AVIATION WEEK

OCT. 17, 1955

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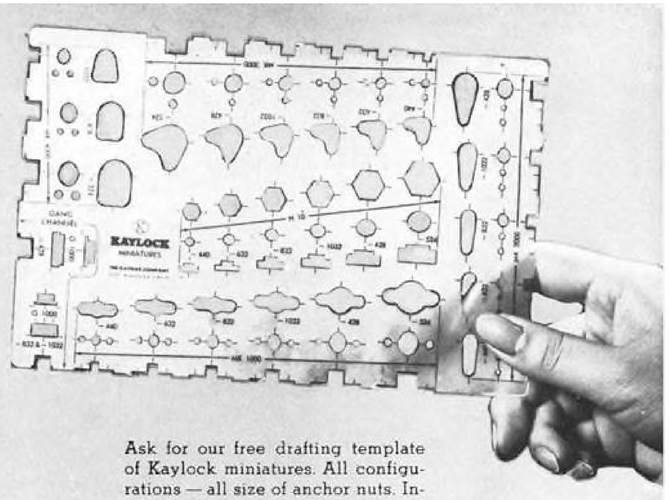

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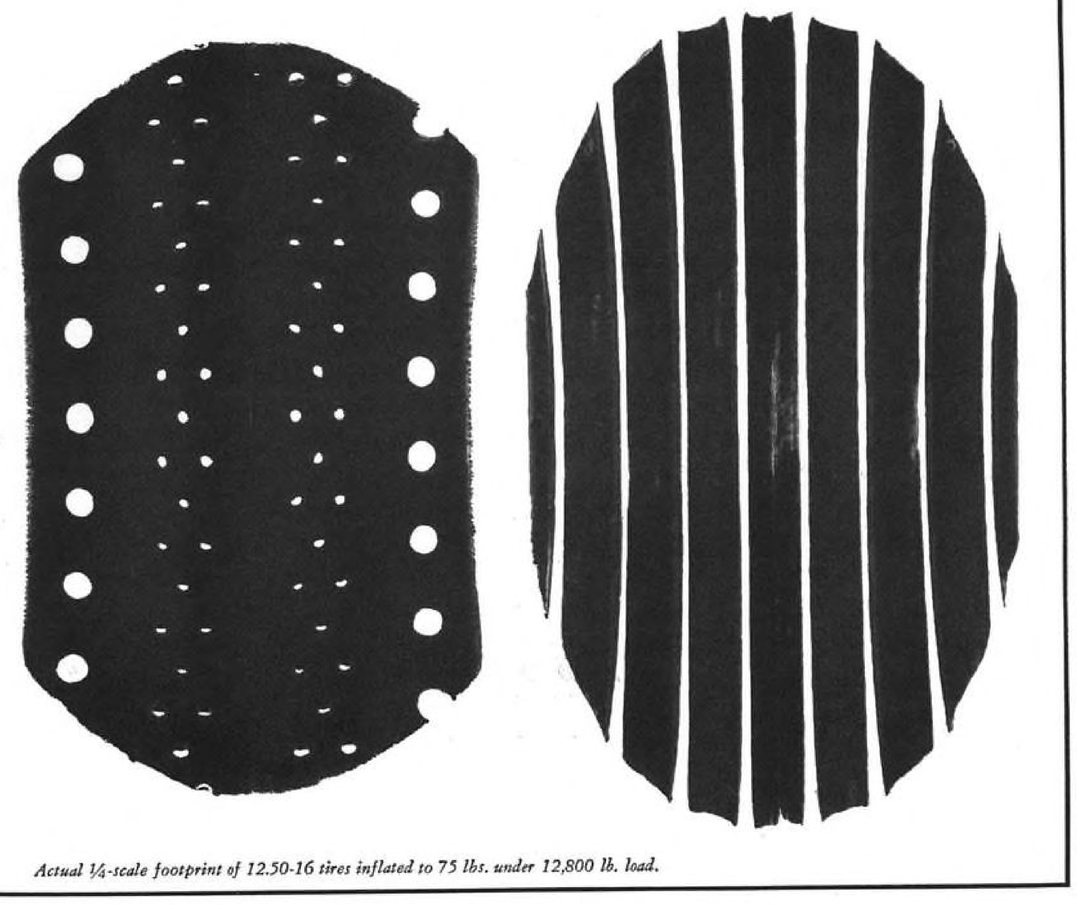
RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



Actual ¼-scale footprint of 12.50-16 tires inflated to 75 lbs. under 12,800 lb. load.

Which tread gives more landings . . . Dimpled or ribbed?

YOU CAN JUDGE a tire by its footprint. The B. F. Goodrich tread pattern on the left gives 10% more landings before recapping, on the average, than the ribbed design on the right!

Why? First, take a good look at the more compact, more rectangular footprint of the B. F. Goodrich Dimpled Tire. That's the result of an overall improvement: the tread profile of the Dimpled Tire is designed to put more tread rubber to work and to spread the load more evenly—shoulder to shoulder. Unlike the conventional ribbed tire which places most of the load on the center ribs, the shoulders of the BFG Dimpled Tire bear their fair share of the load.

Second, notice the most significant difference between the tread patterns—the use of cup-like indentations in the B. F. Goodrich Tire. This unique design further reduces wear because the tread rubber around each dimple is compressed under load—making it more stable and much more resistant to cuts and tears.

Like the first high-pressure Tubeless Tire and the first 300 mph Tubeless, the Dimpled Tire is another example of B. F. Goodrich leadership in research and engineering. Latest example: the first aviation Tubeless Tires in commercial service are Dimpled. *The B. F. Goodrich Company, Tire & Equipment Div., Aeronautical Sales, Akron, Ohio.*

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OCTOBER 17, 1955

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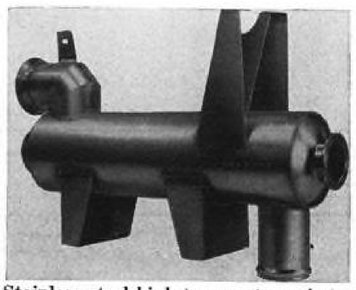


Stainless steel high temperature air-to-air heat exchanger. Clifford's ability to weld and braze stainless steel successfully, plus its unique test facilities gives the company unusual advantages in the new high temperature ranges of aircraft heat exchange applications.

Aircraft Heat Exchangers...

As performance requirements go up, Clifford's Wind Tunnel Laboratory assumes a major industry role.

The numerous heat exchangers illustrated on this page have one important thing in common. They all represent successful answers to heat transfer problems that hadn't been solved until Clifford's Wind Tunnel facilities were put to work.

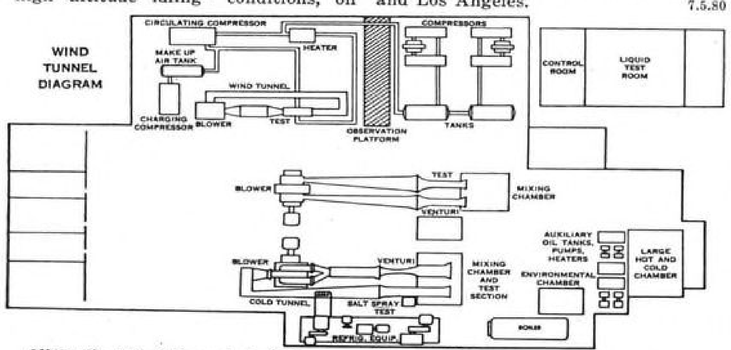
Each one of these heat exchangers represents a different problem — and some of them were highly unusual, involving designs featuring very high capacities within strict limits of space, weight and sometimes shape. In each case, Clifford designed and manufactured the thermal valves that control the oil flow, producing a complete "package" ready to mount for service.

Units have been developed for many different applications, including temperature control of engine lube oil, hydraulic system fluids, afterburner lubricant, cabin, cockpit, gun and camera compartments as well as wing and empennage anti-icing equipment. Recent work of interest includes special air type lube oil coolers for jets to meet "high altitude idling" conditions, oil coolers to meet the highly variable conditions encountered by helicopters in their changes of flight direction from vertical to horizontal. The problems of rocket flight, missiles and the temperature control of avionic equipment are currently receiving attention. The company is also deep into the unusual problems of heat exchange involving the handling of molten metals for atomic energy applications.

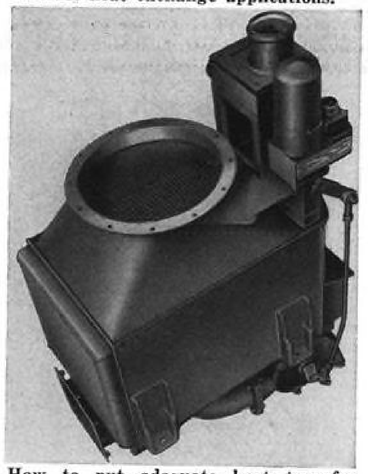
In all these areas, Clifford's unmatched facilities for development and design plus production capacity to provide heat exchangers in needed quantities is your finest assurance of securing the best solution to your problem.

A letter or phone call will put the world's most completely equipped technical facility of its kind to work on *your* problem. Clifford Manufacturing Company, 152 Grove Street, Waltham 54, Mass. *Division of Standard-Thomson Corporation.*

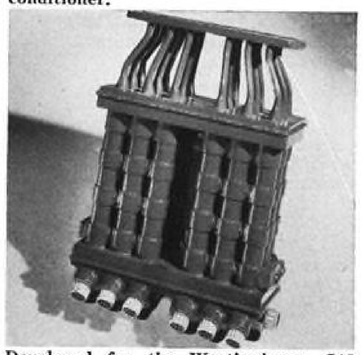
Telephone: WAltham 5-7310. Branch offices in New York, Detroit, Chicago and Los Angeles. 7.5.80



Clifford's Wind Tunnel facilities provide capabilities for accurately reproducing the conditions encountered by aircraft in actual service on any part of the globe and at altitudes from sea level to 80,000 feet.



How to put adequate heat transfer capacity into a restricted space in Republic's RF84F camera compartment to prevent camera port fogging was the problem solved by this Clifford air conditioner.



Developed for the Westinghouse J46 turbojet engine, this oil cooler was first to employ the vaporizing principle in lube oil cooling service. It provided greater heat rejection capacity per unit of fuel flow than ever previously attained.

Both 707s and DC-8s

PAA Orders First U. S. Turbojet Fleet

Pan American World Airways last week signed contracts totaling $269 million for the first major American turbojet airline fleet, ordering 25 Douglas DC-8s and 20 Boeing 707s.

Boeing's Jet Stratoliners will be delivered first, beginning in December 1958. Within five months thereafter, Pan American says it will place these American-built, American powered transports in service on its trans-Atlantic, South American and trans-Pacific routes. Boeing will complete its deliveries by Nov. 1959.

Deliveries of the Douglas jet airliners are scheduled to begin in December 1959 and to be completed by January 1961.

Both aircraft will provide 550 mph. transocean and transcontinental service. The 707, larger and faster than the prototype now flying, will have a range of more than 5,000 miles nonstop. Douglas states that the DC-8 will be "capable of nonstop operations in either direction between New York and London or Paris against headwinds."

Both are designed to cruise up to Mach .88, and the contracts guarantee cruising speeds of 575 mph. at 30,000 ft. altitude.

Pan American lists these potential flight times with the new jet airliners: New York to Paris, 6 hr. 35 min.; New York to Buenos Aires, 11 hr., 15 min.; Chicago to London, 6 hr., 45 min.; Tokyo to Seattle, 8 hr., 32 min. and Honolulu to San Francisco, 4 hr., 30 min.

The Boeing 707s, powered by Pratt & Whitney J57 engines, will carry 104 passengers in standard (first class) configuration and 125 in tourist. Each airplane will cost just under $7 million.

Douglas' DC-8, with a wing area approximately 7% greater than the 707, is designed to carry 108 passengers in standard seating arrangements or 131 tourist class passengers. Pan American says the DC-8 will have "slightly greater range and will be equipped with a larger type Pratt & Whitney jet turbine engine," the P&W J75 (commercial designation, JT4).

Douglas said that its August announcement of the DC-8 performance was based on the J-57, but "the Pan American planes covered by the present contract are designed to utilize jet engines of even greater power and versatility as and when they become available for commercial use."

The DC-8 purchase calls for expenditures in excess of $160 million for the 25 aircraft and spares.

Jet turbine silencers and reverse thrust mechanisms will be installed. With the silencers, Juan T. Trippe, president of PAA, says, "The new jets will make little more noise on the ground than present piston-engined planes." Reverse thrust will be used for braking effect after landing.

The order for jet airliners does not effect the existing $88 million order for 33 DC-7Cs with turbo-compound engines. The first of these will be delivered in the spring.

The combined commitments, totaling $357 million for new flight equipment, are "evidence of Pan American's faith and confidence in the continued expansion of sound two-way international trade as well as greatly increased tourist travel between the United States and the 74 friendly foreign nations which are regularly served by the Pan American Clippers," Trippe stated.

Pan American is non-committal about its long-standing, and perhaps still existing, order for de Havilland Comet 3s. In a statement to AVIATION WEEK, the company said: "PAA has a continuing interest in the de Havilland jet program. Certain confidential written understandings exist between the two companies looking toward a successful outcome."

