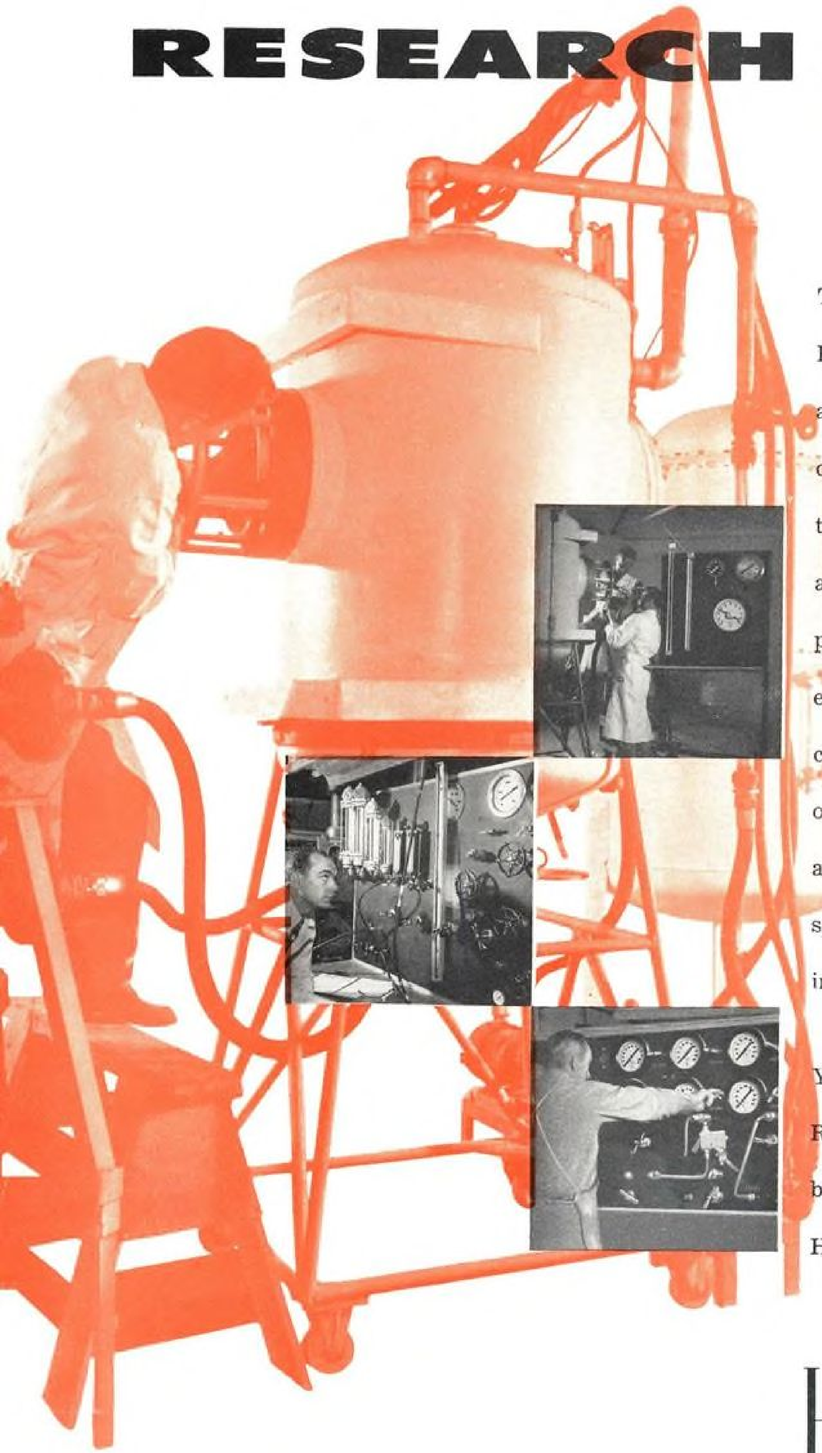
AVIATION WEEK

A McGRAW-HILL PUBLICATION

OCT. 20, 1952

50 CENTS

RESEARCH *is the reason*



The new Engineering Research Laboratories at Hydro-Aire are considered the finest and most complete company-operated in their field. This division is equipped and manned to fabricate prototype parts from preliminary design, evaluate their performance under conditions simulating actual operation and to qualify the units according to customer and military specifications—all without interference to general production.

Yes, Research is an important Reason why every fighter, every bomber, every transport is Hydro-Aire equipped.

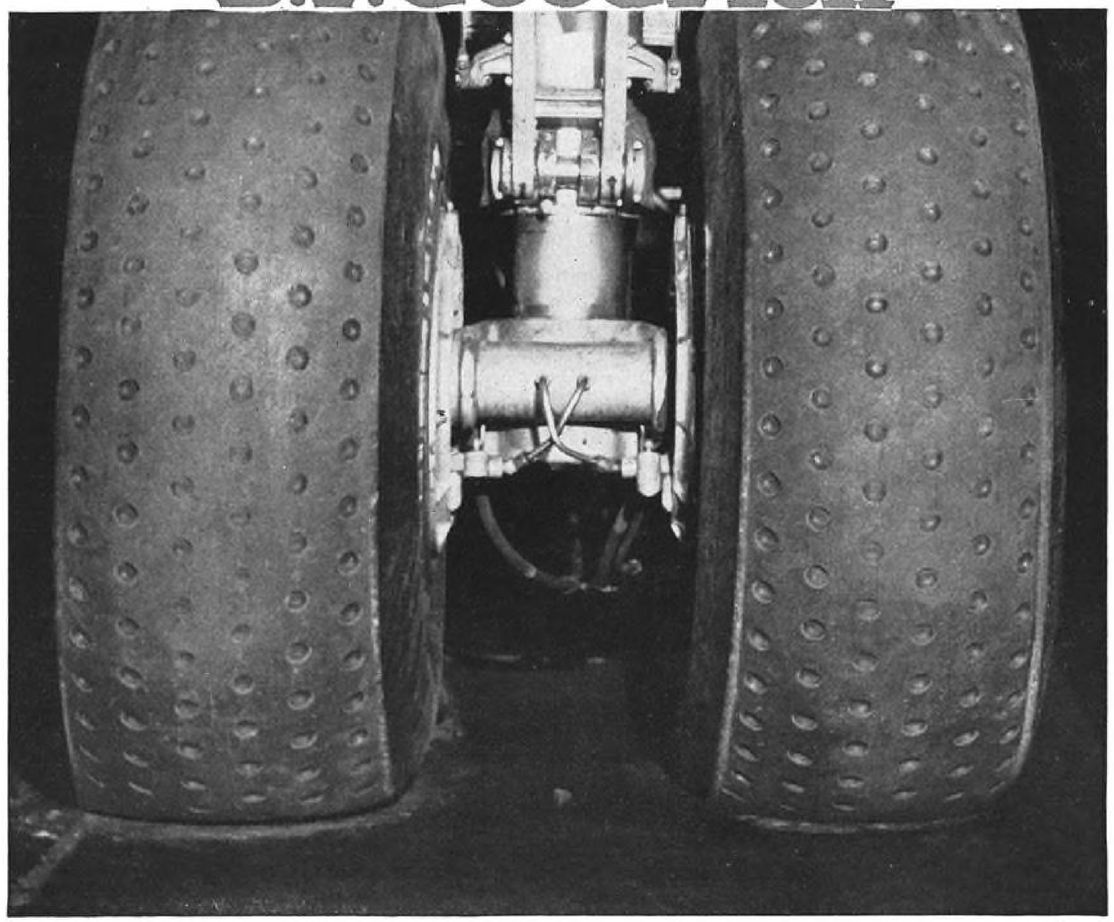
HYDRO-AIRE *Inc.*

BURBANK, CALIFORNIA

Subsidiary of Crane Co.

MANUFACTURERS OF FUEL, HYDRAULIC, PNEUMATIC AND ELECTRO-MECHANICAL AIRCRAFT ACCESSORY EQUIPMENT

B.F.Goodrich



24 ~~20~~ airlines switch to new B. F. Goodrich dimpled tire

WE RECENTLY ANNOUNCED that twenty airlines had tested and switched to the new B. F. Goodrich dimpled tire. Now four other users report that they have adopted it as standard equipment.

One airline reported 20% more landings on DC-4's. A typical report from tests on a fleet of DC-3's: "We removed the tires after 400 hours, 1200 landings. In the process of recapping, we discovered that there was enough rubber left for about 100 hours more, a total of 1500 landings."

The new B. F. Goodrich dimpled tire has a longer lasting cord construction which cuts down separation. It has a new tread with dimple-like indentations in the rubber. These dimples provide better distribution of the tire load and reduce exposure to tread cutting. Retreading is simpler. Carcass rejections are fewer.

The airlines landing on BFG dimpled tires include: American, Braniff, Capital, Central, Continental, Empire, Frontier, Hawaiian, Lake Central, National, Northeast, Northwest, Pan-American, Philippine, Pioneer, Southern, Southwest, Trans-Texas, United and West Coast.

B. F. Goodrich is now producing the dimpled tire in seven airline sizes. The new, longer wearing dimpled tire is another example of BFG's leadership in rubber research and engineering. Other B. F. Goodrich products for aviation include wheels and brakes; heated rubber; De-Icers; Avtrim; Plastilock adhesives; Pressure Sealing Zippers; inflatable seals; fuel cells; Rivnuts; accessories. *The B. F. Goodrich Company, Aeronautical Div., Akron, Ohio.*

B.F.Goodrich
FIRST IN RUBBER

Aviation Week

ABP Member ABC

Volume 57 October 20, 1952 Number 16

43,157 copies of this issue printed

Robert H. Wood
EDITOR

Merlin H. Mickel
MANAGING EDITOR

Robert B. Hotz
EXECUTIVE EDITOR

Alexander McSurely .....Aviation Safety
David A. Anderton .....Engineering
Irving Stone .....Technical
G. L. Christian III ..Equipment & Maintenance
Katherine Johnsen .....Congress
Ben S. Lee .....Military
F. Lee Moore.....Transport
Philip Klass.....Avionics
Scott Reiniger .....New Products

Erwin J. Bulban .....Special Assignments
William J. Coughlin .....West Coast
Byron C. Dempsey .....Dayton

A. W. Bentz.....NEWS EDITOR
Henry Lefer .....News Desk
Victoria Giaculli.....Editorial Makeup
Leo T. Tarpey.....Printing & Production
Helen Rich .....Editorial Research

William Kroger .....EDITOR OF SPECIAL EDITIONS

Editorial Office: 330 West 42nd St., New York 36, N. Y. Phone Longacre 4-3000, or (night) 4-3035; National Press Bldg., Washington 4, D. C., Phone National 3414. *Domestic News Bureaus:* Atlanta 3, 1321 Rhodes-Haverty Bldg.; Chicago 11, 520 N. Michigan Ave.; Cleveland 15, Hanna Bldg.; Detroit 26, Penobscot Bldg.; Los Angeles 17, 1111 Wilshire Blvd.; San Francisco 4, 68 Post St.; Houston 2, 566 M & M Building. *Correspondents* in more than 60 major cities.
Foreign News Bureaus: London, Paris, Frankfurt, Tokyo, Manila, Rio de Janeiro, Mexico City. *Correspondents* in more than 59 major cities.
Aviation Week is served by PRESS ASSOCIATION, INC., a subsidiary of Associated Press.

Robert F. Boger
PUBLISHER

R. W. Martin, Jr., *General Manager;* J. C. Johnson, *Business Manager;* Catherine Miner, *Research and Marketing;* Sales Representatives: J. C. Anthony, *New York;* H. P. Johnson, *Cleveland;* L. J. Biel, *Chicago;* W. E. Donnell, *St. Louis;* E. P. Blanchard, Jr., *Boston;* James Cash, *Dallas;* R. C. Maultsby, *Atlanta;* R. F. Dorland, Jr., *San Francisco;* C. F. McReynolds, *Los Angeles;* W. S. Hessey, *Philadelphia.* Other sales offices in *Pittsburgh, Detroit, London.*

October 20, 1952 AVIATION WEEK Vol. 57—No. 16
Member ABC and ABP

Published weekly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. **Publication Office: 99-129 North Broadway, Albany 1, N. Y.**
Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Curtis W. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publication Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.
Subscriptions: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow ten days for change of address.
Subscriptions are solicited only from persons having a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.
Single copies 50¢. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada, $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par; other Western Hemisphere, $10 a year; $16 for two years; $20 for three years. All other countries $20 a year; $30 for two years; $40 for three years. Entered as second-class matter, July 16, 1947, at the Post Office at Albany, N. Y., under Act of Mar. 3, 1879. Printed in U. S. A.

NEWS DIGEST

Domestic

Donald W. Nyrop has resigned as chairman of the Civil Aeronautics Board effective Nov. 1, the White House announced last week. He had held the post since May 1951. President Truman said he had accepted the resignation with "deep personal regret."

Domestic aircoach passenger miles flown by scheduled carriers during the first six months of 1952 totaled 1,017,082,000, a 70% gain over the same period last year, reports Air Transport Assn. The current six months figures are within a quarter billion miles of the total passenger miles flown in 1951.

Convertawings, Inc., Amityville, L. I., N. Y., has started construction of a small prototype of its "four-rotor" helicopter design. Ultimately the firm plans to build a 40-passenger, four-rotor, four-turbine, shorthaul, passenger and cargo copter.

Civil Air Patrol rated personnel have reached a new high of 18,166; 15,735 being pilots and the remainder observers. Total CAP membership is 76,504 in 1,806 units having more than 5,500 aircraft. CAP is trying to reach 100,000 by Dec. 17, 1953.

Brig. Gen. Kern D. Metzger has been appointed director of the Aircraft Production Resources Agency. Capt. J. E. Dodson, USN, has been elected Navy member of APRA's executive directorate, replacing Capt. Roy Jackson, USN, who will be stationed at Alameda Naval Air Station, Calif.

Pan American World Airways' P&WA R4360-TSB3G engines, used on its Boeing Stratocruisers, will be overhauled and converted to -B6 configuration by Pacific Airmotive Corp., Burbank. Contract extends through Nov. 15, 1953.

Five percent pay increase for all hourly paid employes has been granted by Kaman Aircraft Corp., Windsor Locks, Conn. In addition, pay ranges for hourly paid job classifications have been upped 5%.

More than 300 Boeing B-47s have been built by Boeing Airplane Co., USAF Undersecretary Gilpatric recently disclosed. He also stated that on the 300th B-47, manhours per pound of airframe were 1.7 compared with 14.3 for the first production Stratojet.

HIT-AND-RUN artillery tactics, using large copters, are being used by Marine Corps in Korea to harass the enemy. As soon as the last round is fired from this rocket battery, the S-55 airlifts launcher and ammunition container to a new location where firing is resumed. Tactic makes it tough for enemy to zero-in batteries.

USAF pilots flew 75 Republic F-84G Thunderjet fighter-bombers 7,800 mi. from Texas to northern Japan recently in four hops. Final nonstop leg from Midway was 2,575 mi. Air-to-air refueling was utilized.

Capt. Roy N. Francis, 66, World War I flying instructor, died in San Francisco Oct. 10. He was superintendent of San Francisco Airport for two years in the early 1930s.

Colonial Airlines' new DC-3 night coaches are "doing well for a new flight," sales officials say, and have no scheduling conflicts with the Bermuda service, which is conducted with a DC-4. This corrects a report in AVIATION WEEK Sept. 29, p. 92. The Washington-Scranton-Syracuse coach flight is handling a capacity load on Friday and Sunday, 50% loads on other days. New York-Burlington-Montreal coach loads were reported excellent last week.

Coming series of jet transports is expected to have 500-600-mph. speeds, Adm. D. C. Ramsey, Aircraft Industries Assn. president, told the Wings Club, N. Y. He predicts this will remain the speed range for 12, 15 or even 20 years since an increase into, say, the 900-mph. supersonic range, would require entirely new powerplants, airframe and structural materials.

Slick Airways' sales department has reassured management that loss of the Navy daily transcontinental C-46 contract to Flying Tiger Line won't hurt a bit, because they claim common carriage demand will absorb the capacity, and at higher rates. Common carriage "is where we need to build the most for our long-term business reputation anyway," a Slick Airways' director told AVIATION WEEK. The certificated freight carrier is adding two transcontinental services and an extra midwest-Texas flight daily.

Financial

Beech Aircraft Corp., Wichita, Kan., has voted to raise the quarterly dividend from 20 cents to 25 cents declared an extra 20-cent dividend, both payable Dec. 2 to holders of record Nov. 17. During the recently concluded fiscal year, sales totaled more than $90 million compared with the previous fiscal year's $32,797,829. Backlog is now $200 million.

Northrop Aircraft, Inc., Hawthorne, Calif., reports net profit of $2,068,502 for the eleven months to June 30 on income totaling $167,721,854. In fiscal 1951, Northrop earned $3,276,053 on sales of $89,694,057.

Pacific Airmotive Corp., Burbank, notes sales of $20,888,784 for the nine months ended Aug. 31, a 26% gain over the same period in 1951. Net profit for the current period was more than $677,000.

International

Canadian Dept. of Defense Production has placed aviation orders totaling $987,000 during the first half of September, with largest single order, $915,000, going to Rolls-Royce of Canada Ltd., Dorval, Quebec, for engine overhaul.

AVIATION CALENDAR

Oct. 21—Air Transport Section, National Safety Council, annual meeting, Conrad Hilton Hotel, Chicago.

Oct. 25-Nov. 2—International aviation and travel exposition, Navy Pier, Chicago.

Oct. 26—Los Angeles International Airport Air Fair and Open House, Los Angeles.

Oct. 28-30—Transport Aircraft Hydraulics System Conference, sponsored by Vickers, Inc., Hotel Park Sheraton, Detroit.

Oct. 28-30—AIEE Air Transport Committee annual meeting, Commodore Perry Hotel, Toledo.

Oct. 29-31—AIEE conference on machine tools, Ten Eyck Hotel, Albany, N. Y.

Nov. 6-7—National fuels and lubricants meeting, Society of Automotive Engineers, The Mayo, Tulsa, Okla.

Nov. 7—IRE symposium on microwave circuitry, Western Union Auditorium, New York.

Nov. 8—Annual Midwestern Tool Engineering conference, University of Illinois, Urbana, Ill.

Nov. 11-12—Piper distributors' annual meeting, Lock Haven, Pa.

Nov. 13-15—Acoustical Society of America symposium on aircraft noise, San Diego, Calif. (For details, write ASA, 57 E. 55 St., New York 22.)

Nov. 17-20—National Aviation Trades Assn. annual convention, Hollywood-Roosevelt Hotel, Los Angeles.

Nov. 19-21—Fourth Annual Safety Seminar sponsored by Flight Safety Foundation, Hamilton, Bermuda.

Dec. 2—Symposium on light-metal heavy forgings and extrusions for aircraft, SAE, ASME, IAS and AIME.

Dec. 2-5—Aviation Distributors and Manufacturers Assn. tenth annual meeting, The Kenilworth, Miami Beach.

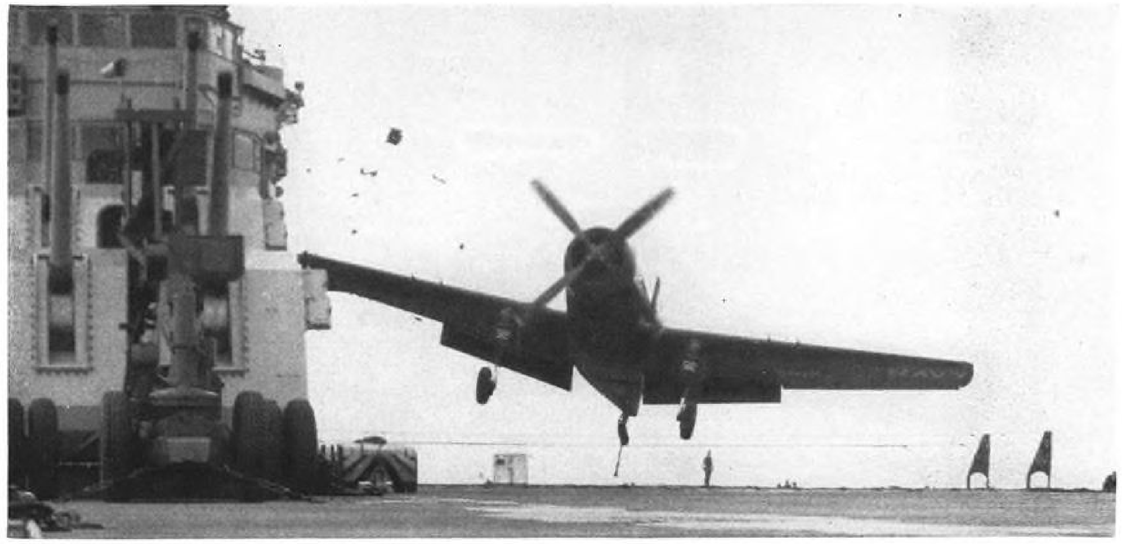
Dec. 3-5—Society for Experimental Stress Analysis, annual meeting, Hotel McAlpin, New York.

Dec. 10-12—Joint AIEE-IRE-ACM conference on electronic computers, Park Sheraton Hotel, New York.

Dec. 17—Annual Wright Bros. dinner, 7:30 p.m., Statler Hotel, Washington, D. C. Wright Bros. lecture to be presented by IAS 3 p.m., U. S. Chamber of Commerce auditorium.

PICTURE CREDITS

7—Wide World; 16—NACA; 18—David Anderton; 21—Russell Adams; 22—(top) Hawker Siddeley; (bottom) Gloster Aircraft; 35—NACA; 37—Howard Levy; 89—UAL; 91—Enell, Inc.



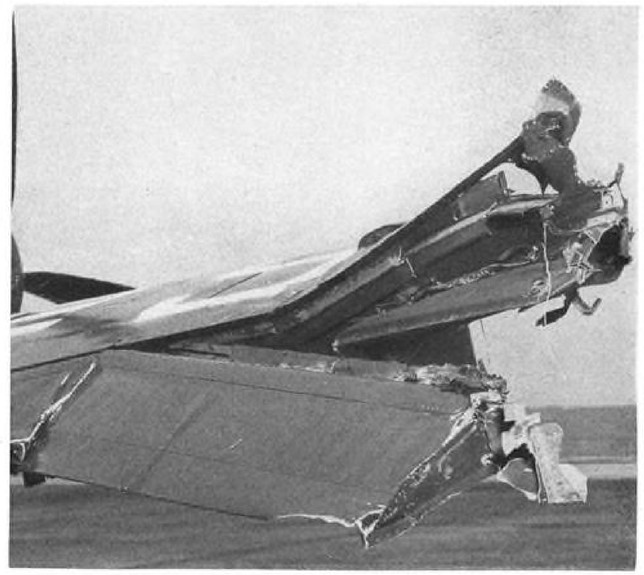
HAVING BOUNCED over the barriers, AD-4 Skyraider (above) strikes the carrier's island with its right wing and pieces fly. Then it . . .

Skyraider Has Ups and Downs

SKIDS along the deck (right) and heads over the side. To avoid a watery crash, the pilot . . .

GUNS THE ENGINE to lift the nose. The AD . . .

LEVELS OFF and heads for Navy land base. After a safe landing, examination reveals . . .



DAMAGED WINGTIP having some five feet shorn off and the aileron torn from its starboard hinge.

WHO'S WHERE

In the Front Office

Dwain E. Fritz has been appointed director of engineering and assistant to the president for Jack & Heintz, Inc., Cleveland, Ohio. He has been chief engineer for the aircraft accessories firm during the past three years. **Joseph E. Mulheim,** formerly with Westinghouse's aviation engineering department, Lima, has joined J&H as chief project engineer and acting chief engineer and **Ralph J. Eschborn** has been promoted to executive engineering manager.

A. E. Moore has been designated vice president and director of research and development for R. M. Hollingshead Corp., Camden, N. J. **V. M. Mantz** has been named director of government and industrial research and **Dr. V. Esposito** has been named director of new products development.

John R. Markey has been named assistant to the vice president of Aro Equipment Corp., Bryan, Ohio, maker of aircraft products, lubricating equipment and industrial tools. Prior to his promotion he had been aircraft sales manager.

R. M. Tonks is new vice president-general manager for Aircraft Engine Service, Inc., Miami International Airport.

Kempton Dunn has been designated first vice president with American Brake Shoe Co., N. Y. Dunn, with the firm since 1932, formerly was vice president-treasurer.

Changes

Victor Welge has been appointed associate director of engineering for P. R. Mallory & Co., Indianapolis, Ind., and will handle electric, electronic and mechanical engineering work.

Arthur L. Munzig, Jr., has been appointed electronic sales engineer at Pacific division of Bendix Aviation Corp., No. Hollywood, and **R. J. Krause** has been named assistant to the general manager of the division.

L. A. Dougall has been transferred to the Los Angeles office of Vapor Heating Corp., Chicago, to handle sales of Vapor temperature controls for aircraft.

R. P. Crawford has been named chief inspector at the Greenville division of Temco Aircraft Corp., Tex.

Rex W. McMillan has been transferred to the W. Hartford, Conn. office of Hitchiner Mfg. Co., of Milford, N. H., maker of precision investment castings. He will handle sales of these products and finished machined parts made by Hitchiner Products Corp., W. Hartford.

W. F. (Wally) Schanz has resigned as Florida State Aviation supervisor and joined Southern Aero Sales, Inc., Atlanta, Ga., as sales manager.

Robert A. Hall has been named assistant chief of Northrop Aircraft, Inc.'s Special Weapons division, Hawthorne, Calif.

Harold Helbock has been designated production manager of Pastushin Aviation Corp., Los Angeles, and **R. E. Vannaman** has joined the firm as personnel manager.

INDUSTRY OBSERVER

► Special refueler wing tanks used for the eight-time aerial refueling of a Lockheed F-80 in Korea last year made it possible for the airplane to remain airborne 14 hr. 15 min. and fly five combat missions. The tanks, equipped with Flight Refueling Inc. probes added about 500 gal. to the airplane's normal capacity each time they were refilled from the drogue of a KB-29 tanker. Tanks had simple overflow valves so pilot ended his contact when he saw fuel coming out of the valve.

► **Snecma, French aircraft engine builders, are working on a new version of their Atar 104 axial-flow turbojet series to be rated at 9,900 lb. static thrust dry and 12,000 lb. with afterburner. Dassault reportedly is interested in the engine for an advanced version of the Mystere interceptor.**

► Navy shortly will release important new data on the upper stratosphere obtained from its rocket-launching balloon project in the Arctic in collaboration with Atomic Energy Commission. When huge balloons bearing rockets reached their maximum altitude, the rockets were released to penetrate the atmosphere further and gather cosmic ray data. Navy suggests that these experiments might have been responsible for the "flying saucers" viewed as far south as mid-U. S.

► **Fairchild Engine and Airplane Corp. is getting delivery within a month on the first two Fokker trainers which it is licensed to build in this country. Plans are to demonstrate the piston-engine S-11 and S-12 trainers, similar light craft, in nosewheel and tailwheel versions at Hagerstown, Md. Later plans also call for shipment of the S-14 jet trainer and the S-13 twin-engine trainer to this country.**

► Fiscal 1953 off-shore procurement funds actually will buy less than the 1,700 European-built interceptors and night fighters originally planned. Additional cost of spare parts and ground handling equipment for these planes will reduce total number of aircraft that can be bought with the $400-million fund to somewhere between 1,200 and 1,500 planes. Planes will be bought in a "package deal" that includes a complete aircraft plus spares and special ground-handling equipment.

► **A strong factor in the renaissance of the seaplane designs is the fact that there is no longer any appreciable difference in the high strength that must be built into a seaplane hull to stand up for water landing impacts and what is now required in the structure of fast land planes to withstand the loads and stresses of supersonic flight. Thus the seaplane will no longer suffer from an inherently higher gross weight that previously gave landplanes a consistent performance edge over their water-based competitors.**

► A total of 11,500 jet engines have been built by Rolls-Royce and its licensees in the U. S. and France. More than a million hours of flight time have been logged on Rolls-designed gas turbines.

► **Gloster estimates that it can produce the transonic Javelin for about the same man hours per airframe pound and using essentially the same production tooling as the Meteor. Because the delta wing is relatively thick (2½ ft. at the root on the Javelin and about 9 ft. on the Avro 698) conventional aircraft construction methods can be used. Big increase in Javelin cost will come from avionic equipment required for all-weather operations. Gloster is completing its third Javelin prototype and will build two more, one for static test to destruction.**

► British airline operators still are looking to the turboprop airliner as their real money-makers long before the turbojets begin to pay off. The Bristol Britannia will carry 104 passengers at 140,000 lb. gross weight and costs about $1,680,000. Vickers Viscount can carry up to 53 passengers, grosses 52,000 lb. and costs about $600,000. In contrast, the Comet I series averages 110,000 lb. gross, can carry 36-44 passengers and costs $1,500,000.

Washington Roundup

Air Army: Bright Future?

There is a resurgence of spirit and aggressiveness in the Army. While Navy men talk of a "global air Navy," Army men enthusiastically talk of "an airborne Army."

• **A changed military objective** due to changed international relations has enlarged Army's role in defense. The key to U. S. military strategy is now "holding land areas." Up to 1950 it was a "knockout" blow against Moscow. In that period, Army, like Navy, took a back seat while penny-pinching Congresses generously appropriated Air Force funds for intercontinental bombers.

• **Navy and Army now see eye-to-eye** on basic military strategy, giving this combination the majority voice in the Pentagon. The old lineup of Army & Air Force vs. Navy is out.

One top Army man explained:

"In fringe wars, we believe strategic aviation will have a limited role.

"In an all-out war, it is well known that Russia's transportation system is poor and if her armies ever roll across Europe or the Near East, we can assume that they will be self-sufficient and equipped to push forward for at least six months. Soviet armies could conquer a vast area in that time, and use its industrial machine and installations."

• **Army position is gaining ground.** Although USAF has received the biggest slice of military budgets for 1952 and 1953 fiscal years—and will again next year—the emphasis in the USAF buildup has been in tactical aviation.

The issue between Army and Air Force is not land power vs. air power. It's a contest over "what type" of air power.

• **Air Force has consistently bucked** Army air power. It has given a low priority to the troop and cargo transports Army needs, and has balked at giving Army a voice in setting up characteristics of the planes. USAF has held down organic Army aviation with a weight limitation (lifted a year ago), by opposing Army air funds and by lagging in the procurement of Army planes.

• **Heart of the matter.** Army and Navy are challenging Air Force at the "heart" of military strategy: atomic weapons. The two services are using their influence to have fissionable material channeled into tactical weapons —baby bombs, guided missile warheads, atomic artillery, radioactive dust—and to hold down the allocation for giant bombs transportable only by large strategic aircraft.

Army Chief Reports

This is the report of Army's outgoing undersecretary, Karl Bendetsen:

▶ **Army Air**—At this mid-point in the mobilization program, Army aviation is just ready for its takeoff. Up to now priority has gone to fighters and bombers. But these programs are now well under way and the materials situation has eased.

• In 1951 fiscal year Army was given $118 million for aircraft to support its operations in Korea. But this dropped to $60 million in 1952 fiscal year, and Army has only $22 million for its organic aircraft this year.

The reasons: USAF didn't agree to lift the weight limitation on Army aircraft in time for Army to put funds into the current 1953 fiscal year budget for large helicopters. USAF gave a low priority to expansion of the helicopter industry. Then Budget Bureau turned down Army requests for funds on lack of production capacity.

• But Army plans a 1954 fiscal year aircraft program approaching $100 million and a 1955 budget approaching $200 million.

▶ **$250-Million Helicopter Program**—Unless its plans are frustrated, Army will launch a two-year $250-million helicopter procurement program next July.

▶ **Tactical and Troop Transport**—The tactical air program of the Air Force is "rolling much better."

Relations with USAF on the troop transport program "are improved over a year ago."

▶ **Air Merchant Marine?**—Army considers an expanded civil air fleet for ground troop logistic support in wartime a national defense "necessity." USAF will go only so far as to call civil air expansion "desirable."

Army doesn't go as far, though, as Donald Douglas, Jr., vice president of Douglas Aircraft Co., who says air transport eventually will provide "complete" support for the field military establishment.

▶ **Army Plane Procurement**—Army shortly will request Secretary of Defense Robert Lovett for authority to procure planes "peculiar" to its needs.

Bendetsen's position: "If a plane, or any other end item, is peculiar to one service and it can be shown that its procurement by that service will result in savings of time and money, and the two are related, there seems to be no sound reason for its procurement by another service."

Army's objective is authority to procure its small fixed-wing aircraft. Army types are almost identical with commercial types and can be readily obtained from manufacturers. Army sees no point in channeling negotiations through USAF, which does not utilize the types in operation and is not familiar with them.

▶ **Guided Missiles**—Army has developments which it thinks eventually will "considerably lessen" the role of piloted aircraft in air defense and on the battlefield.

