman Co., a Houston, Tex., steel-fabricating firm, has applied for patents on the design.

Models of the hangar recently were exhibited to airlines by Rongved and Erwin.

NEW AVIATION PRODUCTS



Flush Latch

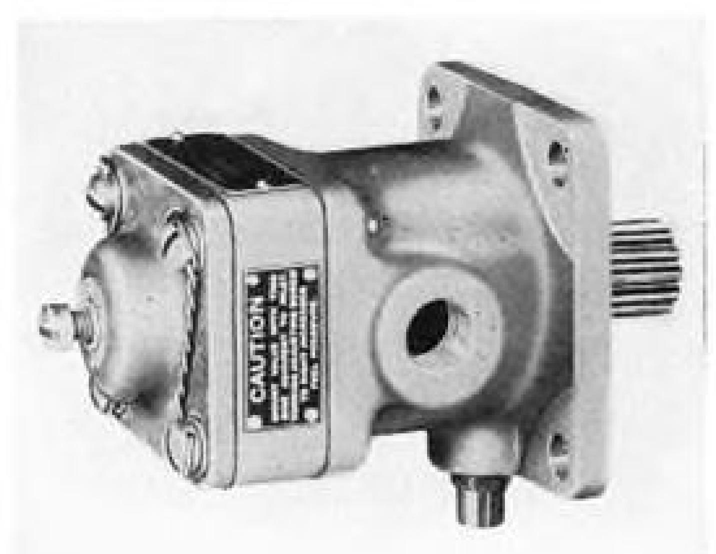
A new flush latch for aircraft, with aerodynamic flushness and high strength, has been placed on market.

Use of aluminum extrusion gives a very small radius of exposed edges, difficult to realize with punch press parts, according to the maker.

For installation, a rectangular slot is cut and a latch bracket fastened with six rivets to the door structure.

The bracket is made of 302 stainless steel sheet stock while 24S-T aluminum extrusions are used for trigger and bolt. Actuating springs are constructed of music wire, cadmium plated to resist rust.

Hartwell Aviation Supply Co., 9035 Venice Blvd., Los Angeles 34.

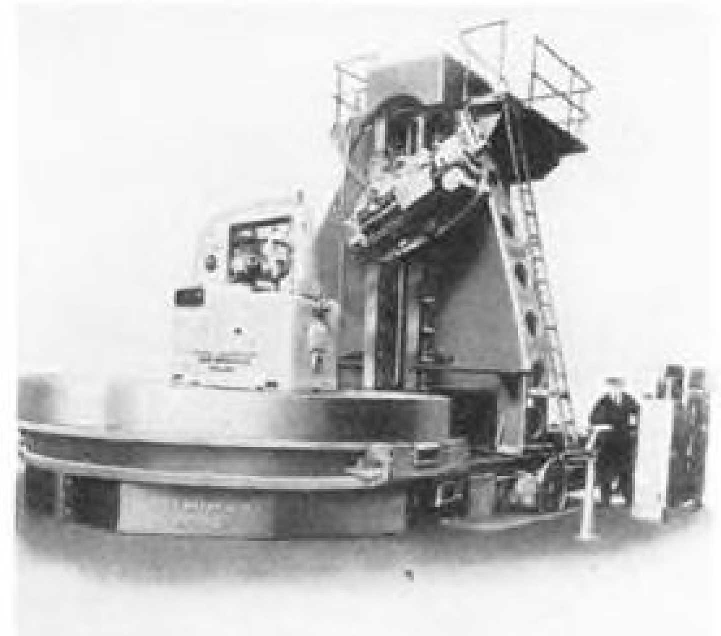


Lightplane Fuel Pump

A new lightplane fuel pump delivers .067 cu. in. per revolution, giving a rated capacity of from 2 to 30 gpm. at 3,700 rpm. Excess flow of fuel is routed through a relief valve and recirculated internally in the pump.

The one-pound unit, Romec's Model RD-7420-B or AJ, is built for engines up to 250 hp. Fuel delivery pressure is adjustable from 8 to 20 psi. A built-in bypass valve permits passage of fuel through the pump during engine starting or as an emergency source.

Romec Division of Lear, Inc., 110 Ionia Ave., N. W., Grand Rapids 2, Mich.



Gear Hobbers

World's largest gear hobber, is title claimed for machine developed by David Brown Machine Tools, Ltd., a British firm.

The machine will hob a gear 20 ft. in diameter. Photo shows a smaller Brown gear hobber perched on work-piece table of large machine.

Brown's complete line of gear equipment, including pinion hobbing machines, gear shavers, and spline hobbers, will be handled in this country by Morey Machinery Co., Inc., 410 Broome St., New York 13.