NEWS DIGEST

U. S. Navy last week grounded the North American FJ-3 Fury jet fighter pending modification of its Wright J65 turbojet engine to prevent overheating.

Convair is discussing a 500 mph. turboprop airliner with Canadair (another General Dynamics division) and Bristol Aeroplane Co. The design for delivery in 1960 probably, is the advanced, thin-wing version of the Bristol Britannia (AW Oct. 25, 1954, p. 13). It will be powered by the Bristol B. E. 25 engine. Canadair is building a military reconnaissance version of the Britannia for RCAF.

A new and complete helicopter control system providing full all-weather operating capability has been developed by Sperry Gyroscope Co., division of the Sperry-Rand Corp. Sperry has just received clearance from USAF to announce details.

United Air Lines September traffic reached a new record for the month with 386,982,000 revenue passenger-miles and 9,693,000 plane-miles, 18 and 19% increases respectively over the same period last year. Freight shipments were up 35% to 4,098,000 ton-miles, express up 27% to 1,276,000 ton-miles and mail up 6% to 2,007,000 ton-miles. Late summer vacationists and school returnees are credited for the traffic increases.

Slick Airways carried a record 4,320,379 ton-miles of airfreight on domestic scheduled service in September, 14% more than the same month last year. Figure does not include the carrier's domestic and overseas charter flights. George M. Bain, Slick executive vice president, predicts a 30% increase in the airline's volume this year over 1954 and a 20% increase in airfreight for all airlines.

Wright Brothers Lecture will be delivered by Raymond L. Bisplinghoff on Dec. 17 in the auditorium of the U. S. Chamber of Commerce Building, Washington, D. C. The lecture is sponsored by The Institute of the Aeronautical Sciences.

Elastic Stop Nut Corp. of America reports $1,101,756 profit after federal taxes for nine months ended Aug. 31. Net sales totaled $14,941,443 compared with $17,086,429 for the same period last year. Firm has voted a 25 cents common dividend payable Nov. 1 to holders of record Oct. 15.

Prototype Saab delta fighter, reportedly capable of 1,000-mph. speeds, is scheduled to fly soon at Linkoping, Sweden. Developed as a result of flight studies with the tiny half-scale Saab Draken, the new multi-engine fighter is about 50 ft. long and has a span of approximately 35 ft. According to present estimates, orders for the delta will total some $150 million and is designed to provide the backbone of the Swedish Air Force in the late 1950s and early 1960s.

Bendix Radio settled its 39-day old strike last week by giving the International Association of Machinists (AFL) a six cents hourly raise with another six cent increase to follow in September 1956. The settlement, which may serve as a pattern for at least part of the avionics industry, included a seventh paid holiday and improved pension and insurance plans.

AVIATION CALENDAR

Oct. 18-19—Seventh annual Aerial Dusting and Spraying Conference, sponsored by the Washington State Aeronautical Commission and the State College of Washington, Wenatchee, Wash.

Oct. 20-21—Sixth annual National Noise Abatement Symposium, Armour Research Foundation, Chicago.

Oct. 24-25—Institute of Radio Engineers' Professional Group on Electronic Devices, first annual Technical Meeting, Shoreham Hotel, Washington, D. C.

Oct. 25-27—Technical Conference on Aircraft Electrical Applications, American Institute of Electrical Engineers, Hollywood-Roosevelt Hotel, Los Angeles.

Oct. 26—Airwork-AC Aviation Spark Plug Clinic, at International Aviation Industries, Inc., Westchester County Airport, White Plains, N. Y.

Oct. 26-28—Southwestern Airport Managers' Assn., annual meeting, Greenville, S. C.

Oct. 27-28—Aircraft Electrical Society, 12th annual display, Pan Pacific Auditorium, Los Angeles.

Oct. 30—Second annual Topeka Aviation Day, Topeka, Kan.

Oct. 31-Nov. 1—Institute of Radio Engineers, 1955 East Coast Conference on Aeronautical and Navigational Electronics, Lord Baltimore Hotel, Baltimore.

Oct. 31-Nov. 2—Society of Automotive Engineers, Golden Anniversary Transportation Meeting, Chase Hotel, St. Louis.

Nov. 2-4—Society of Automotive Engineers, Golden Diesel Engine Meeting, Chase Hotel, St. Louis, Mo.

Nov. 3-4—Institute of the Aeronautical Sciences and Canadian Aeronautical Institute, second annual joint meeting, Chateau Laurier, Ottawa, Ont., Canada.

Nov. 8-10—National Aviation Trades Assn., annual convention, Hotel Westward Ho, Phoenix, Ariz.

Nov. 9-10—Society of Automotive Engineers, Golden Anniversary Fuels & Lubricants Meeting, Bellevue-Stratford Hotel, Philadelphia.

Nov. 9-11—Industrial Management Society, 19th annual time, motion study, management clinics, Hotel Sherman, Chicago.

Nov. 13-18—American Society of Mechanical Engineers & American Rocket Society, annual convention, Congress, Hilton and Blackstone Hotels, Chicago.

Nov. 14-15—Aviation Distributors & Manufacturers Assn., 26th meeting, El Mirador Hotel, Palm Springs, Calif.

Nov. 14-17—Second International Automation Exposition, Navy Pier, Chicago.

Nov. 16-18—Society for Experimental Stress Analysis, annual meeting, Hotel Sheraton, Chicago.

Dec. 2-3—Eighth Annual Aviation Conference & Flight Clinic, sponsored by Tucson Chamber of Commerce and Tucson Airport Authority, Tucson, Ariz.

Dec. 6-7—Professional Race Pilots' Assn., convention, Carter Hotel, Cleveland.

Dec. 12-17—Nuclear Congress and Atomic Exposition, sponsored by Engineers Joint Council, Cleveland Municipal Auditorium.

PICTURE CREDITS

29—Howard Levy.

WHO'S WHERE

In the Front Office

Lloyd E. Schumacher, vice president-sales and customer relations of the T. B. Rea Co., Inc. **Daniel T. Gundersen**, vice president-engineering and production.

E. F. Giguere, vice president-sales of Transistor Products, Inc.

A. H. Hardwick, vice president of International Resistance Co.

W. M. Clough, vice president-general manager of Mason Electric Corp.

George W. Baughman, vice president-general manager of Union Switch & Signal, Div. of Westinghouse Air Brake Co. Other changes: **Dr. F. E. Lowance**, director of research and engineering; **E. F. Brinker**, manager of research and development; **D. P. Fitzsimmons**, assistant manager of research and development.

Thomas J. Hargrave, board member of Westinghouse Electric Corp.

Whitney Straight, executive vice chairman of the board of Rolls-Royce Ltd., Derby, England.

A. E. Underwood, board member of Plessey Co., Ltd., Ilford, Essex, England.

Honors and Elections

Alexander Kartveli, vice president and chief engineer of Republic Aviation Corp., received honorary doctor of engineering degree from the Polytechnic Institute of Brooklyn.

Frederick B. Lee, CAA administrator, received a special citation from the National Business Aircraft Association for distinguished service in the advancement of civil aviation.

Peter F. Hurst, president and general manager of Aeroquip Corp. and **William P. Lear**, chairman of the board and director of research of Lear, Inc., became members of Tau Beta Pi, National Honorary Society.

Changes

Adm. Robert B. Carney (USN-Ret.), consultant to Westinghouse Electric Corp.

Charles E. Davy, consultant at Aluminum Industries, Inc., Cincinnati, Ohio.

Dr. Franklin Kingston Moore, chief of aerodynamic research dept. at Cornell Aeronautical Laboratory, Inc.

R. V. Lynch, sales and service manager of Chance Vought Aircraft, Inc.

Robert T. Hamlett, publication director of Sperry Gyroscope Co., Div. of Sperry Rand Corp.

G. D. Mole, project engineer-engines of Smiths Aircraft Instruments Ltd., London, England.

Allan A. Barrie, general manager of Iranian Airways.

Leslie G. S. Hyland, commercial manager of British West Indian Airways.

W. V. Phillips, chief of industrial relations of the Beverly Hills Electronic Equipments Div. of Litton Industries.

Charles C. Snider, field sales manager of Consolidated Engineering Corp.

(Continued on page 107)

INDUSTRY OBSERVER

► North American Aviation has been picked to build the rocket powered piloted research aircraft to explore altitudes above 100 miles (520,000 ft.). Project is a continuation of the joint USAF-Navy-NACA research aircraft program. Bell Aircraft Corp. and Douglas Aircraft, which have built most of the earlier supersonic research aircraft, were also contenders for the high altitude job.

► **USAF is considering organization of a second intercontinental ballistics missile project as a back-up for the Atlas project now under way. Lockheed, Douglas and Martin are under consideration as possible weapon system managers for the new project.**

► Curtiss-Wright has been informed by USAF that no production versions of its J67 twin spool 12,000 lb. thrust turbojet will be ordered. Experimental J67s will be used in the Republic Aviation F-103 experimental high speed aircraft.

► **Glenn L. Martin Co. will soon roll out the B-57D with two Pratt & Whitney J57 turbojets replacing the Wright J65 Sapphires. Engine nacelles have been enlarged to accommodate the more powerful, larger and heavier J57. New nacelles jut well forward of the aircraft wing.**

► Air Defense Command is now planning to use the Lockheed F-104 supersonic day fighter as its inner defense aircraft.

► **Marquardt Aircraft Co. is experimenting with solid propellents for ramjet fuel.**

► French SS-10 air to surface missiles are being flight tested in a Dassault 315 Flamant twin engine transport. Tests are aimed at adapting the missiles to the Dassault fighter series.

► **Watch for another attempt on the world altitude record, this time by a Rolls-Royce Avon-powered Canberra P.R. 9 which has more wing area than the earlier Canberra used as an Olympus test bed for the 65,876 ft. record flight. The Rolls-Canberra combination would have to top 68,000 ft. to beat the record by the necessary 3%.**

► De Havilland 110 and Vickers Supermarine 113, under development as advanced fighters for the Royal Navy, will not be able to operate from Hermes or Colossus class carriers. They are too heavy for existing arresting gear.

► **Handley Page Victor has unique aileron control system installed in its thin wing. Conventional push rods operate a helical cam in a torque tube which is also the aileron main spar. Lateral motion of the rods produces torsional motion on the spar and therefore deflection of the aileron.**

► Capital Airlines will take delivery of another three Vickers Viscount turboprop transports in November with additional deliveries to follow at a rate of three per month for the next 12 months. By the end of 1956, Capital expects to operate 42 Viscounts with the balance of its fleet of 60 order to be delivered in 1957.

► **General Electric J79 turbojet, already scheduled for the Lockheed F-104 fighter and the Convair B-58 supersonic bomber, is now under consideration for advanced versions of other century series fighters and in Navy aircraft. Twin J79 installation is being considered for interceptor version of the McDonnell F-101 Voodoo replacing the twin J57s now being used.**

► **General Mills has expanded its "Skyhook" plastic balloon business (AW Oct. 10, p. 45) from $100,000 to $6 million in last eight years. The company makes 5,000 to 6,000 high altitude balloons and 500,000 smaller propaganda balloons per year. General Mills is developing a system for using its "Skyhook" plastic balloons to track hurricanes.**

Washington Roundup

USAF Policy Speeches

Fall speech-making season for top Air Force executives is in full swing, with signs that USAF public relations policy tends toward frank discussion of its problems at home and abroad. Here were their views last week:

• **USAF Secretary Donald A. Quarles** discounted recent fears that GOP economy measures would curtail U. S. air power. He said: "There never was any question of abandoning our 137-wing program. Secretary Wilson is as determined as any man I know to develop and to maintain the best possible Air Force program." Quarles also warned the free world it cannot relax because of peace talk, or it will find itself with an inferior air arm.

• **General Nathan F. Twining,** Chief of Staff, said the Russians have numerical superiority over USAF but are not ahead of us in total air power. He said the Reds have more fighters than we have and their performance compares favorably with that of U. S. fighters; they outnumber us in light jet bombers but we have "many times more B-47s than the Soviets have Badgers." U. S. and Russia are about even in the heavy bomber field, where the B-52 is compared with the Red Bison. The B-36, once under bitter attack by the Navy and starting to phase out, "perhaps more than any other factor has kept us from being attacked."

• **General Thomas D. White,** Vice Chief of Staff, in the most provocative speech, said that once the nuclear-aircraft engine is perfected as a power unit, the seaplane may join the Air Force as a water-based bomber.

"It is conceivable," Gen. White said, "that a nuclear powered, water-based aircraft may become an effective bomber, suitable for the Air Force's wartime strategic bombing mission.

"Formerly, of course, water-based aircraft had neither the performance nor the capability to be used as Air Force bombers. However, new engine developments may enable the water-based bomber to take its place alongside other Air Force airplanes and missiles."

It was generally assumed that Gen. White's statement is related to U. S. Navy's reported success in early flying tests with the new Martin P6M SeaMaster, jet flying boat. Navy enthusiasts already have pictured the P6M as a nuclear bomb-carrying aircraft, part of a nautical team for modern warfare, including submarines and the new giant Forrestal-class carrier.