They aren't aimed at replacing piloted planes. For the forseeable future, even the Army believes piloted aircraft will be vital, particularly against maneuvering enemy plane formations.

The Army has six major projects which will provide a "complete family" of guided missiles and free rockets, some with atomic warheads, to be fired from deep in friendly territory against the enemy front line. Other Army missiles are aimed at longer ranges to hit strategic targets.

Plant Expansion: Last Lap

Present expansion of the aircraft industry is about over.

Of the $4.5 billion granted Air Force and Naval Air for plant expansions and production machinery and equipment since Korea, all but $900 million has been obligated—$600 million USAF, $300 million Naval Air.

This will complete current program, except for facilities required in the future for production of new types.

One to Stay?

Watch for Navy brass to work toward keeping Assistant Secretary for Air John Floberg in his post, regardless of the outcome of the election. Navy has industry friends influential in both parties, and, it is expected, will work through them.

—Katherine Johnsen

AVIATION WEEK VOL. 57, NO. 16 OCTOBER 20, 1952

BRISTOL OLYMPUS TESTBED is this twin-engine English Electric Canberra which is gathering flight data on the powerful split-compressor engines. Installation problems have prevented engineers from pulling full thrust capabilities from the Canberra experimental rig.

Split Compressors Usher in New Jet Era

- **Thrust to 15,000 lb., low fuel use are advantages.**
- **U. S. and British push design and production.**

By Robert Hotz

London—American and British airframe manufacturers are counting heavily on the new generation of split-compressor (twin-spool type) jet engines to propel new types of transonic bombers, long-range transports and supersonic fighters.

Development and production of split-compressor jets in the 10,000-to-15,000-lb.-thrust class now is a major objective of engine manufacturers in both countries.

Big attraction of the split-compressor design lies in its combination of higher power with low fuel consumption. This dividend can be paid in a number of ways:

• **For bombers** it means longer range.

• **For transports** it means more economical operations.

• **For fighters** it can mean either higher performance or longer range.

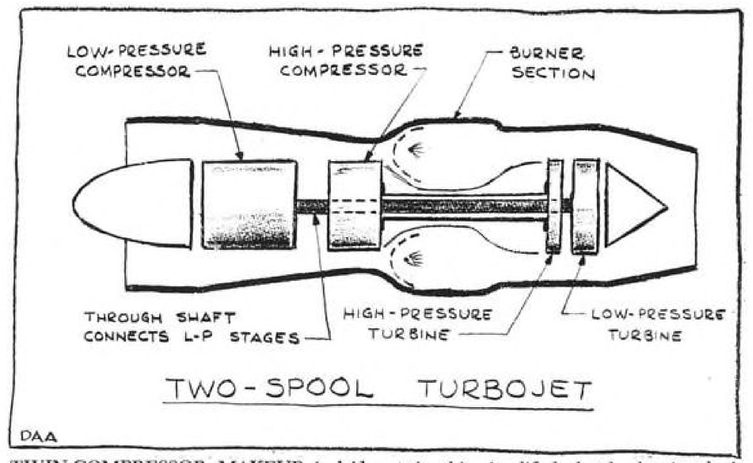
▶ **The Lineup**—Virtually every major aircraft engine builder on both sides of the Atlantic now has split-compressor designs under development. Here is how the international lineup on those designs now stands:

• **Bristol Aeroplane Co., Ltd.** leads in England with its Olympus, now officially rated at 9,750 lb. thrust dry but actually hitting 12,000 lb. on the test stand. Bristol is tooling up its Filton works for Olympus production of the Avro delta-wing bomber and other projects still on the secret list.

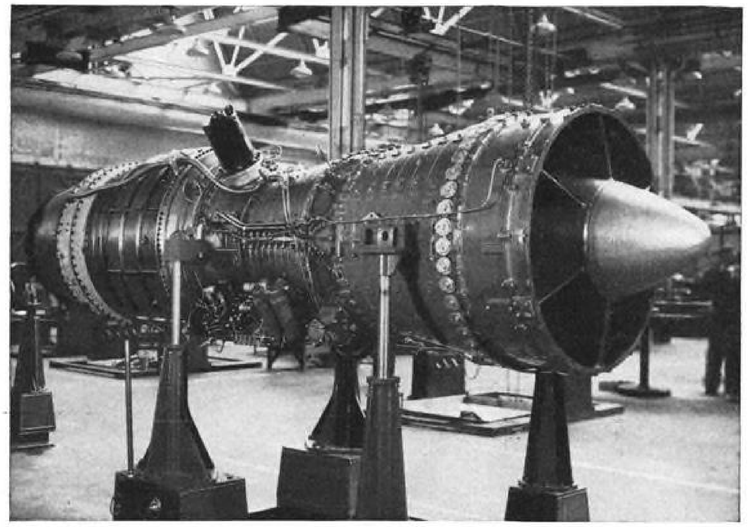
• **De Havilland Engine Co.,** until now known only for its centrifugal-flow jets, will make its debut in the axial field with a split-compressor design by Frank Owner, who originally laid down the Olympus at Bristol. The de Havilland axial is well advanced in development and should push the 15,000-lb. mark.

• **Rolls-Royce Ltd.,** which has pushed its single-spool Avon through a variety of configurations and power ratings from 6,000 to 10,000 lb. thrust during the past four years, also has explored the split-compressor design aimed at bringing in a new engine about where the Avon development ends.

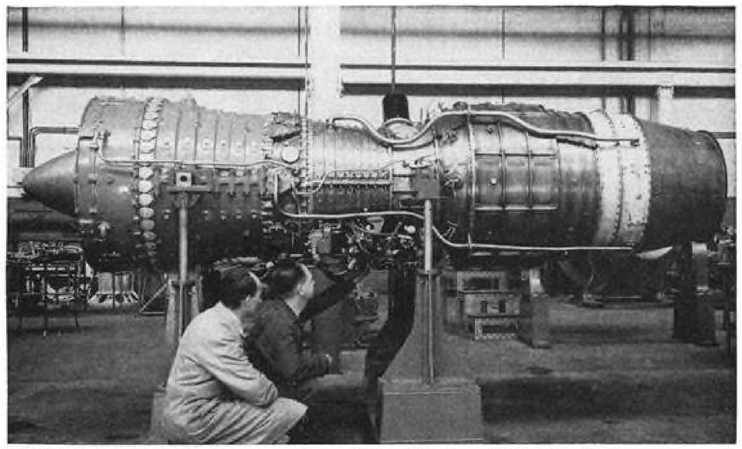
• **Pratt & Whitney Aircraft** still leads both its British and American competitors with its J57 already in limited production. P&WA deliveries to date on the J57 would be classified as substantial production by British standards but are only pre-production by American measurements. P&WA is now well along on tooling for large-scale produc-



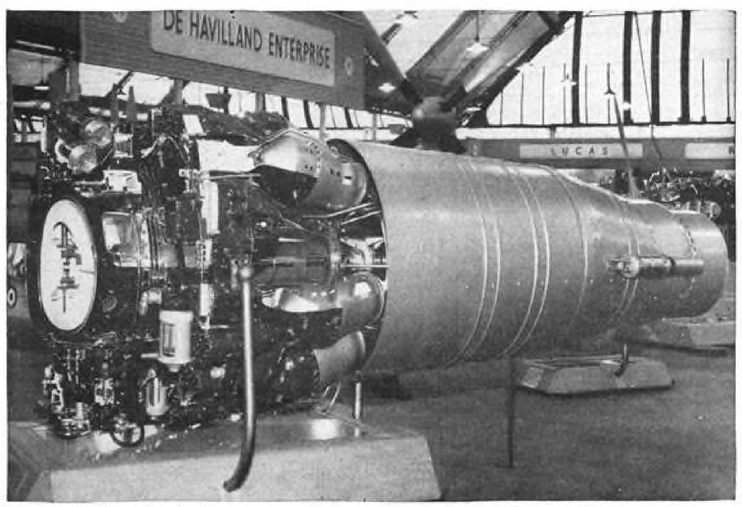
TWIN-COMPRESSOR MAKEUP is laid out in this simplified sketch showing basic features of new generation of turbines.



BRISTOL OLYMPUS split-compressor turbojet is rated at 9,750 lb. thrust.



BRISTOL OLYMPUS, side view, shows 40-in. diameter, 125-in. length.



DH GHOST with afterburner, a typical centrifugal single-compressor type.

tion of advanced models of the J57 both in its East Hartford plant and in Chicago where Ford will build the J57 under license.

Early model J57s that powered the experimental B-52 and B-60 eight-jet bombers were rated well below the published thrust of the Olympus, but P&WA will go into production on a 10,000-lb.-thrust version and has others under development leading to the 15,000-lb.-dry-thrust J75.

• **Wright Aeronautical Corp.** has designed a new split-compressor jet in the 12,000-to-15,000-lb. class based on the original Olympus data obtained under license from Bristol. The C-W J67, however, is a new design, not just a scaled-up Olympus.

• **Westinghouse** is working on a split-compressor version of its basic J40 design aimed at about 12,000 lb. thrust.

• **General Electric** has a split-compressor design in the early development stage and is interchanging technical information on this and other subjects, notably rocket motors, with de Havilland.

• **Allison division of General Motors** has been exploring split-compressor designs, but little is known of their specific projects.

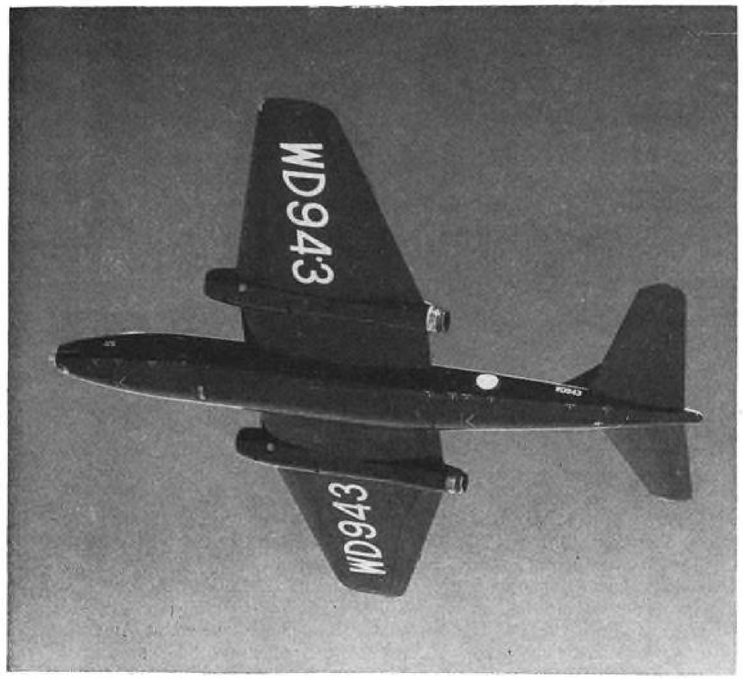
► **Why the Split?**—Basic advantage of the split-compressor design is its ability to produce higher pressure ratios. It seems likely that the split-compressor design is now taking over from the single-spool axials above the 10,000-lb.-thrust mark in much the same manner that the latter superseded centrifugal-flow types above 6,000 lb. thrust.

Future of the split-compressor seems to lie primarily in large aircraft such as bombers and transports that will still operate primarily in lower portions of the transonic speed range, although there are some advocates of this type engine for fighters going into supersonic speeds. At higher supersonic speeds it is likely that the ram effect will take over a good share of the normal compressor load, thus requiring smaller compressors internally in turbojets.

The split compressor, now at the beginning of its development cycle, already offers pressure ratios 50% higher and specific fuel consumptions 25% lower than the best single-spool axials already far along in their development cycle.

During early postwar research on axial compressors it became evident there was a limit on the length of an axial compressor that would operate satisfactorily over the normal range of altitude and rpm. required of turbojets. This limitation seemed to loom at pressure ratios of about eight to one and 16 stages of compression.

► **Avoids Blade Stall**—Splitting the compressor laterally and linking each of the two compressors independently with



ROLLS-ROYCE AVON TESTBED Canberra tests engines having afterburners.

separate turbines allows the compressors to be operated at different rpm. at the same time. This avoids the blade-stalling problems encountered in the single-spool compressors where the entire compressor must always operate at the same rpm. In the split-compressor design each compressor is linked with a separate turbine through concentric shafts and there is no mechanical connection between the high- and low-pressure units.

Pressure ratios as high as 12 to 1 have been obtained from split-compressor engines with specific fuel consumptions lowering to .7 lb. of fuel per pound of thrust per hour. The lower fuel consumption results from the higher pressure at which air is introduced into the combustion chambers.

Early approach to the control problem on split-compressor jets has been to regard the high-pressure units as a separate engine and to design controls aimed solely at regulating this unit. The theory is that the high-pressure unit will bring along the low-pressure unit without any additional control. If successful this will mean relatively low power requirements for starting the engine and an extremely fast acceleration. Test stand operations have shown that acceleration from idling to full power is possible in three seconds.

Rolls-Royce experimented initially with multiple stages of compression using two centrifugal-flow units in its Clyde turboprop and now uses a pair of centrifugal compressors on the production models of the Dart turboprop. However, pioneering on two-stage axial compressors was done by Pratt & Whitney Aircraft and Bristol working independently at about the same time.

► **Production Problems**—The P&WA J57 made its first test stand run as a complete engine in January 1950 while Bristol reached the milestone with the Olympus six months later. The J57 first flew in April 1951 in a B-50 flying test bed rig while the Olympus took to the air initially in August 1952 in specially built Canberra nacelles. P&WA J57 production is at least a year in advance of Bristol's progress.

Tooling and production of the split-compressor axials pose some knotty problems because of the switch in materials away from soft metals such as aluminum and magnesium to tough stainless steels and titanium. Most of the tooling required for the high-powered axials has to be specially designed and built.

Comparing J57 and Olympus versions of about the same thrust, it appears that the Olympus weighs less and uses fewer compression stages. The J57 weighs more, primarily because of its additional compression stages and more extensive use of stainless steels, but produces a higher compression ratio that gives it an edge in fuel consumption.

Comparing the Olympus with the 10,000-lb.-thrust Avon, it is evident that split-compressor axials tend to weigh more because of the heavy concentric shafting required and the heavier steels used particularly for casings. However, the Olympus develops more thrust with fewer stages of compression and has substantially lower fuel consumption.

► **Need Afterburners**—Because of the lower engine weight and its historic neglect of range in fighter aircraft, the Royal Air Force still favors single-spool axials for its current crop of fighters. To get transonic performance in level flight from the Hunter, Swift and Javelin, afterburners will be required for the Avon and Sapphire. Rolls and Armstrong Siddeley are not tailoring afterburners to fit these fighters.

Bristol, P&WA and Wright are also developing afterburners for their split-compressor jets and the U. S. Air Force plans to use the J57 and J67 with afterburners in its next generation of supersonic fighters and there are plans for Air Force and Navy bomber applications. Due to increased air mass flow through the split-compressor engine higher percentage of power increase is possible with an afterburner. Afterburners producing as much as a 40% increase over basic engine thrust are in prospect for split-compressor types.

► **Other Investigations**—There is a good deal of talk in England about the future of the ducted fan variation of the turbojet for special uses, particularly jet transports. Rolls-Royce has been the leading exponent of the ducted fan and is building an experimental engine incorporating this device.

The British engine industry is heavily engaged in a wide variety of other type aircraft powerplants including short-life turbojets, ramjets and rockets. The short-life turbojet is designed for use in pilotless target aircraft, missiles and short-range, stripped-down interceptors. Basic approach to the problem is to build the short-life jets out of cheaper and less durable materials and then operate them at higher temperatures over an engine life of only 10 to 20 hr. Rolls, Bristol and Armstrong Siddeley are all working on short-life jets.

In the rocket field de Havilland has achieved remarkable success with its Specter, particularly on the degree of power control. Armstrong Siddeley's Screamer is another approach to the same problem tackled in its Snarler rocket. Rocket applications are aimed for additional power in supersonic fighters operating at altitudes where turbojet efficiency declines rapidly and for guided missiles.

Bristol, which took over Boeing's data on the Gapa project, and Vickers are active in ramjet development.

► **Production Picture**—In addition to all this development, the British engine industry is still working hard on the problem of getting its earlier jets, the Avon and Sapphire, into the scale of

production required for the "superpriority" defense program. Even the established factories are still expanding their production tooling, and machine tools built in the United States and shipped to Britain under the Mutual Security Agency foreign aid program are in evidence in almost every plant.

Although the production output of Avons and Sapphires is still small by American standards, British jet engine output is currently ahead of the comparable airframe programs. There is now a surplus of jets. Rolls' second source of Avon production at Glasgow is just beginning to turn out engines. while Bristol, Napier and Standard Motors are still tooling up for additional Avon production.

Armstrong Siddeley is putting a new plant into Sapphire production at Gloucester. Both Rolls and A-S are planning substantial production of afterburners for the Avon and Sapphire. De Havilland is still building centrifugal-flow Ghosts for the Venom and Comet.

AF Orders F-102 Into Production

The Convair F-102 delta supersonic interceptor has been ordered into production by the Air Force.

Initial production order is small but tooling provisions accompanying it indicate clearly that large-scale production of the F-102 has been programmed by USAF.

The F-102 is similar in external appearances to the XF-92A that has been undergoing flight tests at Edwards AFB, Calif., since 1948. It will be powered by a Pratt & Whitney Aircraft J57 turbojet with afterburner.

The F-102 uses a relatively thin wing in contrast to the British approach that allows wing thickness up to nine feet at the roots. Some American engineering opinion is skeptical of the British delta's ability to operate much above Mach 1 in level flight. F-102 performance requirements call for level flight performance well above Mach 1.

Prototypes of F.27 Ordered by Dutch

The Dutch Government has ordered prototypes of the Fokker F.27 feederline transport design, according to Fairchild Engine and Airplane Corp., which has exclusive U. S. sales and manufacturing rights to Fokker planes.

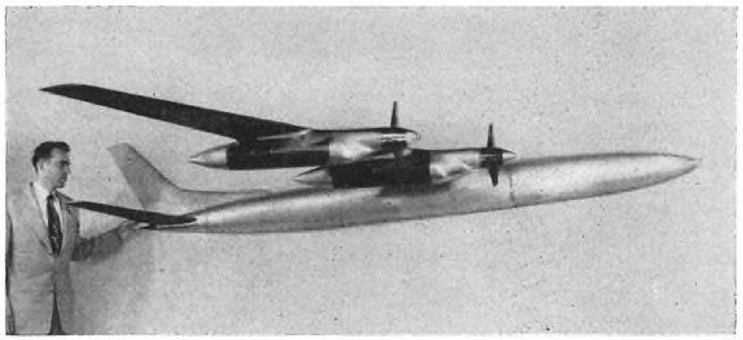
However, there is no talk of producing it in the U. S. unless Air Force wants it, or a commercial market survey shows assurance of a profitable return. Production in Holland is more likely.

The Dutch are confident of a commercial sales potential in Europe and Australasia as a DC-3 replacement.

Fairchild is analyzing production cost and performance for a U. S. version of the Fokker design. When that is completed, and if it looks promising, Fairchild plans a market survey.

Alternate powerplants proposed by Fokker are the Wright R1820 Cyclone with 1,525 hp. (water injection) and the Rolls-Royce Dart turboprop with takeoff power of 1,500 hp. plus 385-lb. jet thrust. The plane would be "about 50 mph. faster than the DC-3," Fairchild estimates.

Whether helicopters of equal or larger payload may threaten the F. 27's commercial prospects in the U. S. for the latter part of this decade is a question Fairchild will explore in its appraisal of the plane, a spokesman says.



NACA MODEL of sweptwing turboprop-powered plane undergoing tunnel tests.

Supersonic Props Tested on Model

Turboprop model tests up to speeds of Mach .92 have been carried out by NACA engineers in a windtunnel at Ames Laboratory, Moffett Field, Calif., with a scale model of a four-engine sweptwing plane comparable in many respects to the Boeing B-47 jet bomber.

Significance of the NACA model turboprop tests is heightened by recent industry reports that the Boeing B-47 aerial refueling tanker may be a four-turboprop aircraft instead of a turbojet plane, because of the longer range possible with turboprop power.

An AVIATION WEEK writer watched a demonstration of three-blade, 14-in. diameter model propellers whirled by .75-hp. electric motors, suspended in sleek pod-like nacelles, under a 35-deg. swept wing. The thin-blade, small-diameter model props are obviously designed for supersonic tipspeeds.

▶**Some Specs**—The turboprop model was described by NACA as representing a hypothetical plane about the size of a Boeing B-50 bomber, but modernized with swept wing and turboprop power. Actually, a turboprop version of the B-47, which has a fuselage length of 108 ft. as compared to 99 ft. for the B-50, answers to such a description.

NACA tests indicate that such an updated plane with turboprops of 12,000 to 15,000 hp. could fly in the 550 to 700-mph. speed range, compared to 300-400 mph. for the B-50. The small-diameter, thin propellers would have a disk power loading of 100 hp./sq. ft.

Propeller engineers at Ames caution that large structural problems are involved in producing supersonic propellers, including flutter, vibration and very high stresses, as would be indicated by the high disk loading.

▶**Powerplants**—USAF has indicated its interest in highpower turboprop engines in the 12,000-to-15,000-hp. range discussed by NACA. Navy is more interested in an intermediate power range of 8,000 to 10,000 hp.

Most powerful U. S. turboprop engines to have flown are in the 5,500-7,500-hp. class: the Allison T40, the Pratt & Whitney T34 and the Wright T35.

However, several other turboprops are in early stages of development. Among them are a Curtiss-Wright turboprop version of the Sapphire J65 engine and the new Pratt & Whitney T52 split compressor turboprop, which aims at an 8,500-hp. rating (AVIATION WEEK Oct. 13, p. 11).

Surplus Sought

(McGraw-Hill World News)

Melbourne—U. S. firms are combing Australia for surplus or obsolete equipment they can overhaul and resell in America. American Aeronautics Corp., Burbank, Calif., recently purchased approximately 270 gun turrets formerly on obsolete Convair Liberators for use in U. S. Navy planes. Other American aircraft manufacturers reportedly are seeking to buy engines from obsolete RAAF planes.

Complexity

- **Douglas engineer urges weight, cost reduction.**
- **Heinemann cites loss of performance as penalty.**

Aircraft weight and cost can be reduced with a net improvement in combat effectiveness, E. H. Heinemann, chief engineer of the Douglas Aircraft Co., El Segundo division, told the Washington chapter of the Institute of the Aeronautical Sciences recently.

Heinemann, designer of the Skyrocket, Skyray and Skyraider, listed four definite steps that should be taken to reduce cost and complexity of modern combat aircraft and increase their combat effectiveness.

- **Educate all personnel** concerned with aircraft design, requirements and procurement on the seriousness of the complexity problem and the relationship between equipment weight, gross weight and cost.
- **Review and re-evaluate** specific requirements to determine their actual military value and necessity.
- **Review design features** and equipment during preliminary stages of each new model from the viewpoint of what is best for the aircraft as a whole rather than upon detailed equipment requirements as they have been established in the past.
- **Apply engineering skill** and ingenuity to avoid many of the problems that cause increased complexity and gross weight.

Heinemann pointed out that as a general rule every pound of equipment added to an aircraft required an additional ten pounds of gross weight in the aircraft to carry it and added more than $400 to the cost of the plane. He translated this general growth and cost factor into terms of specific equipment now standard on modern jet aircraft as follows:

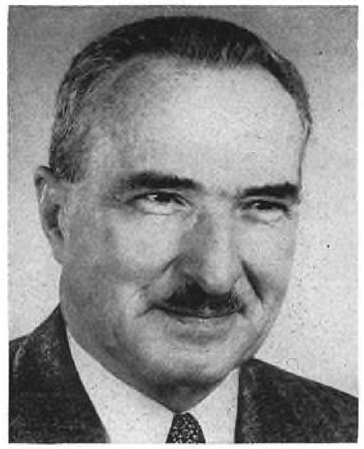
- **Wing de-icers** weigh 300 lb., add 3,000 lb. to gross weight and $120,000 to airplane cost.
- **Barrier crash provisions** for Navy carrier planes weigh 250 lb., add 2,500 lb. to gross and $100,000 to cost.
- **Automatic pilots** weigh 110 lb., add 1,100 lb. to gross weight and $44,000 to cost.
- **Ejection seats** weigh 100 lb., add 1,000 lb. to gross weight and $40,000 to cost.
- **Cockpit defrosters** weigh 50 lb., add 500 lb. to gross and $20,000 to cost.
- **Single point pedal adjusters** weigh 7 lb., add 70 lb. to gross and $2,800 to cost.

Many current military equipment requirements should be considered as desirable rather than necessary and should be carefully screened before inclusion in a specific aircraft type, according to Heinemann.

"In many cases the attempt to satisfy all equipment requirements results in an aircraft so complicated that the 'point of no return' is reached, and as a result of loss of performance and reliability the pilot's chances of carrying out his mission are reduced rather than increased," Heinemann told his engineering audience.

He pleaded with engineers to use their skill to devise lighter, simpler and less costly solutions to the problems encountered in modern high-speed aircraft.

To give an example he cited the ejection seat which performed a necessary function at a relatively high cost in weight penalty and cost. Several other methods of getting pilots safely out of high-speed aircraft have been devised to do the same job for less weight and at less expense, Heinemann said.



NEW NWA PRESIDENT

Harold R. Harris was named president of Northwest Airlines, succeeding Croil Hunter, who is now chairman of the board. Harris formerly was a vice president of Pan American Airways, president of American Overseas Airlines and had a long career in military aviation. He is the first member of the Caterpillar Club.

New Safety Record

Record of U. S. domestic scheduled airlines for passenger safety in the 12 months ending Sept. 30 figures out to a fatality rate of only 0.38 per 100 million passenger miles. This is believed to be the best ever recorded in airline history.

Coach Future

- **Nyrop predicts it may dominate air travel.**
- **And chairman gives CAB major share of credit.**

"In time, coach travel may well be the predominant form of air travel within the U. S.," Civil Aeronautics Board Chairman Donald Nyrop stated in a Norman, Okla., speech to the 1952 Conference on Airport Management and Operations.

Nyrop hands the major share of credit for the current aircoach boom to CAB rather than to the certificated airlines or their nonscheduled competitors. He did not mention the nonskeds in his speech.

The Board urged the airlines to expand coach service and cut coach fares a year ago "despite considerable opposition" of some of those lines. The result of the Board's forcing coach fare cuts and urging coach expansion "has been a substantial and steady increase in the amount of coach service offered the American public and a reduction in coach fares of approximately 11%," Nyrop says.

Coach services now account for 16% of domestic traffic, he adds.

International experience has been similar. Nyrop notes that Pan American's 43,000 trans-Atlantic passengers (almost half coach) from May 1 to Aug. 15—the first 3½ months of coach service—almost doubled the 29,000 PAA total of the same period a year ago, when there was no coach. And TWA's 33,000 passengers (also almost half coach) the same time this year compared favorably with 26,000 total a year ago when there was no coach service.

▶**Coach Proved Profitable**—Nyrop concludes these statistics by stating: "The Board is convinced and the record will demonstrate that a high standard of service at reduced fares can be achieved by the relatively simple device of providing greater seating in aircraft. . . . In short, our concept of aircoach service provides the equivalent of technological changes in aircraft equal to a one-third reduction in operating costs."

Answering the common question as to why this simple invention wasn't used eight years ago when the DC-4 came out of the war with that obvious capacity, Nyrop states, ". . . We have necessarily moved cautiously" because "the Board has a dual responsibility of developing air transportation while at the same time reducing the dependency of the airlines on federal subsidy."

▶**Mail Rates Now Final**—Nyrop cites another major step by CAB during his

tenure as the placing of most airlines on final mail rates. The big four—American, Eastern, TWA and United—were settled on a compensatory (non-subsidy) rate Sept. 19 last year. "Since that time the Board has established 42 final mail rates and 36 temporary mail rates for a total of 78 mail rate cases handled in a period of less than 13 months.

"In addition, there are five final mail rates upon which substantially all of the work has been completed as indicated by the issuance of show cause orders." Nyrop compares this speedy administration during his tenure as Board Chairman against the handling of only 40 mail cases throughout fiscal 1951.

CAB has netted the government $11,311,000 in refunds from setting of new and lower permanent mail rates since Sept. 19 of last year, Nyrop says.

▶**New Airlines Allowed**—Answering charges that CAB has closed the door on new enterprise, Nyrop notes that CAB has allowed certificates to 41 airline applicants since 1938. These airlines are:

• **Local service**—All American, Air Commuting (not renewed), Arizona (merged into Frontier), Bonanza, Central, Challenger (merged into Frontier), Chesapeake (never flew), Empire (merged with West Coast), Florida (not renewed), Island Air Ferries, Lake Central, Mid-West (not renewed), Mohawk, Monarch (merged into Frontier), Ozark, Parks (never flew), Piedmont, Pioneer, Purdue (terminated), Southern, Southwest, Trans-Texas, West Coast, Wiggins, Wisconsin Central.

• **Cargo carriers**—Airnews (terminated), Flying Tiger, Riddle, Slick, U. S. Airlines, Aerovias Sud Americana.

• **Special services**—Resort, Mackey, Midet.

• **International, overseas** — American Overseas (merged with Pan Am), Caribbean Atlantic, Trans-Pacific.

• **Metropolitan copter services**—Helicopter Air Service (Chicago), Los Angeles Airways, New York Airways, Yellow Cab Co. of Cleveland (never flew).

F-89 Is Grounded, Plane Under Study

Northrop Aircraft, Inc., has engaged a trio of technical experts to study structural problems of the F-89 Scorpion as part of an extensive investigation into the series of recent accidents involving this aircraft:

• Edgar Schmued, designer of North American Aviation, Inc., fighters and now a consultant in Los Angeles.

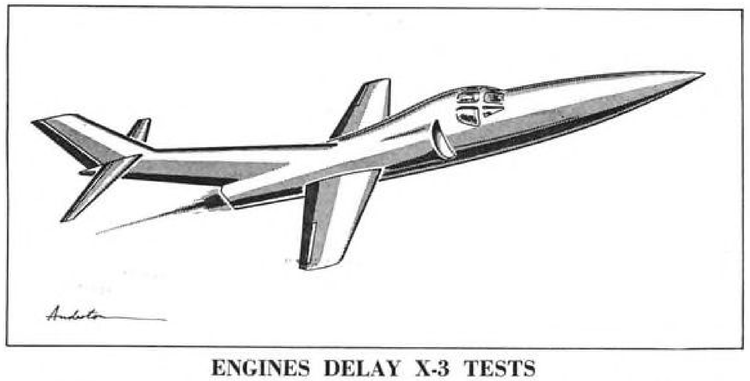
• Capt. Walter Diehl, retired Navy aeronautical authority.

• Dr. J. M. Franklin, a metallurgy and aircraft structure specialist on leave from Chance Vought.

Other phases of the investigation involved static testing of a complete F-89C and a wing structure at Wright Field and altitude flight testing at El Centro, Calif. Air Force has grounded all F-89s pending outcome of the investigation. There have been six accidents involving structural failure of F-89C aircraft since last summer. The grounding exempts aircraft required for flight testing and emergency air defense missions.

The Air Force has not yet made a decision regarding the flight status of the F-89D.

The first deliveries of this model are scheduled for November. Northrop has a production program on the F-89D running until the end of 1955 when initial production of the Convair F-102 is expected to take over the principal air defense role for USAF.



ENGINES DELAY X-3 TESTS

Douglas X-3, supersonic research aircraft now at Edwards AFB, Calif., is shown here in artist's impression of the radical craft. Plane is powered by two Westinghouse J40 turbojets, although some early reports have listed powerplant as combination of turbojet and ramjet. X-3 has been ready for flight for some time now, but difficulties in engine installation have held back flight date. Douglas pilot Bill Bridgeman is to fly the X-3 during its research program, aimed at extending the range of flight observations gathered by the earlier Douglas Skyrocket in the supersonic speed range.

Atlantic Cargo Case Faces New Delay

Killing off hopes of Seaboard & Western, Transocean and European-American for early certification, CAB has decided to make another lengthy "nonsked investigation case" out of their applications to provide non-subsidized trans-Atlantic cargo service. The case started five years ago.

Seaboard and Transocean, after denial of their applications, won reopening of their cases this summer on grounds that Defense Department supporting testimony had been disregarded or else "lost" and that times had changed since the original hearings some years ago. Then President Truman consolidated European-American's similar application with reopening of the Seaboard-Transocean case.

After several months' deliberation, CAB has decided to open their case to all comers. That means at least another year's government deliberation.

Outlook is that the case will be slated for 1954 settlement, according to Washington attorneys who figure three to four years for the domestic nonskeds' somewhat analagous CAB investigation.