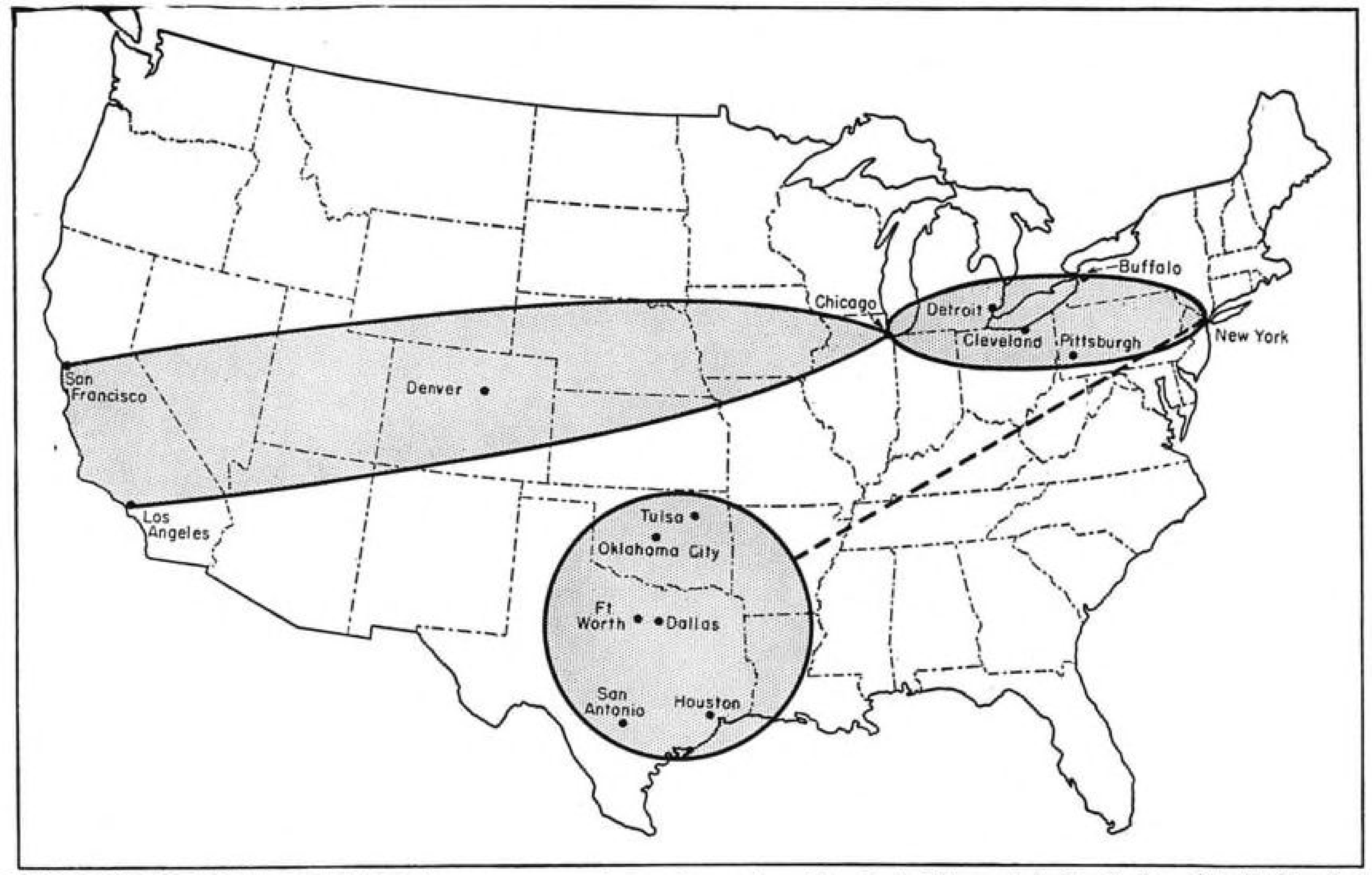
ALSO ON THE MARKET

"Anstac 2-M" is anti-static cleaning solution for aircraft canopies and other plastic areas. Non-flammable and colorless, its use is important where static electricity and dust attraction cannot be tolerated. It is made by Chemical Development Corp., Danvers, Mass.

Aluminum cleaner for use in aircraft and metal plants, composition No. 80-A, is said to provide high degree of safety and efficiency and can be used in soak tanks or pressure-spray washing machines. It is soluble in hot water, rinses in either hot or cold, and does not foam excessively, according to developer, Oakite Products, Inc., 157 Rector St., New York 6.

Rust is removed from steel and alloy steels by a new, free-flowing acid compound Descaler 2A, without the hazards that accompany use of strong sulphuric acid or hydrochloric acid, developer claims. Product gives controlled acid concentration to prevent overpickling, according to Enthone, Inc., 442 Elm St., New Haven, Conn.

Aircraft pipe plugs to specifications AN913 for square heads and AN932 for hexagon countersunk plugs are available in steel, copper alloy, aluminum alloy and magnesium in sizes 1/16 to 2½ in. from U. S. Plug and Fitting Co., Wellington, Ohio.



INVOLVED IN ROUTE MONOPOLIES are three general areas shown above: New York-Chicago, including Buffalo, Detroit, Cleveland and Pittsburgh; Chicago-California, covering San Francisco, Los Angeles and Denver; and New York route to Texas and Oklahoma.

Fight Opens on Big 4 'Monopoly' Routes

- **Exclusive runs still held by American, Eastern, TWA and United at stake in three CAB hearings.**
- **Smaller airlines seek Board permission to compete with major carriers on one-line domestic routes.**

By Lee Moore

A battle to break route "monopolies" held by the Big Four airlines is in its opening round, touched off by Civil Aeronautics Board with the start of hearings that may allow smaller carriers to compete on the New York-Chicago, Chicago-California and New York-Oklahoma-Texas runs.

Three members of the Big Four also are fighting among themselves to gain best route segments from each other. Trans World and American Airlines have applied for permission to serve United Air Lines' Denver and San Francisco routes; UAL is after TWA's Pittsburgh-New York shuttle, and TWA is out to break American's hold on the Southwest.

Braniff Airways and Capital Airlines are among the leading applicants for competitive service on the few remaining exclusive routes which are held by American, Eastern Air Lines, TWA and United.

▶ **First Case Scheduled**—The four CAB members have agreed unanimously on immediate scheduling of the New York-Chicago case, including Braniff's 10-year-old application for Chicago-Detroit service on that route.

Scheduling of hearings on Chicago-California and New York-Oklahoma-Texas route applications was planned by the Board two months ago. CAB's crowded docket has been one major obstacle to meeting that hearing schedule, but both may be assigned prehearing conferences soon, the first this winter and the second by the early part of the spring.

▶ **Fifth Board Member**—Indications are that Republican Board members Oswald Ryan and Chan Gurney do not wish to schedule the two vital route cases until after President Eisenhower appoints a fifth CAB member and designates a chairman.

Appointment of a fifth member was expected momentarily as of last week. Gurney told AVIATION WEEK a month ago he had not asked the White House to speed the CAB appointment, because Mr. Eisenhower would have more important decisions to make. But Gurney indicated last week it is apparent now that important CAB cases will remain deadlocked until the Board is filled out by a fifth member.

▶ **Board Split**—Although Board members and chief examiner Francis Brown are tight-lipped on the question of timing and exact outline of plans for route hearings, AVIATION WEEK learned that Democrats Josh Lee and Joseph Adams want early hearings. Gurney goes along with their efforts, but he leaves timing up to the chief examiner. Ryan probably would prefer delay.