The Martin company also is working on new types of equipment for ground handling of seaplanes, including beaching and drydock facilities that will be ready for Navy tests in the near future (AW Oct. 3, p. 13).

Gen. White's note of caution regarding performance is consistent with USAF's policy that "effective weapons —not scientific novelties" must result from any procurement program. He said nuclear-powered aircraft will be flying within the next ten years, but added:

"I must emphasize that in developing both the intercontinental missile and the nuclear-powered airplane, we could have them both sooner if we were willing to accept more gambles and less effective performance."

Major value of the nuclear-powered aircraft, Gen. White said, will be its unlimited range and endurance, which will widen USAF's choice of tactics. It would permit retaliation against an aggressor from any direction and increase the enemy's defense task. In addition, it would be an answer to the enemy's long range missile.

"Theoretically," he said, "we could keep a large proportion of an atom-powered retaliatory force airborne all the time. It could be positioned to accomplish its mission immediately if an enemy were to launch an attack.

"Airborne and relatively invulnerable, it could be even as effective a deterrent as an intercontinental ballistics missile."

Gen. White emphasized that recent Soviet developments in the field of long range bombers has made America's air defense more important, with the size of USAF's job "related to Soviet airpower and its potential capability for aggression.

"For instance, we need enough radars, fighter interceptors, and air defense missiles to effectively blunt the largest attack an enemy is capable of mounting.

"The bomber production of a potential attacker is a factor in determining the number of air defense interceptors and radars we need. Whether he has 1,000 more or 1,000 fewer interceptors than we do is meaningless in our air defense problem because interceptors do not fight interceptors.

"The number of his interceptors is important, however, in determining the number of offensive airplanes we would need for success in our retaliatory attacks," Gen. White said.

Army Loses Round

Watch for Army aviation proponents to press next for revision of the three-year-old "memorandum of understanding" that restricts size and types of aircraft it can use. Air Force insistence that combat support is one of its missions recently led Defense Department to refuse Army request for a few T-37 jet trainers for evaluation in liaison and reconnaissance role. USAF also fears traffic problems if ground forces start sending their own jets out on missions in the midst of battle where they could tangle with fighters out to bomb or strafe enemy troops. USAF now has agreed to lend the Army some planes for tests, but is prepared to stand firm against changes in the memorandum.

Defense Contractors

The report on the 100 largest defense contractors released last week by the Senate Preparedness Investigating Subcommittee (see p. 16) is only a first, preliminary report. There will be other reports shortly dealing with different aspects of the concentration of military business, and the procurement policies Defense Department has followed with big companies.

Senate Banking and Currency Committee headed by Sen. William Fulbright (D-Ark.) is standing by until the investigating subcommittee completes its studies. This committee's interest is the effect defense business has had on the economy in general and the stock market.

Airfields Down Under

Air Force specialists have departed for Australia and New Zealand to study airfields there to determine if they are adequate for use by RB-36 observation planes which will make weather flights over the Antarctic. Included in the party were personnel from Strategic Air Command Headquarters.

—Washington staff

AVIATION WEEK VOL. 63, NO. 16
OCTOBER 17, 1955

USAF Will Give Industry Secret Plans

ARDC will furnish firms advance technical data in effort to speed weapon system developments.

By Claude Witze

Washington—USAF's Air Research & Development Command, joining in the current effort to stimulate new weapon systems contributions by the aircraft industry, is preparing to release its secret Technical Program Planning Documents to a select list of contractors.

The program, not yet completed but due to get under way before the end of 1955, will be started on a "trail balloon" basis with a list of about 100 selected companies, universities and government agencies.

It will mark the first time secret USAF information on the military problems to be faced over the next 10 to 15 years, present capabilities, possibilities and requirements has been made available to the industry.

Full details on the program will be disclosed by Brig. Gen. Thomas L. Bryan, Commander of Wright Air Development Center, at a national meeting of the Institute of Aeronautical Sciences in Dayton, Ohio, Nov. 8.

Policy Implementation

Major importance is attached to the ARDC announcement because it is the first concrete implementation of USAF's new policy of encouraging greater exploitation of aircraft industry development facilities. Lt. Gen. Clarence S. Irvine, Deputy Chief of Staff for Materiel, already has announced that USAF will favor contractors who show achievement in the development field as well as a capability to produce (AW Oct. 10, p. 12).

In addition, ARDC is expected to overcome one of the industry's principal complaints: That USAF's great concern with security ties the hands of both prime contractors and component specialists, keeping from them knowledge essential to intelligent and productive development programs.

The fact that security restrictions have been a stumbling block to further industrial research and development effort has been stressed by the Air Force in recent months. Trevor Gardner, Assistant USAF Secretary for Research and Development told AVIATION WEEK (Sept. 5, p. 14) that one company had offered to start a new program with $25 million if the Air Force would tell all it knows so that the money can be channeled into the most effective fields of research.

Another firm is willing to build a laboratory if USAF will share the operating expense and share its secrets, Gardner said.

He feels that an easing of present security, now to be accomplished through the ARDC program, would go far toward increasing the productivity of available R & D funds.

Lt. Gen. Thomas S. Power, ARDC commander, said the need for faster development is critical and survival depends on a "vast amount of exploratory development." (AW Aug. 22, p. 12).

The ARDC program was disclosed last week by Col. Taylor Drysdale, Chief of Plans and Programs at the command's headquaters in Baltimore, Md. He spoke before a meeting of the Washington section of IAS.

Drysdale said the program got its start about a month ago at the first of a series of Technical Program Symposia held in New York. Interested contractors received an outline from ARDC's guidance and control specialists on seven areas of research in which advances to new frontiers of science are essential.

Another symposium, on aeronautics and propulsion, will be held in Cleveland late in January. By July of next year, Col. Drysdale said, ARDC plans to complete seven meetings, covering each of the command divisions and 46 different areas of R&D.

The program will be repeated annually.

Another major event on the ARDC schedule is an all-industry symposium to be held at the Baltimore headquarters late this year. Instead of the engineers and managers most concerned with R & D, this meeting will bring together the presidents of the major companies supplying USAF to consider policy matters.

"The ultimate purpose of our actions," Col. Drysdale said, "is to expand the base of air research and development to the limit of our authority and ability, and insure that all members of the team are working in consistent directions with consistent terms of reference."

Col. Drysdale emphasized the declaration of the Air Materiel Command that USAF cannot do its job without industry help.

No Contracts

"The role of industry," he said, "lies in the solution of some of the technical problems which obstruct us in the achievement of our performance objectives. Moreover, spontaneous innovations and unsolicited proposals from industry may provide breakthroughs which no plan would deduce.

"Thus we look to science and industry to research new knowledge, generate new techniques, develop new materials and engineer new systems to help provide our qualitative superiority of the future," Col. Drysdale said.

He made it clear that as far as ARDC is concerned technical development is not expected to result in any hardware, only new techniques and capabilities. He made it clear, there are no contracts for industry to seek under the new policy.

It is USAF's intention that industry, given the freer rein it needs and the hitherto secret information on requirements, will compete in the production of new techniques and capabilities. Production contracts, Gen. Irvine has said, will be the reward to those who make contributions and have production capability.

"Research and development operations in this field implement an approved program of operations, designed to produce these techniques and capabilities," Col. Drysdale said. He added that success can be measured only "by the economy and speed with which we carry out the program."

Planning Studies

The new and closer liaison with industry and research centers of all kinds, including universities and government agencies such as the military services and National Advisory Committee for Aeronautics, is needed, he said, to make sure that ARDC plans are carried through.

They must produce what is needed, when it is needed and exploit the best of America's resources.

To assure this kind of action, ARDC conducts a series of studies which result in the Technical Program Planning Documents. The command has divided R & D into 46 areas such as communications, human engineering and active bomber defense. Each area is covered by a TPPD.

Each TPPD is under constant revision to keep it current and is made up of four parts:

- **A definition** of the military problems looking 10 to 15 years ahead including environment and performance conditions.
- **A review and evaluation** of present capabilities giving at this point some indication of the magnitude and direction of the R & D effort.
- **A review** of the technical possibilities, data already known, proposed innovations, avenues of approach.
- **A definition** of the technical requirements or performance objectives. It is a demand on the appropriate ARDC center to achieve these objectives. The average number of technical requirements for each TPPD is three.

Distribution of the TPPD to industry, Col. Drysdale says, will reverse the pattern where contractors "contributed to our qualitative superiority after the basic pattern of USAF R & D effort had jelled. They were not cut into the pattern in time to take part in its design, and so much of their valuable potential was not employed."

Col. Drysdale said the 100 contractors and agencies on the initial "trial balloon" list will be asked to sign agreements before they are given the TPPD's in which they are interested. These will delineate USAF's responsibility for security and in the field of proprietory information. The contractor will agree to surrender the documents at any time his eligibility is changed.

ARDC said distribution of the TPPD is not a request for proposals.

'Reach the Roots'

After the first experiment, it is planned to expand the program to all interested companies and agencies. Eventually, ARDC intends to reach "the roots of U. S. engineering talent" by distributing the information to small companies who can meet the requirements. These will include:

- **Proper security clearance.**
- **Sound evidence** that the field of interest is suitable.
- **Known capability in the field.**

From ARDC's viewpoint, basic motivation for the program is the realization, Col. Drysdale said, "That our future military superiority cannot be won by the greater flood of war materiel which has played so large a part in our military superiority in the past." Quality now is more essential.

He added:

"The bulk of our production of quantity has been achieved by American industry. Likewise, the preponderance of our production of quality must be achieved by American industry.

"It is in (this) realization that we are endeavoring to activate the Air Force-industry team as effectively as possible."

Gerrity on Development

Los Angeles—Maj. Gen. T. P. Gerrity, USAF Director of Procurement and Production Engineering, reported last week that the Air Force will eliminate development programs which fail to offer large gains in performance in a further effort to keep pace with "the tremendous aeronautical progress" of the Soviet Union. Speaking before the Society of Automotive Engineers Aircraft Production Forum, he declared:

"We are not pursuing programs which offer only small incremental gains in performance. The merits of such . . . gains . . . are too often offset by training and logistics complications caused by new and more complex equipment."

To maintain U. S. preeminence in air power, Gerrity said, the Air Force has decided that the pursuit of applied research and development will be selective, that maximum use will be made of competition within the industry and that an all-out effort will be made to shorten the time cycle between development and production.

Air Defense Radar, Civil Traffic Systems Joined in Boston Test

By Preble Staver

Washington—Integration of air defense radar and civil air traffic control on a test basis in the Boston, Mass., area was ordered last week by the Air Coordinating Committee. Ultimate objective of the test is to establish the first all-radar airways between Boston and Norfolk, Va.

The action followed strong criticism of the Civil Aeronautics Administration's traffic control system by military and civil experts (AW Oct. 10, p. 15). Lt. Gen. Joseph Smith described the present system as "inadequate and obsolete."

Observers said the action was due to the failure of CAA to incorporate present facilities of the military into a common system with civil equipment. They added that the ACC action may foreshadow a reorganization of CAA, including personnel changes, to eliminate resistance to plans of other federal agencies to provide a true common civil-military system.

The plan for the Boston area was the result of a joint effort by the Air Force, Navy, Air Navigation and Development Board and Civil Aeronautics Administration. Headquarters for the operation will be at Deer Island, an Air Force installation near Boston and the operation will be handled by a CAA-military team.

Test Goals

The experiment embraces three factors.

- **Research and development** on air traffic control systems and elements.
- **Test and evaluation** on air traffic control systems and elements.
- **Control of live traffic** by CAA incorporating the development and evaluation results into the live operation.

CAA's control center on Deer Island will be in addition to the regular operations of the Boston Center initially, until the USAF long range radar can be put into the Boston center.

Remote Radar

In operating the experimental Deer Island center, it is hoped to improve immediately air traffic control in the Boston area as part of the overall tests. This is to be done with an expansion of radar control specifically by remoting long range radar data from military installations in the area.

CAA also will have the opportunity to work with many Air Force projects on Deer Island which have elements comparable to those required in the common system. Among the USAF facilities available are the provision of raw video, which provides a picture of a radar scope, narrow band radar data and computer output data for military evaluation.

The Air Force has been developing, testing and evaluating a military terminal air traffic control approach and land-

Air Traffic Meeting

Air Navigation Development Board in cooperation with the Civil Aeronautics Administration is planning an industry-government symposium on the problems and requirements of the air traffic control system.

ANDB has been assigned the responsibility of coordinating a joint CAA-military research, development, test and evaluation on air traffic control systems and elements.

ing system (TRACALA) which is directly concerned with information from the SAGE system. Possible integration of ATC and the SAGE system will also be considered.

By using a combination of CAA and military long range radar the coverage will be extended north to the Portland-Augusta, Me., area, south to Cape Hatteras, N. C., and west to Blackstone, Va., Martinsburg, W. Va., Wilkes-Barre, Pa., and Schenectady, N. Y.

CAA Liberalizes Airport Aid Policy

Washington—A new policy calling for more liberal standards in the administration of the federal aid airport program has been prepared by the Civil Aeronautics Administration.