Airline Shakes Up Its Top Command

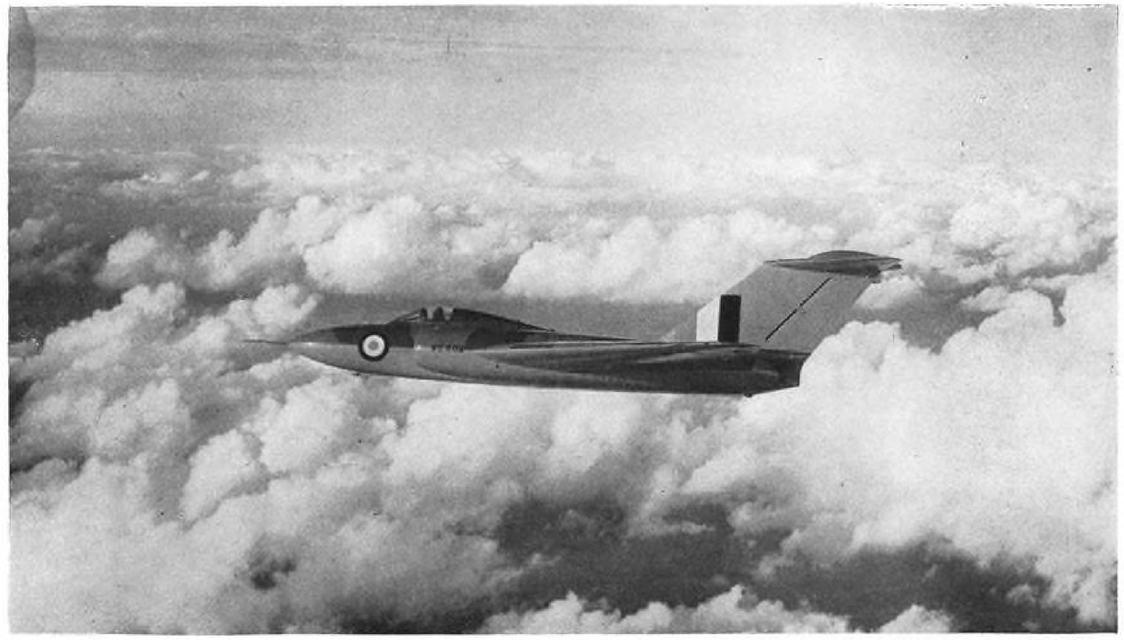
U. S. Airlines' voluntary management and financial reorganization, aimed at reviving the cargo carrier, brought in Fred A. Miller as president. He is a former director and vice president of Flying Tiger Line and recent chairman of nonsked contract carrier Air America.

U. S. Airlines was certificated by CAB in 1949 for all-cargo service between the northeastern states and Florida-Gulf Coast area. Seasonal traffic troubles combined with early stock manipulations and subsequent management problems to keep the carrier in financial straights. Founding president was Harry Playford, Florida promoter, and James Wooten, formerly of Alaska Airlines, filled that office until recently.

Directors appointed Lyle F. O'Rourke as secretary and general counsel. William B. Haggerty and Joseph E. Griffin were reelected as director and treasurer, respectively.

Mackay Trophy Awarded

USAF's Mackay Trophy for 1951 has been awarded Col. Fred J. Ascani for setting a world's record of 635.6 mph. around a 100-km. closed course at the National Air Races in Detroit last year. Ascani flew a North American F-86. Previous mark for the distance was set by the late John Derry in 1948 at 605.8 mph.



EXCEPTIONAL PERFORMANCE over wide altitude and speed range have gained super-priority rating for RAF all-weather fighter.

Why Gloster Gave Javelin a Delta Wing

- **Only a triangle shape could give required all-weather fighter performance, company engineers figured.**
- **Design permits high speeds at high altitudes, low speeds at low, and fine over-all maneuverability.**

By David A. Anderton

Hucclecote, England—The Gloster Javelin, world's first delta-winged twin-jet fighter, is going to be England's prime defensive weapon against high-altitude enemy bombers.

Designed as a heavy interceptor and patrol fighter, with all-weather capabilities and extreme range built in, the Javelin is at the start of what promises to be a very interesting career. In its current state, it marks the transition between the non-automatic interceptor of the current Meteor N.F.11 type and the complete automaticity of tomorrow's generation of guided anti-aircraft missiles.

After the recent SBAC display at Farnborough, AVIATION WEEK's executive editor, Robert Hotz, and I visited the main works of Gloster Aircraft Co., Ltd., here in Gloucestershire, near the rolling hills of the Cotswolds. It is here, where Gloster has built many of the fighters that have made its name famous, the company will build the Javelin.

At the time of AVIATION WEEK's visit, the Javelin was still on the part-publication list—internal details, including structural arrangements, were classified. This also meant there could be no cockpit examination and that Gloster people were considerably restricted in answering questions. Therefore, while a major part of this story is based on notes taken in the Gloster plant, information gleaned from study of released photographs has also been incorporated for greater completeness.

▶ **Javelin Genesis**—The Gloster G.A. 5, later to be named the Javelin, was designed to Air Ministry specification F.4/48, issued in 1948. The first prototype aircraft made its first flight from Moreton Valence airfield about three years later, on Nov. 29, 1951. S/Ldr. W. A. Waterton was the pilot on this and most of the subsequent test flights.

Gloster chose the delta layout because this was the only geometry which would furnish the necessary performance for an all-weather fighter based on current knowledge of structures and aerodynamics. (For general reasons why the British like the delta layout, see AVIATION WEEK Sept. 22, p. 22.)

The resulting airplane, Gloster engineers reasoned, would be able to show high speed at high altitude and low speed at low altitude, with exceptional maneuverability all the way along. This performance versatility was needed, because as Waterton put it, "You don't have to go like bloody hell all the time—you might have to shoot down an old piston-engined bomber."

▶ **Designed Choice**—Final layout of the Javelin showed a 52-ft. wingspan, a 57-ft. overall length and a maximum ground-attitude height of 17.1 ft.

Engines are a pair of Armstrong Siddeley Sapphire turbojets, rated at 8,330 lb. sea level static thrust each.

A reasonable estimate of the gross weight might be 27,000 lb. which would result in a wing loading of about 30 pounds per square foot on the Javelin's gross wing area of about 920 sq. ft.

The Javelin is one delta configuration which might be considered as a sweptback craft with the trailing edge

BANKING JAVELIN shows flat, wide-beamed fuselage and round air intakes.

STANDING JAVELIN shows low angle of incidence. Contrast tailpipe lines in this early picture of prototype with later picture of same plane, p. 21.

portion of the wing and tail filled. Controls are completely conventional; there is a horizontal tail with elevators and the only wing control surfaces are ailerons.

► **Credit Due**—The short time of three years between issuance of the spec and the first flight of the airplane reflects great credit, not generally appreciated, on the Gloster design teams.

Along with many others, I shared the impression that the Javelin was a Hawker Siddeley Group venture, with Gloster's part confined mostly to building an airframe around the AS Sapphires to an Avro aerodynamic layout.

Such a belief completely underrates the tremendous effort of the Gloster technicians and the windtunnel group of the Royal Aircraft Establishment.

In fact, a close look at the aerodynamic configuration of the Javelin shows two basic differences from the Avro 707 research craft. One is the use of the horizontal tail on the Gloster craft, necessary in the tight maneuvers required of an all-weather fighter. The second is in the landing flaps—the 707s have none—to increase the drag and reduce the incidence in landing.

► **Wing Details**—Basic triangle which forms the gross wing area of the Javelin has a 58-ft. base (clipped by rounded corners to the 52-ft. span of the plane) and a 32 ft. altitude, or root chord. A symmetrical airfoil section is used, with root thickness-chord ratio about 8%. Leading edge radius is generous. Sweepback angle, measured at the quarter-chord point, is about 40 deg.

Large plain flaps are fitted to the undersurface of the wing, well forward of the trailing edge. This position minimizes trim changes when the flaps are deflected. Fence-type air brakes are located on both upper and lower surfaces just forward of the trailing edge.

One of the criticisms of delta aircraft is the limited center of gravity travel. On the Javelin, the CG travel is not critical for any contemplated loading conditions. Even though the percentage travel is lower than usual, the physical distance is much larger (because of the large root chord) than on the Meteor, for example.

► **Fuselage Scheme**—Pilot and radarman sit in tandem on ejector seats in a short fuselage inserted between the twin Sapphires. Pilot visibility should be good forward, to the sides and down, but aft it should be like looking through a tunnel. The radarman, who should be watching his instruments anyway, has only a pair of portholes on each side and can see only directly abeam.

The fuselage forward of the pilot contains most of the avionic equipment necessary to the functions of the Javelin. An interesting point is the very small radius of the nose tip, compared to U. S. practices. This means that either the British have learned much more than we have about solving radome re-

fraction problems, or they pay less attention to them.

► **Powerplant**—The Sapphires are installed with their thrust lines not parallel, but converging towards the exits. Air intakes are circular, and straight-through flow provides a high pressure recovery—about 95%—at the compressor inlets. Fuselage boundary layer is separated from the inlet air by a flat ramp just ahead of the intakes on the fuselage, and by the distance between the ramp surface and the air intake.

Afterburners are not fitted, but Gloster may have to succumb to the current trend—resisted bitterly by British designers—and install them.

► **Tail Assembly**—The swept, low-aspect-ratio vertical tail of the Javelin is topped by an all-movable surface (not to be confused with the all-flying tail on the late North American Sabres, for example) controlled by the usual hand-wheel in the cockpit. A fairing for a spin-recovery chute caps the tail assembly; this fitment is temporary, and will be removed when the plane completes its spin tests.

There was some trouble with buffeting in flights of the first prototype, traced to breakaway of flow at the fuselage-tail intersection. On the prototype, the Sapphire tailpipe fairings were lengthened to a vertical knife-edge intersection, instead of being cut back at an angle. This modification cured the buffeting and increased somewhat the critical Mach number of the aircraft.

► **Other Details**—The triangle landing gear is the liquid-spring type built by Dowty Equipment, Ltd. The main wheels, with a tread of about 23 ft., retract inboard; the nosewheel retracts aft. All gear closure doors remain open while the plane is on the ground; no attempt is made to reduce drag slightly at the expense of extra complexity.

There is no indication of armament on the second prototype, although there is enough room in the Javelin to carry anything currently contemplated as offensive weapons. This includes the four 30-mm. cannon specified for most of Britain's new generation of fighters, and the air-to-air missiles which must be coming along in the next few years.

All controls of the Javelin are power-boosted hydraulically.

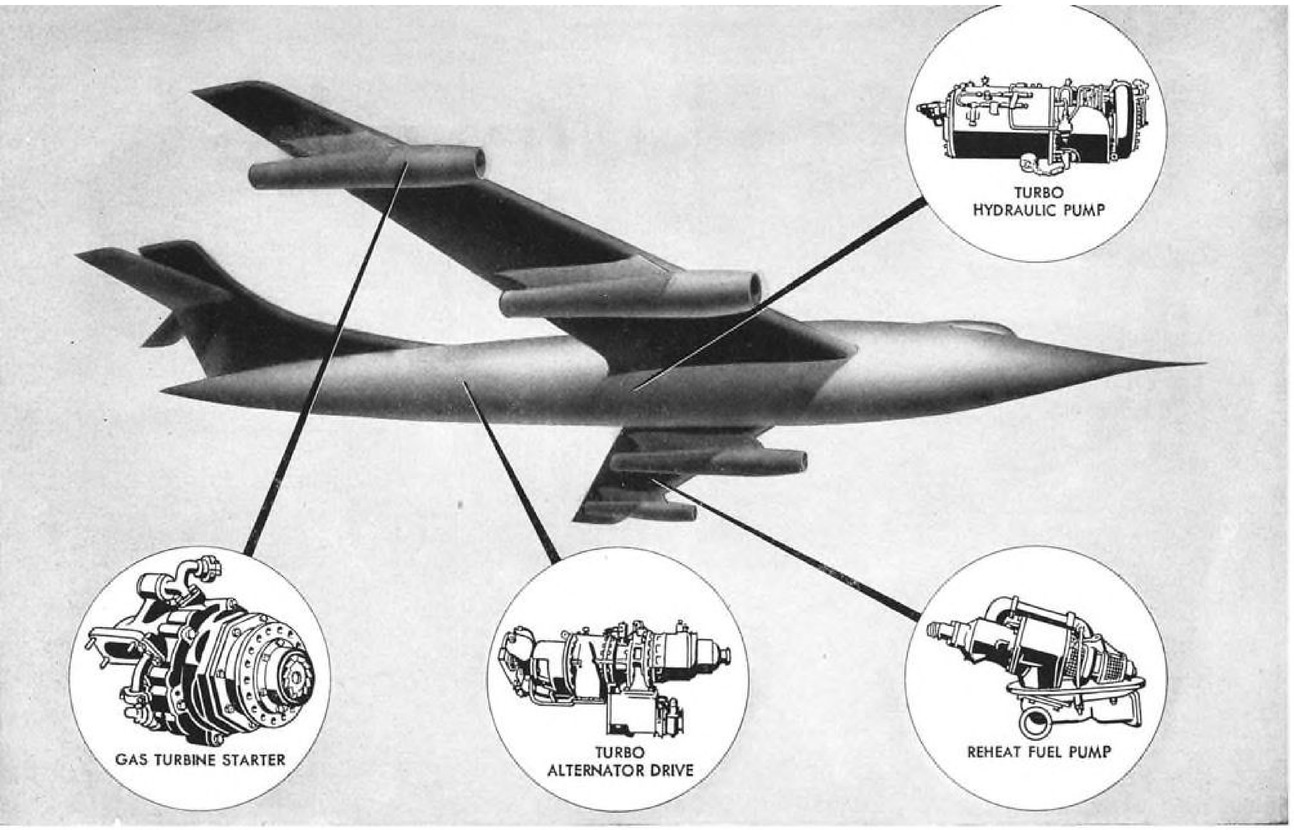
► **Simple Structure**—It will reveal no secrets to say that the Javelin structure is simple and conventional. About the only departure from time-honored practice is in the lack of spanwise stiffeners; all wing bending loads are carried through a single beam. The root thickness gives enough dimension to make a very rigid structure in torsion, and in fact this torsional stiffness is one of the inherent values of the delta wing.

Gloster will complete five prototype Javelins before turning out its early production planes. The first prototype (serial WD 804) was damaged by fire following an accident; the airplane was recovered only because of Waterton's heroism. He had been making high-speed flight runs when elevator flutter started, became violent and ceased when both elevators carried away. Waterton, with little control left in pitch, climbed to 10,000 ft. and found that he could manage to get some control down to about 150% of his normal landing speed.

He decided to land rather than abandon the airplane and set back the test program. But the abnormally high speed of landing was too much for the landing gear, which failed, and fire broke out immediately. Waterton managed to get out and was later awarded the George Medal for heroism.

The second prototype (WD 808) was the demonstration craft at Farnborough, has been flying since Aug. 21, and is currently in an intensive test program. It will shortly be joined by the third prototype. One of the remaining two will go for structural tests and eventual destruction on the test frame, and the fifth will serve in an unspecified way.

► **Flight Performance**—Specific performance data are, of course, classified. Transonic speed is an obvious "must" for such a craft, as is a high degree of

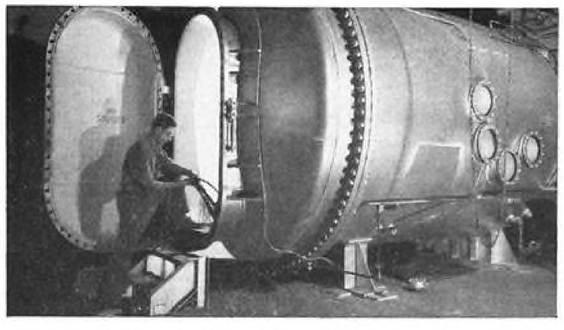


New G-E Accessory Equipment for Jet Aircraft

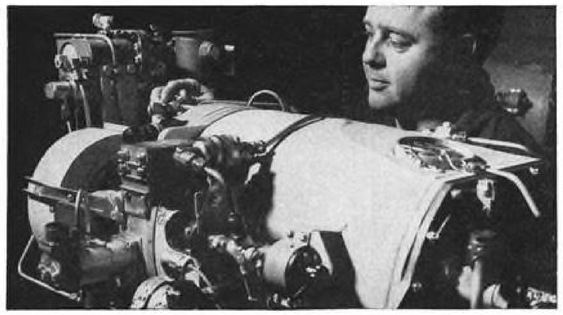
EXPERIENCE. . . G.E. has been developing and producing aircraft turbines since Dr. Moss developed the first turbosupercharger (1918).

Units Can Be Designed For Any Size Airplane

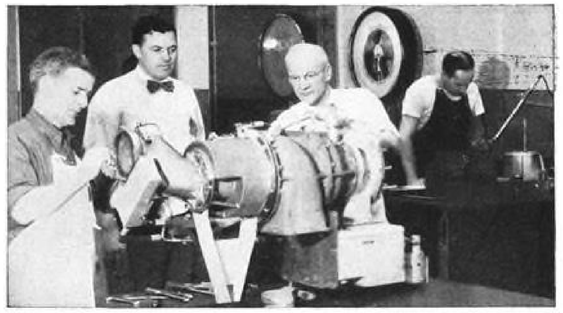
DESIGNED FOR JET AIRCRAFT, new aircraft accessory turbines produce reliable auxiliary power under all conditions. Each product in the line features a high power-to-weight ratio and occupies a relatively small space. All are self-contained and can be easily removed for maintenance.



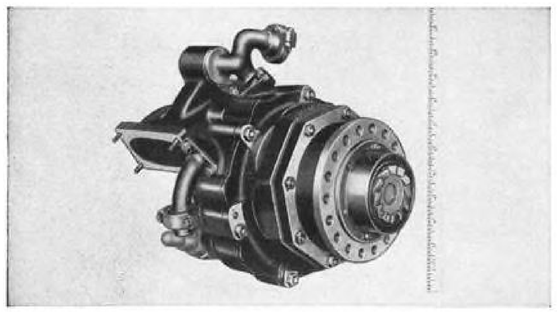
TESTING. . . Accessory turbines are tested under simulated operating conditions. Shown above is turbopump altitude chamber.



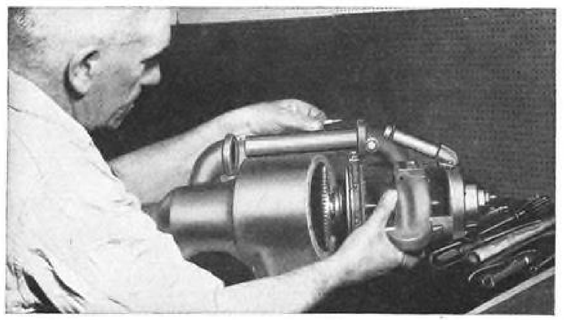
TURBO HYDRAULIC PUMPS bleed air from jet engine compressor to supply hydraulic power for entire airplane.



TURBO ALTERNATOR DRIVES bleed air from jet engine compressor to supply electric power for entire airplane.



GAS TURBINE STARTERS operate on expanding gases from solid or liquid propellants to give fast starts, without ground power.



REHEAT FUEL PUMP bleeds air from jet engine to supply extra flow of fuel for afterburner operation.

Saves Weight, Space, Maintenance Time

RANGE OF APPLICATION for these turbines is unlimited. They can be designed for the smallest fighter or the heaviest bomber. However, each individual airplane determines the detailed specifications that the drives will be designed for. It is important, therefore, that consideration of the drives be given when airplane design is beginning.

THE NEW LINE of turbine-driven auxiliary power at the present time includes: (1) air turbine-drives for alternators and turbo-hydraulic pumps which can be conveniently located anywhere aboard the airplane, (2) air turbine-driven reheat (afterburner) fuel pumps which allow climb rates of thousands of feet per minute, and (3) gas turbine starters which start engines within seconds, without ground power.

OTHER ACCESSORY TURBINE PRODUCTS are now in the design stage. In developing these new aircraft accessory turbines, G-E engineers are applying the knowledge of 35 years of developing and building aircraft turbines. This experience plus the manpower and know-how of General Electric is at your disposal to help solve your auxiliary power problems.

For more detailed information contact your nearest General Electric Aviation Specialist. *General Electric Company, Section 210-63, Schenectady 5, N. Y.*

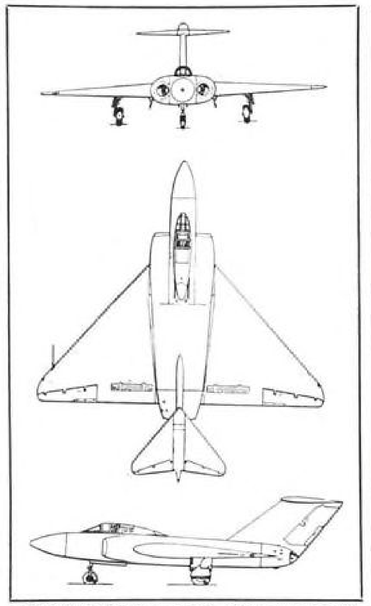
SERVICE . . . G-E service shops are strategically located for aircraft gas turbine and accessory equipment overhaul.

FOR MORE INFORMATION

Persons desiring more detailed information on G-E Accessory Equipment can obtain copies of bulletins listed below. Write General Electric Company, Section 210-63, Schenectady 5, N. Y.

GEA-5815	Accessory Turbines for Jet Aircraft
GEA-5870	Air Turbine Drives for Jet Aircraft
GEA-5871	Aircraft Afterburner Fuel Pumps
GEA-5872	Aircraft Gas Turbine Starters

GENERAL ELECTRIC



DELTA WING and tail of Gloster Javelin are shown graphically in this first published three-view of the plane.

maneuverability and a tremendous rate of climb. The low wing loading and thrust loading indicate that those general characteristics can be met.

Waterton's impressive flight demonstration of the Javelin at Farnborough showed off the maneuverability of the craft. Although operating under a temporary speed restriction to 400 knots—which meant no blistering flypasts—the Javelin impressed technical observers with its extremely small-radius turns at zero feet. There was some evidence as the week wore on that the restricted speed was being interpreted somewhat loosely.

A chilling moment occurred at takeoff of the Javelin. Immediately upon becoming airborne, Waterton would yank the big plane into a steep climbing turn to the left, and (so it seemed from a distance) just clear the runway with the left wingtip. Landings of the Javelin were also noteworthy because of the slow approach and landing speed and the low angle of incidence at touchdown—estimated at only a few degrees above the static ground angle.

▶ **Building the Plane**—Production of the Javelin will be mainly at Gloster's Hucclecote factory in Gloucestershire. This factory is now turning out a variety of Meteors at the rate of about 30 per month for the RAF and the NATO countries, as well as some of the other nations interpreted as being members of the anti-Communist bloc.

The Meteor is an elderly airplane, powered by twin Rolls-Royce Derwent engines, designed to Air Ministry spec. F.9/40. It was the only Allied jet

fighter to be operational in World War II.

▶ **Gloster Production**—At Hucclecote, Gloster is producing:

- **Meteor 8**, a single-place fighter, standard with the RAF and NATO countries. Span is 37 ft., length 45 ft., gross weight 15,550 lb.
- **Meteor 9**, a single-place fighter-reconnaissance plane with cameras as well as guns in the nose. Span is 37 ft., length 45 ft., gross weight 15,770 lb.
- **Meteor 10**, an unarmed high-altitude photo airplane. Span is 43 ft., length 44 ft., gross weight 15,400 lb.

The factory space is full, although not crowded; there is a little space to spare around the paint shop where finished assemblies are stored temporarily.

Based on this hasty factory survey, and earlier knowledge of the general manpower and machinery situation in England, a personal estimate of possible peak production rate for the Javelin would be about ten or a dozen per month. The airplane does have a super-priority rating which extends down to suppliers and equipment manufacturers, but it does not—and cannot, at the moment—extend to labor.

Furthermore, Gloster must compete for personnel in an area where there are several other large industries within easy commuting distance. This is always a tough problem in a "tight" labor area, but it will be even tougher for Gloster. Within the next few months the firm will be phasing out most of its Meteor work and bringing in the Javelin. There will be a short period of slack which must be taken up somehow if Gloster is to hold on to its production workers.

This has been recognized by management and plans are being studied to minimize any changes through the transition.

▶ **Machinery** — Gloster's Hucclecote plant shows the typical sparseness of heavy, specialized machinery upon which American industry relies. There are three Hufford stretchers, one medium and two small; a large Farnham roll and a smaller unit and a few Cincinnati millers. One 5,000-ton rubber press handles the majority of the press work, with two smaller units to take up some of the load of small piecework.

Aerojet Opens New Plant for Rockets

A new facility has been opened by General Tire & Rubber Co.'s Aerojet division on an 8,400-acre site near Sacramento, Calif., for production of rockets, Rato units, guided missile boosters and missile powerplants.

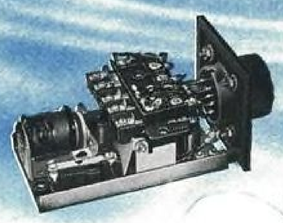
Aerojet's research, engineering and metal parts fabrication divisions remain at the company's Azusa, Calif., plant.

The A-C Control Panel includes an automatic voltage regulator, an exciter control relay, an exciter protection relay, and three differential current protection relays.

Aircraft alternator voltage regulator

Partially disassembled differential relay protection assembly

Circuit breaker (Cover Removed)



Exciter control relay (Cover Removed)

Exciter protection relay (Cover Removed)

Current transformer

Millions of Air-Borne Kilowatthours Protected by Westinghouse A-C Control

Westinghouse offers actual service-tested components for complete control and protection of a-c power systems. Exciter field relays, circuit breakers, differential relays, exciter protection relays and voltage regulators have accumulated millions of successful operating hours under flight conditions.

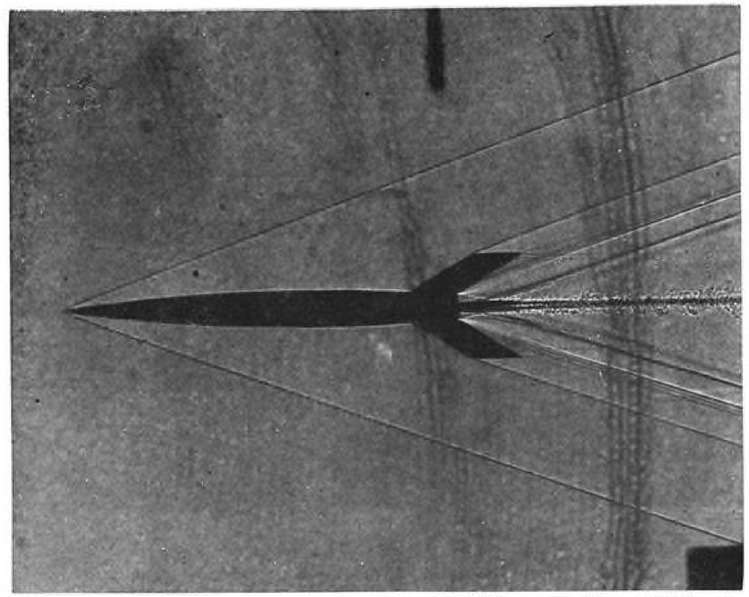
As individual units, or built into compact control panels, their design reflects years of engineering and operating experience.

The practical a-c system for aircraft was pioneered and developed by Westinghouse. The results of this experience in products and services are available for your applications.

Our latest plug-in control panels, for example, offer space and weight savings, simplified airplane wiring and installation. They minimize ground time and reduce maintenance costs.

Go to the leader in aviation experience. For the best equipment and advice on a-c systems, call your nearest Westinghouse representative or write Westinghouse Electric Corporation, Aircraft Department, Lima, Ohio. J-03003

YOU CAN BE SURE.. IF IT'S
Westinghouse
LEADER IN AVIATION EQUIPMENT



SHADOWGRAPH shows flow pattern around typical missile model flying at 2,500 mph. through test section of free-flight windtunnel. Light outline of missile body is boundary layer. Also shown are tip vortices streaming from tail surfaces and turbulent wake behind base of model.

LAUNCHER fires models of missiles into supersonic gale to add velocities of bullet and wind for higher Mach numbers. Model of missile (right) enclosed in plastic sabot is ready for firing. Clear plastic portion breaks away radially from missile after leaving muzzle of launcher; base of sabot tumbles and lags far behind model.

Windtunnel Is a Firing Range

The supersonic free-flight windtunnel at NACA's Ames Aeronautical Laboratory, Moffett Field, Calif., is an old idea with a new twist.

• **Old Idea:** Ballistics range in which a projectile is fired past a series of photographic stations. The resultant pictures, made at split-second intervals, permit both qualitative and quantitative measurements of bullet performance.

• **New Twist:** Firing range is a windtunnel, and the bullet is blasted into the teeth of a gale. The velocities of bullet and breeze add and produce far higher Mach numbers—currently up to Mach 8—than attainable with either device alone.

The gun launchers available vary in caliber from 0.22 in. to 3 in. Model missiles or aerodynamic shapes are fired, using a sabot—a combined piston and clamp made from plastic—to align the projectile and fill the bore of the launcher. The sabot breaks away in pieces after leaving the muzzle of the gun.

High Reynolds' numbers are available with small models because of the high density of the air in the test section. For example, a 6-in. model tested at Mach 7 in the free-flight tunnel gives direct correspondence to a 50-ft. missile at Mach 7 at 100,000 ft.

SAE Meeting Theme: Supersonic Flight

Los Angeles—Dan Barnard, president of the Society of Automotive Engineers, summed up the task of the more than 1,500 engineers who gathered here for the organization's recent National Aeronautic Meeting with one simple phrase:

"Our problem is to make planes go a little higher and a little faster."

The program for the four-day meeting listed 11 informal panel sessions and an equal number of day and night formal meetings on such varied topics as tooling economics, manufacturing cost control, electronics, plant engineering, radomes, turbojet engines and icing. But the real theme of the meeting could be summed up in two words: supersonic flight.

What, AVIATION WEEK asked President Barnard, was the convention accomplishing?

"Whatever the topic," he replied, "it all comes back to this: We're trying to produce airplanes that lift the speed and altitude limits."

General Chairman William Heath had another answer for the same question. "We're exchanging information," he said.

An engineer said: "It's a good chance to find out what the competition is doing."

The competition obviously was busy. As the problems of supersonic flight multiply, the ways of solving them increase in greater proportion.

▶ **Ideas on Forming**—The informal Aircraft Production Forum session on forming gave a good example of the multiplicity of solutions. Planes operating in transonic and supersonic ranges require heavier materials. These heavier materials mean greater pressures in forming, bringing such problems as dies breaking up. New materials, new equipment and new techniques obviously are called for, but agreement ended there.

Should material be formed in a soft

condition and then heat-treated, or heated and then formed? There was no solution—although the argument itself was heated. Proponents listed these advantages of hot forming: easier forming, more exact forming. Opponents objected to dimensional changes wrought by cooling.

Although plastics can be formed in extreme shapes they do not hold up in many cases and several engineers cautioned against tendencies to go overboard on this material.

Boeing disclosed that it is patenting a washaway plaster with which plastic can be formed over a plaster mold which is then washed away rather than chipped out with a hammer at the risk of injury to the part.

▶ **New Approaches**—Two production techniques drew a great deal of interest:

- **Lockheed's new shot-peening** method of contouring sheet uses air pressure for blowing small shot through multiple-heads onto the sheet. No form is used but a skilled operator is required.
- **North American's die-quenching** process forms heated part, then liquid-cools it to room temperature while still in the die. Springback and warping are thus eliminated. A die pressure as high as 10,000 psi. is used. No finish forming is required. North American reports this is now an accepted production technique there, with more than 11,000 parts turned out in this manner.

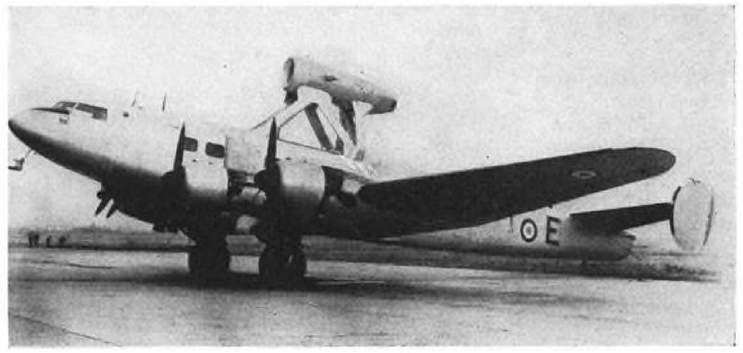
One production panel considered ways to introduce design changes with minimum delay and confusion in production. Another took up methods of quality control to reduce production costs and raise quality levels. Another panel covered plant layout.