Gurney said scheduling of cases generally is up to the chief examiner unless the Board sets a definite priority of case hearings. But he refused to reveal CAB's instructions for hearings on the three routes.

▶ **Examiner's Discretion**—Chief examiner Brown indicated that scheduling of the route cases now is up to him.

"As soon as examiners are available and the Bureau of Air Operations staff can report its readiness to testify, the examiners will put the route cases down for hearing," he said.

Brown could proceed rapidly with the area route-case program the Board laid down for him in late 1952, assigning it priority over other CAB hearings. He also could interpret the apparent hesitancy of the Board to press the two cases as nullifying earlier instructions to expedite them.

▶ **New York-Chicago**—The free-for-all got underway last week at a prehearing conference, where at least eight trunk lines pressed old applications and introduced new ones for practically every combination of routes from New York through major industrial cities on the Chicago route. Capital Airlines appears to some Washington observers as the greatest potential gainer in this case, and American is the most likely to suffer increased competition.

Main routes that one or more applicants may be granted by CAB in this case are:

• **New York-Buffalo.** This American Airlines route is the biggest single target of the case. Passenger-miles in the 1950 official survey (latest available) ranked 35th among all city pairs in the country. Capital, Colonial, Northwest and United are among carriers seeking to compete with American on the same route.

• **Syracuse, Rochester and Buffalo.** American has exclusive rights to serve New York, Detroit and Chicago from all three of these cities. New York-Buffalo service is the prize, but Capital will fight hard for rights on the other routes.

• **New York-Pittsburgh.** TWA has exclusive rights to unrestricted service between these points. Capital, United, and Chicago & Southern are among the applicants. C&S and United could compete only through extension of present routes.

• **New York-Detroit.** American also has an exclusive franchise on unrestricted service to this route, although several other lines serve parts of it.

• **New York-Cleveland.** CAB has separated this case as the New York-Cleveland nonstop case. United has exclusive certificated rights to unrestricted service. But Capital has similar rights granted by special CAB exemption and is considered certain of formal Board certification in this case. CAB gave the route to Capital in 1950. Northwest failed to ask consolidation of a similar application at the time but later got the courts to rescind Capital's award on grounds that CAB should have included Northwest in the case automatically. Applicants in the current case also include American and TWA.

• **New York-Chicago.** Braniff and Delta have long sought rights to enter New York. But the Board limited this case to routes terminating at Chicago and New York. Braniff and Delta may have a better chance for through service to New York in the Texas-Oklahoma case.

▶ **Chicago-California**—This will be a battle of transcontinental carriers American, TWA and United. Seniority of the case stems basically from TWA's 1945 application for Denver as an intermediate stop on its transcontinental routes through St. Louis to Los Angeles, plus nonstop flights from Denver to San Francisco.

TWA is adding an application for nonstop Chicago-Denver rights to this application, making the Trans World application heavily competitive with United's exclusive rights to east and west service from Denver.

American Airlines, prompted by United's attack on high-density coach policies, recently asked CAB for unrestricted rights to compete with UAL and TWA on Chicago-San Francisco service.

In the New York-Chicago case that went to prehearing conference last week, United asked CAB to add Pittsburgh to its Denver-Chicago-New York route. This makes TWA's Denver application and United's Pittsburgh petition identical route requests, in effect.

▶ **New York-Oklahoma-Texas** — Tulsa, Oklahoma City, Dallas, Ft. Worth and Houston are chief targets in this case. Bitter fights can be expected, and the case may be long delayed through its impinging on the northeast-southeast route system. Many airline rivalries will be involved. The exceptional pride of southwestern states and cities in their air-service status can be expected to bring heavy congressional pressure on CAB to grant competitive service.

Part of this case's seniority stems from a TWA application in 1946 to serve Tulsa and Oklahoma on its transcontinental routes. American is the only carrier into these two cities from the East and West Coasts.

Braniff has a two-year-old application to extend its Texas-Oklahoma system northeast to Pittsburgh, Washington and New York. It would bring competitive service to Eastern's New York-Houston and American's New York-Dallas monopolies, as well as Tulsa and Oklahoma City.

Other applicants include Delta, which will vie with Braniff for a New York route. Delta's application and similar petitions will involve the eastern north-south route pattern. The Board may have a hard time deciding how to limit this case without rejecting vigorously pressed applications of eastern operators.

FIRST CIVIL TURBO-COMPOUND SUPER CONNIE

Minus propellers and other gear, the first commercial version of the Super Constellation to be powered by Wright Turbo-Compound engines is shown being transferred from final assembly to another Lockheed hangar where it will be fitted out with all the trimmings. This model Super Connie will fly 59 first-class passengers or 99 tourists, and orders have been placed by a dozen airlines to the extent of $100 million. Cruise speed will be approximately 350 mph., maximum speed 400 mph. Lockheed has been flight testing a Turbo-Compound-powered Super Connie for Navy, the R7V-1.

Canada Licenses Two U. S. Carriers

Two American charter airlines have been licensed by the Canadian Air Transport Board to carry payloads from certain points in the United States to Canada:

• **Vincent Astor** of New York may fly a load of from 1,100 to 6,000 lb. per plane from Teterboro, N. J., airport to any point in the Canadian provinces and Labrador.

• **Aero-Ways, Inc.,** aircraft are allowed to carry up to 6,000 lb. each from the airline's home base at Cleveland to Toronto, London (Ontario), North Bay and Ottawa.

Enforcement Action On UAL Coach Begins

Civil Aeronautics Board members told United Air Lines attorneys last week that CAB is starting enforcement action against United for offering first-class service at coach fares in violation of its tariff.

The Board last Tuesday suspended a new United tariff that proposed the lower-capacity service at coach fares, contrary to CAB policy. The Board told United attorneys it would start enforcement within the week unless UAL complied with the seating terms of its existing tariff or filed a new tariff complying with CAB policy.