Major changes will be the elimination of the strict 3,000 annual passenger or 30 based aircraft standard and the restrictions against use of federal funds on terminal buildings.

Formerly, an airport had to meet the 3,000 passenger criterion in order to be eligible for federal aid. A more liberal standard will judge eligibility on the aviation needs of the community involved and will give the CAA considerable flexibility in deciding which communities should get government money for their airport projects.

Easing of the controversial prohibition against use of federal money for terminals will help communities in the development of their passenger and cargo handling facilities, although the CAA is expected to insist that money used for terminal construction and for other projects be primarily aimed at improving safety and efficiency.

The CAA has already programmed $20 million for Fiscal 1956. Still to be allotted is $42.5 million appropriated by Congress as part of the four-year $252 million program. CAA is expected to announce allocations shortly after Jan. 1.

Under the new program, CAA can make allocations for future years, but the program administrators will probably try to keep the majority of its projects on a one-year basis.

Along with the new flexible standards for airport eligibility, CAA will have standards for the development of new airports. New facilities will be eligible in cases where a community proves the need for one or where one airport could serve two or more cities better than separate facilities. Additional airports can be authorized for communities where existing facilities are inadequate or cannot be economically expanded. When an airport gets past the mark of 100,000 movements a year, a potential need for another airport exists.

ADC Interceptors Being Fitted With Falcon Air-to-Air Missiles

By William Coughlin

Yuma, Ariz.—Interceptor aircraft of the Air Defense Command soon will be equipped with the Hughes' Falcon GAR-1 air-to-air missiles, it was revealed at the close of the 1955 fighter weapons and rocketry meet.

Air Force interceptor pilots will begin training with the Hughes-built guided missiles here early next year.

USAF's current crop of interceptors, the North American F-86D, Lockheed F-94C and Northrop F-89D, will be equipped with rockets as well as Falcon missiles during the training programs.

Convair's F-102A, soon to be phased into the program, is designed to carry the missiles.

To provide targets capable of altitudes and speeds which will test the performance of the Falcon-equipped weapon systems, a squadron using Ryan Q-2 drones will be organized here within a few months.

"Certainly use of the drones will be expensive but so is the Falcon," said a high-ranking USAF officer.

Every Air Defense Command pilot will fire at least one, and possibly two, Falcons during his annual training period at Yuma AFB. Falcons will give the pilots a wider accuracy limit than the 2.75 folding fin rockets now in use.

Martin B-57 Canberras will phase into service here as target tow ships, further enabling interceptor pilots to fire in training at altitudes higher than is possible with the North American B-45s and Boeing B-29s.

Plans to step up training in both rockets and air-to-air missiles were revealed at the conclusion of a rocket meet which left official observers somewhat disappointed in the scores.

"We are not too good yet," commented Col. Robert F. Worley, commander of the training base.

First place in the rocket meet went to a team from Eastern Air Defense Force, flying Lockheed F-94C Starfires. EADF scored 11,600 points out of a possible 24,000.

In second place with 10,600 points was an Air Training Command team, flying North American F-86Ds. Northeast Air Command, flying Northrop F-89Ds, scored 9,000 for third. Results of the fighter weapons phase of the meet, held at Nellis AFB, Las Vegas, were reported in AVIATION WEEK, Oct. 10, p. 17.

Maintenance men said the Hughes Aircraft E-4, E-5 and E-6 fire control systems installed in the interceptors showed improvement over last year but "still had a long way to go" in reaching acceptable reliability.

Col. Worley estimated that the great majority of "misses" in the meet were due, not to errors on the part of the pilot or ground controller, but to inaccuracy or malfunctioning of the fire control systems. The low scores indicate this remains a considerable problem.

Air Force maintenance crews are a long way from mastering the intricacies of maintaining the fire control systems, he said.

Commenting on the Hughes system, he added: "As weapons go, this is still awfully new. We're still in the process tactically of learning to walk with it."

During the meet, interceptor pilots were required to go under the hood at 10,000-ft., make all firing passes "blind," and remain under the hood until returning to the 10,000-ft. level.

F-86Ds equipped with control system tie-in CSTI equipment had it wired off during the meet.

Firing was at 9 ft. x 45 ft. Radar reflecting nylon marquisette targets towed at 380 kts. true airspeed at altitudes of 18,000 and 30,000-ft. Aircraft were limited to 24 rockets on each mission.

"If the F-89 could fire 104 rockets, it probably would score 100 per cent," Col. Worley said.

Hughes Stepping Up Falcon Production

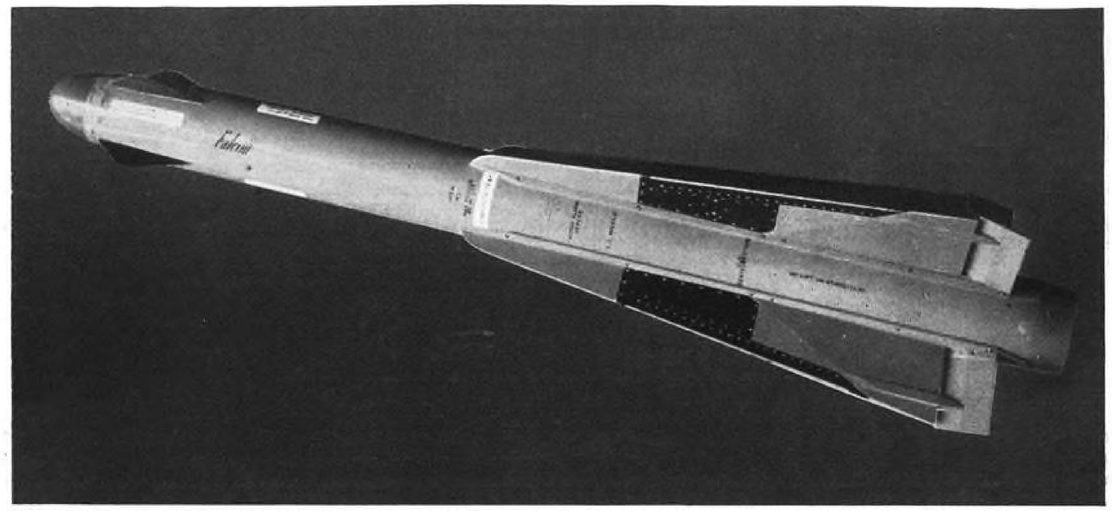
Tucson—Hughes Aircraft Co. is stepping up production of the USAF's Falcon air-to-air missile from its present rate, believed to be in excess of 100 per month, according to observations made during a recent visit to the Hughes plant here.

Present cost of the Falcon is estimated to be between $25,000 and $50,000 each. The figure is expected to drop to $10-15,000 within the next year or two.

Employment at the Hughes Tucson plant is nearly 4,400, 50% above last year.

It is scheduled to reach 5,500 by the end of 1956. Another indication that Falcon production is being increased significantly is the recent addition of 15 major subcontractors. When they reach full production late next year, subcontractors will supply nearly 50% of the Falcon production effort.

Despite the general stretchout of production in the avionics industry, Hughes Aircraft's employment, facilities and sales have increased since AVIATION WEEK's original visit in 1953. The company now employs 19,000, up from 16,000, while floor space is up from 2.4 million to 3.1 million square feet.



USAF'S FALCON AIR-TO-AIR MISSILE, now in sizable production at Hughes' Tucson plant, has built-in radar guidance system.

Sales this year will run "somewhat more than $200 million," a company official said. The figure was slightly less in 1953.

These figures indicate that Hughes has recovered and stabilized from the management exodus which shook the company two years ago (AW Sept. 28, 1953, p. 15). Hughes reveals that it has produced more than 8,000 interceptor fire control systems at its main Culver City (Calif.) plant, 3,000 of which have been turned out since Jan. 1954. This equipment, widely reported in the daily press last week, was reported in AVIATION WEEK, beginning more than three years ago (Feb. 25, 1952, p. 69).

At that time AVIATION WEEK reported:

"The interceptor's radar will then track the target, providing . . . information (which) will be fed to a computer which instantly calculates what path the airplane should fly to intercept the target.

"Signals from the computer will go to the autopilot which will quickly maneuver the airplane onto the desired flight path."

"Much more advanced guided missiles than the Falcon are very close to production," a Hughes official said. These are under development at Culver City, although the company is transferring all missile production engineering functions to Tucson.

Special test equipment, developed by Hughes for checking Falcons under simulated flight conditions, cost $15 million, a million dollars more than the combined cost of the Tucson plant and its machine tools.

LEAVING THE NEST, a group of Falcons shown in shipping cases will be used for flight test purposes, as evidenced by telemetering antennas (silver strips) mounted on insulated portions of the wing. Reliable sources report that the Falcon missile is capable of operating well into the supersonic speed range.

USAF Orders F-104As

Burbank, Calif.—An order valued at more than $100-million for new F-104A jet fighters for the Air Force was received last week at Lockheed Aircraft Corp. The prototype XF-104 started its flight tests in February of 1954 and at present is flying at Edwards Air Force Base.

Congress Starts Study Of Automation Effects

A study of the effects of automation and technological developments on the financial structure of industry and labor requirements has been started by the Joint Congressional Committee on the Economic Report.

Hearings before a subcommittee headed by Rep. Wright Patman (D.-Tex.) have been scheduled for this week and next week. Witnesses to testify on automation in the electronics industry are Don Mitchell, president, Sylvania Electric Products; Robert C. Tait, president, Stromberg-Carlson Division, General Dynamics Corp.; and Cledo Brunetti, director, Engineering Research and Development, General Mills. Other witnesses include Vannevar Bush, president, Carnegie Institution; Ralph Cordiner, president, General Electric Co.; Sheldon Hall, vice president, Burroughs Corp., D. Z. Davis, vice president, Ford Motor Co.

Propeller Reversal Blamed in Crash

Crash of a United Air Lines' DC-6 shortly after take-off on a training flight from New York's McArthur Field Apr. 4 was probably due to the unintentional movement of one throttle into reverse range, according to Civil Aeronautics Board's accident investigation report.

With the other three engines operating at high power output, the aircraft quickly became uncontrollable once airborne, the report said.

Three pilots were killed: Capt. S. C. Hoyt, UAL New York area flight manager, in command, and Capts. V. H. Webb and H. M. Dozier, aboard for their periodic instrument proficiency check.

Evidence indicated that the one throttle was moved out of reverse by the pilot into the forward position in an attempt to unreverse, the report said, but the reverse warning flag was not lifted, resulting in increased reverse thrust. There was insufficient time and altitude for any pilot corrective measures to become effective.

Defense Dept. Top Contractor List 'Misleading,' Sen. Johnson Charges

Washington—The Senate Preparedness Investigating Subcommittee issued a list of the 100 largest defense contractors, charging that an earlier list released by the Department of Defense is "inaccurate" and "misleading."

Sen. Lyndon Johnson (D.-Tex.), chairman of the subcommittee, said that his group "feels a complete and accurate picture of these awards should be made available to the public."

He said the subcommittee concluded that the Defense Department report on the major contractors "made it impossible to determine who currently were the largest defense contractors and that methods used in collecting statistics clearly needed review and overhauling as a result of errors made in compilation."

Major difference between the two lists: Defense Department does not include General Motors Corp. as one of the top 100; the Senate subcommittee puts GM at the top of the list with over $6.6 billion in defense business. A supplement to the department report shows GM with a "minus" $58.9 million in defense business.

Forty-five other firms not found in the department's "100" list but appearing in the subcommittee's include Chrysler Corp., Westinghouse Electric Corp., Northrop Aircraft, McDonnell Aircraft Corp., and Bell Aircraft. On the Senate list Chrysler has the 10th largest volume of defense business; Westinghouse, 16th; Northrop, 18th; McDonnell, 25th; and Bell, 31st.

The main reason behind the difference is that the Defense list covers the period from mid-1953 through 1954 (AW May 30, p. 15), while the Senate list begins with the military mobilization program in mid-1950.

Defense Explanation

The Defense Department promptly denied the charge that its report of last May was misleading. Defense said that a "cover sheet on the 'analysis of large military prime contractors' May 16, 1955, states 'General Motors, for example, undoubtedly is still one of the largest suppliers of military equipment.' It is certain that many of the 45 companies are still among the largest suppliers in terms of current procurement.

"The companies referred to are large suppliers which were not listed on the report for the reason that cancellations and terminations partially or wholly offset new business awarded them during this period.

". . . The report was prepared in response to a specific request of Sen. Fulbright who expressed a particular interest in the awards to large suppliers during the 18-month period covered by the report. The information that cancellations for General Motors and other large suppliers exceeded new awards during the period was significant information and appropriate to Sen. Fulbright's study of the stock market."

Report 'Inconsistent'

"It is axiomatic," the Senate subcommittee maintained, "that any statistical series must be prepared on a consistent basis if it is to be of any real usefulness. Otherwise the data ceases to be of value for comparative purposes and much important information is lost or suppressed."

The Defense report was "inconsistent," the subcommittee complained, because while "purporting to cover only the 18-month period from mid-1953 through December, 1954, it did eliminate from the aggregate contracting totals for this period, cancellations of contracts awarded prior to the period."