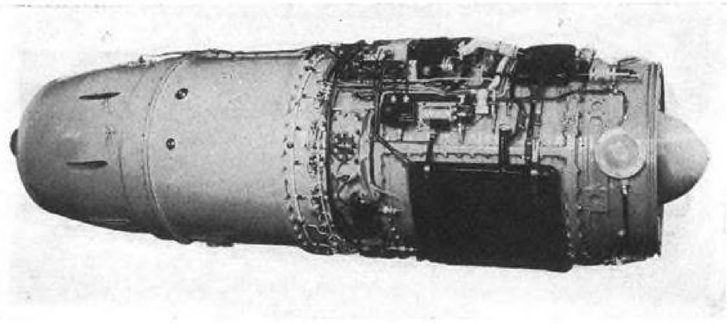
Conclusions in general were similar and familiar: Old methods can't be summarily discarded while new techniques still are in the experimental stage; whether a new technique can replace an old one depends on the individual case; new techniques mean new problems.

But one conclusion was obvious: A tremendous manufacturing expansion is underway in the new supersonic era.

Some papers at the formal meetings were presented by strange faces with new ideas; others were delivered by familiar faces plugging away at familiar themes—such as Convair's Ernie Stout and his "Highspeed Water-Based Aircraft."

The reason for all this emphasis on supersonic flight was all too clear from the leading topic at the heavily-attended confidential session Thursday night: "Soviet Air Weapons." —WJC





A BIG FRENCH JET

The French Atar 101C axial-flow turbojet engine, which is rated at 6,160 lb. thrust normally or 9,100 lb. with afterburner. Top view shows the turbojet mounted atop a French Air Force S.E. 161 Languedoc for flight testing; lower view is a closeup of the engine's exterior. The 101C has seven compressor stages, 1 turbine stage. It is 112 in. long, 34.9 in. in diameter and weighs 1,150 lb. dry.

DURANICKEL

may easily provide the spring properties you need in a corrosion-resisting alloy!

You might look a long time before finding another alloy with all the advantages of Duranickel.

A wrought alloy, Duranickel is age-hardenable, or capable of having its hardness and strength increased by thermal treatment – and has the dependable corrosion resistance of Nickel.

And that's only the beginning! You can figure for yourself just how valuable Duranickel could be for a spring application of yours when you consider its other principal characteristics:

- **uniform spring properties at temperatures up to 600°F.**
- **high fatigue strength and endurance limit for non-ferrous, corrosion-resisting materials**
- **ready workability**

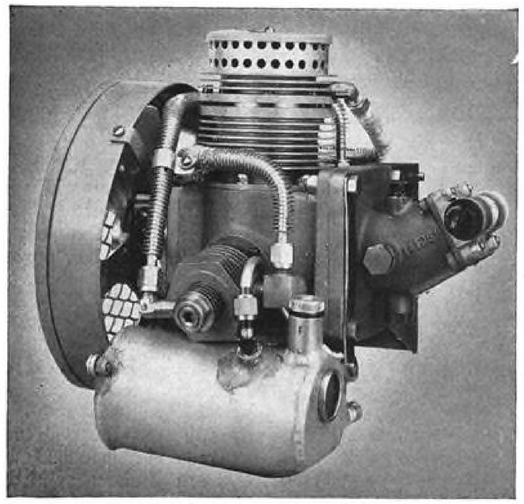
As a typical example of Duranickel's usefulness, let's examine briefly the new Kidde 4-stage compressor shown above.

Developed for pneumatically-operated airborne equipment, this lightweight compressor has neither connecting rods, wrist pins nor other complications required by conventional design. Instead, a crankshaft-riding cam simply pushes the pistons into their cylinders. A scotch yoke and sliding rod reverses the first piston while compressed air from preceding stages retracts the others.

For the disc valve in the first stage which is intricately shaped and then heat treated, the design engineers of Walter Kidde & Company, Inc., specified age-hardenable Duranickel. They also called for Duranickel for valve assist springs.

Mechanical Property Ranges of Duranickel

Form and Condition	Tensile Strength 1000 psi.	Yield Strength (0.2% offset) 1000 psi.	Elongation in 2 in. per cent	Hardness Rockwell C
Rod and Bar				
Hot-finished	90-130	35-90	55-30	75B-22
Hot-finished, age-hardened	160-200	115-150	30-15	32-42
Cold-drawn, as-drawn	110-150	60-130	35-15	90B-32
Cold-drawn, age-hardened	170-210	125-175	25-15	32-42
Strip				
½ hard	130-155	.....	15-3	25-34
½ hard, age-hardened	170-210	.....	20-7	33-42
Spring	155-190	.....	10-2	30-40
Spring, age-hardened	180-230	.....	15-5	36-46
Wire				
Spring	160-200	.....	5-2	....
Spring, age-hardened	200-240	.....	10-5	....



NEW COMPRESSOR delivers volume at high altitudes. At 35,000 feet, this 4-stage, 4-piston air compressor delivers (from ambient pressure) one cfm of free air compressed to 3,000 psi. Its sea level delivery of 4 cfm of free air compressed to 3,000 psi can be maintained at high altitudes when inlet air is pressurized. The compressor weighs only 15 pounds, has first-stage valve of Duranickel, and Duranickel assist springs to insure closing of intake valves. ***Photo courtesy of Walter Kidde & Company, Inc., Belleville, N. J.***

Duranickel is well able to withstand the high temperatures encountered in meeting the severe requirement. It is not affected by moisture squeezed out of the air during compression. And it offers high strength to prevent warpage.

Put Duranickel down in your book for *workability*, too. It can be hot-worked, forged and cold-worked.

It is most readily machined in the annealed condition, and is commercially machinable in other conditions at hardnesses up to 275 BHN.

Duranickel can be joined by commonly-used welding, brazing and soft soldering processes.

You'll find detailed engineering data on Duranickel (and its companion alloys, Duranickel "R" and Permanickel®) in Technical Bulletin T-32, "Engineering Properties of Duranickel." A copy is ready and waiting for you. Write us for it.

Meanwhile, keep Duranickel in mind for any applications where corrosion resistance, high hardness and great strength are needed in high stress application. Remember, though, that Duranickel, like other nickel alloys, is now on extended delivery because of defense requirements. So it is important to include NPA rating and complete end-use information when you place orders.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street, New York 5, N. Y.

Nickel INCO Alloys

MONEL® • "R"® MONEL • "K"® MONEL
"KR"® MONEL • "S"® MONEL • NICKEL
LOW CARBON NICKEL • DURANICKEL® • INCONEL®
INCONEL "X"® • INCOLOY • NIMONICS® • PERMANICKEL®

THRUST & DRAG

The model airplane business is growing up. With several million hobbyists buying as much as $30 million of supplies and equipment each year, the industry has come a long way from the hard-balsa-and-mimeographed-plan kits of the Thirties.

Much of this spectacular growth happened during the postwar years. Models have gotten more like the real thing. The "old men" of the hobby have stayed on, and a whole new generation has moved in. Radio-controlled miniatures, control-line acrobatic and team races have added color and appeal to the game. Powerplants run the gamut from the strong right arm of the modeler through pulsejets and compression-ignition engines to solid-propellant rockets. Current speed record stands somewhere around the 160 mph. mark.

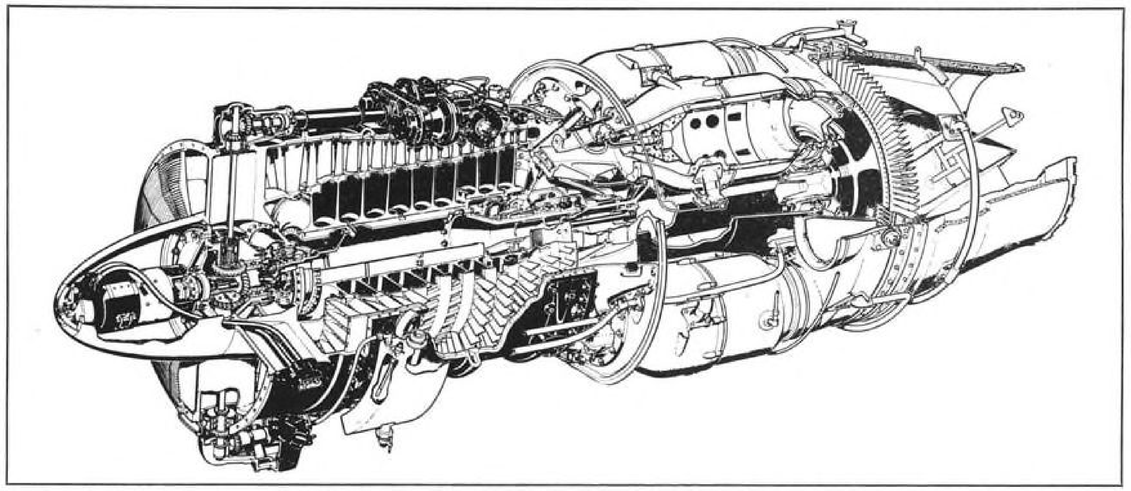
And most important—thousands of kids are eased through the early learning phases of aerodynamics, structures and powerplants. They constitute a prospective reserve of engineers, A&E mechanics, pilots and scientists to support the entire American aircraft industry.

Maybe the rest of the industry should take leads from firms like Grumman or Plymouth Motors and sponsor a meet or donate a trophy or loan some acreage for flying. It would pay off.

—DAA

CARGO-CARRYING F-84

This Republic F-84 uses a salvaged external fuel tank for small cargo job. "Cargo tank," idea of personnel in 31st Fighter-Escort Wing, is padded on inside and fitted with safety straps for securing packages. Units toted have included tubing, gaskets, valves, brackets, fittings, couplings, miscellaneous hardware and service bulletin kits.



FIRST DETAILED ORENDA CUTAWAY shows 10 compressor stages, large combustion cans and its single turbine wheel.

Canada Aviation Expands to Make Orenda

- **A. V. Roe opens plant for CF-100 engines.**
- **Peak production scheduled for end of 1953.**

ORENDA POWERPLANT will be mass-produced in Avro's new Malton plant. It will drive Canadair-built F-86 (foreground) and Avro CF-100 twin-jet fighter (background). Thrust of Orenda has been reported as slightly over 7,000 lb.

Canada's first engine factory to mass-produce turbojets recently opened at A. V. Roe Canada Ltd., Malton, Ont.

This new, windowless 700,000-sq. ft. jet facility for building the company's Orenda was completed in little more than a year. During this time all machinery and manufacturing accessories were procured and installed.

Before the plant was opened, planned output was doubled on government instruction, without changing target dates. Peak production is scheduled for the end of 1953.

▶ **For Two Fighters**—The Orenda will power the Avro-designed CF-100 Canuck twin-engine all-weather fighter, produced in a facility adjoining the engine plant. Orenda will also be supplied for F-86 Sabres being made by Canadair Ltd. at Montreal, under license from North American Aviation. First of these Canadair-built Sabres powered with Avro's Orenda was test-flown toward the end of September.

▶ **Wide Effect**—More than 400 suppliers are producing 70% of the parts needed to make the Orenda. Many of these 400 facilities are new ventures in Canada—set up in the last two years by American and British companies.

Establishment of the new Orenda plant has attracted production and manufacturing skills needed in Canada's aviation industry. From the U. S. and Great Britain have come design specialists and skilled workmen who are training Canadians.

New facilities have been set up for the manufacture of high-temperature alloys and the processing of special high-alloy and aluminum forgings for jet blades. New manufacturing plants have been built for making special gearbox assemblies, large-size ball and roller bearings, and for machining and heat-treating large-diameter castings and other fabricated components for jets. These are but a few of the related factors which will have a permanent effect on the Canadian aviation industry.

▶ **Plant Details**—The main production building of the Orenda plant covers 462,000 sq. ft., including receiving docks and offices. There are eight self-contained zones, each about 50,000 sq. ft. in area. Everything is on one floor except washrooms and servicing equipment, which are elevated to save space for the installation of machinery.

The square-plan building permits production lines to be run in either direction. There is 22-ft. headroom throughout the plant. The steel structure is capable of taking 3-ton cranes.

Windows are eliminated, except in

tioning, and the roof is decked with precast concrete panels plus cork and standard roof insulation. The plant will be kept at a constant 75-deg. temperature all year.

Dust both inside and outside the plant is carefully controlled by treating the floors, and landscaping and paving all approaches to the plant. Weather-protected passages and vestibules have electro-automatically operating doors for cleanliness and to keep heat losses down during Canada's cold winter.

There are six engine test cells built of steel and heavy concrete. This installation covers 34,000 sq. ft. and is soundproofed to the outside with intake and exhaust silencing equipment. Hooked to the test cells is storage space for 420,000 gal. of aviation kerosene.

Service buildings cover 70,000 sq. ft. A new overhaul extension already under construction covers 50,000 sq. ft. Storage and inspection quarters occupy another 67,000 sq. ft.

► **Equipment**—In the main plant each production line has a battery of floor-supported jib cranes. These can lift, maneuver and place a compressor casing into a fixture and move it from one machine to the next where another crane takes over.

The standards room, where inspection instruments are regularly checked, has its own air conditioning and control equipment to maintain a constant 68 deg. and 45% humidity.

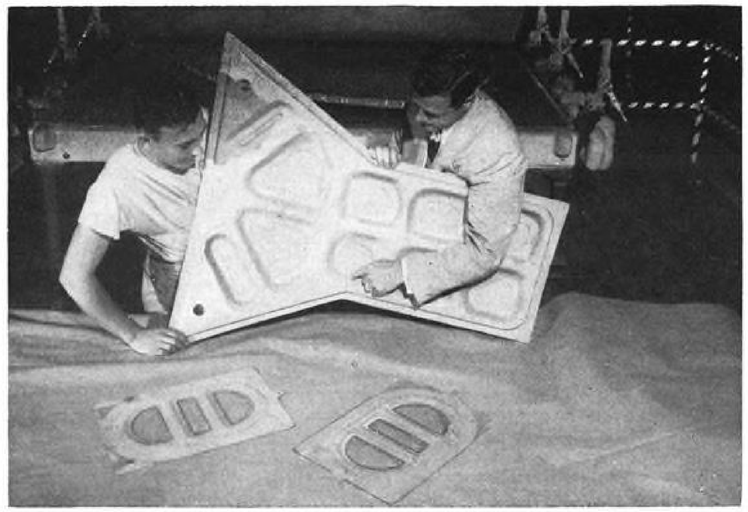
Production heat-treat and process department is also completely self-contained, is able to do chromating and chromic acid anodizing. And there is a heat-treat laboratory where a test piece from each batch of parts going through the heat production lines is tested.

All major components are handled on a straight-line production system. Inspection operations are carried out as part of production so that at the end of the line each article has been passed out as satisfactory. Production lines concentrate on one particular part for perhaps a week, then switch over to production of a slightly different piece, after which they return to making the original.

The plant is lighted with 8 mi. of fluorescent lighting, giving between 34 and 40 foot-candles of light at the working level.

A diesel-operated emergency standby generator big enough to supply sufficient lighting for the plant cuts in when there is a sudden drop in the main voltage supply.

Production of the Orenda is directed by Thomas S. McCrae, general manager of Avro's Gas Turbine division. McCrae comes from the United States, and was formerly with General Motors' Allison division, where he was assistant director of engineering.



METALBONDING SPECIALISTS at Lockheed demonstrate the technique which gives increased strength and simplifies production. Costs are claimed at 30% less.

Metalbond Wing for Super Connie

Lockheed Aircraft Corp. is setting up a production department for use of metalbonding to assemble the secondary structure of the skin panels on the inner wing for the Super Constellation. At the same time the company continues development work on this production process for adhesive joining of metals.

For the past year and a half Lockheed has made extensive tests of many structural adhesives for physical properties and analyzed structural designs for metalbonding application. It has made numerous pilot-plant runs using production-type facilities for surface preparation and metalbonding assembly. Test panels from these runs have been proof-tested for required loads.

► **Metalbond Advantages** — Utilized properly, a metalbonded assembly offers these advantages over riveted and spot-welded units, Lockheed production methods engineer S. W. Golem reports:

- **Optimum outer skin smoothness.**
- **No stress concentration** points on bonded areas.
- **Cost savings up to 30%** through simplified assembly techniques when production quantities are sufficient to justify tooling expense.
- **Dissimilar metals can be joined,** where galvanic action normally would take place.
- **Non-weldable metals** may be used for liquid- or pressure-tight joints.
- **Greater utility of thin skin** for light structure design, because "canning" does not occur in assembly.
- **Weight savings**—in some instances up to 15%—through more efficient use of material, reduction of fasteners, elimination of sealants, etc.
- **Higher total strength.**

Pilot runs on metalbond assemblies, compared with production rivet assemblies, indicate greater production output per square foot of factory floor space, Golem says. Increased savings in production also are seen with new methods to reduce curing cycle time.

USAF CONTRACTS

Following is a list of recent USAF contracts announced by Air Materiel Command:

Marman Products Co., Inc., 11214 Exposition Blvd., Los Angeles, clamps, $25,602.

Midway Electric Supply Co., Inc., 115 W. 33 St., New York, connectors, $81,822.

National Extrusion & Mfg. Co., Orchard & Elm Sts., Bellefontaine, Ohio, aluminum alloy, $51,278.

Pacific div., Bendix Aviation Corp., North Hollywood, Calif., valve assemblies, $27,624.

Pratt & Whitney div., Niles-Bement Products Co., West Hartford, Conn., drilling machine, $93,942.

Precision Extrusions, 190 E. Green Ave., Bensenville, Ill., aluminum alloy, $43,120.

Radio Corporation of America, RCA Victor div., Front & Cooper Sts., Camden, N. J., altimeters, 110 ea., $66,857.

Rochester Optical Mfg. Co., Rochester, N. Y., sun glasses, 45,036 ea., $133,757.

Romec div. of Lear, Inc., Elyria, Ohio, spares, $37,469.

Steiner Plastics Mfg. Co., Inc., Pratt Oval, Glen Cove, L. I., N. Y., dome, $76,446.

Taranger, E., Inc., 441 Lexington Ave., New York, alloy tubing, $81,120.

Textile By-Products Corp., Hudson, N. Y., felt, $41,259.

U. S. Gauge div., American Machine & Metals, Inc., Sellersville, Pa., transmitters, 268 ea., $36,078; transmitters, 1,142 ea., $112,509; 570 ea., $70,147.

United States Rubber Co., 1230 Ave. of the Americas, New York, hose, $125,854.

Vanant Products, Tomah, Wis., envelope, engine protective, $102,574.

Van Der Horst Corp. of America, Olean, N. Y., cylinders, 12,000 ea., $468,000.

Western Gear Works, Lynwood, Calif., parts, actuator, $51,253.

Westinghouse Electric Corp., Lima, Ohio, transformers, $30,855.

Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark, N. J., indicator, 4,434 ea., $3,502,606.

AiResearch Mfg. Co., The Garrett Corp., 9851 Sepulveda Blvd., Los Angeles, repair and overhaul parts, $109,538.

Allen, R. C., Business Machines, Inc., 678 Front Ave., N. W., Grand Rapids, indicators, 6,000 ea., $200,000.

Allison div., GMC, Indianapolis, engines, 5 ea., $90,565.

American Machine & Metals Inc., U. S. Gauge div., Sellersville, Pa., transmitter, 2,426 ea., $238,233.

Armstrong Furnace Co., 851 W. Third Ave., Columbus, shipping container, 1,500 ea., $100,845.

Atlantic Parachute Corp., 750 Suffolk St., Lowell, Mass., parachute assembly, 852 ea., $1,231,131.

Barden Corp., Danbury, Conn., ball bearings, $201,350.

Bell Sound Systems, Inc., 555 Marion Road, Columbus, racks & mounting, $198,-937.

Bendix Products div., Bendix Aviation Corp., South Bend, Ind., stop assembly, throttle, $109,723.

Continental Motors Corp., 205 Market St., Muskegon, Mich., spare parts, $77,445.

Craig Machine, Inc., 90 Holten St., Danvers, Mass., shelter, 70 ea., $159,136.

Dial Light Co. of America, Inc., 900 Broadway, New York, indicator lights, $64,-246.

Eastern Stainless Steel Corp., P. O. Box 1975, Baltimore, steel sheet, 1,165,000 lb., $592,955.

Eclipse-Pioneer div., Bendix Aviation Corp., Teterboro, N. J., inverters, 1,113 ea., $75,251; spare parts, 191 ea., $69,621.

Jefferson Electric Co., 910 5th Ave., Belwood, Ill., regulators, $235,987.

Lear, Inc., 110 Ionia Ave., N. W., Grand Rapids, spare parts, 23 items, $603,540.

Lee and Henry Mfg. Co., 441-445 Minna St., San Francisco, paper shredder, 120 ea., $76,500.

Leece-Neville Co., Cleveland, spare parts, $97,932.

Lewis Machine Co., Inc., 892-894 Newcomb St., St. Paul, heat induction machine, 61 ea., $59,282.

Marlin-Rockwell Corp., 402 Chandler St., Jamestown, ball bearings, $60,750.

Maurer, J. A., Inc., 37-01 31st St., Long Island City, N. Y., machinery & equipment, $200,000.

Murray Corp. of America, 7700 Russell St., Detroit, industrial facilities, $1,100,000.

National Machinery Co., Tiffin, Ohio, presses, 5 ea., $318,007.

New Departure div., GMC, Bristol, Conn., ball bearings, $300,700.

Pacific Optical Corp., McCulloch Motors, 5965 W. 98 St., Los Angeles, lens assembly, 900 ea., $64,350.

Parcell and Bauer Products Co., 8840 Strathmoor Ave., Detroit, machinery and equipment, $116,000.

Paulson, Henry & Co., 131 S. Wabash Ave., Chicago, jewelers' lathes, 232 ea., $56,794.

Portable Electric Tools, Inc., 320 W. 83 St., Chicago, inverters, 180 ea., $95,705.

Precision Tube Co., Inc., 3828 Terrance St., Philadelphia, tubing, 40,000 ea., $35,634.

Radio Receptor Co., Inc., Brooklyn, radio receiver, 800 ea., $413,845.

Skinner Purifiers div., Bendix Aviation Corp., 1500 Trombly Ave., Detroit, maintenance parts, 52 items, $69,040.

Turk, Joseph, Mfg. Co., Bradley, Ill., typewriter desk, 637 ea., $53,826; typewriter desks, 1,500 ea., $126,750.

Union Carbide & Carbon Corp. (Haynes Stellite Co.), Kokomo, Ind., machinery and equipment, $452,200.

Westinghouse Electric Corp., 32 N. Main St., Dayton, filter, $42,505.

Whirlpool Corp., St. Joseph, Mich., industrial facilities, $530,000.

Aeroquip Corp., 300 S. East Ave., Jackson, Mich., aircraft hose, $148,609.

Alco-Deree Co., 4300 N. California, Chicago, steel, $219,983.

Alloy Products Corp., 1045 Perkins Ave., Waukesha, Wis., cylinder assembly, 1,602 ea., $277,146.

American Steel & Wire Co., United States Steel, 50 W. Broad St., Columbus, O., steel cable, $26,637.

Atlantic Parachute Corp., 750 Suffolk St., Lowell, Mass., parachute seat, 180 ea., $32,792.

Barden Corp., Danbury, Conn., ball bearings, $36,400.

Barnes Mfg. Co., 600 N. Main St., Mansfield, Ohio, fuel servicing aircraft nozzle, 4,924 ea., $81,442.

Barrett Equipment Co., 2107 Cass Ave., St. Louis, brake shoe grinder, 76 ea., $34,267.

Brown & Sharpe Mfg. Co., Providence,

SOLAR GETS ITALIAN MILL

This 5½-ton Italian Ceruti horizontal boring mill was loaned to Solar Aircraft Co. by USAF to speed J-47 engine parts program. Precision machine has 74x40-in. bed. This is only one of the foreign-made machine tools Solar will get under USAF program until American tool manufacturers catch up with back orders.

Flight Test Opportunities for

- EXPERIENCED FLIGHT TEST INSTRUMENTATION ENGINEERS
- FLIGHT TEST ENGINEERS
- FLIGHT TEST ANALYSTS

Dealing with

- GUIDED MISSILES
- AIRPLANE SYSTEMS
- AUTOPILOTS

The Missile and Control Equipment Laboratory of North American Aviation has openings in its flight test organization to handle flight testing of guided missiles and electronic control systems.

Excellent opportunities are offered for experienced engineers and analysts with airplane and guided missile flight test and flight test instrumentation background.

Outstanding opportunities are available on a long-range development program on basic guided missile work.

- SALARIES COMMENSURATE WITH TRAINING AND EXPERIENCE
- EXCELLENT WORKING CONDITIONS
- FINEST FACILITIES AND EQUIPMENT

Write now.
Give complete resume of education, background and experience.

NORTH AMERICAN AVIATION, INC.

Engineering Personnel Department
Missile and Control Equipment Laboratory

12214 LAKEWOOD BLVD.
DOWNEY, CALIFORNIA

universal tool grinders, 10 ea., $114,186.

California Aircraft Supply Co., 5734 Camille Ave., Culver City, Calif., heat exchangers, 350 ea., $64,750.

Cardex Corp., 307 N. Michigan Ave., Chicago, maintenance parts, $110,255; maintenance parts, $76,101.

Colonial Plastics Corp., 523 Raymond Blvd., Newark, N. J., navigator's observing dome, 1,264 ea., $34,128.

Continental Electronic Ltd., 302 Oakland St., Brooklyn, N. Y., magnetic circuit breaker, $33,660.

Continental Inc., Danbury Airport, Danbury, Conn., trainer, $33,751.

Covel Manufacturing Co., Benton Harbor, Mich., surface grinders, 77 ea., $189,218.

Dow Corning Corp., Midland, Mich., sealing compound, $25,000; tubes, $60,500.

Dumont Aviation Associates, 1401 Freeman Ave., Long Beach, Calif., rivets, 51,420 lb., $26,278.

Eastman Kodak Co., 343 State St., Rochester, N. Y., photographic film & paper, $37,846.

Eclipse-Pioneer div., Bendix Aviation Corp., Teterboro, N. J., transmitter, $1,122 ea., $64,133.

Erie Mfg. Corp., 300 N. Eighth St., Milwaukee, controller assembly, $51,900 ea., $26,053.

Fafnir Bearing Co., New Britain, Conn., ball bearings, $35,000.

Felsenthal, G., & Sons, 4100-4118 W. Grand Ave., Chicago, computer—course and distance, 15,000 ea., $27,045.

Fletcher Aviation Corp., Pasadena, Calif., fuel tanks, 15,000 ea., $369,765.

General Electric Co., Schenectady, position indicators, 720 ea., $42,696.

Gosiger, C. H., Machinery Co., Dayton, drilling machine, 13 ea., $38,160.

Hathaway Mfg. Co., 1500 Railroad Ave., Bridgeport, Conn., terminal—snap, $62,400 ea., $31,046.

Hewitt Rubber div., Hewitt-Robins Inc., 240 Kensington Avenue, Buffalo, N. Y., gasoline hose, $152,199.

Homelite Corp., Port Chester, N. Y., spare parts, $63,603.

Hurst Industries, Inc., 1763 Monterey Road, San Jose, Calif., fire extinguisher parts, $62,883.

Kinsey, E. A., Co., Cincinnati, grinders, 8 ea., $107,225; lathe, screw cutting, 12 ea., $71,087.

Kollsman Instrument Corp., 80-08 45th Ave., Elmhurst, L. I., N. Y., indicator, 4,443 ea., $275,868; camera control systems, 2 ea., $30,723.

Link Aviation, Inc., Binghamton, N. Y., radio assembly, 70 ea., $25,622.

Marian Screw Products Co., Marian, Ind., film plotting table, $27,162.

Marman Products Co., 940 W. Florence Ave., Inglewood, Calif., Coupling clamps, $34,137.

Mercury Trading Corp., 157 E. McMichen St., Cincinnati, radio sets, 110 ea., $84,124.

Metal Industries, Inc., 1420 E. 20th St., Indianapolis, Ind., trainer, weather condition demonstrator, 175 ea., $32,375.

Michigan Seamless Tube Co., South Lyon, Mich., steel, 1,017,931 ft., $333,910.

Mitchell Camera Corp., 666 W. Harvard St., Glendale, Calif., 16-mm. camera, 10 ea., $57,712.

Morse Instrument Co., Hudson, Ohio, printer developing outfit, $81,066; processing machines, 30 ea., $290,610.

National Lock Co., 1902 Seventh St., Rockford, Ill., screw—wood-steel, 8,723,000 ea., $34,402.

Northern Radio Co., 143-145 W. 22nd St., New York, oscillators, $1,585,368.

North American Aviation, Inc., Los Angeles International Airport, Los Angeles, training parts, $35,000.

Petroleum Accessories, Inc., Pur-O-lator Products, Inc., Ringtown, Pa., maintenance parts, $96,329.

Pfaff & Kendall, 84 Foundry St., Newark, mast, 881 ea., $89,165.

Precision Rubber Products Corp., 3110 Oakridge Drive, Dayton, packing O-rings, $46,816.

Reade Supply Corp., 241 Church St., New York, cloth—cotton flannel, 60,800 yd., $66,138.

Reliance Mfg. Co., Inc., 212 West Monroe St., Chicago, pack assembly, $35,152.

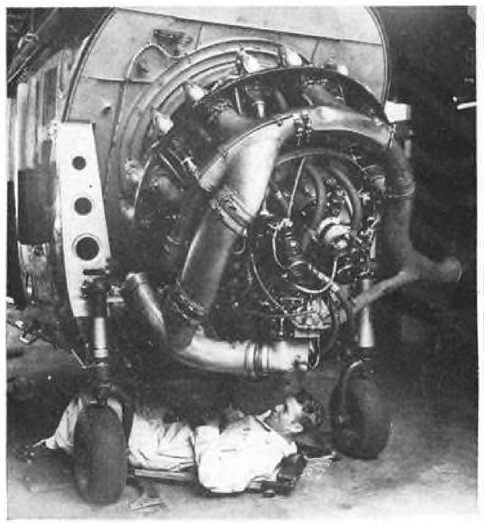
Fast Writeoffs

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

In the following list of recent certificates, company name is given, followed by product or service, cost of construction deemed necessary for defense expansion, and the percentage of the expansion cost allowed for fast write-off. Fast write-off permits property to be depreciated in five years.

- **Flour City Ornamental Iron Co.,** Minnesota, Minnesota aircraft parts, $10,932, 70%.
- **Armstrong Furnace Co.,** Des Moines, aircraft parts, $79,890, 65%.
- **Beech Aircraft Corp.,** Wichita, aircraft and parts, $39,365, 65%.
- **Mid-Western Industries, Inc.,** Wichita, aircraft parts, $19,917, 65%.
- **Boeing Airplane Co.,** Wichita, aircraft, $29,933, 65%.
- **General Tire & Rubber Co.,** Waco, airplane lifting bags and rafts, $72,525, 50%.
- **Burton Mfg. Co.,** Los Angeles, aircraft parts, $5,721, 70%.
- **Sequoia Metalcraft Co.,** San Carlos, Calif., aircraft parts, $23,740, 50%.
- **Moore Tool Works,** North Hollywood, Calif., aircraft parts, $29,633, 45%.
- **Bill Jack Scientific Instrument Co.,** Solana Beach, Calif., aircraft parts, $67,817, 50%.
- **Metal Improvement Co.,** Los Angeles, aircraft parts, $25,052, 40%.
- **Smith Heat Treating Co.,** Los Angeles, aircraft and ordnance parts, $15,589, 70%.
- **B & Y Machine Co.,** Los Angeles, aircraft parts, $22,391, 70%.
- **Adams Rite Mfg. Co.,** Glendale, aircraft parts, $11,500, 45%.
- **Strongman Machine Co.,** Burbank, aircraft parts, $25,200, 60%.
- **Lindberg Steel Treating Co., Inc.,** Los Angeles, heat treating of metals for aircraft, $76,980, 45%.
- **Lockheed Aircraft Corp.,** Burbank, aircraft and spare parts, $2,192,616, 60%.
- **Wemac Co.,** Inglewood, Calif., aircraft parts, $27,164, 45%.
- **Archer Machine Products Co.,** Los Angeles, aircraft parts, $136,726, 50%.
- **Bendix Aviation Corp.,** Pacific division, North Hollywood, hydraulic cylinders for military end items, $72,500, 40%; and aircraft parts, $34,340, 65%.
- **Continental Can Co., Inc.,** Seattle, aircraft parts, $40,000, 65%.
- **Saxco Mfg. Co.,** Los Angeles, aircraft fittings, $10,048, 80%.
- **Swedlow Plastics Co.,** Los Angeles, acrylic products for aircraft, $5,733, 60%.
- **Elliott Engineering Co.,** Lynwood, Calif., aircraft parts, $22,420, 75%.
- **Dynamic Air Engineering Inc.,** Los Angeles, aircraft parts, $7,783, 70% and anti-icing and defrosting systems, $4,182, 70%.
- **Besler Corp.,** Emeryville, Cal., aircraft parts, $60,471, 80%.
- **Worth Mfg. Co.,** Los Angeles, aircraft parts, $3,300, 80%.
- **Boeing Airplane Co.,** Seattle, airplanes and spare parts, $630,112, 65%; and $76,875, 65%.
- **Western Gear Works,** Lynwood, Calif., gears for aircraft, $2,602, 65%.
- **Lear, Inc.,** Los Angeles, automatic control systems for aircraft, $3,715, 75%.
- **Sweetland Engineering Co.,** Pasadena, aircraft hydraulic equipment, $11,806, 80%.
- **National Heat Treating Co.,** Los Angeles, aircraft parts, $14,700, 50%.
- **Mar Vista Engineering Co.,** Los Angeles, aircraft parts, $270,526, 70%.
- **U. S. Propellers, Inc.,** Pasadena, aircraft parts, $103,200, 60%.
- **Pacific Airmotive Corp.,** Burbank, aircraft parts, $28,225, 65%.
- **Rocket Jet Engineering Corp.,** Glendale, aircraft parts, $9,075, 70%.