CAB says UAL has been violating its existing coach tariff since last Nov. 21 when United president W. A. Patterson ordered his airline to stop selling more than 54 seats on his 66-seat DC-4 coach, although his tariff stipulated a minimum availability of 66 passengers in the plane to justify the low coach fare.

In suspending the new United tariff proposal to continue this low-density seating, the Board said it would be unfair competition since other carriers are abiding by Board policy requiring greater passenger loads.

The Board also said that such United competition would force other lines to reduce their loads, thereby forcing a general increase in fares.

Enforcement procedures open to the Board:

• CAB can start criminal or civil action in a U. S. district court. In a criminal proceeding, the Board could seek penalties of from $100 to $5,000 per individual violation of the tariff. In a civil proceeding, the Board could ask the court to issue an injunction to prevent further violation.

• Or the Board can content itself with a formal proceeding of its own, involving oral arguments between the CAB Enforcement Section and United Air Lines before the CAB members.

United recently cut its DC-4 coach capacity from 66 seats to 54, charging that the high-density-seating standards of CAB are unsafe for emergency evacuation.

▶ **CAB View**—But CAB officials consider coach seating of some other lines considerably safer than United's new standard. They point to Eastern's 68-seat, 10-exit plane, which has one exit for every seven passengers: United's new 54-seat, six-exit standard provides that there will be one exit for every nine passengers.

United, in a rebuttal to Eastern's formal complaint challenging UAL's sincerity in the coach safety controversy, argued that Eastern's 67% increase in the number of exits did not necessarily make the plane safer for emergency evacuation.

For instance, if the extra exits are blocked off by fire, United said, "evacuation times increase with increases in number of passengers" (AVIATION WEEK Feb. 2, p. 12). A CAB official counters this by pointing out that the same eventuality that might shut off six of Eastern's exits could shut off six of United. "Then under United's own hypothesis," he says, "Eastern's 54 passengers would still have four exits left while United's passengers would have no exits at all."

Illustrating the same point, the CAB official poses the occasional situation of having one side of a plane blocked off in a crash. Eastern's 68 passengers would still have five exits, or one for each 13½ passengers. United's 54 passengers would have three exits, or one exit per 18 passengers. Eastern's exit availability thus would be 33% greater than United's, he argues.

More exits and better cabin crew training have been recommended by the Air Line Pilots Assn. for emergency evacuation. ALPA agrees with the Airline Stewards and Stewardesses Assn. that there should be two flight attendants on a coach or any plane carrying more than 40 passengers.

▶ **Passenger Comfort**—In the meantime, safety experts are debating another

coach-seating question: For any given number of passengers, is evacuation smoother with five-abreast seating allowing full leg room or four-abreast seating with less leg room?

The same question applies to passenger comfort. American Airlines fits eight more paying passengers into its five-abreast, 80-seat DC-6 coach than United's planned 72-seat transport. But American claims its full 40-in., first-class leg room offsets the comfort advantage of United's four-abreast seating plan, which provides only 35 in. between seats.

On window location, the disadvantages of each system about balance. Alteration of the seat interval in a four-abreast coach causes unconventional window location in reference to the seats. In a five-abreast coach the middle-row passengers have poor window visibility.

As airlines and manufacturers gain experience, they may be expected to design more comfort into coach seating.

CAA Seeks $45-Million Aid Fund

Special expenditure asked for buildup of navigation and traffic control aids on military, civil airports.

Civil Aeronautics Administration leaders are seeking a special high-priority expenditure of $45 million over the next three years to complete installation of navigation and traffic-control aids under the proposed U. S. common system for civil and military aviation users, a tentative new CAA program disclosed last week.

CAA also will ask additional appropriations for the Air Navigation and Development Board to finance an accelerated research program on new aids at an annual $11-million level.

The new administration program, which details ways in which CAA proposes to implement the recent recommendations of the Truman Administration's Special Airport Commission, is being circulated to U. S. aviation and airline industries.

Return comments are asked by Feb. 15, after which the proposed program and revisions will go to Commerce Secretary Sinclair Weeks for final action.

▶ **Long-Range Program**—The proposed special expenditures would be sought under recommendation by the commission for acceleration of "research and development programs and installation projects designed to improve aids to navigation and traffic control in the vicinity of airports, especially in congested areas." The recommendation says installation and adequate manning of radar traffic control systems should be given high priority.

Explaining plans to put this recommendation into effect, the tentative program says CAA will request funds to accelerate installation of air navigation aids. The administration estimates that approximately $45 million is required for the three-year period ending July 30, 1955, to accelerate the program for meeting the immediate objective of CAA's portion of the common system.

For ANDB's long-range program, "future appropriations at an annual level of approximately $11 million will be required," the program says.

The proposed new program endorses virtually 100% of recommendations made by the special commission. Members of the commission included CAA administrator Charles F. Horne, chairman James Doolittle and Jerome C. Hunsaker, chairman of the National Advisory Committee for Aeronautics.

▶ **New Airport Requirements**—To implement the commission's proposal for airport runway extensions and zonings, CAA offers to set up mandatory requirements for new airports as part of grant agreements for federal participation in local financing of the fields.

Requirements would provide for:

- Cleared runway-extension areas at least a half-mile long and 1,000 ft. wide, free from housing or other obstacles at each end of the dominant runway for all new airports of feeder size or larger.
- Fan-shaped zoning beyond each runway extension at least two miles long and 6,000 ft. wide at the outer limit. Height of buildings and use of land would be controlled to prevent construction of public assembly places and to restrict construction of residences to "more distant locations" within the zones.

CAA said the runway extension is primarily for safety of persons on the ground. The extensions are not overrun areas for runways; areas will not be graded except for removing obstructions; and building restrictions do not apply to air navigation aids that may be installed on extensions.

For existing airports, cities should go "as far as practical" in clearing areas and zoning runway approaches, EAA said.

New constructions should not be permitted on runway extensions, and objectionable structures should be removed wherever possible. Operating procedures should be designed to minimize hazard and nuisance to persons in the vicinity.