The subcommittee also objected that by using mid-1953 as a starting point, the Defense list "produced a further misleading overall picture" by failing to show heavy procurements during the six previous months, starting January, 1953, when the Eisenhower Administration started. During this period, the report said, contracts were awarded to General Motors for $1.4 billion; to Boeing, $2.4 billion, and to General Dynamics, $1.1 billion.

Defense Department issued its report in mid-May because it was directed to do so by two congressional committees—Senate Banking and Currency Committee and the House Small Business Committee. The department had decided to discontinue the reports for "economy reasons" after issuing one for the mid-1950 to mid-1953 period in January, 1954. The listings of defense contractors had previously been issued every six months.

The Banking and Currency Committee, headed by Sen. William Fulbright (D.-Ark.), turned the department's report over to the Preparedness Subcommittee for evaluation.

Observing that "the distribution of defense contracts among producers has long been a subject of considerable interest, not only to the Defense Department and businessmen generally but also to Congress, other government agencies, and the general public as well," the committee recommended resumption of regular release of lists of 100 top contractors by Defense Department, using mid-1950 as starting point.

The subcommittee observed: "The pattern of distribution of defense contracts has important implications in many different directions. The concentration of contracts may tend to affect the forces of competition and to alter the relative positions of competing units. In some cases competition may be strengthened; in others there may be tendencies toward creation of restraints of trade or monopolies . . ."

House Majority Leader Rep John McCormack (D.-Mass.) in another attack, declared (AW July 4, p. 11):

"I would think that the former chairman of the General Motors Corp. would have been hurt at this drop in rank and prestige with his well-known economic-political philosophy that 'what is good for what'. When I read the report my heart really went out in sympathy for GM. I would not understand why Charles Wilson as Secretary Wilson should discriminate against this company. But as we view the real statistics, the picture is different."

100 LARGEST DEFENSE CONTRACTORS

This is the list of companies with the largest volume of military business prepared by the Senate Preparedness Investigating Subcommittee.

Rank	Company	Total Contracts	Terminations and Cancellations (In Millions)	Net Value
1	General Motors Corp	$7,471.1	$832.2	$6,638.9
2	Boeing Airplane Co	5,411.9	244.1	5,167.8
3	Douglas Aircraft Co., Inc	4,180.3	270.7	3,909.6
4	United Aircraft Corp	4,250.8	373.3	3,877.5
5	General Electric Co	4,048.9	376.4	3,672.5
6	Lockheed Aircraft Corp	2,971.0	78.1	2,892.9
7	North American Aviation, Inc.	2,888.2	46.4	2,841.8
8	General Dynamics Corp. (Consolidated Vultee) (X)	2,869.4	119.4	2,670.0
9	Republic Aviation Corp	2,236.9	29.7	2,207.2
10	Chrysler Corp	2,600.0	511.1	2,088.9
11	Curtiss-Wright Corp	2,092.6	6.3	2,086.3
12	American Telephone & Telegraph Co	1,916.0	160.7	1,755.3
13	Ford Motor Co	1,826.3	163.1	1,663.2
14	Grumman Aircraft Engineering Corp	1,463.8	43.1	1,420.7
15	Bendix Aviation Corp	1,185.5	30.3	1,155.2
16	Westinghouse Electric Corp	1,601.1	454.7	1,146.4
17	Sperry Corp (The)	1,137.9	47.3	1,090.6
18	Northrop Aircraft, Inc	1,070.0	81.8	988.2
19	Hughes Tool Co	993.6	57.9	935.7
20	Martin (Glenn L.) Co	930.8	11.2	919.6
21	Kaiser Motors, Inc	926.6	25.1	901.5
22	Studebaker-Packard	583.2 442.7	102.0 102.7	821.2
23	Radio Corporation of America	823.1	82.7	740.4
24	American Locomotive Co	847.9	143.0	704.9
25	McDonnell Aircraft Corp	883.9	191.8	692.1
26	International Harvester Co	771.8	134.8	637.0
27	Goodyear Tire & Rubber Co	573.2	30.5	542.7
28	Fairchild Engine & Airplane Corp	568.6	27.3	541.3
29	International Telephone & Telegraph Corp	611.5	85.5	526.0
30	Avco Manufacturing Corp	544.4	22.0	522.4
31	Bell Aircraft Corp	630.4	136.8	493.6
32	Du Pont (E. I.) de Nemours Co	637.7	146.8	490.9
33	Olin Industries Inc	532.9	50.2	482.7
34	Eastman Kodak Co	501.3	19.9	481.4
35	Hercules Powder Co	456.5	23.8	432.7
36	Firestone Tire & Rubber Co	450.6	21.5	429.1
37	American Motors (Nash-Kelvinator Corp.)	427.0	12.9	414.1
38	Philco Corp	450.8	46.5	404.3
39	International Business Machine Corp	430.3	38.6	391.7
40	Bethlehem Steel Corp	377.2	.7	376.5
41	Newport News Shipbuilding & Dry Dock Co	374.1	.1	374.0
42	Raytheon Manufacturing Co	376.0	6.7	369.3
43	Standard Oil Co (New Jersey)	367.4	16.3	351.1
44	Collins Radio Co	361.2	19.6	341.6
45	Piasecki Helicopter Corp	323.9	5.3	318.6
46	Reo Motors, Inc	333.8	29.2	304.6
47	Standard Oil Company of California	307.4	6.2	301.2
48	United States Rubber Co	308.0	9.5	298.5
49	Food Machinery & Chemical Corp	324.2	29.3	294.9
50	Continental Motors Corp	309.8	18.3	291.5
51	American Car & Foundry Co	375.9	84.5	291.4
52	Stevens & Co., Inc	283.3	.1	283.2
53	American Woolen Co	277.8	.8	277.0
54	United States Steel Corp	281.2	10.4	270.8
55	Beech Aircraft Corp	258.5	3.5	255.0
56	General Tire & Rubber Co	263.5	17.2	246.3
57	Federal Cartridge Corp	276.0	33.3	242.7
58	Swift & Co	222.2	.1	222.1
59	North Atlantic Constructors	217.5	.....	217.5
60	Rheem Manufacturing Co	220.3	18.5	201.8
61	Armour & Co	198.5	.1	198.4
62	Minneapolis-Honeywell Co	207.4	13.8	193.6
63	Hazeltine Corp	213.9	22.8	191.1
64	Remington Rand, Inc	190.4	.2	190.2
65	Sylvania Electric Products, Inc.	198.9	13.7	185.2
66	American Bosch Corp	190.0	5.6	184.4
67	Norris-Thermador Corp	183.1	4.3	178.8
68	United States Hoffman Machinery Corp	188.0	12.5	175.5
69	Ingalls Iron Works Co	174.1	.....	170.5
70	New York Shipbuilding Corp	173.7	8.1	165.6
71	Bath Iron Works Corp	165.4	.....	165.4
72	Mason Co	179.7	16.8	162.9
73	American Machine & Foundry Co	162.3	2.8	159.5
74	Massey-Harris Co., Ltd	161.1	2.7	158.4
75	Phillips Petroleum Co	160.0	2.2	157.8
76	Allis-Chalmers Manufacturing Co	177.0	20.7	156.3
77	National Gypsum Co	202.3	46.6	155.7
78	Cities Service Co	155.3	.8	154.5
79	Gilfillan Bros., Inc	153.1	.....	153.1
80	Motorola, Inc	161.0	8.0	153.0
81	American Smelting & Refining Co	156.1	5.4	150.7
82	Goodrich (B. F.) Co	153.6	3.6	150.0
83	Burlington Mills Corp	146.4	.....	146.4
84	Admiral Corp	152.0	6.4	145.6
85	Baldwin-Lima-Hamilton Corp	154.2	9.6	144.6
86	Sinclair Oil Corp	145.0	1.6	143.4
87	Borg-Warner Corp	167.2	24.2	143.0
88	Pacific Car & Foundry Co	162.8	19.9	142.9
89	Caterpillar Tractor Co	132.0	2.9	129.1
90	American Steel Foundries	128.4	.2	128.2
91	Stewart-Warner Corp	128.7	4.1	124.6
92	Diamond T Motor Car Co	178.4	59.4	119.0
93	Procter & Gamble Co	145.2	28.9	116.3
94	Sun Oil Co	114.3	.....	114.3
95	American Safety Razor Corp	134.1	20.5	113.6
96	Bowen & McLaughlin Co	114.5	2.6	111.9
97	Mack Trucks, Inc	140.1	29.7	110.4
98	Day & Zimmerman, Inc	134.0	23.8	110.2
99	Fruehauf Trailer Co	127.1	18.9	108.2
100	National Cash Register Co	147.0	46.6	100.4

(X) Companies merged in 1954. Total figures include all Convair procurement, but does not include all of the procurement of General Dynamics Corp. for the period.

NBAA May Finance Development Of Modern Executive Transport

By Erwin J. Bulban

Detroit—The National Business Aircraft Assn.—irked by what it considers the "foot-dragging" tactics of U. S. aircraft manufacturers—is thinking of underwriting the development of a high-speed transport especially designed to fill executive needs.

The problem of just how to get modern executive planes off the drawing boards and into the air will be the first agenda item to come before the association's new executive advisory committee at its initial meeting in New York City early in December.

The committee is composed of 15 executives of several U.S. corporations.

Henry W. Boggess, who was re elected president of the association at the meeting, said the committee would have no difficulty in raising the large sums needed to subsidize the development of a transport prototype.

Boggess also revealed a plan to decentralize NBAA activities in order to deal with on-the-spot local problems, particularly those relating to airports, more effectively.

Industry Interest

Despite unfavorable flying weather, official registrations at the annual meeting totaled 517, the largest in NBAA's history, (435 showed up at Dallas last year and 237 appeared at the 1953 meeting in St. Louis). The association also reported a 21% increase in membership since its Dallas meeting last year, for a total of 323 corporate members operating 850 planes.

Industry interest in this sizable and fast-growing market was indicated by the representation of approximately 70 firms at the meeting.

The increased competition for the business plane owner's dollar was evident from the displays by North American Aviation, Inc., and Fairchild Airplane Division of new turbine-powered transport proposals. Representatives of the firms were busy collecting pilot and owner opinions on various design and operating features of their proposals. The NBAA question, however, was when, and if, these planes would leave the drawing board.

North American showed turboprop and turbojet powered designs with these common features:

Eight-passenger normal seating capacity (15 passengers in the high-density version); cabins pressurized to equivalent of 8,000 ft.; 1,500-statute-mile range; tricycle landing gear; thermal anti-icing for wings and tail, and 75-in. standup head-room. The airplane's size was said to fall between that of the Lockheed Lodestar and Douglas DC-3.

The placard accompanying the display said the planes could be available to purchasers 30 months after the firm received a go-ahead to produce.

The turboprop design was planned around two Rolls-Royce Darts and would have a gross weight of 21,500 lb. Operating altitude would be 30,000 ft. Initial cost was given as $450,000 and operating cost for 1,000 hr. at $60/hr.

North American's turbojet showed a gross weight of 36,300-lb., an operating altitude of 43,400 ft., initial cost of $550,000 and direct operating cost of $130/hour.

However, industry observers at Detroit noted that North American reportedly has designed a highspeed twinjet trainer for the Air Force which could push development of the business plane studies aside at least temporarily.

Fairchild's Design

Fairchild's new project, a development of the M-225 proposal (AW July 25, p. 16; Aug. 15, p. 122), showed some changes over the original design.

The company has increased the wing area from 250-sq.-ft. to 325-sq.-ft. to increase jet fuel stowage and provide over 5,000 gal. internally. With additional external fuel, the new M-225 could carry 7,300 gal.

An important change is planned in the powerplant layout. Originally scheduled for four jets in the Fairchild J44 class, the new proposal would have three engines, all placed in the tail. Company spokesmen refused to talk about the new powerplants except to say that they are military types still in the MX-number state.

To get the airplane off to an early flight test program prior to availability of the new MX-type engines, the prototype will be powered by two Westinghouse J34s totaling 7,200 lb. thrust, an indication of the approximate thrust of the advanced powerplants planned.

Industry observers at Detroit reported that Ryan Aeronautical Corp. is another contender in the turbine-powered executive transport field. Republic Aviation Corp. is also mentioned as having finalized a DC-3-size design powered by two Rolls-Royce Darts.

Company officials said they now have orders for some 40 Rato installations to date, many of them for business aircraft.

Forum Discussions

Safety awards keynoted the sessions. Recognition of flight safety records achieved by corporations and pilots pointed up the heavy flying activity by U.S. companies. The awards included:

• **John P. Gaty,** vice president-general manager, Beech Aircraft Corp., Wichita, Kan., received the 1954 Annual Business Flight Safety Award of the Women's Aeronautical Association of Kansas. Presented for the first time, the silver cup recognized Gaty's safety promotion efforts since 1934.

• **Million-miler safety awards** were given 15 officers of NBAA-member corporations, who have flown a total of 18,179,225 plane-miles without accident.

• **500,000-or-more-mile safety awards** were granted 54 NBAA-member pilots who have accumulated a total of 37,606,770.5 accident-free plane-miles.

• **Meritorious safety awards** were given 19 member corporations whose aircraft have one million or more accident free miles. These represented a total of 35,450,367 safe plane-miles.