LOS ANGELES AIRWAYS' first Sikorsky S-55 in flight on proving run of world's first certificated helicopter airmail route.



ACCESS DOORS removed, S-55 undergoes 240-hr. check.

AUTO TRIM stabilizer fins which caused one maintenance problem.

S-55 Proving Run a Success, LAA Says

But some maintenance problems involving conversion from military to civilian use are encountered.

By William J. Coughlin

Inglewood, Calif.—Proving run of Los Angeles Airways' first S-55 helicopter turned up a number of maintenance problems but showed the Sikorsky craft easily adaptable to the world's first certificated helicopters airmail route.

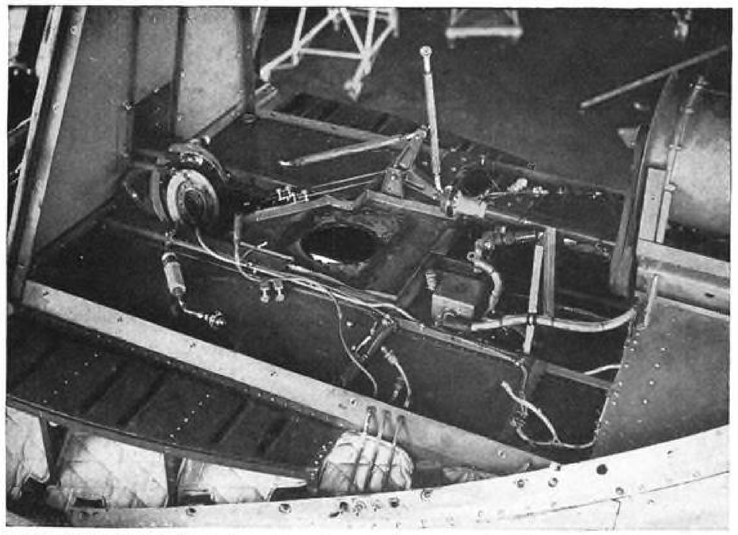
"The S-55 has proved to be a first-class piece of equipment maintenance-wise," says LAA President Clarence Belinn. "We've had a minimum of trouble with it and have received maximum cooperation from the Sikorsky plant."

Most of the maintenance problems concerned conversion of the S-55 from military to civilian use, according to LAA Superintendent of Maintenance Harry Botterud.

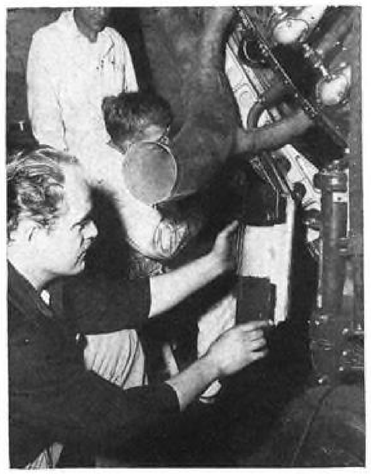
▶ **Scheduled Operations**—Pilots have full confidence in the craft after flying it on twice-daily schedules over the line's Route B between Los Angeles and San Bernardino. One pilot said the S-55 in comparison with the S-51 handles like a Cadillac compared to a Ford.

LAA has now taken delivery on its second S-55 with three more on order. The line also operates three S-51s on its 350-mi. route.

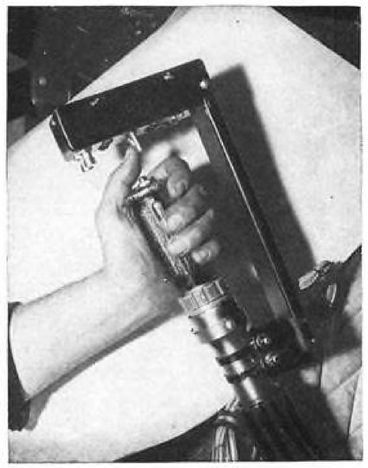
The first S-55 was undergoing 240-hr. inspection when the second was delivered. The 240 hours were compiled between June 10 and Sept. 12 with a 1-hr. training flight daily supplementing two 2-hr. scheduled flights. Thirty-hour in-



EASY DISCONNECT fittings to main gear box, rotor head and rotors speed work.



ALUMINUM SHIELD protects strut.



LAA's BRACKET for landing light switches.

spections therefore fell due about once a week.

A broken exhaust-valve push rod caused a forced landing on Sept. 5 but the pilot set the craft down in a field on auto-rotation without damage.

One reason for LAA's enthusiasm was clear during the 240-hr. inspection. Where it required a full day to remove the rotors, rotor head and main gear box of the S-51 Botterud's crew did the same job on the S-55 in two hours.

After the S-55's three-month proving, a number of modifications were made; others still are in the planning stage.

▶ **Instrument Panel**—Major instrument panel changes are planned, involving both instruments and switches:

• **Sperry H-5 Gyro Horizon** and Sperry C-2A Gyrosyn electrical compass, now in use in the S-51s, will be installed in the S-55s.

• **Carb air temperature indicator** may be replaced with a carburetor mixture temperature indicator, since operations feels the latter is more accurate. A test gauge is being installed to gather data necessary for CAA approval of the change.

• **Volt ammeter** and hydraulic servo pressure gauge, as well as the carb air (or mixture) indicator will be moved to bring them from far to the left of the pilot to a position more nearly in front of him to eliminate parallax error.

• **Dual instruments** for training purposes, such as manifold pressure gauge, tachometer and airspeed indicator, will be installed.

• **Switches and safety guards** for the servo battery and generator will be rearranged for a more convenient switch grouping.

▶ **Boost Pump**—Another major modification is conversion to an automatic auxiliary fuel pump. As a safety factor, Operations prefers to make the boost automatic rather than depend on the pilot's memory. Installation of a pressure switch tapped into the fuel system will automatically cut in the fuel boost pump in event of any drop in pressure.

To prevent the boost pump from operating during starting operations, a microswitch will be installed on the mixture control so that the boost will function only when the engine is out of idle cutoff.

A red light flashing on the panel as the pressure pulsates will warn the pilot he is operating on his auxiliary pump.

▶ **Lights**—Several of the changes involve lighting to adapt the military model to LAA's mail operation.

• **Location of landing lights** on the bottom of the aft section proved to be unsatisfactory in night flying, since nose tilt deflected the lights downward and the pilot was unable to see the heliport ahead of him as he approached. CAA approved shifting of the landing lights forward to the engine access doors on the front of the helicopter.

• **Installation of a flashing red** navigation light on the rear is planned to make the craft more easily visible at night in the busy Los Angeles International Airport area.

• **Landing light switch bracket** was installed and switches moved near the pilot's thumb on the collective pitch stick. Previously, pilots faced with necessity for frequent night landings and takeoffs along LAA's 35-heliport route, found landing light switches in an awkward position.

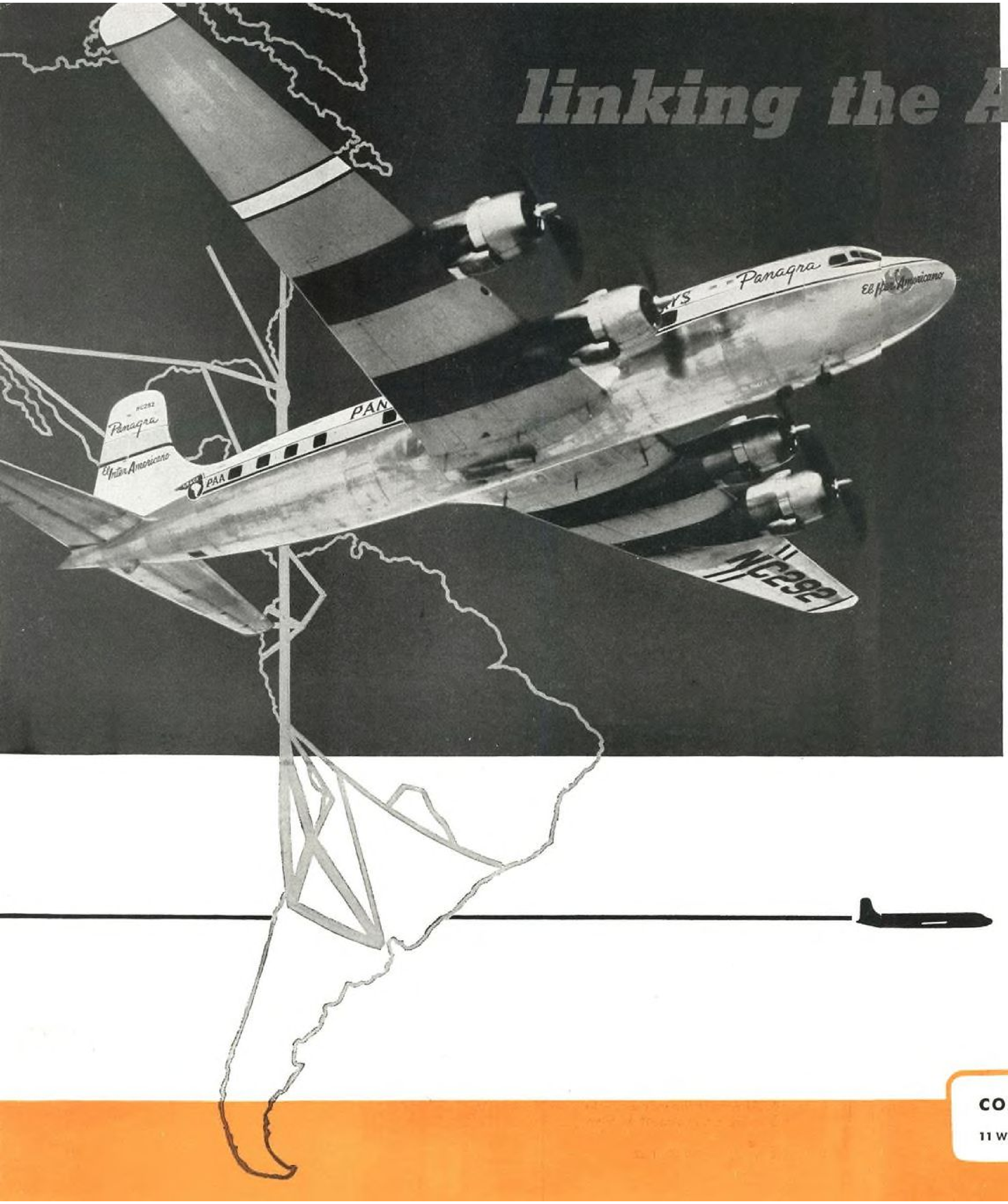
• **Other changes involving lights** include relocation of the cargo compartment light switch in a more convenient position and fabrication of a loading light to be mounted on the landing gear strut to facilitate mail handling at night by illumining the side of the helicopter.

▶ **Radio**—Complaints from the pilots of excessive radio background noise led to discovery that loose magneto shielding, which could not be clamped securely, was causing the interference. Maintenance first installed jumper bond from harness to shield to breaker housing with fair, but not perfect, results. Special magneto shields, ordered from Scintilla, are now being tested. If satisfactory, they will become permanent equipment.

▶ **Passenger Operations**—Future passenger operations will require, in addition to installation of seats, two other changes, one minor and one major:

• **Installation** of a "fasten safety belts-no smoking" sign in the cabin.

• **Relocation** of the aft electrical compartment. At present the only access to the aft baggage compartment is from



linking the Americas by air

Panagra
PAN AMERICAN GRACE AIRWAYS INC.

and COLLINS

Keep good neighbors in touch

Overnight to Buenos Aires . . . daily via the short route down South America's west coast . . . this is the "Red Carpet" air service that has made Panagra one of the leading international airlines in South America. The men who pilot Panagra's luxury fleet of DC-6's and DC-6B's rely on Collins' communication and navigation equipment to maintain daily, overnight service on schedule. Collins research, design and precision production skills provide Panagra with radio and electronic equipment second to none in accuracy and dependability.

Known as the "World's Friendliest Airline", Panagra treats every customer as an honored guest, actually rolling out a red carpet at every airport of call. El Inter Americano, Panagra's deluxe service, is the ultimate in air travel . . . extra fast, with such luxury flight features as the Fiesta Lounge, Gourmet Galley meals, bed-sized berths and pressurized cabins. In its 24th passenger-pleasing year, Panagra remains the only International airline giving daily DC-6 service to our South American neighbors. Panagra's silver streaks across the equator tie North and South America with bonds of acquaintance, keeping good neighbors in touch.

In Radio Communications and Navigation Equipment, it's . . .

COLLINS

COLLINS RADIO COMPANY, Cedar Rapids, Iowa

11 W. 42nd Street, NEW YORK 36 · 1930 Hi-Line Drive, DALLAS · 2700 W. Olive Avenue, BURBANK

inside the cabin where the access door would be difficult to reach when seats are installed. It is planned to relocate the electrical equipment, such as radio, battery and inverters in this cargo compartment and make the present electrical compartment into a baggage compartment since it has an outside access door.

► **Maintenance**—Several changes have been recommended by Botterud to speed up ground work:

• **Inductor vibrator will be relocated.** In its present position, mechanics have to disconnect the lead between the inductor vibrator and the magneto to slip out the engine ring cowl. By shifting the inductor vibrator over a few inches this will be unnecessary.

• **Clips will be fabricated** to replace the cotter pins now holding the ring cowl, to speed up access.

• **Air filter will be reworked** for quick removal. It now takes from 12 to 15 min. to remove and install the filter, which must come out every 30 hr. Removal time will be cut to a few seconds by replacing present screws and nut plates with quick disconnect fasteners.

• **A center section support,** as a safety factor, will be provided on the throttle cross shaft, which is in a position where it could be bent easily during maintenance work on the nearby clutch compartment.

► **Early "Bugs"**—LAA's discrepancy reports on the proving run reveal some of the "bugs" found in the S-55:

• **High-frequency flutter** and constant hunting of auto trim stabilizer fins during flight loosened rivets at the root of the stabilizers. An S-55 crash in Texas which killed two Air Force officers is believed to have been caused when these stabilizer fins tore loose in flight and fouled the tail rotor. LAA has replaced the rivets with Cherry rivets.

Navy reports that removal of these stabilizers results in no change of flight characteristics at speeds below 90 knots. LAA operates below that speed and may ask permission to remove the fins.

• **Left nose strut,** passing through the engine compartment near the exhaust tailpipe, overheated to the point where it was too hot to touch. This resulted in an unlevel position of the aircraft due to uneven strut elongation. This in turn resulted in an unstable condition at low rpm. with the blades out of phase. It also meant possible warpage of the left nose strut which would result in the wheel not centering after takeoff, thereby causing loosening of the left nose scissors during roll on landing.

LAA attempted to correct the condition by installing an experimental aluminum shield lined with asbestos between the strut and the exhaust pipe. Pressure in the strut also was lowered. These measures brought some relief,

but tests are not yet conclusive.

• **Damage to copper ring assembly** of the free wheel unit was uncovered by early inspection. Damage resulted in excessive end play to the main driveshaft and copper chips in the free wheel unit. Sikorsky supplied an experimental nylon ring which proved very satisfactory.

• **Rivet trouble developed** when droop restrainer rivets loosened, threatening loss of counterweight arms. Cause was attributed to pilot technique. Normal procedure for low pitch holds the blades down on the blade rest; when the slightest pitch is applied at high rotor rpm., the counterweights snap out very swiftly, putting a tremendous shear force on the rivets. Maintenance remedied this by replacing the rivets with stress screws and Elastic Stop Nuts.

• **One of the main blades** was replaced after a 3-in. separation appeared at the bonded edge of one of the inner pockets. This separation appeared in lesser degree in other pockets, which also developed cracks at trailing edge rivets. Sikorsky worked closely with LAA on this problem.

• **Cracks in the structure** at the base of the battery rack led LAA ground crews to believe the battery rack was improperly supported. They repaired the crack and installed battery supports with success.

• **Improper tooth pattern** in the tail rotor gear box resulted in scuffing and rolling over of material on the outer edge of the gear teeth. The gears were replaced with new factory parts.

• **An oil leak** in the free wheel unit was traced to a defect in the machined face of a casting. "It appears that insufficient material was removed to true up surface during manufacture," says the LAA report.

• **Sharp edges of holes** cutting into an O ring caused nose seal leakage on four occasions. The holes were stoned and polished smooth by Maintenance to eliminate the trouble.

• **Routine maintenance problems** included a slight leak at the parking brake valve, chafing of exhaust muff bolts, and chafing of a short push-pull rod on a servo lever in the main gear box.

▶ **Analysis**—Maintenance Superintendent Botterud feels that position of the P&W R1340 engine in the forward position with wide-opening access doors is a great improvement over the S-51. As some of the less obvious advantages, he cites smoother engine operation and less magneto trouble. Magnetos, no longer below the engine, are freer from oil drippings.

One of Botterud's main complaints about the S-55 concerns difficulty in removing various sections of cowling on the military version. Cowling covering the transmission oil cooler and fan assembly, which must come off every

30 hr., is held with screws and nut plates. Botterud would prefer cam locks there.

The cowling to the main gear box also is a problem to get on and off, he reports.

Fairing over the fuel tanks on the bottom of the aircraft is held in place by numerous screws and nut plates, which LAA would like to see replaced with quick-disconnect fasteners.

Another maintenance difficulty is that operational specifications put overhaul out of phase. The main rotor head requires overhaul at 360 hr., but the dampers, a part of the head, are scheduled for 600-hr. overhauls. Two overhauls on the main rotor head thus get the dampers out of phase and the ground crews are unable to overhaul them as a package. Likewise, the generator attached to the main gear box has a 500-hr. overhaul period while the gear box itself has a 300-hr. period, again throwing maintenance work out of phase.

OFF THE LINE

Hawaiian Airlines has carried out a thoughtful idea for the benefit of its passengers and crews. Walkways to the planes are raised a few inches above the ramp. This helps to keep feet dry when sudden downpours, to which the Islands are sometimes subjected, temporarily flood loading areas.

Pan American-Grace Airways is installing R2000 Pratt & Whitney Aircraft engines in several of its DC-3s operating in South America to help planes carry a payload out of such high fields as La Paz's El Alto Airport (13,398 ft.) in Bolivia. First installations have been completed and are in operation.

United Air Lines is installing Bendix Scintilla portable airborne ignition analyzers on its fleet of six Boeing Stratocruisers. An additional six Scintilla units are being installed on UAL's DC-6s (or -6Bs) for service test. An airline spokesman says the decision on UAL's Convair 340s will "probably parallel the decision we reach on the DC-6s." In this installation the analyzer, may be carried aloft whenever it is considered necessary.

Engine malfunctions on Trans World Airlines' 049 Constellations have taken a sudden drop, according to airline spokesmen. Part of the improved performance is attributed to using new, tight-fitting piston rings, using new cylinders in critical locations and pulling 100 hp. less in cruise.

NEW AVIATION PRODUCTS

Stratos Units Cool Hot Sabre Cabins

A new refrigeration unit for North American F-86 Sabre cockpits is being shipped in quantity by Stratos div., Fairchild Engine & Airplane Corp.

The equipment, NURH15, delivers air at a temperature of about 28F, normally around 18.5 lb. air/min. It consists mainly of three parts—two heat exchangers and an expansion turbine—weighing 17 lb. in all.

Air for cooling the cockpit is drawn hot and at high pressure from the jet engine compressor section, passed through the first heat exchanger, cooled some, passed through the second heat exchanger for further cooling, then given a big chill going through an expansion turbine, after which it is ducted directly to the cockpit where it cools and then exhausts out through a pressure regulator valve.

Each of the cooling units—heat exchangers 1 and 2 and the expansion turbine—in the refrigeration circuit cool by different means:

• **Expansion turbine:** Cockpit air ducted through the expansion turbine expands and gives up energy in spinning the turbine wheel. The loss in energy is represented by a drop in temperature and pressure.

• **Exchanger No. 2:** Cockpit air is refrigerated here by ambient air which is drawn through the exchanger by a blower. The blower is mounted on the same shaft with the expansion turbine and provides the turbine wheel with a means of unloading the energy which it absorbs from the cockpit air in cooling.

• **Exchanger No. 1:** Ram air cools the hot jet compressor air as it passes through on its way to become refrigerated air for the cockpit.

This cockpit cooler is the latest in a broadening line being developed and produced by Stratos. Units with capacities ranging from 13 lb. air/min. for a Navy fighter, to 60 lb./min. for the cockpit of a jet bomber are being produced. Others for delivery pressures of 100 lb./min. are in final development stages, the company reports.

Stratos div., Fairchild Engine & Airplane Corp., Bay Shore, N. Y.

Accurate Drill for Jet Engine Housings

A production tool for drilling jet engine housings on faces with identical radial locations has been announced by Modern Industrial Engineering Co.

A five-way drilling and tapping machine, the equipment features multiple drill heads on two of the five stations. The tool is designed to provide precise work on relatively low production schedules with minimum scrap. The jet engine housing is loaded and clamped to the drill fixture manually. Indexing also is by hand.

Here is the sequence of operations: The aluminum alloy jet engine housing is loaded on fixture and its position is located by an outside diameter ring and a pin in a bolt hole; fixture is rotated by hand to positions where individual holddown clamps can be tightened; fixture is brought to starting position and the index lever is operated to lock it in place (with actuation of lever, three air-operated index table holddown clamps are applied); a reset button is pushed to set a counter and circuit for automatic selection of head combinations.

Indexing between operations is done manually by rotating the table after the index pin and clamping cylinders have been automatically released by the return stroke of the heads. The table can be indexed in a clockwise direction only and cannot be indexed past successive stations. Nine manual indexes complete the multiple drilling and tapping of holes in the housing.

The machine weighs 28,000 lb., measures 15 ft. wide, 8 ft. deep and 5½ ft. high.

Modern Industrial Engineering Co., 14230 Birwood, Detroit 4, Mich.

Aircraft Valve

An unloading valve for aircraft hydraulic systems which the maker says is quieter-operating and better protected from foreign matter is being produced by Vickers, Inc. It is the latest in the AA-3500 series made by the firm.

The unit, also known as a pressure regulator, has been simplified internally.

It has a new screen and a built-in accumulator check valve. The screen protects the assembly from contaminants in the hydraulic oil.

First application of these production units is in the Convair 340 twin-engine transport, in the main hydraulic circuit. This particular part is Model AA-3455-A. Older valves can be modified to the new design at Vicker's Detroit factory. Various airlines are sending them in, the company reports.

In the 340, the part is put to rugged use and must cycle up to 100 times per minute when cabin cooling is called for on the ground.

Vickers, Inc., 1400 Oakman Blvd., Detroit 32, Mich.

Test Plane Sections

A new dynamometer that can be set for any loading point between 0 and 100,000 lb. and is suitable for widely divergent tasks, from static load testing of aircraft assemblies to warning of overloads on cranes and hoists in factories, is made by W. C. Dillon & Co.

The equipment, labeled Model "EL," indicates loads directly or remotely. It has no springs, working on the principle of deflecting a calibrated beam. The all-purpose dynamometer is protected against overloads, is said not to be affected by extremes of temperatures and along with factory and laboratory uses, is applied in field work. It weighs 8½ lb.

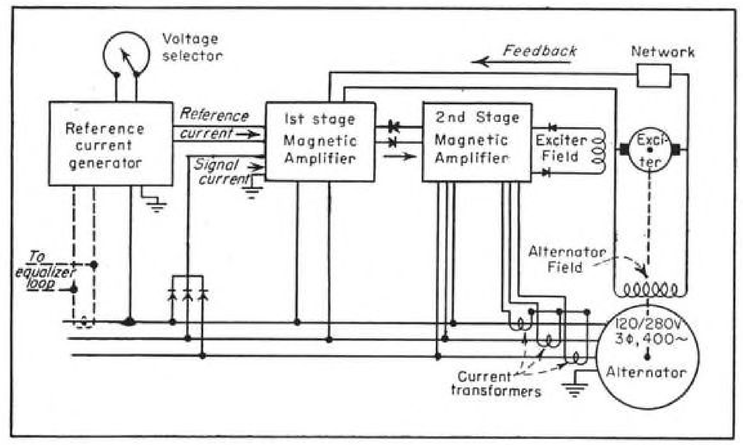
W. C. Dillon & Co., Inc., 1421 S. Circle Ave., Forest Park, Ill.

ALSO ON THE MARKET

Oil-filled capacitors are suitable for low-temperature operation (—70F) and where space and weight are prime considerations. Units are easy-mounting single-stud tubular type meeting salt water immersion requirements. Included in the series are 600- and 1,000-v. d.c. models. Industrial Condenser Corp., 3243 N. California Ave., Chicago 18.

Insulated terminal for intricate control panel wiring can be installed with one stroke of tool. The terminal is said to be insulated by an improved method where no conducting surface is exposed even if the insulating sheath on the terminal neck is inadvertently pierced. Aircraft-Marine Products, Inc., Harrisburg, Pa.

L1000 lamp assembly can be mounted on aircraft instrument panel for warning functions and other indications. It weighs ¼ oz., length is 1⅝ in. overall. It is packed in nickel-plated brass case: lenses in several colors are available. Hetherington, Inc., Sharon Hill, Pa.



TREND toward use of rugged mag-amplifiers in aircraft voltage regulators is indicated. Here is schematic of Westinghouse AVR-22 unit.

New-Type A.C. Regulator Shown

Westinghouse mag-amplifier voltage unit uses no tubes, is smaller than others that have been announced.

By Philip Klass

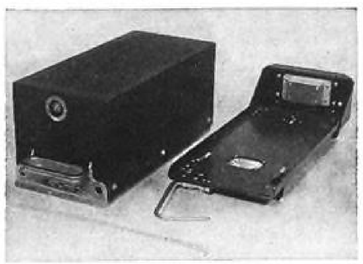
This week Westinghouse Electric Corp. unveils its new aircraft voltage regulator for alternators (a.c. generators) which uses magnetic amplifiers throughout. Following on the heels of the General Electric mag-amplifier regulator development (AVIATION WEEK Aug. 11, p. 36) indications are that the older carbon-pile type regulator is on its way out for alternators.

The swing to magnetic amplifier regulators is attributable to their ruggedness, potentially long life, and reliability inherent in their lack of moving parts. Carbon-pile regulators, with their carefully balanced moving armatures, are inherently sensitive to shock and vibration and leave something to be desired in reliability.

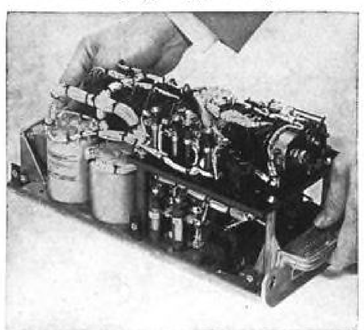
But for the moment, at least, the carbon-pile regulator is secure in the d.c. generator field since nobody has yet devised a mag-amplifier regulator to operate from d.c.

▶ **Design Edge?**—GE may have a head start with Navy production orders in hand, but Westinghouse thinks its new Type AVR-22 mag-amplifier regulator has the design edge over its competitor. In addition to the generally acknowledged mag-amplifier advantages of increased reliability, ruggedness, and long life, Westinghouse points to these exclusive advantages of its AVR-22:

• **Uses no vacuum tubes:** Westinghouse has devised a voltage reference for its regulator which eliminates the cold-cathode type tube GE uses.



AVR-22 UNIT can be mounted compactly in a standard plug-in type of tray.



COVER OFF view reveals how the device's components are fitted snugly.

• **Interchangeability:** AVR-22 can be substituted for a Westinghouse carbon-pile type regulator and operated with any existing or future narrow-speed-range Westinghouse alternator in the 15-to-90-kva. range, the company says. (For best results, the GE mag-amplifier regulator requires an alternator with a special bias winding not found on alternators designed for use with carbon-pile regulators.)

• **Smaller:** AVR-22 occupies about 485 cu. in. (roughly the same size as the Westinghouse carbon-pile regulator). The GE unit is roughly 660 cu. in.

• **Plug-in package:** AVR-22 is packaged in a plug-in panel to fit the mounting tray used in the standard USAF Type B-3 control panel for d.c. regulators. This AVR-22 plug-in feature permits speedy replacement. The GE unit requires removal of five mounting bolts for replacement. Neither regulator requires shock mounts.

On a weight basis, the AVR-22 is only slightly lighter than its competitor. When the weight of three external current transformers and the mounting tray are included, the AVR-22 weighs about 16½ lb., about ½ lb. less than the GE.

▶ **Quoted Performance**—AVR-22 is designed for 120/208-v. alternators built to proposed "A" revision to Spec. MIL-G-6099 and driven through a constant-speed drive at 5400/6600 rpm. to give an output frequency of 360 to 440 cps. Westinghouse says its AVR-22 will hold voltage constant within:

• ±2½% over the full range of speed, zero to 100% load, at 0.75 power factor, between the temperatures of −55C and 71C.
• ±3% from zero to 150% load
• ±3½% from zero to 200% load
• ±5% under all environmental conditions in proposed Spec. MIL-G-6099A in the range from sea level to 65,000 ft., and from −55C to 71C.

▶ **No Flight Experience, Yet**—Westinghouse tests on its new regulator have so far been limited to bench tests with 40- and 60-kva. alternators. However, Westinghouse expects flight tests to duplicate bench test results since the regulator has no moving parts (except for a relay which operates only when the system is first turned on.)

Qualification tests on a production model are scheduled to begin in November, and by early 1953, Westinghouse expects to be able to handle large-scale production. Because the AVR-22 was developed with Westinghouse funds and kept under wraps, the company has no orders from either military service yet.

▶ **Wider Speed Ranges**—Westinghouse is currently investigating the performance of AVR-22 over the wider frequency range of 320 to 480 cps. for

MAGNETIC AMPLIFIERS are small. Most of the space is taken up by rectifiers.

which one of the present GE mag-amplifier regulators is designed.

Westinghouse is also at work on a modified design to enable the regulator to handle direct-driven alternators having a frequency range of 380 to 800 cps. Westinghouse expects the wide-speed-range regulator to be about the same size as the AVR-22 and weigh about 3 lb. more.

▶ **How It Operates**—For competitive reasons, Westinghouse is keeping mum on how its reference signal circuit operates. The company says that it does not use vacuum tubes, hot-wire constant current devices, batteries or permanent magnets and that it has no moving parts.

The device generates a constant-current signal which is unaffected by the specified variations in alternator voltage or frequency, the company says. This reference signal is compared with a signal proportional to alternator output voltage obtained by rectifying and then combining the three line voltages.

Actual comparison between the two signals takes place in the first-stage mag-amplifier where each signal feeds its own control winding. The relative magnitude of the two signals determines the output current level from this stage. A manually operated rheostat can be used to change the regulator's control point by varying the signal from the alternator output voltage.

The first-stage output is rectified and supplied to the control winding of the second-stage mag-amplifier which feeds the exciter's field winding. This in turn controls the current supplied to the alternator's field winding and thus its output voltage (sees block diagram, p. 63. The second stage is a mag-amplifier which is powered from all three phases of the alternator.

▶ **When Voltage Changes**—An increase

in alternator voltage increases the alternator signal current to the first stage, decreasing its output. This reduces the output of the second stage, cutting exciter field current and alternator field excitation, thereby reducing output voltage to the desired value. A feedback circuit, through a network, introduces an "anticipatory" signal from the exciter to the first-stage mag-amplifier to insure system stability.

A novel feature is the use of current transformers in each of the alternator's three output busses. These signal the regulator to boost alternator field excitation as the load increases.

By this means Westinghouse says its AVR-22 can maintain excitation sufficiently high to enable the alternator to deliver at least 300% rated current during short-circuit conditions. This in turn permits prompt tripping of protective circuit breakers to clear the fault.

► **Parallel Operation**—When two or more alternators are operated in parallel, reactive load must be divided approximately equally between them. Otherwise the alternator carrying the greater reactive load will overheat.

To divide reactive load equally among paralleled alternators, the AVR-22 uses an arrangement similar to that used for the same purpose with carbon-pile regulators. A current transformer is added in one output bus of each of the paralleled alternators and is connected both to its respective regulator and to the other current transformers used for reactive load division.