▶ **Raise Ceilings**—The commission's held that ceiling and visibility minimums under which aircraft are permitted to circle or maneuver in congested terminal areas should be raised by utilization of existing radio navigation aids.

CAA proposes to reduce the number of circling approaches by setting up additional radio navigation aids to provide additional straight-in instrument approach procedures.

The commission also offers to raise minimums at airports where safety considerations warrant, after re-evaluation. The commission found straight-in approach minimums were adequate.

Other implementation proposed by CAA from the airport commission's findings:

- Work with the National Institute of Municipal Law Officers to revise airport zoning model ordinances and in preparing test cases on constitutionality of airport zoning.
- Seek revisions of Civil Air Regulations for more flight-crew training; encourage use of flight simulators and group acquisition of simulators by air carriers.
- As equipment becomes available, review the degree of positive air traffic control desirable in each high-density traffic area. Full positive control in high density is the ultimate long-range objective, providing due consideration for all users.
- Conduct flight tests to establish a crosswind component of 30 mph. for Convair 340, Lockheed 649, 749 and Martin 2-0-2 airplanes; carry out research in cooperation with industry to determine maximum allowable crosswind components in adverse runway conditions, including ice.
- Encourage installation of special crosswind gear on transport aircraft, and continue policy of single-runway or parallel systems.
- Continue annual studies of community-airport requirements and runway lengths; available data indicates that 8,400-ft. standard runway length for transcontinental or intercontinental airports will suffice for a substantial number of years.
- Carry out programs to minimize noise at airports, install acoustical gear in runup areas and teststands; reduce noise nuisance of airplanes in approach and departure procedures through pilot instruction and training; arrange patterns to avoid unnecessary flight over thickly settled areas but only within safe flight limits; train crews away from residential areas; make test flights away from builtup areas; separate military and civil flying at congested airports by developing a list of airports by categories of exclusive use and joint civil-military use.
- Encourage helicopter development for shuttle and short-haul use—emphasizing safety, reliability and public ac-

ceptance. This is to be done through pushing certification for transport-type copters and operating copters and through pushing development of heliports and special landing areas at airports.

- Encourage maximum use of "fail-safe" devices and further research in this field.
- Encourage simplification of airplane design wherever feasible.
- Work with the Aero Medical Assn. in a study of pilot aging and allied problems.
- Secure funds to add more CAA inspectors, and increase emphasis on supervision of aircraft maintenance, operating and training.
- Consider relocation of airway facilities where practicable to reduce flying over thickly settled areas. Locate new installations to avoid noise nuisance and flight hazards.
- Promote use of radar control, including surveillance radar and airborne anti-collision radar.
- Encourage use of airborne and ground recording devices.
- Expedite development of a miniaturized distance-measuring equipment, and work for airborne omnirange and DME in all instrument-flying aircraft.

Heacock Resigns As ACTA President

Amos Heacock, president of the nonscheduled airlines' Air Coach Transport Assn. since its founding more than two years ago, has resigned to resume full-time attention to his own airline business. The board of directors met last week to discuss appointment of a successor who can give undivided attention to ACTA affairs, as urged by Heacock at the general meeting last year.

An ACTA official said Heacock resigned now to hasten selection of a successor. Heacock will remain on the board.

He also is president of the Seattle-Alaska nonsked, Air Transport Associates, Inc. He served as president of ACTA without salary.

His airline faces revocation of its operating rights by Civil Aeronautics Board this year unless the Supreme Court reviews Heacock's appeal of the CAB order (AVIATION WEEK Feb. 2, p. 90).

Heacock has been an outspoken critic and a relentless challenger of CAB policies forbidding nonsked competition with scheduled airline operations.

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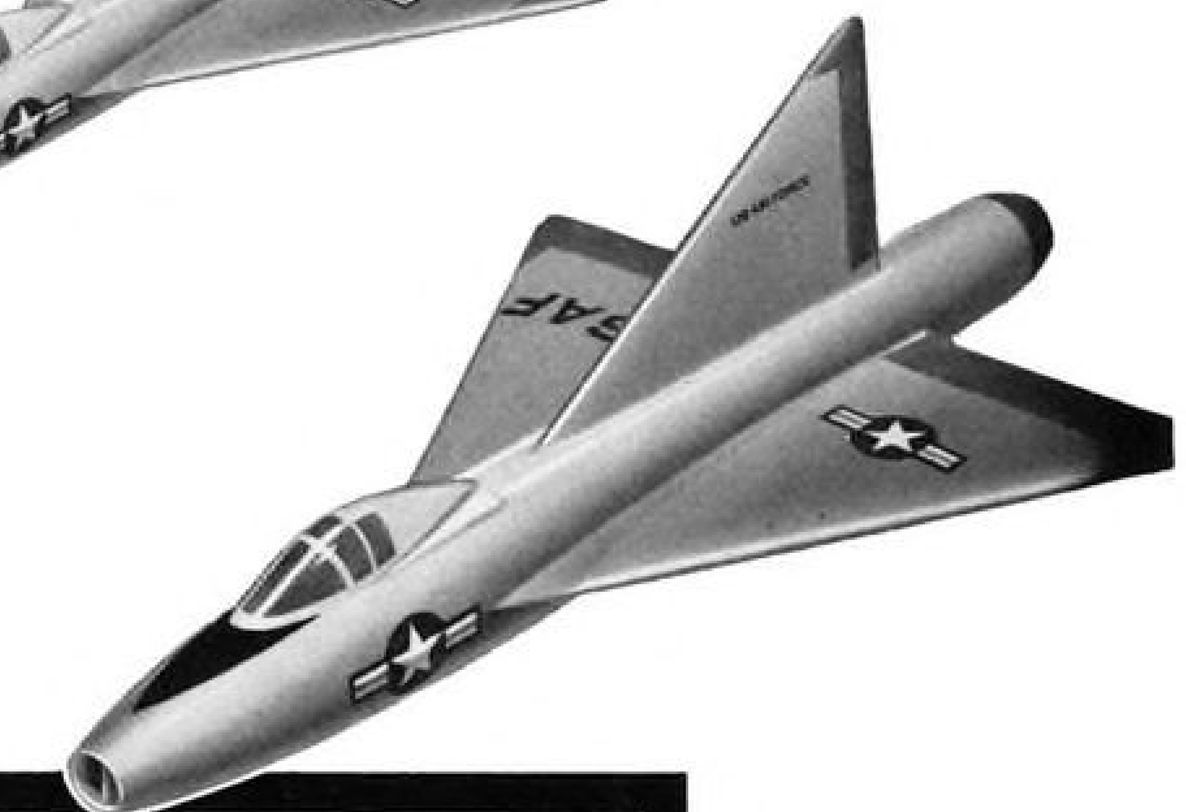

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SHORTLINES

▶ **American Airlines** has told CAB it will be glad to furnish unrestricted Dallas-San Antonio service as requested in a San Antonio Chamber of Commerce application to CAB. Service currently is restricted to those flights starting or ending in Mexico.