The need for exchanging information relating to administrative, maintenance and operating problems was indicated by the heavy emphasis on these phases of business plane operations.

It was obvious that because of the individualistic operations of hundreds of business aircraft operators using a wide variety of greatly modified aircraft, there is a big need for standardizing overhaul requirements if costs are to be reduced.

Fixed base operators said that, with labor costs running about $4.50/hour, they are lucky to make three percent profit after taxes. Many pilots complained that aircraft down-time often greatly overran initial estimates.

The maintenance representatives said that one of their big problems is getting a detailed specification from the plane owner sufficiently in advance to schedule stocking of parts. One maintenance operator said that some DC-3 and Lodestar items now take 60-120 days to procure. Another said he thought that he should have detailed specifications on the work to be done on an airplane a minimum of 120 days before the craft arrived at his shop.

In addition to the re-election of Boggess as NBAA president, Walter C. Pague, Armco Steel Corp. captain, was named national vice president. Gerald J. Eger, International Harvester Co., was re-elected treasurer and Jean DuBuque was re-elected executive director-secretary.

New members of the board: Curtis G. Talbot, General Electric Co., and Robert Sprague, Jr., Sprague Electric Co.

Federal Contractor Policy Scored

Washington—The Defense Department's order to limit contractor payments to 105% of incurred costs (AW Sept. 26, p. 18) actually is "an effort to dodge the shortcomings of government internal contract administration," the National Security Industrial Assn. has charged.

The Department's aim, to cut back on the need for substantial refunds when price revision shows a contractor has collected more than his product is worth, could be achieved by simple contract changes, according to NSIA. At the same time, NSIA said, this system would avoid financial and administrative hardships that will result from the department's directive that went into effect last month.

NSIA Objections

In a letter last week to Reuben T. Robertson, Jr., Deputy Secretary of Defense, NSIA raised these objections to the directive:

- **It will leave** the government nearly always in debt to the contractor.
- **It is arbitrary and inequitable,** adds to the accounting burden, deprives the contractor of needed funds.
- **It will not speed** the repricing procedure, which now takes more than a year because of administrative delays by the customer.
- **It is impossible** for most contractors holding price-revision or incentive-type contracts to certify their costs on day-to-day basis.
- **It is feared** that the effect of the directive will be to convert fixed-price contracts into cost-type contracts, thus increasing auditing and administrative work.
- **It is feared** that the process of getting a price-revision amendment to a contract will take longer when additional payments usually are due the contractor.

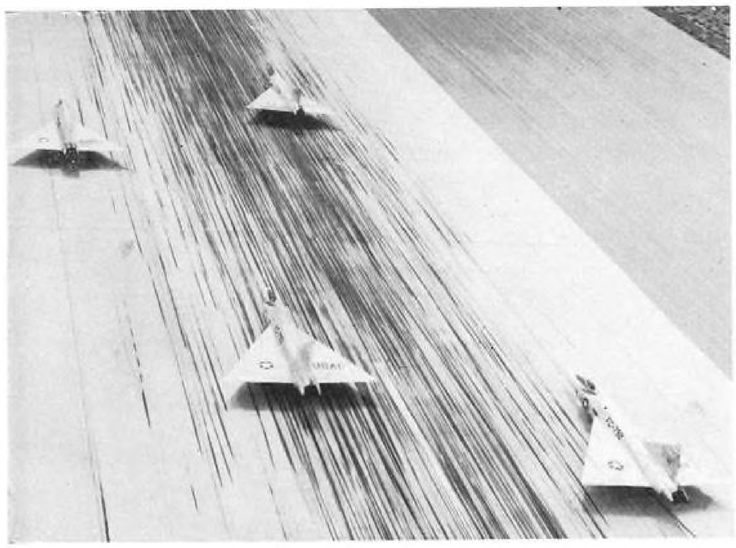
In a letter to Robertson, NSIA said that the September directive is similar to a Navy instruction issued last July. The organization, which maintains liaison between industry and the Defense Department and offers advice on industrial experience and practices, had discussed the problem with the Navy and prepared a study for submission to N. P. Cassidy, Assistant Navy Comptroller. In view of the Defense Department's action, the report, was sent to Robertson.

Faster Action Urged

NSIA said it does not disagree with the objective, but fears that the government action "represents a drastic overcorrection."

"Our study of the problem," it said, "has indicated that the principal reason for existing delays in making refunds to the government after final determination of prices is the government's inability to put through price-revision amendments.

"We believe that most of what the government desires could be achieved



F-102As at Palmdale

FOUR CONVAIR F-102A jet interceptors line up for takeoff on runway at Palmdale, Calif. Illusion of speed comes from the hundreds of tire streaks left on concrete by landing aircraft. F-102As are undergoing production flight tests at Palmdale.

by faster internal administration. However, we also have in mind that another related purpose of the government is 'to facilitate timely adjustment of provisional billing prices.' We think that both of these objectives can be achieved without unduly penalizing contractors by relatively minor alterations in the price-revision technique."

Basically, NSIA said, they recommend that contract redetermination clauses "require both the refunding of excessive payments and the reduction of current billing prices at an earlier date in the life of the contract." NSIA believes the new prices should be put in effect at once when they are determined, without waiting for the pertinent contract amendment.

The report to Robertson includes suggested changes in both the Form IIB Price Redetermination Clause used by the Air Force and the contract form used by the Navy.

Pratt & Whitney Gets Certificate of Necessity

Pratt & Whitney Aircraft Division of United Aircraft Corp., East Hartford, Conn., has been granted a $1,712,000 certificate of necessity for military aircraft engines by the Office of Defense Mobilization with 65% of the amount allowed for rapid tax amortization.

Other recent certificates include:

Bell Aircraft Corp., Wheatfield, N. Y., military aircraft, $132,774 certified with 65% allowed, military aircraft, $15,000 certified with 60% allowed; Ft. Worth, Tex., military aircraft, $9,179 certified with 65% allowed.

Ryan Aeronautical Co., San Diego, Calif., military aircraft assemblies, $140,000 certified with 60% allowed; aircraft parts, $50,000 certified with 60% allowed.

R. H. Freitag Manufacturing Co., Akron, Ohio, military aircraft parts, $202,352 certified with 70% allowed.

Parker Aircraft Co., Los Angeles, Calif., aircraft parts, $221,150 certified with 70% allowed.

Ex-Cell-O Corp., Highland Park, Mich., aircraft parts, $146,287 certified with 65% allowed.

McDonnell Aircraft Corp., St. Louis, Mo., military aircraft, $55,000 certified with 60% allowed.

Lord Manufacturing Co., Erie, Pa., aircraft engine parts, $97,417 certified with 65% allowed.

Sanitary Scale Co., Belvidere, Ill., aircraft parts, $17,443 certified with 70% allowed; aircraft parts, $11,205 certified with 70% allowed.

Fairchild Engine and Airplane Corp., Stratos Division Bay Shore, N. Y., aircraft parts, $85,305 certified with 65% allowed.

Southwest Airmotive Equipment Co., Dallas, Tex., military engine overhaul facilities, $580,388 certified with 60% allowed.

Air Transport Manufacturing Co., Los Angeles, Calif., military aircraft parts, $15,505 certified with 70% allowed.

Bendix Aviation Corp., Pacific Division, North Hollywood, Calif., aircraft components, $83,126 certified with 65% allowed.

Allegheny Ludlum Steel Corp., Brackenridge, Pa., titanium processing facilities, $1,590,000 certified with 75% allowed, Watervliet, N. Y., titanium processing facilities, $307,000 certified with 65% allowed; Dunkirk, N. Y., titanium processing facilities, $397,000 certified with 65% allowed.

Tail section of North American F-100

Hawaii Airline Studies Fokker Turboprop

Trans-Pacific Airlines, Hawaiian Islands operator, has announced that it is considering the purchase of two or three turboprop-powered Fokker F. 27 Friendship transports as replacements for its DC-3s.

David A. Benz, TPA executive vice president and Olen V. Andrew, operations manager, recently returned from Europe where they studied current DC-3 replacements including the 40-passenger F. 27 and the Aviation Traders Accountant.

Benz said that, although no firm decision has been reached by the airline on purchasing either of the planes, he and Andrew will return to Europe sometime early next year to be on hand to watch the initial flight trials of the Friendship transport.

The new transport plane is scheduled to be available to operators in 1957, TPA's target date for modernizing its current fleet.

Trans-Pacific plans to buy new planes with funds from the sale of its DC-3s.

Officials of Bonanza Air Lines, Inc., with headquarters in Las Vegas, also have announced their interest in the Fokker Friendship. Edmund Converse, Bonanza president, plans to inspect the Friendship and has said that the plane "may be the solution to the local-service airlines' problem."

Skymotive to Open New Service Terminal

A new business aircraft operations and maintenance terminal centered around a recently-completed 125-ft. x 400-ft. partial cantilever hangar will be opened by Skymotive, Inc. at O'Hare Field-Chicago International Airport on Oct. 19.

Skymotive has obtained a 20-year lease on the area around its new quarters—enough to more than double the size of its present facilities—for possible expansion.

The terminal operator reports that it already has more than a dozen corporations leasing space in the facility, which includes a CAA-approved repair station, airframe, Class I & III, no limitation; radio, Class I & II, no limitation.

The new airport will be opened officially for airline use October 30th, when major carriers will transfer operations from Chicago's congested Midway Airport.

More room in the sky

...through

TACAN

revolutionary IT&T development

...providing multiple airlanes instead of one!

This remarkable system can virtually make the sky as much as "ten times wider."

Now *parallel* all-weather airlanes can be marked off in the sky by electronic means...airlanes that lie side by side, only a few miles apart, yet never meet. This can now be accomplished through a computer which derives its information from a single airborne "package" that measures the distance to a known ground station and determines bearing with pinpoint accuracy.

Thus, in heavily-traveled areas, multiple and accurate routes can be provided for aircraft to fly safely and efficiently, maintaining heavy traffic schedules in adverse weather.

TACAN is the result of a series of development programs sponsored by the U. S. Navy and the U. S. Air Force at Federal Telecommunication Laboratories, a division of IT&T. Federal Telephone and Radio Company, division of IT&T which now manufactures the military version of TACAN, will also manufacture and market the commercial aircraft and private flier versions of the equipment.

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CAB Proposes Pacific Mail Rate

Final service mail rate for Pacific operations of Pan American World Airways and Northwest Airlines have been proposed by the Civil Aeronautics Board.

The proposed rates are based on equalization of mail rates on competitive route segments.

The Post Office Department will save $5.9 million in the year ending Mar. 31, 1955, compared with mail pay due under the old rate of 67 cents a ton-mile.

The new rates are calculated to yield an average of 41.74 cents a ton-mile for Pan American and 46.32 cents a ton-mile for Northwest on system-wide mail operations. They are effective Apr. 1, 1955.

CAB set a rate of 51.77 cents a ton-mile for Northwest and Pan American for all Pacific services during 1954. In the period Jan. 1, 1955 to Mar. 31, 1955 the two carriers would be paid 46.76 cents a ton-mile.

CAB is sticking to its decision to apply a standard mileage for trans-Pacific mail pay of 5,078 miles. This is the actual distance on Northwest's great circle route, and PAA objects strongly to the standardization since it has to fly a route that is 1,600 miles longer.

The Board says it can find no sound economic reason for charging the Post Office Department a different rate for transportation of mail between Tokyo and the United States for different routings.

The Board points out that passengers pay the same fare whether they fly Pan American or Northwest, and the same principle applies to cargo.

The proposed rates have been determined through a ratio technique. CAB applies the ratio between Northwest and PAA mail costs and the costs of the Big Four domestic carriers—American Airlines, Eastern Airlines, to the mail rate average yield for these carriers.

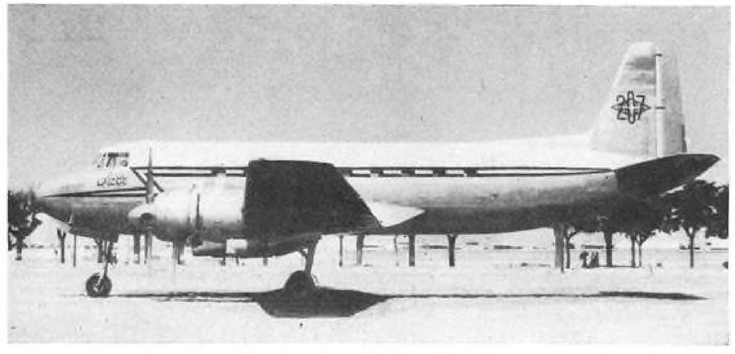
The result is a service mail rate for the Pacific carriers.

Since rates are equalized over competitive segments, rates on non-competitive segments have been adjusted to provide an average yield for each carrier which reasonably approximates the overall recognized cost of mail service.