If an alternator is carrying less than its share of the reactive load, the signal from its current transformer will call for more alternator excitation, and vice versa. With this arrangement, Westinghouse says its AVR-22 regulators will divide reactive load equally within 10% among paralleled alternators.

► **Wye Or Delta?**—The AVR-22 can be used with either wye or delta connections of 120/208-v. alternators without changing the internal regulator circuitry. Necessary differences in wiring are introduced in the circuits between the regulator's mounting tray and the alternator in the airplane.

Hence a standard AVR-22 can be plugged in and will work in either type of alternator installation.

► **Conservative Specs**—Oscillograms which Westinghouse showed to AVIATION WEEK make its quoted performance for the AVR-22 appear conservative. For example, Westinghouse says that generator voltage will return to 95% of its normal (rated) value within 0.1 second after full load is switched in or out. But the oscillograms show voltage recovery in:

- **Less than 0.05 sec.** from no load to 100% load.
- **Less than 0.1 sec.** from short circuit (more than 300% rated load) to no load.

The company says that removal of rated load, specified overload, or three-phase short circuits (at rated rpm.) will not cause voltage transients in excess of 150% of normal voltage. The oscillograms show voltage peaks of only:

- **120% rated voltage** when full load is removed.
- **121% rated voltage** when a short circuit is removed.

► **Credit**—Although many persons have contributed to the AVR-22 development, Westinghouse credits W. G. Evans of its magnetic amplifier section in Pittsburgh, and G. H. Stearley of its aviation engineering dept. in Lima, Ohio, with major responsibility for the new mag-amplifier regulator.

RCA's Avionic DC-3

RCA has equipped a DC-3 with its latest navigation and UHF communications equipment and will fly it to major airframe manufacturers' plants to demonstrate approved test and installation procedures. RCA considered including its AN/APS-42 transport radar but found the DC-3 nose too small for the antenna.

CAB Accident Investigation Report

National Airlines, Inc.,
Elizabeth, N. J.,
Feb. 11, 1952

THE ACCIDENT

At approximately 0020E,[1] Feb. 11, 1952, a Douglas DC-6, N 90891, owned and operated by National Airlines, Inc., as Flight 101, crashed and burned after striking an apartment house within the limits of the City of Elizabeth, N. J., shortly after take-off from the Newark Airport, Newark, N. J. There were 63 persons aboard the aircraft, including one infant and a crew of four. Of these, 26 passengers and three members of the crew lost their lives, together with four persons who were occupants of the apartment house into which the aircraft crashed. The other passengers and the stewardess received injuries varying from minor to serious.

HISTORY OF THE FLIGHT

The aircraft involved arrived at New York International Airport,[2] N. Y., at 2233, Feb. 10, 1952, as Flight 402 from Miami, Fla. This flight was routine, with stops at West Palm Beach, Fla., and Washington, D. C. A turn-around inspection at Idlewild was performed, and 1,911 gallons of 100/130 grade fuel added, bringing the total fuel aboard to 2,700 gallons. Also, sufficient oil was added to bring the quantity of each tank to 30 gallons. At 2322 the aircraft departed Idlewild on a ferry flight to Newark with a new crew consisting of Captain W. G. Foster, First Officer C. E. St. Clair, Flight Engineer I. R. Shea, and Stewardess Nancy J. Taylor. The aircraft arrived at Newark Airport at 2335, from which point it was scheduled to depart at 2359 as Flight 101, nonstop to Miami, Fla.

A second inspection was accomplished at Newark and the aircraft was loaded with 2,953 pounds of mail, baggage, air express, airfreight, and 59 passengers, including one infant. The computed takeoff gross weight was 83,437 pounds, or 6,463 pounds less than the allowable gross of 89,900 pounds. This weight was so distributed that the center of gravity was within the approved limits. No fuel was added at Newark.

The flight was given an instrument clearance from Newark to Miami, with West Palm Beach as alternate. To this clearance was attached the pertinent weather reports which indicated, among other things, that at Newark the ceiling was 20,000 feet, thin overcast, with the entire en route weather generally clear with ceilings of 30,000 feet at Palm Beach and Miami.

At 0013, Feb. 11, Newark Control Tower gave the flight taxi clearance to Runway 24, stating the wind was south, variable at six m.p.h., and altimeter 29.92. At approximately 0017 the flight advised the tower that it was ready for takeoff. Takeoff clearance was issued, and the controller observed the aircraft taxi into take-off position and proceed down the runway in a normal manner, becoming airborne at 0018 after a roll of approximately 3,200 feet.

The climb-out appeared normal until the aircraft passed the vicinity of the Newark Range Station. Here it was observed by Control Tower personnel to lose altitude suddenly and veer slightly to the right. This sudden loss of altitude and the movement to the right are supported by statements of surviving passengers and ground witnesses.

The controller then called the flight and asked if everything was all right, to which he received the following reply, "I lost an engine and am returning to the field." The time was established as 0019. The flight was immediately cleared to land on Runway 6, which clearance was at once amended to land on any runway desired. No further radio contacts were made with flight. During the last radio transmission the controller observed the aircraft continue to veer

[1] All times referred to herein are Eastern Standard and based on the 24-hour clock.
[2] Hereinafter referred to as "Idlewild."

to the right at a low altitude and then disappear from sight.

At 0020 tower personnel observed a fire in the vicinity of Elizabeth, N. J. It was later established that Flight 101 had crashed in Elizabeth near the intersection of Scotland Road and Westminster Ave.

INVESTIGATION

Investigation disclosed that the aircraft had first made light contact with the top of tree located on the west side of Salem Ave., immediately followed by heavy impact of the right wing with the roof of an apartment building. This impact was of sufficient force to shear the right wing just outboard of No. 4 engine nacelle, the wing falling into the apartment house courtyard. It was in this building, badly damaged by subsequent fire, that four occupants lost their lives. The aircraft continued forward along an approximate heading of 280°, striking other obstructions and disintegrating along a path that terminated at Westminster Ave.

To expedite the investigation and to assure the most thorough examination possible of the aircraft and its components, working groups were formed—Witness; Operations; Structures; Electrical and Electronics; and Power Plants and Propellers—composed of appropriate representatives of the industry, CAA, and the State of New Jersey. A CAB investigator was in charge of each group.

The Witness group interviewed more than 80 persons and obtained written statements from 40 who were able to supply pertinent information. All surviving passengers, whose physical condition permitted, were interviewed and where possible, either submitted written statements or testified at the public hearing. To summarize the information gathered from these surviving passengers, it appears evident that shortly after takeoff the aircraft made a sudden drop and veered to the right.

Associated with the sudden drop and change of aircraft heading was an unusual engine noise variously described as "wail," "whine," "roar," "propellers going into reverse," "grinding sound or shrill noise," and "noise like an explosion." Reaction of other passengers described the aircraft as "shuddering," "vibrating," and "shimmying from side to side." Two passengers, sitting on the right side of the aircraft, both stated that shortly after takeoff they noticed that the outboard propeller on the right side came to a stop. One of these passengers, on her first flight was concerned to the extent that she called this fact to the attention of her husband sitting beside her. His reactions, however, are not known since due to the seriousness of his injuries he recalls no details of the flight.

The Operations group confined its efforts to the investigation of items concerning refueling, dispatching, take-off weight load distribution, crew history and crew training, weather, radio contacts, flight documents, and such other documents and manuals as are required to be aboard the aircraft. No irregularities which in any way would affect the operation of the aircraft were found. The aircraft was properly certificated and dispatched, and nothing was found to indicate that it was not in an airworthy condition upon departure from Newark.

The crew was also properly certificated, and previous to boarding the aircraft at Idlewild for the ferry flight to Newark had had a rest period of 17 hours and 10 minutes.

Study of the crew history revealed that Captain Foster had been employed by National Airlines as captain since November 4, 1942, and had accumulated a total time as pilot of 11,901 hours, of which 1,059 hours were in DC-6 equipment. His last six-month instrument flight check was accomplished on January 3, 1952, with a grade of average. The instrument check preceding this one was accomplished on DC-6 equipment June 8, 1951, with a final grade of average. On June 9, 1951, Captain Foster successfully completed an instrument check on DC-4 equipment with a grade of average. He had also accomplished three line checks since December, 1950, in which he received passing grades.

First Officer Carney E. St. Clair had been employed by National Airlines since December 1, 1950. He had received average or above average in all his work and had been recommended as captain material. His total flight time was 3,804 hours, with 941 hours in DC-6 equipment.

Flight Engineer Shea was originally employed by National Airlines as a mechanic in February, 1948, transferring to the Operations Department on Dec. 3, 1951, as Flight Engineer. His total flight time was 139 hours, all of which was on DC-6 equipment.

The task of the Structures group was to locate, identify, and make a detailed examination of all portions of the airframe structure, and make a record of the position and setting of all instruments, controls, and movable mechanisms associated with the operation of the aircraft. This was accomplished, to the extent necessary, before any of the wreckage was moved. A distribution chart was made showing the location of all major portions of the wreckage, and numerous photographs were taken, not only as a permanent record but to be used in the future study and evaluation of the material.

Following preliminary examination of the wreckage at the scene and completion of the distribution chart, the wreckage was removed to a place where the material could be stored under cover and a detailed examination of the various components was made. A comprehensive study of the airframe structure and associated systems revealed no evidence of structural failure, malfunctioning, or fire prior to the initial impact with the apartment building. All damage to the aircraft structure and the various components was the result of impact and subsequent fire. A list of reading of items on the cockpit control pedestal and instrument panels is attached. As a result of the complete disintegration of the forward portions of the fuselage, these readings and positions may or may not be indicative of the readings and positions prior to impact.

The Electrical and Electronics group found no evidence of incorrect installation or improper maintenance of equipment, nor was there any indication of internal fire. Mechanical damage and fire was observed in parts of certain cables and equipment, but all such damage appeared to have come from external sources, such as might result from impact and subsequent fires.

Although all parts of the electrical sys-

tem and wiring could not be examined because of impact or fire damage resulting from the crash, examination of those parts recovered or otherwise available with the wreckage for examination revealed no faults which would lead to a suspicion of faulty equipment, faulty installation, or improper maintenance. The four propeller feathering switches were found in the "open" position, normal for de-energized position. All ignition switches were found to be on "both" position, and no electrical leakage of the circuits was detected.

The Power Plant group was divided into two sections; one to cover the mechanical aspects of the engines and accessories, and the other the propellers and governors. The positions of the power plants and propellers, as they finally came to rest at the scene of the crash, were photographed and plotted on the wreckage distribution chart. Examination at the scene revealed that all three blades of the propeller on No. 3 engine were broken off, as was one blade each from propellers on engines Nos. 1, 2, and 4. The broken portions of all blades were recovered with the exception of the outer portion of No. 1 blade from No. 3 propeller. However, a large piece of molten metal subsequently found in the burned apartment building, when analyzed, was found to be of propeller material and was undoubtedly the remaining portion of the missing blade. Before being removed from the scene, the domes of the propellers were removed and the low pitch stop positions noted and photographed.

The engines and propellers were then taken to a more appropriate location for a detailed inspection and examination of parts, and for such further technical studies as the examination of the material indicated.

Damage to the engines as a result of impact and subsequent fire was comparatively light. There was no evidence found to indicate structural failure or malfunction of engines Nos. 1 and 2 prior to impact. The pitch setting of the propeller blades of these two engines, as well as the general pattern of bending and leading edge damage, indicated considerable power was being developed at the moment of impact. Engines Nos. 3 and 4 were completely disassembled with particular attention directed to any evidence that might indicate structural failure, malfunction, or overspeed. The ignition harnesses had suffered impact damage to such an extent that they could not be functionally tested. Neither was it possible to recover the complete fuel system. However, no evidence was found to indicate structural failure or malfunctioning prior to impact, either by visual observations or by functional tests where such tests were possible.

During the examination of No. 3 engine particular attention was directed toward possible evidence of this engine having been subjected to overspeed. While no evidence of overspeed was found, such lack of evidence is not conclusive proof that an overspeed did not occur since the presence of such evidence depends upon the duration and extent of overspeed and the amount of power being developed at the time. Sufficient evidence, however, was found to indicate conclusively that No. 3 engine and propeller were rotating in their normal direction and No. 4 engine was stopped

at the time of impact.

As a result of the preliminary examination of the propellers at the scene and a later detailed technical study and evaluation following disassembly, propellers on engines Nos. 1 and 2 were found in the 46° to 53° positive pitch range, the propeller on engine No. 3 was in full reverse pitch, and the propeller on engine No. 4 was fully feathered.

A careful examination of the records associated with the propeller reversing system on aircraft N 90891 revealed that on Jan. 29 and again on Feb. 3, 1952, the red flag indicating the propellers could be reversed came up and stayed up after takeoff. This flag should have dropped back out of sight when the wheels left the ground. In both instances the difficulty was corrected by replacing the micro-switches located on the nose wheel and right main landing gear.

On Jan. 24, 1952, during a maintenance run-up check, it was found that propeller No. 160993, installed on No. 4 engine, aircraft N 90891, would go in reverse pitch when being taken out of the feathered position. The propeller was removed and taken to the propeller overhaul shop where it was found that possible moisture between the slip ring and contact plate was causing the trouble. The slip ring assembly was replaced. This corrected the difficulty and on January 31, 1952, the propeller was reinstalled in aircraft N 90891 on No. 3 engine, in which position it was at the time of the accident.

Investigation disclosed no evidence that fire existed prior to impact which is substantiated by statements of surviving passengers.

ANALYSIS

No discussion seems necessary with regard to the aircraft structure, the control surfaces and their related system, since no evidence was found to indicate failure or malfunctioning of these items prior to impact.

Power plants in No. 1 and No. 2 positions were undoubtedly functioning in a normal manner and developing substantial power at the time of the accident. No. 4 engine was stopped prior to impact with its propeller in the fully feathered position, which indicates that this condition had been accomplished through action by the flight crew. A complete tear down revealed nothing to indicate that this engine and propeller were not operable at the time their use was discontinued. A complete tear down of No. 3 engine revealed not only that it was operating at impact but disclosed no evidence whatever to indicate that it was not capable of continued operation.

This analysis will be concerned primarily with the propeller (No. 160993) installed on No. 3 engine inasmuch as there is conflicting testimony concerning its probable pitch position prior to and at initial impact with the roof of the apartment building.

Testimony of persons aboard the aircraft who survived the crash, as well as that of persons on the ground who observed the flight following takeoff, has been carefully analyzed. This testimony in general describes circumstances which would be expected to accompany a sudden reversal of a propeller under power in flight. These circumstances include a sudden increase in noise level, which was of short duration, ac-

companied almost simultaneously by abrupt settling and veering to the right of the aircraft. There was no testimony to indicate that any malfunctioning was either heard or felt prior to the loud noise and abrupt maneuver which preceded the accident. This tends to eliminate any action on the part of the crew in the course of trouble-shooting which may have initiated a propeller reversal. Further, the reported abruptness and extent of the maneuver indicates that the crew was not anticipating any difficulty at that moment.

The circumstances described would be expected in the event of a reversal of one propeller with the engine producing substantial power. (It should be recalled that No. 3 propeller was found at the full reverse—minus 18°—position when the dome was removed at the scene.) If the crew did not immediately recognize that a propeller had reversed in flight, attention might well have been directed to the outboard engine which in the event of loss of power would produce a more severe yaw than would an inboard engine. It is reasonable to assume that the comparatively violent maneuver, which occurred at low altitude and low air speed, created an emergency with such attendant urgency in the cockpipt that the crew did not have sufficient time to make a correct analysis of the difficulty. Under these conditions the feathering of No. 4 propeller appears to have been a logical action. The feathering of this propeller with No. 3 propeller operating in reverse pitch at appreciable power would adversely affect performance resulting in a high rate of descent. However, had the aircraft been equipped with reverse pitch indicating lights in the cockpit, the malfunctioning propeller could have been readily identified and the No. 4 propeller undoubtedly would not have been feathered.

A lengthy study has been made of the physical condition of No. 3 propeller. There are a great many parts with significant indications, and it is not believed that a firm conclusion with regard to the position of the propeller can be arrived at on the basis of any one condition.

It is considered pertinent that the prominent impact damage to the blade shim plates, blade gears, and rotating cam gear occurred while the propeller was in the reverse pitch position. A faint mark corresponding to plus 29° (low pitch) on the reverse signal ring and one shim plate is of no particular significance. Similar indications have been observed on shim plates and reverse signal rings removed from propellers in the course of routine overhaul. Furthermore, the reverse signal ring is of a thinner section than the shim plate with which it is in intimate contact circumferentially. It would not be possible to mark the reverse signal ring by impact loads without also marking the thicker shim plate at its adjacent location, and no such marks were found. The marks which were observed at the corresponding 29° location are due to the fact that this is the one fixed position at which the propeller operates during ground run-up, start of takeoff, and reduced throttle in flight, and is also the position at which the propeller rests when not in operation.

All evidence on No. 2 and No. 3 blades indicated that they were in reverse pitch

when they contacted the roof of the apartment building. Both of these blades were twisted by loads tending to turn the blades in the reverse pitch direction. Evidence consists of rearward bends, failure in tension on camber side, camber side of both blades being discolored by roofing material, and pieces being broken from the trailing edge of No. 3 blade by loads imposed on the camber side. Of particular significance is the fact that the dowels and screws which retain the blade gear to the blade were sheared on all three blades by loads tending to turn the blades toward reverse pitch direction.

No. 1 blade was broken approximately 11 inches from the butt end from a load applied on the face side adjacent to the leading edge. A piece of this blade about 15 inches long was found inside the apartment building in a partially burned condition. Unfortunately, the outer portion of this blade as such was not recovered, thus preventing a complete study of all factors.

The direction of break of this blade does not conform to the direction of break of the other two blades. In fact, it suggests a loading which might result from the blade's striking an obstruction while rotating in the positive low pitch position. Consequently, much study has been devoted to the various possibilities.

The direction of shear of the blade gear dowels and screws is the same as on the other two blades, of which all indications point to their being in reverse pitch at the time of impact with the roof of the building.

Shearing of the blade gear dowels and screws resulted in the blade's being free to turn about its longitudinal axis. Aerodynamic loads on the blade would tend to turn it away from full reverse toward the positive low pitch position. Score marks on the butt face of the blade indicate that it did turn in the barrel arm subsequent to shearing of the dowels and screws, resulting in the direction of fracture of the blade being of no particular significance in relation to its position at initial impact.

For the propeller blades to be at plus 29° at the initial impact of No. 1 blade and the following two blades to be at minus 18° at the time of their respective initial impacts, the propeller blades would have to change pitch 47° during one-third propeller revolution. At 2600 engine rpm., this would have to occur in .017 seconds, necessitating a pitch change rate of 2780°/sec., and would require oil to be displaced from the dome at the rate of approximately 692 gal./min. Although no substantiating data are available, it is not believed likely that pitch change rates of such a magnitude could be attained. The normal maximum rate of pitch change is about 30°/sec.

In arriving at the sequence of failure, it appears logical that the dowels and screws sheared first, followed by breakage of the blade. Had the blade broken first, it is doubtful if the short portion that remained could be subjected to forces great enough to rotate the propeller to reverse pitch and shear the dowels and screws. Consequently, the only plausible sequence of events is that the dowels and screws sheared first, leaving the blade free to rotate in the barrel arm, and such rotation did occur.

The wedge insert was found to be broken

A DIGEST OF NEW DEVELOPMENTS IN HIGH PERFORMANCE PUMPS

PISTON TYPE FLUID POWER PUMPS

Constant and Variable Delivery Types . . . 0.25 gpm to 10 gpm . . . direct engine driven and motorized units.

Featuring continuous working pressures to 3000 psi and continuous speeds to 3750 rpm, today's STRATOPOWER oil hydraulic Pumps (both constant and variable delivery types), afford special advantages for aircraft and other applications. The dual pressure Pumps incorporate remote oil pilot controlled pressure regulator. An electric modification provides selective pressure control and Pump unloading. These Pumps are self-priming and develop suction line pressures approaching 1" Hg. absolute and will also operate under conditions of high reservoir pressurization.

VANE TYPE FLUID POWER PUMPS

Capacities 3 gpm to 120 gpm. Standard models rated at 1200 rpm . . . specials to 3600 rpm.

A distinctive Dual Vane construction, which provides increased fluid delivery rates (even with extremely thin fluids), makes DUDCO Hydraulic Pumps and Motors the first single-stage vane type proven for 2000 psi operation. The minimum size and high efficiencies of these Pumps and Motors create new opportunities in the design of hydraulic fluid power systems for all types of industrial equipment as well as countless applications on heavy-duty machinery and ordnance vehicles.

GEAR TYPE FLUID POWER PUMPS

½ gpm to 130 gpm for working pressures to 1500 psi and operating speeds to 2000 rpm.

A unique Four-Bolt design, which locates the assembly bolts within the area of greatest internal pump pressure, indorses HYDRECO Hydraulic Pumps for the heavy-duty required in equipment for the construction and materials handling fields. This Four-Bolt design provides the rigidity and stability that reduces distortion of housing parts and wear plates and insures against uneven wear and loss of overall efficiency in the face of extreme mechanical and hydraulic loads.

LIQUID HANDLING PUMPS

Plain or steam jacketed Rotating Plunger or Heliquad Types 2 gpm to 3360 gpm.

Virtually any material that will flow through a pipe, including difficult viscous fluid, can be handled with meter-like volumetric accuracy with today's KINNEY Rotary Plunger and Wide Angle Herringbone Gear Pumps. The Rotary Plunger Pump features a construction with no valves, blades, pistons or springs. The versatile line of Herringbone Gear Pumps includes models driven by timing gears with anti-friction bearings located outside the pump chamber. Both types available with or without heating jackets.

HIGH VACUUM PUMPS

Single Stage and Compound types, ¼ HP at 2 cu. ft. per min. to 751 HP at 1800 cu. ft. per min.

There is only one principle which has been found suitable for Vacuum Pumps in all capacity ranges . . . that of the Rotary Plunger employed in KINNEY High Vacuum Pumps. First to use the oil-sealed Rotary Plunger, these Pumps develop absolute pressure readings of 0.1 Micron (0.0001 mm Hg.) or better. Alone or in combination with oil diffusion Pumps, they provide the answer to the most exacting high vacuum applications in the electronic, processing and research fields.

MOTORS, VALVES & CYLINDERS

In addition to the complete range of Pumps described, there are equally important components . . . Hydraulic Motors, Valves and Cylinders . . . all available from a single source. DUDCO Hydraulic Motors, employing the remarkably efficient DUAL-VANE principle, with high running torques averaging 90% or more of theoretical at any speed down to nearly stalled and with smooth operation under load. Models rated from 9 to 720 in. lbs./100 psi for 2000 psi operation. HYDRECO Hollow Plunger Valves in single or multiple plunger units for controlling single, double-acting or telescopic HYDRECO Cylinders as well as other Hydraulic Power Units . . . capacities from ½ gpm to 150 gpm and for operating pressures to 1500 psi. Relief Valves, Pressure Regulators, Flow Dividers and other special purpose Valves are available for nearly any type of Hydraulic circuit.

The New York Air Brake Company and its affiliates provide a most comprehensive coverage of Pumps and related equipment for the needs of defense and industry. Here, in one organization, is "Know How" teamed with advanced facilities and a tradition of precision and craftsmanship. Here is research and development dedicated to the constant improvement and the ever-broadening service which hydraulic and vacuum equipment can contribute now and in the future.

Catalogs and complete information on the Hydraulic Pumps, Motors and other components herein described are available on request.

THE NEW YORK AIR BRAKE COMPANY
420 LEXINGTON AVE., NEW YORK 17

AFFILIATES: DUDCO DIVISION • • • HYDRECO DIVISION • • • KINNEY MANUFACTURING CO.

with evidence that the breakup occurred at some time prior to the accident. This particular wedge insert, however, had been installed at the time the slip ring assembly was replaced following the propeller reversal difficulty on maintenance run-up, Jan. 24, 1952. A flat spot was found in the surface of the low pitch stop wedge in the area normally contacted by the low pitch stops. The possibility that high impact loads were transmitted to the low pitch stops, thus causing the flat spot, has been considered. This did not happen. The contour of the low pitch stops is such that they would not make a flat indentation on the wedge. Furthermore, there are score marks on the surface of the flat spot that correspond with score marks all around the periphery of the wedge. This indicates that there was operation of the propeller subsequent to formation of the flat spot. It is considered likely that unequal loading on the wedge when it was in position for one low pitch stop lever to contact the flat spot resulted in the breaking and displacing of the wedge insert.

Detailed study was given the deep indentations on the piston sleeve and the lip of metal formed over the chamfered surface at the three points where contact with the low pitch stop levers is made. This study was made to determine, if possible, whether this deformation was the result of one impact force of high magnitude or of several of lesser magnitude.

The curvature of the flow lines of the metal in the bulbous shaped lip indicates a progressive forming and bending of the metal over and under. Also of particular significance are the three layers of copper imbedded in the metal forming the lip which undoubtedly came from the copper coated end of the piston sleeve. This indicates conclusively that its formation was the result of a number of smaller impact forces rather than of one impact force of major magnitude.

Tests conducted independently of the Board have been reported which indicated that indentations such as were found on the piston sleeve would have to have been the result of crash impact loads, had they resulted from one blow. There is no known manner in which a loading of such magnitude could be generated in flight. However, since the evidence indicates definitely that the indentations on the piston sleeve were progressively formed, this possibility is discarded.

The fact that evidence indicates that the propeller inadvertently reversed in flight raises the question as to what caused this reversal. Due to impact damage and fire, the propeller control system in its entirety could not be examined. There are certain facts, however, which can be considered.

Although the system was carefully designed with safeguards to prevent inadvertent reversal, such an occurrence is not impossible. The governor solenoid valve circuit, which extends from the cockpit to the governor on the nose of the engine and which was not isolated from other circuits, will cause reversal of the propeller if it should become energized. Should this occur, due to some fault in the electrical system, resulting in unwanted voltage to the governor solenoid valve circuit, reversal of the propeller would result without any action on the part of the crew and as long as the

circuit remained energized, the propeller could not be taken out of the reverse pitch position.

On Feb. 19, 1952, the Administrator of Civil Aeronautics sent to all CAA regional offices the following telegram:

". . . to preclude possibility of inadvertent propeller reversal of Hamilton Standard propellers on Douglas DC-6, DC-6A and DC-6B aircraft the wiring from the engine firewall to the governor solenoid valve is to be isolated from all other circuits to prevent inadvertent application of electric power to solenoid circuit. This is to be accomplished preferably by removing wire from any bundles in which it may run and placing it in separate isolated conduit. Isolation of this portion of circuit to be accomplished as soon as possible but not later than midnight February 18. Portion of circuit behind firewall and throughout remainder of aircraft to be inspected immediately. Inspection to include check of all terminal points to assure no hazard of contact with loose wires nearby and check of all points where chaffing or other damage may occur which could permit energized wires to contact solenoid circuit wire or terminals. Further instructions re isolation of portion of circuit behind firewall will be transmitted as soon as available. We do not recommend deactivation of reversing propellers on any aircraft while above program being accomplished."

National Airlines on Feb. 13 began a program of rendering the propeller reversing feature inactive on all their DC-6 equipment. This was completed on Feb. 15. A reactivation program in compliance with the terms of the above telegram was started on Feb. 15, and completed Feb. 18. However, on Mar. 12, National Airlines began a program for the permanent deactivation of the propeller reversing feature on all their DC-6 equipment. This program was completed on Mar. 20, 1952, and is currently in effect.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The carrier, the aircraft, and the crew were properly certificated.
2. The flight was properly dispatched.
3. The weather was satisfactory for VFR operations and had no bearing on this accident.
4. Mechanical difficulty developed during climb shortly after takeoff from Runway 24.
5. No. 3 propeller reversed in flight, and No. 4 propeller was feathered.
6. Under these conditions the aircraft did not maintain altitude and settled rapidly.
7. There was no fire prior to impact with the apartment building.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was the reversal in flight of No. 3 propeller with relatively high power and the subsequent feathering of No. 4 propeller resulting in a descent at an altitude too low to effect recovery.

By the Civil Aeronautics Board:

/s/ Donald W. Nyrop
/s/ Oswald Ryan
/s/ Joseph P. Adams
/s/ Chan Gurney

Josh Lee, Member, did not participate in the adoption of this report.

AA Sets Its Sights on Long-Range Coach

- **Carrier reveals tourist plans at nonsked hearing.**
- **Cost-conscious vacation travelers fit in picture.**

By F. Lee Moore

American Airlines now sees its greatest future in long-range aircoach service with high-density seating to get lower unit fares. American will increase capacity of its six DC-6 coaches from 70 to 80 seats and convert four more planes for coach service by spring.

The new policy was revealed in American Airlines testimony at the Civil Aeronautics Board hearings in the nonsked airline investigation. Main issue of this proceeding is whether CAB should continue its regulations preventing nonskeds from expanding their own aircoach services. Major statements of American policy were presented by assistant vice president and general sales manager Charles R. Speers.

He said AA believes its biggest growth potential lies in vacation travel, 90% of which now goes by automobile. The company believes low fares and intense promotion can and must lure more of this huge but extremely cost-conscious market to air travel. The "standard" or first-class market is nearing saturation. American believes. Air coach must now expand rapidly to keep the previous growth of air transport going.

Here are highlights of Speers' testimony on American policy:

- **Shorthaul coach won't pay.** Convair service already is fairly high-density.
- **Off-hours coach won't pay,** generally.
- **Coach earning rate** on investment must be the same as first-class.
- **Tapering fare structure** is necessary. The shorter the haul, the higher the fare must be.
- **Long-range coach service** is American's biggest growth market now.
- **First-class travel** is relatively saturated, and is over-inflated by war mobilization—may actually decline temporarily.
- **Vacation travel by coach** is therefore American's key to expansion but this market is extremely cost-conscious.
- **Lowest possible fares** are therefore the way to get that expansion.
- **But AA coach is not "second-class"** service, the line contends.

AA, Nonsked Coach Business

American aircoach vs. all nonsked passenger business revenue passenger miles, 12 months ended June 30 (fiscal years):

	1951	1952	Change
American Airlines "air tourist"....	123,402,133	278,408,821	up 123%
All nonskeds (domestic and int'l.)*	870,651,000	1,290,634,000	up 49%

* U. S. nonsked passenger miles including government contract flights.

Sources: American Airlines and CAB Irregular Air Carrier Section, Bureau of Air Operations.

- **American's coach investment** is $6,877,118, more than four times that of the 40 domestic nonskeds, according to Speers. American's cost of converting a standard plane to coach runs about $75,000 each.

These are highlights; here are some of Speers' more detailed statements explaining these conclusions:

▶ **American's Price Philosophy**—Before cross-examination Speers outlined the American fares-and-service policy in a carefully worded statement beginning: "We believe that the major expansion in air transportation will take place in the air tourist field. We believe that the opportunities in the standard-fare field are definitely limited."

Speers then frankly outlined AA's prospects in its three markets, which American calls "commercial, personal and emergency and vacation."

- **Business travel.** "The commercial market has been deeply penetrated."

And he added, "Furthermore, we believe business travel is highly inflated at the present moment due to war conditions and that, if anything, there is likely to be a reduction in the total first-class commercial market."

- **Personal travel.** "The personal and emergency field is automatically limited by its very nature. Emergencies are not created—they occur, and we believe that we probably have a very high percentage of the emergency travel that presently exists or that will move in the future."

Thus, American believes its business growth in the standard or luxury class is slowing. Observers studying these revealing statements last week in Washington wondered why the airline should state such a prospect publicly, especially in view of the fact that American has presently on order 25 non-coach Douglas DC-7s worth close to $50 million and has recently added to its fleet about 25 additional non-coach DC-6Bs. Apparently, American will give its very newest and fastest equipment to first-class travel, and spend $75,000 each converting the older standard DC-6s to coach.

Some observers also speculated that in pinning its future squarely on coach, American is warning CAB not to endanger the future of the certificated airlines by letting nonskeds compete in that vital field.

- **Vacation travel.** "We believe our future lies in the vacation market," Speers continued. "This is an extremely cost-conscious market. They (vacationers) have specific areas of interest. They can't be sold, many of them, on spending their vacation in industrial areas or non-vacation areas. This market is highly seasonal. . . .

"This market is difficult to reach. . . . It requires expensive promotional effort. In this market, time is relatively less important than it is in the business or commercial market."

American therefore concludes that price will be all-important: "All this adds up to an extremely cost-conscious market, which will be influenced to

AA 1953 Fleet

American's fleet next year will include—

Aircoach:
- 10 DC-6s (longhaul)

Air freight and charter:
- 13 DC-4s
- 3 DC-6As

First-class passenger:
- 25 DC-6Bs (longhaul)
- 78 Convairs (shorthaul)
- (plus 25 DC-7s on order)

travel by air when the fares and costs generally attract many to it."