▶ **British European Airways** claims a London-Cologne speed record of 70 min., 17 sec., flown by a BEA turboprop Vickers Viscount despite bad weather that caused 10 minutes delay in a GCA landing.

▶ **Canadian Pacific Airlines** proposes trans-Pacific immigrant coach fares of $500 from Hong Kong and $450 from Tokyo to Vancouver, Portland, Seattle, San Francisco or Los Angeles—30% under present fares of $726 and $650 respectively. . . . CPA has taken delivery of the first of four 50-passenger DC-6Bs and two DC-6A cargo planes on order.

▶ **Eastern Air Lines** has retired the last of its DC-3s, replaced by 60 Martin 4-0-4s. The fleet had piled up 83.5 million miles since starting operation in 1936. DC-3 No 344, with 56,782 hours flight time (6½ years actually in the air), goes to Smithsonian Institution's National Air Museum. . . . Eastern has expanded passenger facilities at New York International Airport.

▶ **El Al Israel Airlines** managing director Louis Pincus, referring to a decision to convert the carrier's entire operation to coach, says: "We will attempt to make tourist service a specialty, not merely an inexpensive alternative to luxury travel."

▶ **Flying Tiger Line** domestic freight volume in 1952 was 48% higher than a year ago to 41,584,387 ton-miles. . . . Flying Tiger has cut garment freight rates eastbound 11 to 12½% on movements of 5,000 lb. or more.

▶ **International Civil Aviation Organization** navigation commission has decided that airline life jackets must be supplied with a waterproof, battery-operated flashlight.

▶ **Port of New York Authority** has published an airfreight origination and destination survey.

▶ **National Airlines** has grown from the "smallest of the country's 16 domestic airlines" in 1939 to a major carrier topped only by the Big Four in annual net income earned, Selig Altschul of Aviation Advisory Service reports in a study and appraisal of NAL.

▶ **Northwest Airlines** trans-Pacific mail rate (Aviation Week Jan. 26, p. 77) is expected to become effective within a few days, as soon as CAB Opinion-Writing Division dispenses with exceptions filed by nonsked Air Transport Associates, Inc. . . . This will clear the way for financing of some new equipment by Northwest. . . . Reports 1952 passenger-miles of 720,046,264, 20% higher than a year ago. Freight ton-miles gained 2% to 11,416,019; express decreased 1% to 2,005,482; and mail increased 10% to 5,017,993. Passenger load factor was 64% in both 1952 and 1951. . . . December passenger-miles of 56,252,693 were 26% more than a year ago.

▶ **Pan American World Airways** sales and traffic vice president, Willis Lipscomb, told a PAA sales conference in Rome: "There is no such thing as an economic jet. But once the human being experiences jet travel, we have to satisfy his desire for that kind of transportation." Lipscomb predicted jets for luxury and piston power for coach. The meeting was to boost PAA Italian travel to meet rising domination by TWA. . . . PAA reports its 3,900-mi. nonstop Tokyo-Honolulu Stratocruiser schedule this winter is "the longest nonstop scheduled flight in the world." West-east "jet stream" winds of 70-80 mph. at 23,000 ft. make it possible, cutting time from 18 hr. to 11. Second longest nonstop is the 3,623-mi. New York-Paris run.

▶ **Scandinavian Airlines System** carried some 600,000 passengers last year compared with 506,000 in 1951 and 434,-000 in 1950. Paid ton-kilometers increased to 85 million last year, against 73 and 62 million recorded the previous year.

▶ **United Air Lines** has juggled its DC-6 coach inauguration again, rescheduling the California-Hawaii run for Mar. 22 and the trans-continental flight for Apr. 26. . . . UAL has joined Radio Corporation of America in an airborne weather-detection radar development (Aviation Week Dec. 22, p. 11). The equipment will be developed for United by RCA engineering products department, Camden, N. J., which expects to deliver an experimental model early this summer in time for the thunderstorm season. . . . United also has introduced a new punchcard ticketing system for New York-Chicago flights as a forerunner to introducing it on the entire 13,250-mi. route system. . . . UAL reports machines and machine parts led all other types of airfreight by weight flown on United transports in 1952.

WHO'S WHERE

(Continued from page 11)

of guided missile components and computer equipment.

Gaither Littrell has been appointed public relations director of Rosan, Inc., Newport Beach, Calif., producers of aircraft parts.

Harvey M. Thompson has been named chief pilot of Allegheny Airlines.

William F. Ballhaus has been appointed assistant chief engineer of Northrop Aircraft, Inc., Hawthorne, Calif. Also named to Northrop posts are **Clare Harris**, assistant chief engineer in charge of projects and components; **Frank B. Bolte**, chief of engineering research; **Stanley J. Worth**, chief engineering administrator; **W. R. Clay**, chief project engineer, and **R. A. Hall**, chief of electro-mechanical laboratories.

O. W. Babcock has been appointed staff superintendent of United Air Lines' personnel development. He is succeeded in his former post of district personnel manager at Los Angeles by **William Looney**.