Proposed Mail Rates

	Cents per mail ton-mile
JAN. 1, 1954-Dec. 31, 1954	
Northwest (all Pacific services)	51.77
Pan American (all Pacific services)	51.77
JAN. 1, 1955-MAR. 31, 1955	
Northwest (all Pacific services)	46.76
Pan American (all Pacific services	46.76
ON AND AFTER APR. 1, 1955	
Northwest	
Seattle-Anchorage	47.00
Seattle-Honolulu	32.65
Seattle-Tokyo	46.44*
All other Pacific services	46.44
Pan American	
Seattle-Honolulu	32.65
San Francisco-Honolulu	32.94
Los Angeles-Honolulu	32.77
San Francisco-Tokyo	46.44*
Seattle-Tokyo	46.44*
All other Pacific services	66.05

* To be applied to the standard short-line distance of 5,078 miles.



Spain's 207 Azor

The third twin-engine aircraft model designed in Spain to reach the production stage, the all-metal 207 Azor is fitted with two 2,040 hp. Bristol Hercules engines and can carry a maximum of 38 passengers over 1,085-mile routes.

New Plan Devised by USAF Pilots Accelerates Atomic-War Training

By William Coughlin

Las Vegas, Nev.—New delivery methods worked out by the pilots themselves may allow the Air Force to speed up the training of pilots in tactical atomic warfare. Some of the details were revealed here during the Special Weapons phase of the 1955 U. S. Air Force Fighter Weapons Meet.

First details of the new method of atomic training was disclosed by Col. R. C. Franklin Jr., of the 21st Fighter Bomber Wing, United States Air Forces in Europe.

Col. Franklin was interviewed by AVIATION WEEK after his team, flying F-86F Sabre Jets in their initial appearance in the classified Special Weapons event, placed second—and in doing so defeated a number of more-experienced units.

The team commander said both the F-86 and new training methods developed within his unit were responsible for the remarkable performance of the team. He credited Marine Maj. George H. Dodenhoff with development of the atomic delivery techniques. Dodenhoff, familiar with both Navy and Marine operations, is now on exchange duty with the USAF unit.

"The heart of our training method is in insisting that each pilot fly a standard maneuver," Col. Franklin explained. "We make him do it by the book. The setting on all our planes are exactly the same. The problem is calculated once and fed into all airplanes, and the pilots are made to fly it that way."

"Kentucky Windage"

The "Kentucky windage" factor is thus removed and each pilot forced to stick to the standard technique.

While details of the Special Weapons competition were classified, it is known that there were three types of drops used:

- **High angle dive bombing.**
- **Low angle bombing system with an** initial point.
- **Low angle bombing system without** an initial point.

The low altitude system involves "toss" bombing with a 4-G "over-the-shoulder" getaway maneuver to reverse course and escape the atomic blast.

"Every delivery we make is strictly on instruments, an all-weather delivery," Col. Franklin said. "We use only an operational delivery, there are no soft tosses."

The team captain pointed to himself as a "walking example" of the effectiveness of the standardized training method. With only 15 days practice in special weapons delivery, Col. Franklin not only led his team to second-place in the meet but won individual trophies for first place in low angle bombing with initial point and for high team captain.

The first "shape" that any of the USAFE team had ever dropped was a competitive bomb in this meet, Maj. Dodenhoff said. Practice sessions were with smaller conventional bombs. "Our method is so standardized that we can compute the ballistics from the bombing tables and obtain acceptable delivery immediately," he said.

Delivery Pattern

With this standardized tactical delivery, it actually is not necessary for the pilot to even know what type of weapon is hung on his airplane, Dodenhoff said. "The problem is computed, he flys the same delivery pattern and the bomb releases at the right time."

"What we are trying to sell is our

method of training," Col. Franklin said. "Any six pilots in the wing would have done as well, that is the important thing. Our training methods make the airplane and pilots interchangeable."

Franklin said no competition was held in his wing to select the pilots for the special weapons meet. "We just picked the pilots available from the group," he said. "Some of our best people still are in Europe due to our operational commitments. We did not dare strip our unit of all its best people."

Low Angle Bombing

The primary mission of the 21st Fighter-Bomber Wing is delivery of atomic weapons, and it is maintained combat-ready at all times.

Under the unit's training methods, all factors can be fed into the low angle bombing system (LABS) instrument prior to takeoff with one exception. The only item left to last-minute calculation is wind at the target.

The basic element in this system of delivery, Dodenhoff said, is the elimination of the "Kentucky windage" factor under which each pilot develops the delivery technique which he thinks best fitted to his individual foibles. The standardized method makes possible widespread training of many pilots in accurate tactical atomic delivery, Dodenhoff believes.

Noting that the standardized method can be based on bombing tables, the Marine officer pointed out that in the event of a major conflict in which new types of bombs came into use, acceptable accuracy in delivery could be maintained throughout. And Col. Franklin concluded:

"We hope influential persons will show interest in not just what scores were made here but how the scores were attained and methods used."

Scorpion Sampling

The Air Force has been accepting production Northrop Scorpions for more than a year on the same basis used in the acceptance of the Lockheed T-33 (AW Oct. 3, p. 23).

Only one out of every four Scorpions is flight-tested by USAF pilots. If it is approved, the other three are accepted without military flight test, saving the government time and money.

Provision is made to increase the sampling ratio to one-in-eight when statistics indicate it is warranted.

Piasecki Leases Plant

Piasecki Aircraft Corp. plans to develop an aircraft manufacturing area at Philadelphia International Airport. The firm expects to move into buildings leased from the city within a month.

Performance vs. Tradition:

Gnat Wages Uphill Battle for Acceptance

By David A. Anderton

Hamble, England—The Folland Gnat has become England's most controversial airplane. Praised by service and foreign pilots as the logical answer to the problems of fighter-interceptor design, the Gnat has been plagued by a long-time lack of official backing, by foot-dragging in procurement and by illogical arguments.

Its most ardent supporters are the many pilots who have flown it or the Midge, its aerodynamic prototype. Its loudest detractors are among the military brass, the civil servants and competing companies.

But in balance, the case for the Gnat seems to be winning out. Here's why:

• **Development batch of Gnats has been ordered** by the Ministry of Supply for evaluation; the number has not been stated but should compare to the 20 English Electric P.1 interceptors ordered in a similar program.

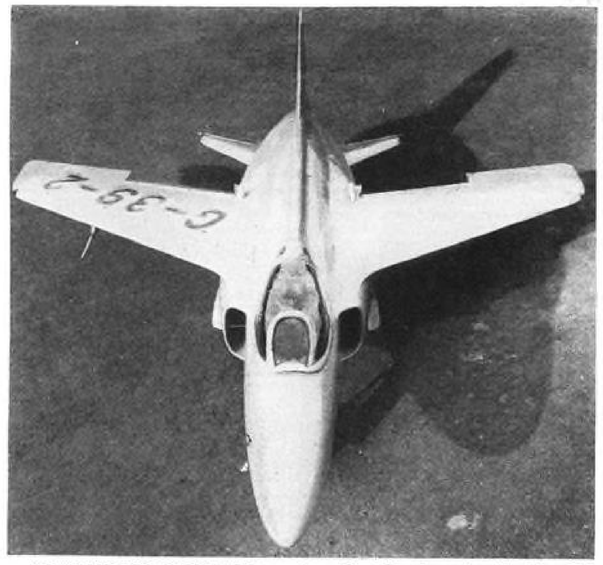
• **Negotiations with foreign countries**—particularly India—have followed interest by those countries in the Gnat. In recent weeks, Folland has been visited officially by missions from India, Finland, Holland, Belgium, New Zealand, Germany, Jugoslavia and Switzerland. The Canadian Navy is interested in a Sea Gnat carrier modification; the U. S. Navy has asked for bids on a special version of the airplane.

• **Squadron Leader Tennant's demonstration of the Gnat** thrilled Farnborough crowds this year as did his show of the Midge in 1954 (AW Sept. 20, 1954, p. 13). Tennant, chief pilot for Folland, made highspeed runs at 580 knots or better (close to Mach 0.9) low above the runway, finishing with a rocketing climb on his first run, and turns of 7G on his subsequent passes.

The sparkling display impressed aviation journalists—one London newspaper carried an article praising the Gnat and headed it: "Who will rescue this airplane?"

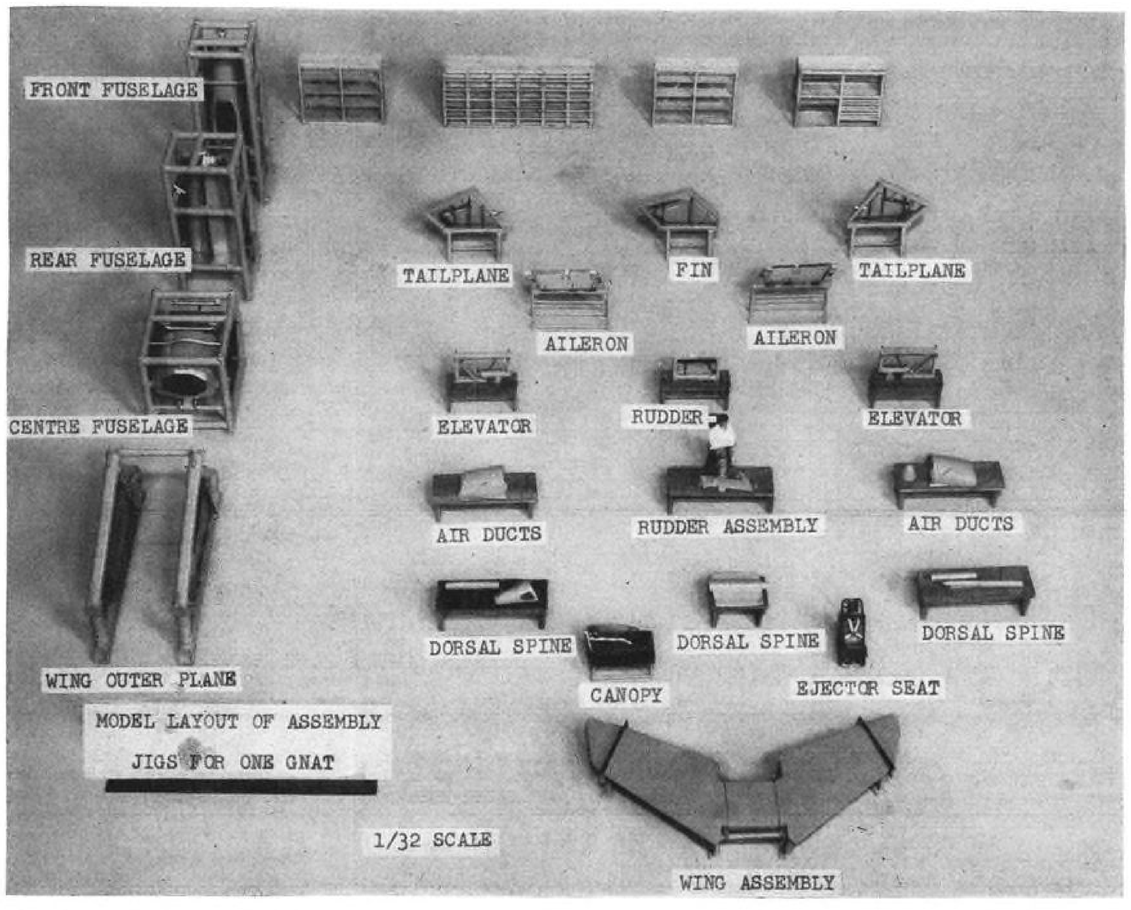
• **Reaction of pilots at the Aeroplane and Armament Experimental Establishment** (official proving ground of RAF

GNAT PERFORMANCE at Farnborough helped plane overcome official foot-dragging.



POWERED BY ORPHEUS jet engine, Gnat has been heralded by Folland as "the world's first successful light jet fighter." Plane is easily controllable right up to high-subsonic performance limit.

POWER-OPERATED inboard ailerons droop when undercarriage legs are fully down and serve as flaps to steepen angle and reduce Gnat's landing-approach speed.



equipment) was enthusiastic. A&AEE pilots, who have almost unanimously roasted every postwar British military airplane, reported complete satisfaction with the Midge. In particular, they singled out the longitudinal control system for praise, emphasizing by indirection the known inadequacies of that control on other British aircraft.

Tangible Proof

The Gnat is tangible proof of the light-fighter concept; its design philosophy—to do unto others more, for less, than they can do to you—is the product of W. E. W. Petter.

Like the Gnat, Petter is a controversial figure.

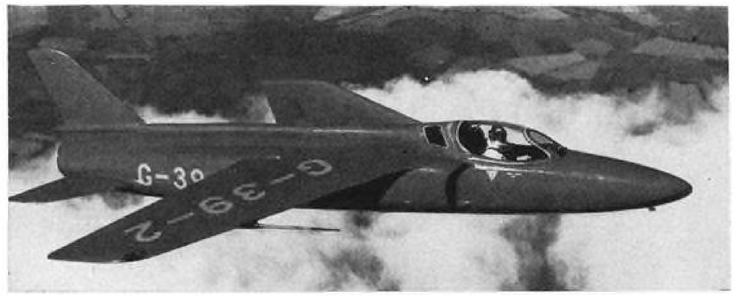
To his design credit are the Westland Lysander, Whirlwind and Welkin and the English Electric Canberra; he also contributed to the concept of the P.1 before he left English Electric. He refuses to be bound by tradition in design and has locked horns publicly with one or more of the old-time British designers. This has not made the path any smoother for the Gnat.