▶**Coach Market History, AA Version**—Here is how Speers interprets the history of aircoach development so far:

• **"The nonskeds . . . fell** into the coach business. There wasn't any question in 1948 and 1949 but what American was going to have low fares. The question was, what kind of low fares?"

• **American was divided,** up to mid-1949, on fare reduction policy. When President C. R. Smith testified to the Senate (Johnson) Commerce Committee in April 1949 that American would lose money on aircoach, he was "thinking in terms of an across-the-board fare reduction," Speers said.

• **Smith "changed his opinion** (shortly thereafter) based on recommendations of his own staff, and we proceeded to develop the two-fare air tourist type of service," Speers testified.

• **Coach "load" proved needs."** Under cross-examination by CAB counsel Ronald M. Cohen, Speers admitted AA's high load factors and long waiting lists on its coach are what caused the line to expand it. Cohen asked Speers if American's 81% average coach load factor in 1951 and continued high loads today were "some indication to you as to need for low-cost transportation between those points?" Speers answered directly: "The fact that they were carrying passengers is an indication that there was need."

That is what the nonskeds wanted American to say, as it might indicate that the nonskeds, too, are filling a "public need and necessity" when they fly as frequently as the public indicates demand for their services by buying nonsked tickets. It was CAB member Joseph Adams' contention in dissenting when the Board revoked and suspended certificates of nonskeds for flying too often.

That is the history of aircoach to date, as Speers interprets it for American.

▶**Future of Air Fares**—Here are additional important statements by Speers enlarging on American's view of how fare structure should go. This is the first key to American's position in the coming CAB "general fares investigation." In that proceeding, CAB will seek to review the whole fare structure of the scheduled airline industry in light of present and future developments.

• **Shorthaul coach won't pay.** Asked if American planned coach service over shorter hauls, Speers stated: "We do not think that aircoach service over short distances and medium distances will develop new traffic at the same rate or the same degree as over long distances.

"The difference in fares, less the saving in time for the vacationist, is relatively less important, so we think that the opportunities for broadening the market in that field are very much less than in the longer haul markets, and that refers specifically to a distance like New York-Washington. . . .

"If we were to establish an air tourist . . . service over distances of that type, we might end up with a coach rate substantially at the present levels, and a standard fare somewhat higher."

• **Tapering fare structure.** "We must maintain an adequate return over our entire system to purchase new equipment, to attract new capital. . . . We have attempted, in establishing our air tourist fares, to develop the tapering-fare principle." For instance, the fare per mile New York-Chicago is higher than the longer Chicago-Los Angeles segment. First-class fares taper similarly, American says. But, Speers pointed out, AA believes the shorthaul first-class fare can't be raised much, for that "would tend to dry up the market over many of the short segments."

• **Shorthaul.** Speers says that although shorthaul earnings are marginal now, the service pays off indirectly because it feeds longhaul routes and it also pioneers "first riders"—acquaints them with air travel. However, observers note that American's fleet expansion since 1950 has been in longhaul aircraft.

• **Coach load factors.** "We believe that, in the long run, our air tourist flights are likely to be operated at a lower annual load factor than our standard-fare flights because of the seasonality of the traffic." This conclusion is one apparent reason for American's decision to increase further the seating density of its coach services. The present 70-seat configuration at 4½ cents a mile yields about the same revenue per flight as 50 seats at about 6 cents. If the coach load factor were considerably less, it would upset American's "balanced fare structure."

By increasing seating to 80 in the coach, the flight yields much more than standard fare flights with 50 seats, and provides a big cushion for the anticipated drop in average coach load.

• **Diversion from first-class.** Speers stated that he believes its coach service will divert from 35 to 50% of passengers from AA's first-class service. "If there is to be diversion . . . and if the first-class market generally were to decline, it again must be made up in our air tourist services. . . ."

American is no longer worried about its own aircoach diverting passengers from its first-class service under the new policy. The big worry is the possibility of other airlines diverting American's business—specifically, further growth of the nonsked industry. "A diversion from American Airlines to other carriers, without corresponding growth in our standard-fare flights, would soon result in an unbalanced fare structure . . . might destroy the growth in air transportation over other segments."

That is the main message American wishes to convey in the CAB nonsked investigation.

DRIVE-IN TICKET SERVICE

A new look in airline ticket offices will make its appearance next January when United Air Lines opens this neat drive-in ticket office 12 miles southwest of San Francisco Airport on King's Highway. It is designed to service suburbanites who make up 50% of UAL's passengers in the San Francisco area. Two canopied windows will allow motorists to pick up tickets without leaving their cars.

Modern Lighting at Jan Smuts Field

(McGraw-Hill World News)

Johannesburg—A $300,000 centerline approach lighting system is going into the new Jan Smuts Airport, with runway and approach lights having five stages of brilliancy to a maximum of 33,000 beam candles.

Included in other lighting equipment being installed will be a ceiling light projector for measuring height of the cloud base.

Operations at the field will open on full scale early next year and at least seven international carriers are expected to make use of the facilities.

Airlines to Compete In 13,000-Mi. Derby

More than 1,000 entry forms have been distributed by the Canterbury International Air Race Council, New Zealand, to whip up widest possible participation in the forthcoming 13,000-mi. England to Christchurch, N. Z., air derby scheduled to start about Oct. 10, 1953.

Interest in the long-distance event reportedly has been expressed by high USAF and U. S. Navy officials. KLM Royal Dutch Airlines is said to have plans well along on its entry, which may encompass three different types of U. S.-built transports. A provisional entry also has been placed by Qantas Empire Airways which may put one of its new Super Connies in the transport handicap section.

Several British airlines and manufacturers are expected to enter jet and turborprop transport planes in the competition.

▶**Prizes**—Two sections have been set up: a speed section, in which entrants may utilize air-to-air refueling, and a transport handicap section designed to give small and large planes an equal chance to win.

There will be four cash prizes in each class, first prizes being approximately $28,000. Federation Aeronautique Internationale regulations are being followed.

Co-sponsor of the event is the Royal Aero Club. Information and entry blanks may be had by writing the Secretary-General, Royal Aero Club, 119 Piccadilly, London, W.1, or the Secretary-Treasurer, Canterbury International Air Race Council, Inc., 116 Hereford St., Christchurch, N. Z. Entries, in duplicate, must be returned by Jan. 31, 1953.

BEA 1951 Deficit Near $4 Million

Citing 1951 as "the most difficult year in its history," British European Airways Corp. has recorded a $3,986,110 deficit on operations ended Mar. 31, higher than the previous fiscal year loss of $2,741,947.

Blamed for it are sharply increased costs, delays in deliveries of new equipment and labor difficulties during the peak months of July and August.

A 7% increase in load factors and a 20% gain in revenue load ton-miles over the previous year was reported, however.

Revenues totaled $30,289,523, up 20% over a year ago.

Officials of the carrier believe that the coming year may be even tougher than the one just past. Some of the problems they face are bringing the Ambassador Elizabethan-class and turboprop Viscount Discovery-class airliners into service and equipping a new maintenance base in order to handle them.

U. S. Airline Subsidies

Domestic airline subsidies decline as international carriers' needs continue to rise:

	Domestic Systems	International, Territorial	Total Subsidy
1951	$36,130,000	$40,627,000	$76,757,000
1952	26,013,000	45,343,000	71,356,000
1953	25,621,000	44,982,000	70,603,000
1954	24,568,000	46,562,000	71,130,000

(CAB staff estimates)

CAB Cuts Estimated Subsidies

Domestic airlines' business has improved so much in the last year that CAB has cut estimates of their combined subsidy for fiscal 1952 and 1953 by $3 million. That is the highlight of CAB's revised report updating its original "Administrative Separation of Subsidy From Total Mail Payments" of last year.

It also shows that domestic subsidies will continue declining, while international, territorial and overseas airline subsidies must continue upward at least until 1954—latest year projected in the CAB staff study. The original international subsidy estimate came out this June (released in July), yet CAB already has cut its total estimate for 1952 and its 1953 estimate by about $250,000.

For the current fiscal year, ten trunklines will get no subsidy. Their final mail rates do not include subsidy, CAB says.

Total subsidy estimates for the remaining trunklines: $615,000 for C&S; $851,000 Colonial; $618,000 Continental; $391,000 Mid-Continent (the three months before Braniff merger), and $1,263,000 for Northeast.

Whereas the entire scheduled helicopter experiment (three lines) will cost only $1.5 million in service mail pay, most fixed-wing local service lines will get more than $1 million each in subsidy this fiscal year: Piedmont $1,632,000; Pioneer $1,799,000; Southwest $1,128,000; All-American $1,698,000; Frontier $2,805,000; Ozark $1,920,000; Southern $1,633,000; Trans-Texas $1,599,000; West Coast-Empire $1,572,000; Wisconsin-Central $1,861,000, and Central $1,615,000.

Locals estimated to get subsidies under $1 million are Bonanza $714,000; Lake Central $717,000, and Wiggins $323,000.

Copter services, hauling mail only, are figured as getting no subsidy—only compensatory mail pay. For fiscal 1953 this is estimated at $495,000 for Helicopter Air Service, $513,000 for Los Angeles Airways and $500,000 for New York Airways.

Global Service Is Planned by British

(McGraw-Hill World News)

London—An all-British service circling the globe may be in operation within two years. This is forecast by authoritative sources following discussions here between top government civil aviation officials of Great Britain and Australia.

British and Commonwealth operators feel that they could capture much of the growing round-the-world passenger traffic now going to U. S. lines. It is believed that the final decision will rest on giving American carriers right to operate in Australia in return for trans-U. S. privileges given to the British.

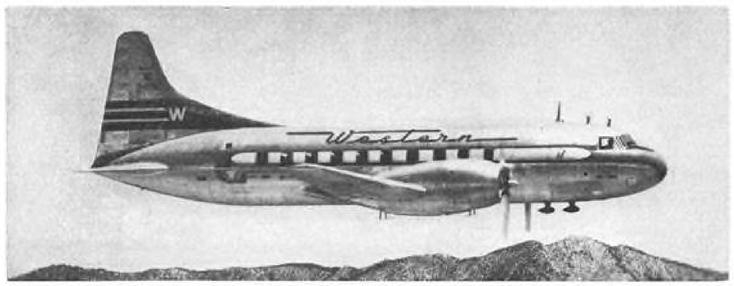
No concrete, final plan could be agreed upon because New Zealand's Minister for Civil Aviation was unable to attend the discussions. Further talks between the three governments are planned for a later date.

Two United 340s Are Damaged

United Air Lines first two Convair-Liner 340s have been damaged in pilot training landings.

Both accidents were during landings at Stapleton Airport, Denver, altitude 5,200 ft.

The first 340 plane hit ground before reaching the runway, resulting in major internal damage to the wing spar structure as well as bent landing gear and wrinkled fuselage skin. Cost is estimated at over $100,000. The second accident was a hard landing, producing skin wrinkle at the wing root.



WESTERN CONVAIR 240: Is it adequate to handle the heavy Las Vegas trade?

Western Faces New Route Setback

United and TWA are hot on the trail of WAL's prized Las Vegas-Los Angeles run.

Las Vegas, Nev.—Western Air Lines, recently deprived of its certificate to serve El Centro and Yuma, now faces loss of its exclusive right to the rich Las Vegas-Los Angeles trade.

Western's Route 13 stretches northeast out of Los Angeles across the Nevada desert before swinging north toward Salt Lake City and Canada.

The richest segment of Route 13 lies between Los Angeles and Las Vegas, for it links the heavily-populated Southern California area to one of its favorite playgrounds.

Seldom has an area offered better argument for air travel. The 335-mi. rail trip between the two cities takes 7-10 hr. and often is hot. By automobile it is a 6-7 hr. trip across the desert. Western's Convairs make the trip in 80 min.

▶ **Other Interests**—Since 1943 Western has held an exclusive franchise for the Los Angeles-Las Vegas run, which brings in some $1,235,000 annually, 8% of Western's total system revenue. It has flown the route since 1926.

Now both United and TWA want Western's shorthaul route opened to competition, with Bonanza Air Lines an extremely interested onlooker. A CAB hearing was held this summer and AVIATION WEEK recently conducted an on-the-spot survey.

Two interesting points stand out in the controversy:

- TWA and United, which stop at Las Vegas, already are competing with Western on the Los Angeles-Las Vegas run through the subterfuge of ticketing passengers beyond those two terminal points and then refunding the difference.
- Western faces strong opposition from the town which it helped build to a major resort center.

It is common knowledge in Las Vegas that if you cannot obtain a ticket to Los Angeles on Western, you can buy one on TWA or United to Long Beach for $1.15 more and obtain a refund for the difference upon arrival in Los Angeles. The system also is used in the opposite direction by purchasing tickets to points further east than Las Vegas. Both airlines admit the practice, and encourage it.

A Western representative disclosed that when no space is available on Western, would-be passengers sometimes are told about the subterfuge which permits them to travel on TWA and United to Los Angeles.

▶ **Little Damage**—What can CAB do to close the loophole? Very little, apparently. If a passenger knows about the subterfuge, there is nothing to stop him from using it. One Las Vegas travel agency owner says he has used the practice to ticket as high as 100 passengers a week to Los Angeles.

A top TWA official testified at the CAB hearing on the "almost absolute impracticability of ever enforcing the restriction."

It is obvious that neither TWA nor United can base its flight schedules or advertising upon such practice. Therefore traffic taking advantage of it is light and damage to Western comparatively small.

As long as the restriction remains in effect, it protects Western's near-monopoly of the traffic.

The question CAB must decide is whether it is in the public interest to continue that protection for Western. That brings up a second interesting point: Why is Las Vegas so unfriendly to Western, which has poured so much money into the town?

"The traffic now moving over the Las Vegas-Los Angeles segment is traffic which Western and Western alone pioneered, developed and helped promote, at considerable cost, time and effort," say Western officials.

▶ **Traffic Problem**—But popular resentment against the airline is strong in Las Vegas. The town offers a peculiar traffic problem. Static population is around 33,000. But there is a heavy tourist flow from Los Angeles on Fridays and a heavy flow back to California on Sundays. Many townspeople resent the fact that air reservations are difficult to obtain on weekends. Hotel people say they are considering charter flights to bring in guests because of Western's inability to handle the traffic.

The CAB hearing in June on application of the City of Las Vegas and the Las Vegas Chamber of Commerce for removal or modification of the restriction was marked with bitterness.

▶ **Hearing Flareup**—In one flareup, Western vice president Arthur Kelly told the CAB examiner: "Historically the position of TWA in Las Vegas is threaded with bad faith and backdoor tactics." Western also accused United Air Lines of moral breach of contract in seeking to have the restriction lifted after agreeing to it as a condition of the sale to United of Western's Route 68 Los Angeles-Denver in 1947.

United's reply: "The restriction was put in and was agreed to by United at a time when Western was in a very bad financial condition, and when it needed protection against competition if it was to survive financially. Since that time Western's condition has improved greatly and the protection is not needed, at least it is not needed to the extent required at that time."

▶ **Mayor Questioned**—Tenor of the CAB hearing was established by Mayor C. D. Baker in discussing the official action in filing an application for removal.

Asked if that action was taken after due deliberation by the board of commissioners and himself, the mayor replied that it was taken after receipt of numerous complaints from the public and licensed businesses.

▶ **Many Complaints**—The mayor's testimony was followed by complaints on Western service from the managers and public relations men of the major Las Vegas hotels, as well as private citizens.

Widespread anti-Western sentiment is plentiful in Las Vegas. Townspeople questioned complained of Western service. Western's defense includes the following points:

- Western helped develop the Las Vegas trade, has promoted travel to the city through advertising and is entitled to protection for its efforts.
- Western is providing adequate service as witnessed by the line's segment load factor since mid-1949 of less than 75% and the fact that between January 1948 and March 1952 Western increased the number of scheduled air seats available daily to Las Vegas traffic from 168 to 452, or 269%, an increase far greater than economic growth of Las Vegas for the same period.
- Complaints at the hearing were vague, indefinite and not convincing.
- Western would suffer financially to the public detriment through diversion of its traffic to UAL and TWA if the restriction were lifted.
- Such action would endanger the base of Western's route to Canada.

One telling point in Western's favor is the extreme overcrowding of hotel facilities in Las Vegas on weekends and holidays. "Even if we brought more people in here, they don't have any place to put them," one Western official pointed out.

Western flights to and from Las Vegas daily now total 14, following addition of four flights in August with planes available when the El Centro-Yuma segment closed down. Extra flights operate on weekends and holidays. Western contends it also has the equipment to handle any future expansion.

▶ **Bonanza Interested**—Although TWA and United have been the principal contenders, Bonanza Air Lines, with headquarters in Las Vegas, is considered another likely prospect for a Los Angeles-Las Vegas route in competition with Western (AVIATION WEEK Oct. 13, p. 92). Bonanza executives deny any interest in such a route but Las Vegas observers insist Bonanza wants the route to close the final gap on its circle from Las Vegas to Los Angeles by way of Phoenix and San Diego.

Three courses are open to the CAB in this case:

- Continue the restriction as it stands.
- Modify it to permit United and/or TWA to carry Los Angeles-Las Vegas passengers on that segment of their transcontinental runs.
- Eliminate it entirely, allowing United, TWA or Bonanza to compete with Western on shuttle runs between Los Angeles and Las Vegas.

Western officials, although protesting, are resigned to the probability of some change.

German Airline Courted by Allies

(McGraw-Hill World News)

London—British airliner manufacturers reportedly have been offering the Germans 30 planes, 15 turboprop Vickers Viscounts and 15 de Havilland Series 2 Comets, with deliveries during 1954-1955.

DH has denied the story, but the Vickers angle sounds feasible, especially since a Viscount only recently completed a demonstration tour of Germany.

The price for the 30 planes reputedly was set at some $61.5 million—higher than competitive offers by U. S. manufacturers. But the British do not require dollars in payment, and the Germans could use domestic kerosene in the planes instead of importing aviation gasoline.

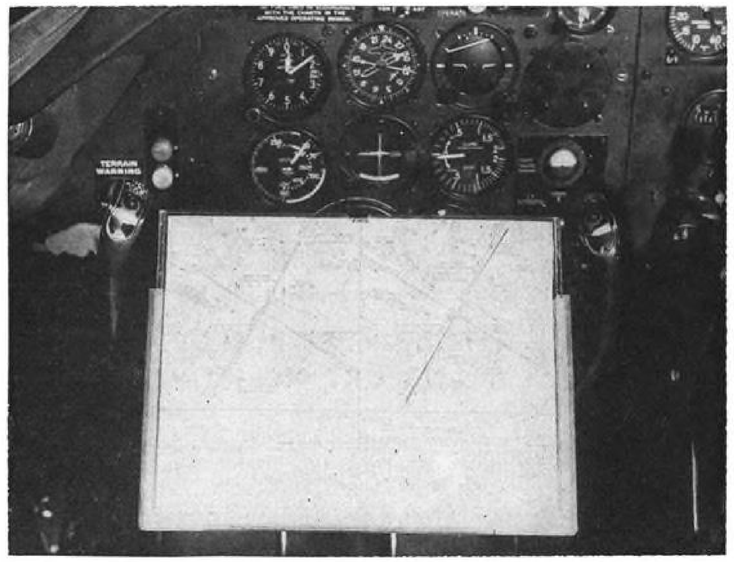
Competition to sell to the new market is growing. The Germans hope to get airline services started next spring using chartered or second-hand transports. The British are offering Dakotas (C-47s) and Vickers Vikings at "bargain-basement" prices.

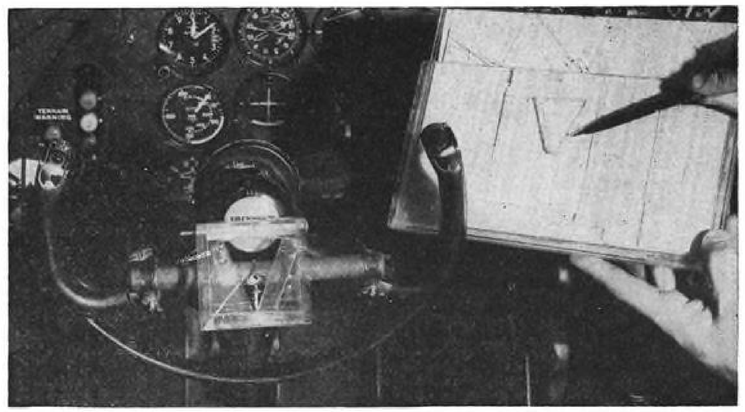
The Germans would like license rights to make one British or U. S. transport. One Briton threw cold water on the idea by stating that it will take the Germans ten years to renovate their aircraft industry. But some Germans are more optimistic—Messerschmitt reputedly is negotiating with the city of Essen to build an assembly plant which would employ 3,000 initially.

India May Nationalize

(McGraw-Hill World News)

The Indian Government reportedly is studying legislation that would bring about a compulsory merger of all existing domestic airlines in India and organize a corporation to run all internal air services. Although this legislation is unlikely to be presented to Parliament during its next session, a policy decision is expected to be taken shortly. The Air Transport Inquiry Committee has reported against nationalization for a period of at least five years.





VITAL CHARTS ALWAYS VISIBLE

This transparent chart holder has been devised by an airline pilot to keep necessary data in sight for ready reference while reading critical flight instruments during approaches and landings or en route. Top photo, taken from pilot's eye level, shows the Plexiglas holder affixed to 749 Connie wheel. Note instruments (background) are easily visible. Lower photo details the components. Inventor is O. M. Gove, Trans World Airlines' supervisor of flying, Atlantic region, N. Y.

SHORTLINES

▶ **Bonanza Airlines** plans excursion fares from Reno to Las Vegas and Hawthorne. . . . Has a final mail rate estimated by CAB to pay $727,948 a year, of which all but $13,000 is subsidy.

▶ **British Overseas Airways** is still studying in-flight refueling of the Comet, but reportedly cannot use it in near future because of commercial cost of refueling stations; equipment and operation is prohibitive unless a big airline fleet is using the service along a particular route.

▶ **Chicago & Southern** and TWA interchange service New York-Houston is urged by CAB bureau counsel, although examiner recommended consideration after CAB decision on the Delta-C & S merger. That merger would not alter interchange's merits, bureau counsel says.

▶ **Civil Aeronautics Board** investigators returning from the Apr. 29 PAA Stratocruiser crash site in Brazilian jungle report tail and rudder were five mi. from main wreckage "indicating that they had broken from aircraft in the air prior to ground impact." Furthermore, the undiscovered No. 2 engine and prop apparently must be even farther away.

▶ **Colonial Airlines'** stockholders approved the Eastern Air Lines merger agreement almost unanimously, whereas they barely failed of a two-thirds majority to approve a National Airlines merger. . . . Company merger hearings at CAB Oct. 27 will be full of fireworks when Eastern and National fight for CAB preference to buy Colonial. Observers see CAB bureau counsel favoring National.

▶ **East African Airways,** BOAC affiliate, is replacing its ten Lodestars with nine 28-seat DC-3s.

▶ **Iberia,** Spanish airline, plans a 3,263-mile nonstop route segment from Canary Islands to Puerto Rico using compound-engine Super Constellations. The plane has a maximum 3,920-mi. airline range plus normal full reserves, Lockheed says.

▶ **KLM Royal Dutch Airlines** has moved its North American division executive offices to Daily News Building, New York.

▶ **National Airlines'** annual stockholders meeting elected three new directors, replacing previous minority opposition group headed by W. K. Jacobs, who resigned after a proxy battle last June. New directors are J. W. Cross, J. C. Brawner and B. O. Hedges.

▶ **Pan American World Airways** has started "Super 6" DC-6B sleeperette service from N. Y. to Johannesburg, cutting 6½ hr. from its previous scheduled time on Constellations.

▶ **Pioneer Air Lines'** profit on DC-3 sales is an offset to subsidy need claimed by Pioneer in its application for an increased mail rate to carry Martin 2-0-2 costs, CAB bureau counsel and the Post Office argue. They say the sale was not "consummated" before Pioneer reopened its final mail rate. Pioneer claims that profit was free and clear before the mail rate had been reopened.

▶ **Slick Airways** expects CAB to fix a new freight charter rate above 73.9 cents a C-46 plane mile and near the old 77-cent rate. CAB allowed Flying Tiger to break the 77-cent rate because Navy requested it, Slick says.

▶ **Trans World Airlines** now operates six $99 transcontinental aircoach flights a day from New York—three to Los Angeles and three to San Francisco.

We desire personnel of the highest caliber—experienced in the field of airborne automatic electro-mechanical control equipment

★

ENGINEERS

MECHANICAL DESIGN
ELECTRONIC
SERVO

DESIGNERS-LAYOUT MEN

ELECTRONIC
MECHANICAL

This work deals with the manufacture and development of highly complex equipment of the most advanced type in a new and expanding division of an established firm with 20 years of successful experience in the precision instrument field.

We cite a few of the good reasons why you might like to join our organization . . .

SALARY increases are based on merit and initiative—two weeks VACATION, HOSPITALIZATION BENEFITS, GM's own INSURANCE PLAN—POSITIONS ARE PERMANENT due to long range manufacturing and developing programs—EXPENSES incident to interviews and moving all absorbed by company—HOUSING and LIVING CONDITIONS among the best and finest of any along Lake Michigan.

- **We have a Junior Engineering Training Program of one year for inexperienced engineering graduates. Opportunity to become acquainted with all phases of industry.**
- **For the convenience and direct use of engineers in our Engineering Department, we have our own model shop where highest skilled mechanics are employed.**
- **Educational opportunities for advanced degrees available at U. of W., Marquette, Technical engineering offered at Milwaukee Vocational School.**

. . . all inquiries answered—write or apply . . .

★ *AC SPARK PLUG DIVISION*

GENERAL MOTORS CORPORATION

1925 E. KENILWORTH PL. MILWAUKEE 2, WIS.

FLIGHT TEST *Engineers!*

Immediate openings available at all levels for flight test engineers and flight test analysts to work on long range piloted aircraft programs. One or more years of experience in flight testing or allied fields, and a degree in aeronautical or mechanical engineering required. Previous experience with high performance, jet-powered airplanes desirable.

These are salaried positions in our flight test section which is currently working a 48-hour week. Moving allowance provided. Liberal employee benefits include cost of living allowances. Rental housing available amid the excellent recreational and cultural facilities in the Dallas metropolitan area.

If interested in employment with America's oldest military airframe designer and builder, send resume to Engineering Personnel Section, Chance Vought Aircraft, P. O. Box 5907, Dallas, Texas.

CHANCE VOUGHT AIRCRAFT

Dallas, Texas

DIVISION OF UNITED AIRCRAFT CORPORATION

ENGINEER

Centrifugal Pump Experience Preferably Aircraft

LEAR, INCORPORATED
Romec Division
Abbe Road Elyria, Ohio

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

CO-PILOT: with instrument rating multi-engine rating minimum 2000 hours flight time. For corporate aircraft flying in Lodestar and twin-engine Beech based in Ohio. Salary equivalent to airlines co-pilot with 1 to 3 year seniority. Reply P-5598, Aviation Week.

ENGINE MECHANIC — Major overhaul and maintenance of R-985 engines. Murrayair, Limited, Honolulu Airport, Honolulu, T. H.

POSITIONS WANTED

EXECUTIVE ADMINISTRATIVE Pilot position desired. Age 40, with 14 years Airline Pilot experience, and 2 years of Quality Control. Over 13,000 Certified hours on all types equipment. Draft free and available immediately. PW-5580, Aviation Week.

FLIGHT ENGINEER 3600 hrs., 12 yrs. exp. in aviation. Age 34, also A & E lic. Will relocate. Write Box 639, Hempstead, L. I., N. Y.

PILOT OR CO-pilot with Private Corporation. 2000 hours Military and Airline. Single-Multi Instrument Ratings. Age 35. Will relocate. PW-5695, Aviation Week.

YOUNG ENGINEER (BSME) experienced in machine shop practice: plant engineering of chemical industry; currently operating general machine shop doing aircraft and ordnance work in Florida desires production, management, or engineering position with small, progressive, manufacturing industry or consultant firm in Los Angeles area. Reply to P.O. Box 2168 Sarasota, Florida.

WORK WANTED

Engineering Office Wishes Drafting & Design Work. Write to Engineering Drafting Service—38 Park Pl., Newark 2, N. J.

FOR SALE

D18S Beechcraft Executive Twin. Custom cabin for four. Complete ARC Radio, Auto-Pilot, new boots. Mfg. 1946. Total Time 3000 hours. Available for demonstration. Write or call Atlantic Aviation Service, Inc., Box 1709, Wilmington, Del. Tel New Castle 506.

Consolidated "Liberator" LB-30-Factory converted for passenger or cargo use. Large Cargo doors. Cargo floor. Long range, 3100 U. S. gals. Speed over 200 M.P.H. Three aircraft available. Completely overhauled and zero times throughout. FS-5627, Aviation Week.

Attention—Looking for a buy in a Lodestar? This ship formerly owned by a Major Oil Co. Ship hangared, and perfect condition. This is a once in a lifetime buy, don't write! wire immediately, this ship must be sold. No brokers please. FS-5641, Aviation Week.

WANTED

WANTED-AT-6 PROPS

12D40-211-6101A12 Complete Propeller Assys. 12D40-211 Prop Hubs and Hub Parts including 50384 Barrel Assy., 51458 Spider, 51430 Bracket, 51432 Ctwt., 51462 Barrel Support, 51433 Cyl. Assy., 50386 Piston, AN5009-40 Soap Ring, S-8501 Ctwt. Cap, 50220 Cyl. Head.

Also: 2D30-237 Prop Hubs
Also: AN5773-1 Engine Gauge Units

New or Overhauled & Certified Material OK.

COLLINS ENGINEERING COMPANY
9050 Washington Blvd., Culver City, Calif.
TExas 0-4811

RESEARCH AND DEVELOPMENT

forge the KEY to America's future in the AIR
take YOUR place . . . with GOODYEAR AIRCRAFT

The continued and steady growth of established research and development projects presents a number of unusual opportunities for outstanding and experienced men.

SCIENTISTS **ENGINEERS** **DESIGNERS**

Positions are available in our organization for qualified personnel in the following fields:

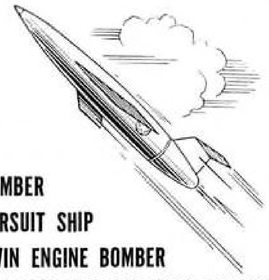
- Electrical Systems
- Circuit Analysis
- Analog Computers
- Servomechanisms
- Test Equipment
- Structures
- Aerodynamics
- Applied Mathematics
- Electronics
- Physics
- Stress Analysis
- Flight Test
- Missile Design
- Dynamics
- Microwaves

Openings also exist for welding engineers, civil engineers, and mechanical engineers with experience in metals fabrication; and for personnel with ability and experience in technical editing, art, and motion pictures.

Positions are available at several levels, and inquiries are also invited from recent graduates. Salaries are based on education, ability, and experience. Liberal salary, vacation, insurance, and retirement plans are yours if you qualify.

If YOU are interested in a secure future, write, giving full details, to
Mr. C. G. Jones, Salary Personnel Department.

GOODYEAR AIRCRAFT CORPORATION, 1210 Massillon Road, Akron 15, Ohio



1ST
- BOMBER
- PURSUIT SHIP
- TWIN ENGINE BOMBER
- AMERICAN AIRCRAFT POWER TURRET
- SUCCESSFUL AMERICAN DESIGNED HIGH ALTITUDE ROCKET

1ST IN OPPORTUNITY FOR ENGINEERS

Interesting Career Work On Guided Missiles, Rockets and Conventional Aircraft in—

STRUCTURAL DESIGN
Airframe and Mechanical

WEIGHT ENGINEERING
Analysis control and new design studies

Dynamics Analysis & Test
Vibration flutter and dynamics loads

Flight Test Instrumentation

Comprehensive background in AERONAUTICAL, MECHANICAL, CIVIL, ELECTRONIC, MATHEMATICS OR PHYSICS SPECIALTIES desirable for Senior and Group Engineer positions. Excellent opportunities also available for Jr. Engineers.

Submit confidential resume giving full details of education and experience. Personal interview will be arranged.

Martin

THE GLENN L. MARTIN CO.
301 Technical Employment
BALTIMORE 3, MD.

Pioneers in Aircraft since 1909

MC DONNELL AIRCRAFT CORPORATION

Invites you to . . . Build your future with a company . . . young in years, young in spirit and ideas.

Opportunities In Engineering
Design Engineers
Aerodynamicists
Servomechanism Engineers
Stress Analysts
Electronic Specialists

Manufacturing Positions
Production Planners
Field Representative—Purchasing
Methods Engineers
Master Planners

Tooling
Tool Designers
Tool Planners

Starting salary commensurate with experience background. Opportunity for advancement with quarterly salary reviews. Complete employee benefits.

Write to:
Technical Placement Supervisor
MC Donnell Aircraft Corporation
Box 516 St. Louis 3, Missouri
YOU'LL LIKE WORKING FOR M.A.C.!