H. A. Pfaff recently was named manager of Emery Air Freight Corp.'s central region. Other changes announced by the cargo carrier: **G. J. Pimlott**, district manager, Cincinnati; **John C. Emery Jr.**, manager eastern region; **K. C. Impellitier**, district manager, Buffalo; **P. E. George**, district manager, New York; **J. R. Whittemore**, district manager, Baltimore; **P. J. Byrne**, midwest regional manager; **A. M. MacIver-Campbell**, west coast regional manager.

J. F. Robertson has been elected to the board of directors of Hawker Siddeley Group., Ltd., London.

Henry F. McKenney has been appointed chief engineer of Ford Instrument Co., division of Sperry Corp., L. I. City, N. Y.

Honors and Elections

Clay P. Bedford, president and a director of Chase Aircraft Co., Inc., has been elected a trustee of Rensselaer Polytechnic Institute, Troy, N. Y.

Reginald James Seymour Pigott has been elected president of the Engineers Joint Council, succeeding **T. G. LeClair.** A consultant to Gulf Research and Development Co., Pigott was former president of the American Society of Mechanical Engineers.

Joseph D. Ryle, public relations director of American Airlines, has been named chairman of the public relations advisory committee of the Air Transport Assn.

Vincent J. Schaefer, of General Electric's research laboratory and scientific director of Munitalp Foundation, Inc., received the Robert M. Losey Award last week for outstanding work in aeronautical meteorology.

Frank N. Piasecki, board chairman of Piasecki Helicopter Corp., Morton, Pa., has been named one of the 10 outstanding young men of 1952 by the U. S. Junior Chamber of Commerce for his "leadership in . . . development of the helicopter industry."

Irving Kendall Clark, General Electric field service supervisor for aircraft gas turbine apparatus, recently received GE's Charles A. Coffin award for "work of outstanding merit during 1952."

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—FEBRUARY 9, 1953

LETTERS

Pictorial Computers

In Capt. R. C. Robson's "Treatise on Pictorial Computer" in AVIATION WEEK for Nov. 24, in our opinion, several assertions need clarification.

In speaking of accuracy, Capt. Robson quotes a maximum possible OBD system error of nine degrees. We understand that the CAA will not commission any VOR station with an error in excess of three degrees. (One degree of this error is permitted to be in the airborne equipment and two degrees are permitted to exist in the ground station.)

Some VORs may presently be in operation with greater error than this, but all commissioned stations have been or can be adjusted to within three degrees maximum system error. We further understand that DME error does not exceed 0.5 mi. in any of the currently available equipments.

All pictorial computers designed by any manufacturer meet a uniform specification of one-half degree maximum azimuth error and 0.4 mi. maximum distance error.

The combined OBD system accuracy as presented on a pictorial computer can presently be expected, under the worst conditions, to lie within 3.5 deg. of azimuth and 0.9 mi. in distance: not a maximum nine-degree error in azimuth, as Capt. Robson suggests.

The confidence of CAA traffic control experts in these accuracies is such that their future planning of holding patterns and other terminal area separations is based on them. When the VOR is less than 20 mi. from a given airport, as is planned in most cases, the maximum error will be about one mile. This will be a considerable improvement over present terminal area navigation and will be entirely adequate for terminal area traffic patterns under present and foreseeable traffic densities. Thus the usefulness of the OBD and its pictorial computer is not limited to en route navigation alone.

With respect to reliability, the elements of the OBD system are at least as reliable as a radar system would be. Neither system is fail-safe. Although the VOR is not self-checking at present, it is understood that the possibility of transmitting a "check-bearing" to the pilot prior to the clearance of his flight plan is being seriously considered. There is inherent reliability in the contemplated final pictorial computer designs.

Picture size: It is expected that space can be found on the instrument panels of many current aircraft types for a seven-inch situation display.

The purpose of the OBD system is to provide improved navigational reference data for safety while flying over charted airways. The purpose of the pictorial computer is to use this data to compute the aircraft position and then to display position on a conventional airways chart. Radar will not do this.

It is agreed that the detection of other aircraft and of bad weather pockets is important and that equipment to do this should be developed. We understand that such equipment is neither simple nor cheap and is not likely soon to reach the market. When it is available, the display unit of such equipment could appropriately be incorporated in the display screen of the pictorial computer, which in the meantime will offer the most easily interpreted situation display yet developed for both en route and terminal area flight.

S. J. DAVY
Computer Engineering Dept.
Arma Corporation
Garden City, New York

Fighters and Altitude

J. Murray of Grand Prairie, Texas (Jan. 5, Letters), raises a point concerning low-altitude operation of high-altitude fighters which is a moot question among aircraft designers. Are we saddling our interceptors with too much beef in order to insure their safe operation at low level? We don't think so at North American and, briefly, here's why:

Although the F-86D or any high-altitude interceptor is designed primarily to fight above 40,000 ft., obviously it must be capable of operating also at lower altitudes. The resulting aircraft, of necessity, is a compromise.

We appreciate only too well the effects of high wing loading on high-altitude airplanes. Since jet engines develop maximum thrust at sea level these airplanes are capable of obtaining maximum speeds at low level. Limiting their speed at these altitudes because of structural weakness is placing a severe restriction on their operation.

Climbing quickly from takeoff to altitude is an extremely important function of any interceptor. And once the fight has begun, would you ask our pilots to break off a dive on any enemy airplane at 10,000 ft. because they'll shed their wings if they don't?

As a matter of public record, this is a maneuver which has been employed by Air Force F-86 pilots in Korea to bag a MiG. Our pilots have received kill credits by outdiving the Russian-built fighters which apparently cannot withstand a high G dive pull-out. The kill ratio in Korea stands at 8 to 1 in favor of the Sabre, which makes us believe our fighters aren't too heavily compromised.

The record-breaking run of the F-86D, incidentally, was made only after structural tests demanded by the Air Force proved it could take the tremendous "G" pressures at low altitude.

Selection of the below-sea-level Salton Sea speed site was made primarily to take advantage of the area's high ambient temperatures. It is generally known that modern jet fighters in the transonic speed range have a maximum given Mach number in level flight. Mach number varies with temperature. Therefore, at the limiting level flight Mach number, higher true speeds may be obtained under higher temperature conditions.

MILT KUSKA, F-86D FLIGHT TEST PROJECT ENGINEER
North American Aviation, Inc.
International Airport
Los Angeles 45, California

Cornell's Stalls

Your article Dec. 22 concerning the Cornell Aeronautical Laboratory's stall projects seems to have confused our actual accomplishments in this field with the possibilities, however remote, that may result from our work.

We have successfully studied and performed full-scale experiments upon the longitudinal motion of a stalled airplane, and are now continuing with lateral motion.

As part of this work, we have developed an automatic control which is highly successful in stabilizing the fully stalled airplane. We have not, however, "ridden the stall all the way to the ground," nor have we any intention of doing so with the present test airplane, since its minimum rate of descent in a stall with full power is some 1500 ft./min.

If a landing were made with a fully stalled airplane, the forward speed would be greater, not less, than in conventional landings, because the lift coefficient drops off above the stall. The landing roll probably would be less, as stated, due to the very high drag of the stalled wing.

John Seal is our chief pilot, as stated, but Gifford Bull, project engineer and pilot on the stall work, has done practically all the flying on this particular project. We are anxious that this point be clarified and it would be appreciated if the content of this letter could be published in an early issue of AVIATION WEEK.

W. F. MILLIKEN, JR., MANAGER
Flight Research Department
Cornell Aeronautical Laboratory, Inc.
4455 Genesee Street
Buffalo 21, N. Y.

(The parts of the story referred to were read by telephone to an authorized Cornell spokesman before publication, and these sections were not challenged then.—ED.)

Helping Inventors

Laurels to Mr. Grover Loening (Jan. 19, AVIATION WEEK) for getting at the heart of why, as many have observed, this country's ratio of aeronautical improvements to dollars spent is low and for describing what happens "if there was an inventor looking for help on a new idea . . ." and congratulations to AVIATION WEEK for publishing this provocative address.

But has it not occurred to AVIATION WEEK after collecting $6 each from 40,000 subscribers as an indirect result of all of our aeronautical inventiveness and after feeling benevolent enough to donate engineering educations, safety awards, and other stereotyped prizes, it is being slightly Pentagonish in not directing one cent of these donations to stimulate any unfinanced inventor or to help reduce that "discouragement (which) is evident by the very few new accepted designs . . . since the war"?

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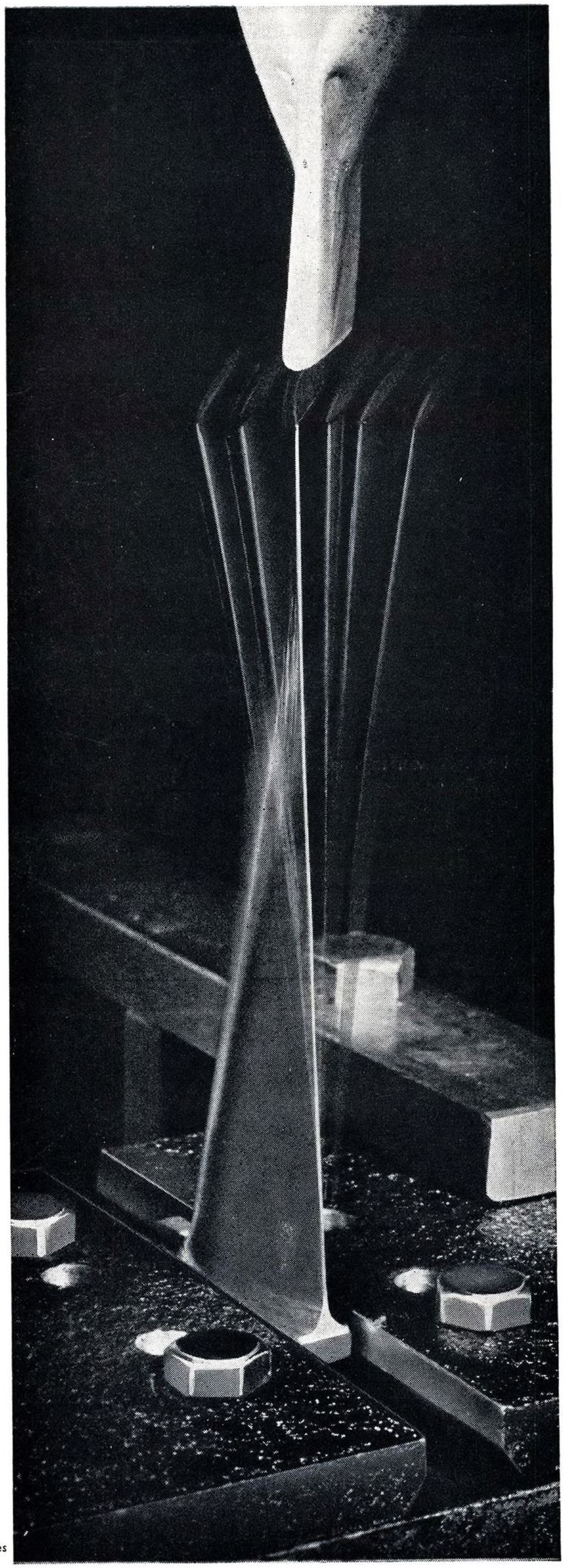

You recall the old trick in which a singer shatters a glass by holding a high note at the critical vibration frequency of the glass.

Here at Allison we use a similar idea to determine the fatigue life of jet engine compressor and turbine blades. By electro-magnetic, air jet (as pictured) or siren excitation, we stress-cycle the blade at increasing vibration amplitudes until its endurance limit is reached. This enables us to predict "critical" engine speeds—and with this data we modify blade design for higher performance and longer service life.

Then we go a step further: The information obtained in these laboratory tests is checked by installing strain gages on blades in running engines. This stress-measuring equipment had to be specially designed by Allison engineers to meet the high temperatures, since gages of this type were not commercially available. Many Allison engine improvements have been based upon the results of these tests.

All of this is one example of the engineering thoroughness that goes into every Allison jet engine — a thoroughness that pays off in the greater dependability that has won the confidence of American jet pilots everywhere.

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