TRANSONICS SUPERSONICS HYPERSONICS

Unusual opportunities for engineering specialists to associate with established firm in the design and development of the world's largest high speed test facilities and other interesting projects.

Trapsfers to operational phase optional as construction progresses.

Positions also available for Mechanical, Electrical, Instrumentation, and Structural Engineers.

SVERDRUP & PARCEL, INC.
Consulting Engineers
915 Olive, St. Louis 1, Missouri

DESIGN DRAFTSMAN

Centrifugal Pump Experience
Preferably Aircraft
LEAR, INCORPORATED
Romec Division
Abbe Road Elyria, Ohio

master scheduler

Several years' experience in the airframe industry. Must be familiar with statistics and uses of graphs, charts and learning curves in planning and scheduling of future production capabilities. Should be able to project and direct tooling labor and labor man-hour budgets.

LIBERAL MOVING ALLOWANCES

Send Complete Resume and Salary Requirements to:

EMPLOYMENT MANAGER
CHASE AIRCRAFT COMPANY, INC.
WEST TRENTON, NEW JERSEY

AIRCRAFT STOCK ROOM SUPERVISOR

Midwest executive transport operator requires man with airline or overhaul base experience in supervising receiving, shipping, warehousing, and materials scheduling activities. Give details of training, experience and salary requirements.

P-5693, Aviation Week
520 N. Michigan Ave., Chicago 11, Ill.

RADIO MAN

To repair and install aircraft radio equipment. Must have experience on Bendix, Collins, Lear, ARC. Vacation, excellent working conditions. High salary. Reply

P-5674, Aviation Week
330 W. 42 St., New York 36, N. Y.

WANTED:
SALES ENGINEER AND DISTRICT MANAGER
AERONAUTICAL EQUIPMENT
ROBBINS & ASSOCIATES
826 KNOTT BLDG., DAYTON 2, OHIO

Don't forget the
BOX NUMBER

When answering the classified advertisements in this magazine, don't forget to put the box number on your envelope. It's our only means of identifying the advertisement you are answering.

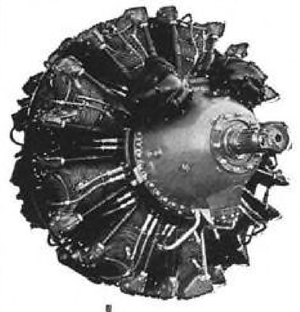
INSTRUMENTS

Authorized Factory Sales and Service
for
*** Eclipse–Pioneer**
*** Kollsman**
*** U. S. Gauge**

C.A.A. Approved Repair Station #3564
Contractors to U. S. Air Force
Our stock of instruments is one of the largest in the East.

IMMEDIATE DELIVERY
CALL • WIRE • WRITE

INSTRUMENT ASSOCIATES
Telephone: Great Neck 4-1147
351 Great Neck Road, Great Neck, N. Y.
Telegraph: WUX Great Neck, N. Y.



R-2800's 31's-51's-75's

prices, on request

These engines are 00:00 time since C.A.A. approved overhaul and have had ACES C.A.A. approved outside in lubrication system blower to thrust plates incorporated. They have also been block tested in our modern test cells and have been prepared for long term storage.

C.A.A. APPROVED OVERHAULS
- R 1340-AN-1 exchange only
- R-1830-92 ..... $2,700.00

ALL WORK AND ENGINE SALES CARRY OUR 100 hr. WARRANTY

AIR CARRIER ENGINE SERVICE Inc.
C.A.A. Approved Repair Station No. 3604
Intl. Airport Branch
P. O. Box 236, Miami 48, Florida
Cable "ACENGSER"

ACES AIR CARRIER ENGINE SERVICE, INC.

DC-3's

Several Former Scheduled Airline DC-3 Aircraft Are Now Available For Immediate Sale, Lease or Lease-Purchase.

Contact Owner Direct
KIRK KERKORIAN
Los Angeles Air Service
Municipal Airport
Hawthorne, Calif. Osborne 60411

EXECUTIVE TRANSPORT AIRCRAFT

DOUGLAS, LOCKHEED, BEECH, GRUMMAN, and CURTISS aircraft for sale. For top value executive aircraft call or write ATLANTIC AVIATION CORP., P. O. Box 146, Hasbrouck Heights, New Jersey. HA 8-1740. Complete aircraft maintenance facilities at Teterboro, N. J., and Logan Airport, Boston.

BUYING and SELLING ELASTIC STOP NUTS

ANY QUANTITIES
INDUSTRIAL BOLT & SUPPLY CO.
212 W. Bigelow Street
Newark 8, N. J. Bigelow 8-1666

HANGARS FOR SALE

All Steel packaged for shipment complete.
2 sizes: 194' x 200'—148' x 162'
Immediate Delivery—We erect anywhere

ANDERSON AIRCRAFT CORPORATION
1700 Sawtelle Blvd., Los Angeles 25, California
Bradshaw 2-1242 Arizona 3-2681

VARIABLE SPEED DRIVES
FREQUENCY CHANGERS
LOW-VOLTAGE GENERATORS
American ELECTRIC CORPORATION
DEPT. AW, Box 133, INDIANAPOLIS, IND.

FORMER
EASTERN AIRLINES DOUGLAS DC-3's
AVAILABLE FOR LEASE

We have available for immediate lease to corporations and airlines DC-3 Passenger and Cargo Airplanes. These aircraft are fully equipped for scheduled airline operation. Executive versions also available. Call on us for more information on the advantages of leasing. We can give you all the advantages of ownership without large capital expenditure. Let us show you the advantages of our corporate leasing plan. Our 20 years of aviation knowledge is at your disposal. Airplanes available for inspection at our Fort Wayne or Miami, Fla., base. Available with Wright or P & W engines.

BRANCH:
Miami, Fla.
1104 C of C Bldg.

EXECUTIVE AIR INC.
BAER FIELD • FORT WAYNE INDIANA
PHONE HARRISON 2145

MIAMI
Phone
9-1218

P & W R 2000 Engine Parts.

7-11-9-13

Cylinders • 50724 Valves
Piston Pins • Crank Cases
Crank Shafts • Prop. Shafts

New and Serviceable
TRANSPORT AIRCRAFT—ENGINES

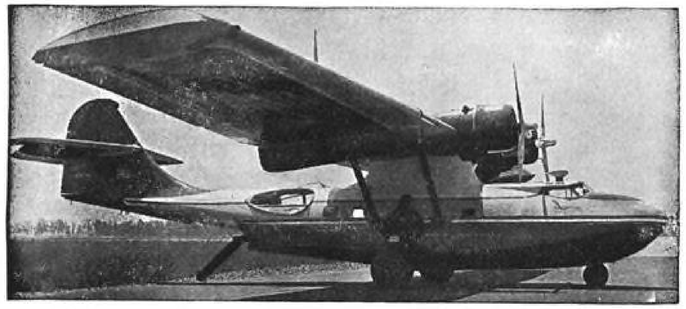
AIRLINE EQUIPMENT CORP.
Newark Airport, Newark, N.J.
MARKET 2-0963-4

LOCKHEED LODESTAR

Now in major overhaul. Can be finished your specifications. One of last built. R-1820 205A Engines.

ENGINEERING AND MANUFACTURING CORP.
P. O. Box 479
Galveston, Texas

PBY5A Specialists



Complete Overhaul & Maintenance of All Types of Aircraft

We have 15 complete PBY5A Aircraft Prices starting at $25,000.00 each

Southern California Aircraft Corp.

Box 433 *Ph: Ontario 6-3871* Ontario, Calif.

ONE STOP EXECUTIVE AIRCRAFT SERVICE

Major Rebuild — Authentic Integral Fuel Tank Sealing
Interiors — Radio Installations — Relicense

One of largest stocks of new Lodestar parts in the country

We can handle your work.

ENGINEERING and MANUFACTURING CORP.

P. O. Box 479 Galveston, Texas

LOCKHEED PV-1

Speed 260 mph (T.A.S.) - Range 1500 Mi.

We have several Lockheed PV-1 Venturas that are ready for immediate flyaway. They are now unconverted. Aircraft are very low time—one having a total of only 440 hours since new. These ships are in unusually fine condition. Will stand rigid inspection.

These Ships may be inspected at Fort Wayne, Baer Field

Call or Write

LEEWARD AERONAUTICAL

Fort Wayne, Ind. Ph. H-2145

FOR SALE

DC-3C—26 seats. Airline radio, heavy gear, large airstair door. 12V system. Aircraft TSO 5304:04, TT 8664:23. Engines P&W 1830-90D. Left 00:00 TSO, right 639:17 TSO. Low time props. Contact

LAKE CENTRAL AIRLINES, INC.

Weir Cook Airport

Indianapolis, Indiana Phone Belmont 2436

Speed Up Your Navion!!

Bring your ship to Palo Alto Airport, Palo Alto, Calif. or write this address for full details on new, CAA-approved, Tail Change Kit.

FOR—LEASE
OR SALE

C-46A

PASSENGER AND CARGO

EXECUTIVE AIR INC.

1104 C OF C BLDG. MIAMI, FLA.
Phone 9-1218

FOR SALE

PBY 5A

Presently being relicensed and recovered.
CAA licensing in accordance with Specification 28-5ACF
Total Airframe Time 1861:25 Hours
Left engine and propeller: 377:45 hrs. since overhaul
Right engine and propeller: 161:05 hrs. since overhaul
Major airframe overhaul accomplished at 1336:50 hours by Naval Aircraft Factory
24 Volt Electrical System with special 9 cubic foot airplane type refrigerator installation
Firewall modified and covered with Monel metal.
Both nacelles have firewall shut-off valve installation.
Flight engineer station removed from center section.
Write, phone or wire inquiries to

DASCOMP AIRCRAFT SALES CO.

100 Bush Street, San Francisco 4, Calif.
YUkon 6-6423

SPARKPLUGS

New:

C-35S-.40 ea. RC 35S-.60 ea. LE 44 -1.45 ea.
C-34S-.40 ea. RC 34S-.60 ea. RB 5/3-1.60 ea.
LS 86-.50 ea. LS 87 -.15 ea. LS 88 - .70 ea.

Overhauled like new, in our own shop

C-35S-.30 ea. RC 35S-.45 ea. C-26S-.55 ea.
C-34S-.30 ea. RC 34S-.45 ea. C-26 -.45 ea.
LS 86-.40 ea. LS 87 -.10 ea. LE 44-1.25 ea.
C-26S available in lots of 50 for .50 ea.
C-26 available in lots of 50 for .40 ea.

New Stromberg Mixture Controls

P/N A30041 P/N 382090
P/N A30117 P/N 395031
P/N 392281 $16.00 ea.

Pumps, relays, magnetos, component parts for mixture controls and mags are now available in our stock.

L & H SUPPLY

8202 Cedar Springs Dallas 9, Texas

BUYING OR SELLING

Either way our 28 years of experience and nation-wide contracts are at your service in Personal, Executive and Transport Aircraft.

JIM WELSCH
AIRCRAFT SALES
60 East 42nd Street, Suite 628
New York 17, New York Murray Hill 7-5884

FOR SALE
HILLER HELICOPTER

Model 360. Mfd. April, 1950 — Total Time 650 hours. Equipped with Improved Agricultural Spray System. Now in overhaul.

EAST COAST AVIATION CORPORATION
Lexington 73, Massachusetts

HAMILTON STANDARD
Propellers—Governors—Parts

LARGE INVENTORY
Advise Your Requirements
EDRAND AVIATION COMPANY
6111-12th Ave. So., Seattle, Wn.
LAnder 7871

FOR SALE
COMPLETE P&W INVENTORY
TOOLS - PARTS
R-1340 R-1830 R-2000 R-2800
Inquiries Invited
CAPITAL COMMERCIAL COMPANY
8731 West Third Street, Los Angeles 48, California

UNUSUAL OPPORTUNITIES

can be found each week in the

SEARCHLIGHT SECTION

WHAT DO YOU NEED?

Buy from one of America's largest stocks of

UNUSED AIRCRAFT PARTS

1500 COMPLETE UNITS OXYGEN BREATHING EQUIPMENT

For high altitude flying—new surplus—complete, ready for use. Manufactured for U. S. Navy. Available for inspection. Priced at a fraction of original cost.

AIRCRAFT ENGINES

WRIGHT

Quantity
1 R1820-52 Low total time since new
16 R1820-54 Low total time since new

Quantity
4 R1820-60 Low total time since new
4 R1820-62 NTSN

PRATT & WHITNEY
1 R1830-43 LTSO

750 OXYGEN and CO_2 CYLINDERS
Various Sizes—Shatter Proof
High pressure—with valves

1 CARLOAD
Miscellaneous Engine Parts for RANGER V-770

TURRET PARTS
Manufactured by or for General Electric
Control units—grips—motors
Amplidynes, etc.

500 LBS
Nichrome Alloy Wire 0031 enameled Manufactured by Driver-Harris Co.

MISCELLANEOUS COMPONENTS

(Many items in this group have not been listed in previous ads.)

Quantity	Part No.	Mfg.	Description
20	36001 0	Eclipse	Compass
11	14601-1F-81	Eclipse	Gyro Indicator
71	828TY13Z9	Weston	Oil Temp Indicator
26	897TY14Z9	Weston	Cyl Head Temp Indicator
40	119869	Weston	Carb Air Temp Indicator
10	15401 1	Eclipse	Amplifier (PB10)w ED3 MOUNT
66	10078-1AG	Eclipse	Gyro Indicator
69	CO-9	Eclipse	Clutch Switch (PB10)
20	12078 1	Eclipse	Amplifier (PB10)
57	MF45-3911-20Z	Vickers	Hydraulic Pump (3000PSI)
327	PF4-713-20BCE	Vickers	Hydraulic Pump
75	1416-12C	Eclipse	Starter
142	28008	Airesearch	Jack (Cowl FLAP)
6	12011 1	Eclipse	Transmitter
85	3123-3A	Eclipse	Warning Unit
45	AN4103-9	Clifford	Brass (Valve #U4785) Oil Cooler
190	MF9-713-15A	Vickers	Hydraulic Pump
550	TFD 8600	Thompson	Fuel Booster Pump
125	D7818	Adel	Anti-icer Pump
250	AN4014	Erie Meter	Wobble (D-3) Pump
1000	AN5780-2	G.E.	Wheel & Flap Position Indicator
400	AN5780-2	Weston	Wheel & Flap Position Indicator
115	P4CA2A	Parker	Primer
70	AN3213-1	Scintilla	Ignition Switch
450	A-9 (94-32226)	Nasco	Ignition Switch
90	JH950-R	Jack & Heinz	Starter Motor
53	AN6203-3	Bendix	Accumulator 10"-1500 P.S.I.
140	K14949E	Marquette	Windshield Wiper Kit
188	EYLC-2334	Barber-Colman	Control
11	12086-1C	Eclipse	Amplifier
250	558-1A	Eclipse	Oil Separator
100	716-3A	Eclipse	Generator (NEA-3A)
89	318	Edwards	Horn
230	921-B	Stewa t-Warner	Heater (200000 BTU)
97	6041H-146A	Cutler Hammer	Relay (B-12)
22	0655-D	Aro	Oxygen Regulator
65	ASDC2	CO2 Mfg. Co.	Fire Detector
384	564-2A	Eclipse	Oil Separator

PRATT AND WHITNEY AIRCRAFT ENGINE PARTS

Quantity	Part No.	Description
166	1045A	Bearing
500	3506	Flange
130	8288	Follower Ass'y
814	35814	Blower Ass'y
53	48362	Shaft
75	48363	Shaft
56	48392	Sump
390	48461	Gear
78	76936	Gear
1178	84289	Bearing
113	84487	Housing
77	84591C	Nose Housing
200	48350-D	Crankcase Ass'y
200	84083	Cylinder
100	84084	Cylinder
200	84085	Cylinder

CARBURETORS! MAGNETOS! SPARK PLUGS!

Quantity	Part No.	Description
247	PD12K10	Stromberg injection Carburetor
19	1375F	Holley carburetor
407	SF9LN-2 (manufacturer's part No. 10-12453-6 Spec. AN9511)	Bendix Scintilla Magneto
42	SF5RN-12 (manufacturer's part No. 10-26170-1)	Bendix Scintilla Magneto
185,000	LS4AD1	Spark Plug (Aero)

SPECIAL GROUP!

Ideal for tear-down for parts

Quantity	Part No.	Description
328	PD12K10	Stromberg injection carburetor
236	PR48-A1	Stromberg carburetor

43 PIECES ENGINE QUICK CHANGE UNITS Applicable to GRUMMAN FM-1 AIRCRAFT. COMPLETE with ACCESSORIES

2000 OIL COOLER ASSEMBLIES W/VALVES
From 5" to 16" diameter
Manufactured by Harrison Radiator Co. and United Aircraft Products

18 PIECES ENGINE QUICK CHANGE UNITS APPLICABLE TO CONSOLIDATED VULTEE B24D

We own and offer all parts listed—plus many thousands more—stocked in our Baltimore warehouse. Write for **FREE CATALOG** Please make your request on your company letterhead.

COMMERCIAL SURPLUS SALES CO.

4101 CURTIS AVENUE, BALTIMORE 26, MARYLAND TELEPHONE: CURTIS 3300

Miracle In New York

Here, right on page 1 of the Herald Tribune is the picture of an airline pilot! And, of all things, no crash story with it, no houses demolished, nobody killed. Am I seeing things?

The event was retirement of Eastern Air Lines Capt. Walt Shaffer, a 2-million miler, with a flying career dating back to 1915. The story described his early flying with the Lafayette Escadrille in World War I, his early air mail flights and service with ATC during the last war.

There have been other pilots to fly 2 million miles, remain active past 60 and never scratch a plane. Not many, of course, and I've rarely read about them in a newspaper; never on the front page of a New York paper. Things like this usually make the front page back home—it probably did in Atlanta, Capt. Shaffer's home. Good. But hometown and Atlanta, beggin' yo' pardon, is not New York.

Some 30 puzzled minutes later, past the sports pages and the daily bridge column, I reached another retirement story. This one, on page 35, was about the Cunard Lines Commodore George Cove, master of the Queen Elizabeth. This Captain was also retiring; stepping down after 47 years "in the cockpit" at the age of 62. Ordinarily, news of the largest vessels afloat, the glamorous Queens, would be headline news in New York where the natives turn out in droves to admire the beauties. But not today, not Oct. 1, 1952, the day of the miracle.

Exactly why the aviation story got the big play, I do not know. If it was Eastern's publicity department, fine; if the idea was all the Trib's finer still. The important thing is that a sensible story about a fine aviation achievement appeared, with picture, on page 1.

New York newspapers as a breed are no more for or against flying than those of any other city. They can, however, have a profound effect on public thinking, and at times during last winter they made it sound as if pilots were taking deliberate aim on women and children, that they delighted in flying low, with props in flat pitch at 3 a.m., and all sorts of horrible things.

The Herald Tribune deserves some sort of award of merit for this story. It has helped everyone connected with airplanes. Walt Shaffer, retired captain, 25-year safe pilot, also deserves one; he made possible a miracle in New York.

Pilot, 65, Ends 25 Years' Flying For Line; Not a Plane Scratched

Capt. Walter J. Shaffer

A sixty-five-year-old air line pilot, Capt. Walter J. Shaffer, retired yesterday from Eastern Air Lines after nearly twenty-five years with the line and its predecessor companies and a flying record that dates back to 1915 and includes service in two World Wars.

Capt. Shaffer, who the airline says "never scratched a plane" in all his service, covering about 2,000,000 air miles, began his retirement yesterday in Atlanta as he taxied to a stop after a flight from Indianapolis.

The veteran pilot is believed to be one of the oldest men in service on a regularly scheduled air line. The aviation industry itself is only forty-eight years old, dating from the Wright Brothers' first heavier-than-air flight at Kitty Hawk, N. C. on Dec. 17, 1903.

Capt. Shaffer began his flying career in the stick, wire and canvas era of early aviation, soloing in rickety pusher seaplane at Easington, Pa.

In World War I, he served with the Lafayette Escadrille, winning the Croix de Guerre with three palms and the Medaille Militaire. He was a major in the Air Transport Command, serving in the Pacific theater in 1944 and 1945.

Capt. Shaffer, who lives in Atlanta with his wife, Mrs. Gertrude Shaffer, and their two daughters, was married on Dec. 1, 1927. On the following day, he joined Pitcairn Aviation Corp., predecessor of Eastern Air Lines.

He was the pilot of the first passenger plane to fly from New York to Miami. He flew the first night mail planes between Washington and New York and between Philadelphia and New York.

From Page 1, New York Herald Tribune

WHAT'S NEW

Telling the Market

Thin self-locking nuts are described in a 26-page catalog detailing sizes, fits, part numbers, dimensions, tensile values, materials, packing quantities and weights. Write Standard Pressed Steel Co., Box 566, Jenkintown, Pa.

Analysis of plant layout methods, including two-dimensional paper cutouts, two-dimensional plastic templates, three-dimensional models and Repro-Templets and two-dimensional templates made of photo negative material, is available from Visual Equipment Planning Co., Inc., Pennsylvania Ave. at River, Oakmont, Pa.

Catalog 16 gives list prices and dimensional data on Setco and Zip-Grip set screws. Available from Set Screw & Mfg. Co., Bartlett, Ill.

New Addresses

Rears & Simpkins is a new firm offering representation at aircraft and engine manufacturers in the Midwest and at Wright-Patterson AFB. C. L. Rears has been with Douglas Aircraft Corp., Steel Products Co., and United Aircraft Products, Inc. J. R. Simpkins, a former USAF pilot, previously was a buyer at Wright-Patterson and in the sales department of United Aircraft Products. The manufacturers' service is located at 1026 Reibold Building, Dayton, Ohio.

Earl F. Slick has moved his office to 427 Reynolds Bldg., Winston-Salem N. C. Phone is 6138.

Whirlajet, Inc., maker of guided missile power supplies, has moved to new research and development labs at 21043 Wilmington Ave., Long Beach 10, Calif.

New Publications

Current listings of **civil aircraft owners** on basis of aircraft makes and models or engine makes and models or geographical distribution are being made available by Aircraft Owners and Pilots Assn. at standard rate of $25 per 1,000 names (minimum order $10). Specialized listings will be quoted. Address AOPA, Washington 14, D. C.

Fletcher Standard Aircraft Workers Manual, 8th edition, published by Fletcher Aircraft Corp., 190 W. Colorado Blvd., Pasadena 1, Calif., is completely rewritten version of book which has sold some quarter-million copies. A ready reference for mechanics and draftsmen, the publication is designed to aid the student or apprentice. Price $2.50.

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—OCTOBER 20, 1952

SEARCHLIGHT SECTION
(Classified Advertising)
H. E. Hilty, Mgr.

EDITORIAL

Spineless Pussyfooting

Some red-blooded officers in the Pentagon can hardly be blamed if they "boil over" privately at the two latest Russian outrages perpetrated on the U. S. Air Force on the same day, Oct. 8.

Two Russian jet fighters made menacing passes at an unarmed C-47 hospital plane flying between Frankfurt and Berlin. One fighter loosed machine gun bullets near the transport. Our hospital ship ducked into clouds and escaped undamaged.

In the north Japan area an unarmed B-29 disappeared. Radar observations indicated a non-UN plane intercepted the bomber's course just before the B-29 radar image disappeared and ground witnesses saw a plane fall into the sea, streaming smoke.

Earlier, two other U. S. planes disappeared near Russian borders. Later, posters appeared in Russia in connection with special awards to Russian pilots for "distinguished service." Was it coincidence that the planes pictured were the same types as the two planes we lost?

Unless these aircraft flew beyond Russian borders, which we doubt, we—like the men in the Pentagon, and many U. S. citizens—are wondering how much longer this nation will continue to accept this kind of atrocity so meekly? The more we take of this kind of stuff, the more of it we are likely to get, the Red Dictator's mentality being what it is.

There are many retaliations far short of war which we can and should take. Some would hurt Russia, commercially and otherwise, and a few of our respected military people believe this realistic response might ease the Communist trigger itch.

Our State Department-dominated government continues to run up an unenviable, unprecedented record of pussyfooting and appeasement, for the rest of the world to see. A spineless Administration capitalizes on our fears of war as an alibi for failing to uphold national honor and international law.

More Stalling Tactics

While Civil Aeronautics Board's Chairman invites public praise in his speeches for the Board's efforts in promoting aircoach service among the certificated airlines, his agency continues its perfect record for stalling on certificating even a single unsubsidized international airfreight carrier.

Last week, in the reopened U. S.-Middle East airfreight case, the Board decided once again to throw overboard the priceless time and the untold thousands of dollars spent by applicants and the Board itself in hearings once held and completed. It will start them all over.

It repeats its delaying tactics, which are so obvious in its current re-investigation of the nonscheduled coach passenger carrier problem, to determine if there is a "need" for this type of airline.

American Aviation Daily now says this proceeding will cost "millions of dollars" and will take four or five years, with the average total monthly cost for transcripts already running between $15,000 and $20,000.

This is how CAB saves public money. This is how it saves legal expenses of certificated as well as uncertificated airlines. This is how it hurries new coach service to the public. It is also one example of how rumors start or are kept freely circulating about CAB, and the extent of its public interest. Here is more new ammunition ready-made for gossip columnists and authors of such books as "How to Get Rich in Washington."

Our Transport Editor, F. Lee Moore says the Board's decision to reopen the Middle East airfreight case to all comers means at least another year's deliberation. The outlook at this moment is that the case will be slated for 1954 settlement!

Thus, foreign air carriers are given a clear field to increase their cargo leadership over the Atlantic, and the Defense Department, eager to build up the nation's airfreight fleet, can look forward to another case of too little and too late. Not to mention the public's interest in better and cheaper U. S. flag line freight service, that we believe could be offered by unsubsidized carriers.

Reporting on Air Safety

AVIATION WEEK's recent appointment of Alexander McSurely as Aviation Safety Editor has resulted in gratifying response.

Both the Aircraft Industries Assn. and the Air Transport Assn., for example, have circulated memoranda to safety people in manufacturing and airline companies announcing the appointment and urging cooperation.

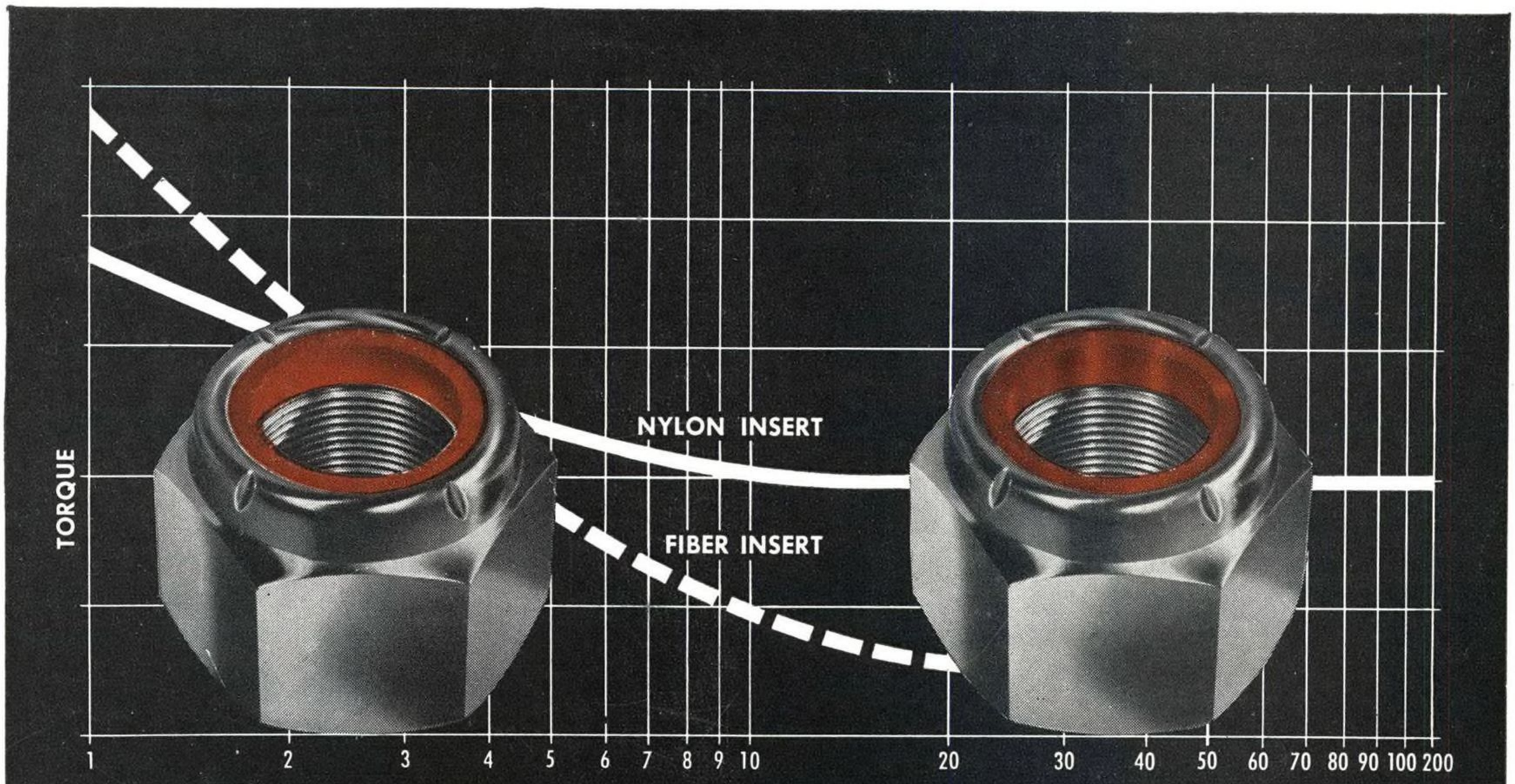
"For many years the AIA and ATA members, technical and management personnel, have deplored the tendency of the press to emphasize the industry's safety problems rather than its safety initiative and progress," E. W. Norris, Airworthiness Engineer of Boeing Airplane Co., wrote in a memo to fellow safety committee members, with other aircraft manufacturers.

"Such editorial and reporting policies have undoubtedly influenced critical attitudes in many legislators and have encouraged the expansion of federal regulatory activity," Norris said.

"Little can be done to prevent publication of air accidents and disasters. There is much to be done to counterbalance the effect of such publicity. Every manufacturer and operator has evolved many features or practices which are intended to reduce hazards and advance flight safety. Effective publicity on such features which originate in industry without compulsion can, I am convinced, reduce the trend toward mandatory detailed safety rules and regulation.

"A step in the direction of improved public, industrial and governmental relations for aviation has been taken by AVIATION WEEK in the designation of Alex McSurely as Aviation Safety Editor. By encouraging a long-range program of good reporting on the many worthwhile accomplishments in this field, we should help to create a less critical atmosphere in which to continue our cooperative efforts toward a more workable airworthiness regulatory system."

—Robert H. Wood



Elastic Stop Nuts with the fiber locking insert assure satisfactory locking torque characteristics for normal reusability requirements.

New nylon locking inserts, now available for any standard type or size of Elastic Stop Nut, will provide more than 200 re-use cycles.

How do you measure Reusability?

UP TO FIFTEEN TIMES?

For assemblies that must be locked in place, Elastic Stop Nuts with fiber locking inserts guarantee a permanently secure grip—plus ample reusability to cover most normal maintenance requirements.

For assemblies that must be disassembled and reassembled five, eight, ten, or more times during normal use, fiber insert Elastic Stop Nuts make the ideal self-locking fastener.

When an Elastic Stop Nut is run on a bolt, the Red Elastic Collar hugs the bolt—actually makes a skin-tight fit against the entire contact length of the threads—and this controlled torque firmly resists vibration or shock. When the Elastic Stop Nut is removed from the bolt, the natural resiliency of the Red Elastic Collar is your guarantee of continuing torque when the nut is reapplied.

MORE THAN FIFTEEN TIMES?

Now, for assemblies that require constant adjustment or frequent disassembly for checking and maintenance, ESNA offers all standard types and sizes of Elastic Stop Nuts with the new nylon locking inserts.

Reusable up to 200 times with remarkably constant torque characteristics, these new Elastic Stop Nuts offer the one-piece construction, the shock resistance, and the moisture-seal features that many manufacturers now depend upon in the standard Elastic Stop Nuts.

One of these Elastic Stop Nuts is probably the solution to your most troublesome fastener problem. It will pay you to look into the self-locking performance of Elastic Stop Nuts. For information, write for a new, free booklet. **Elastic Stop Nut Corporation of America,** 2330 Vauxhall Road, Union, New Jersey, Dept. N5-1025.

ESNA
TRADE MARK

ELASTIC STOP NUTS


HIGH TENSILE


ANCHOR


HIGH TEMPERATURE


SPLINE


CLINCH


GANG CHANNEL


NYLON CAP

NYLON AND FIBER INSERT TYPES ARE QUALIFIED TO SPEC. AN-N-5