But Petter's stubborn refusal to give an inch, plus his determined drive to get the light-fighter concept accepted, have pushed the tiny blue plane into being and into the limelight of argument.

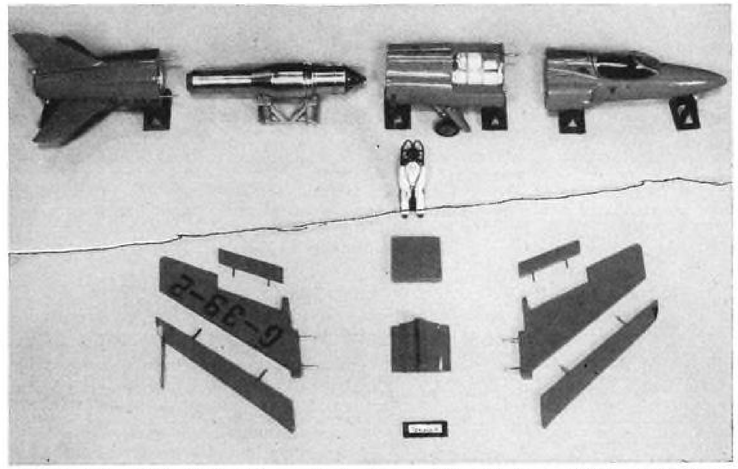
Basically the Gnat has performance matching or bettering its contemporaries. Its speed is high subsonic, and it remains easily controllable right up to its performance limits. "You fly the Gnat," said one British test pilot, "It doesn't fly you."

It can stay in the air for more than one hour with internal fuel and for two hours with external tanks. Its ceiling is over 50,000 ft., and can be expected to improve as the airplane and engine develop during the next few years.

Span of the tiny craft is 22 ft. 2 in.; overall length is 29 ft. 9 in. Wing sweep is 40 degrees. Gross weight is under 7,000 lb.



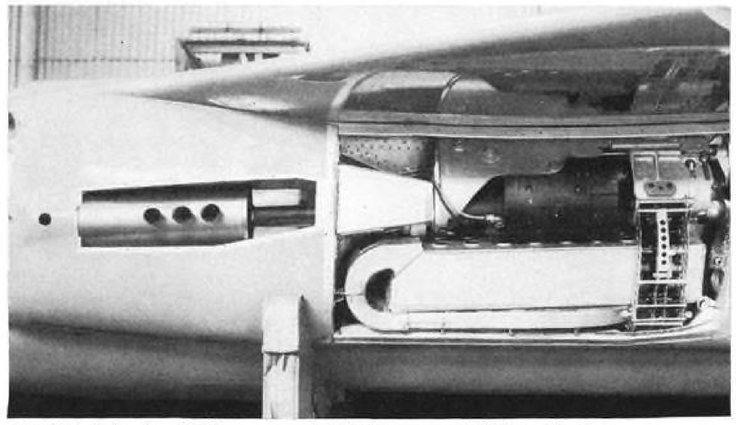
SIDE VIEW shows Gnat's low horizontal all-flying tail, high swept wing.



MODEL designed by Folland shows Gnat sub assemblies. Parts are 1/24th actual size.

Powerplant of the Gnat is the Bristol Orpheus axial-flow turbojet, an engine with a thrust-weight ratio approaching five. Now rated near the 4,000-lb. thrust level, the Orpheus is expected to be type-tested at 4,850 lb. by the end of this year.

Meanwhile, production of the first few Gnats is on schedule. The third airplane—second Gnat—is in the jigs nearing completion. Production jigs and fixtures are being built on a small section of the crowded main assembly floor of the Folland plant here. Subassemblies for Number Four and later airplanes should now be headed for component assembly.



DETAILS of the Gnat's 30 mm. gun installation are revealed in static display.

Design Improvements

Paralleling production development is a program to keep the Gnat design abreast of the changing aeronautical times. Aerodynamic and structural improvements are slated for incorporation in early models. Among the contemplated developments for the Gnat:

• **Slab tail for aerodynamic efficiency above sonic speed.** Current Gnat elevator design—a modified all-flying tail—holds its effectiveness up to Mach 1 in flight. One example: Tennant has pulled more than 6.5G at 25,000 ft. at an indicated Mach number of 0.95, with the stick force less than 30 lb. Petter said that engineering has been completed for the slab tail design but that he intends to hold off on the Mk.1 Gnats because of the increased cost and maintenance associated with slab tail.

• **Thin wing of 6% thickness-chord ratio** replacing the present 8% surface. This thin wing has been designed and

built in Folland's experimental shop. Structural testing of the surface has been successful and it will be incorporated on production Gnats at an early date.

• **Redesign of the upper back of the fuselage.** The dorsal spine of the Gnat is enlarging because there are more things to put in it, and the rear fuselage may be expanded to accommodate an afterburner for the Bristol Orpheus. Both these changes may force a reshaping of the rear contours of the fuselage to eliminate the indentations on the upper surface, either side of the spine.

• **Cockpit modifications in layout.** The throttle quadrant will be lowered a little for better visibility of the side shelf; all side instruments are to be angled to match the pilot's line of sight.

• **Other aerodynamic changes of a minor nature**—such as trying out wing fences because of the slight tendency of the Gnat to drop off on a wing at the stall. The duct inlet lip is being cut back now to find its effect on engine performance and inlet-engine matching.

Petter says the area distribution of the Gnat is probably favorable enough so that the plane would not have to be redesigned to the area rule.

Gnat Aerodynamics

Aerodynamic design of the Gnat is conventional by current standards. The wing is of low aspect ratio (3.6) and is swept 40 degrees.

The horizontal tail is set low on the fuselage to avoid pitch-up problems; its sweep is greater than that of the tail.

Both wing and tail are of constant 8% thickness-chord ratio, but, as mentioned above, the wing will be changed to a 6% value in later production airplanes.

Two features help account for the maneuverability of the Gnat—inboard ailerons and a variation on the all-flying tail.

The inboard ailerons are power-operated; they droop to act as flaps during the landing approach. The design was tried on the second wing fitted to the Midge and proved completely satisfactory. The rate of roll stayed the same, the landing approach with ailerons drooped was slower and steeper and the landing run was reduced.

The Gnat horizontal tail combines power and manual operation. The stabilizer is powered by hydraulics for large deflections, and there is an overriding electric trim motor for the stabilizer. Elevators are manually operated from the stick. Motion of the elevator moves a valve which allows the hydraulic system to operate the stabilizer as a follow-up. The pilot may switch the hydraulic power system in or out as he

desires. Tail deflection is from zero to minus 12 deg. incidence.

The rudder is not powered but has centering springs.

The first reaction of any observer of the Midge and Gnat in flight is apt to be, "You can't maneuver like that!" To see Tennant pulling tight turns at near-zero altitudes is an unforgettable and startling experience. Seen from behind, the Gnat appears to quarter-roll up on a wingtip and then pull into a turn of tiny radius.

Handling the Gnat

Takeoff of the Gnat at Farnborough was somewhat longer than expected; part of this was due to the de-rated thrust of the Orpheus, and part to the natural caution of a pilot with the only prototype at a public display.

Rate of roll of the Gnat is extremely high, comparable to a delta's rate. If the power boost is not used, the ailerons stiffen up at high Mach numbers, as is expected. Both Tenant and L. M. Whittington, who is the other Folland pilot, believe they could fight with the Gnat without power on the controls. But they are both powerfully built, and the job of flying without power might not be so easy for a smaller or lighter man.

The Gnat shows no tendency to pitch up or to dig in during accelerated maneuvers, say the pilots, nor is there any evidence of buffeting at high Mach numbers.

Stall is gentle and occurs at about 104 knots true IAS with the airplane dirty and at about 109 knots true IAS in the clean condition. Approach speeds are around 115 to 120 knots. The Gnat shows some tendency to drop out of the stall on the left wing, but at that time the attitude is so nose-high that Tenant feels there is no danger of stalling out on approach. Approach speeds are between 115 and 120 knots.

There is no speed restriction on lowering the brakes, which are formed by the landing gear doors and the gear itself, lowered only partially. With the brakes down, the Gnat decelerates from top sea level speed to landing speed in about one minute.

At first glance, there might appear to be pilot objection to the track width of the landing gear, which is only 61 inches. Tennant said that other pilots had mentioned it before flight but not after making landings, indicating that there was no trouble.

Gnat Structure

Simplicity was Petter's guiding star in developing the Gnat. Its structure is a model of simplicity.

Basis of the airplane is a single large forging that serves as the attachment point for wing, landing gear and guns. Forward of this is a box made of vertical

shear webs and horizontal beams, running to the inclined bulkhead just behind the pilot. From there forward, the structure is conventional ring and stringer and is the pressurized portion of the plane.

To this basic box with a nose are buttoned the duct inlets and ducting, the dorsal spine and the ventral sections. Thus, the box is the only fuselage item that must be built in an expensive jig; the ducting and upper and lower sections can be bench-built in simple fixtures.

Six tapered locating pins define the wing position, and four bolts are the connection between wing and fuselage.

One of the most unusual test rigs in the aircraft business has been developed at Folland for measuring stresses in the airplane when the 30-mm. Aden revolver cannon are fired. It consists of a strong-back frame, much like any structural test rig, in which a forward fuselage partial section of the Gnat is spring-suspended. Springing has a low frequency and simulates the general dynamics of the airplane in flight.

More than 600 strain gages have been fixed to the fuselage section to measure the stresses; 100 of these are earmarked for the local loads produced by the firing. The reason for the rig is that the Aden has an offset breech mechanism, and firing the guns produces a torsional load from the recoil on the gun mount.

Powerplant

Folland engineers give much credit for the success of the Gnat to its powerplant, the Bristol Orpheus. This lightweight turbojet had never been flown before its installation in the Gnat prototype, and there was—quite naturally—considerable apprehension about its airborne performance.

Many hours of ground runs had proven the engine; the big question was what it would do in the air.

Before the first flight, Tennant had taxied the Gnat all over Chilbolton airfield at all speeds and attitudes to satisfy himself that the intakes worked and didn't stall out at angles of yaw or attack. Final proof came on the first flight, and the Orpheus has given no trouble during the test program.

The long-life Viper, used to power the Midge prototype, also proved its worth during the more than 110 hours racked up by that plane before it was lost during takeoff by Swiss pilot Max Mathez. Originally cleared for only 25 hr. flight time, the Armstrong Siddeley engine was cleared further for 50 hr. before the 25-hr. period had elapsed. The engine was changed at the 50-hr. mark and replaced with a new engine. The older engine was reworked and installed in the Midge at the 100-hr. flight time level.

One thing must be understood about

the Gnat: It is a complete airplane, just as is the Douglas A4D, pioneering the light-fighter concept in this country. Instrumentation is standard, as are the equipment and controls. Cockpit layout is roomy enough to take Tennant in an inflated pressure suit, and that should provide room enough for most pilots.

Equipment includes a completely automatic and lightweight ejection seat, a gyro gunsight, oxygen regulator, VHF radio and standby set, DME, radar ranging or IFF gear, a braking chute and provision for a homing device. Cockpit temperature is regulated by the pilot; a single selector valve gives him cold, warm or hot air or intermediate mixtures.

The Gnat is tiny, and most of the maintenance work in the nose of the airplane can be done at waist height. When you stand alongside the airplane to talk with the pilot seated in the cockpit, his eyes and yours are about at the same level.

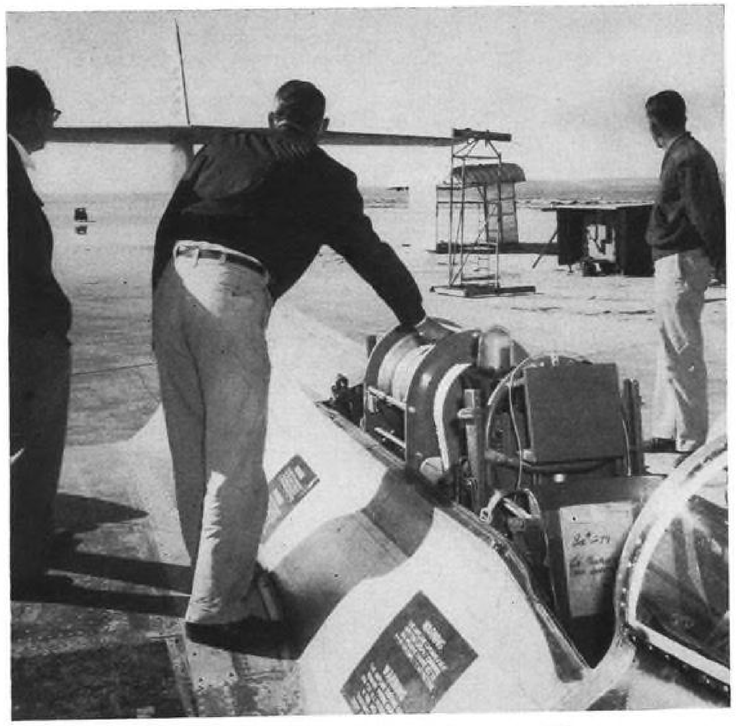
But for its size, it can pack a formidable wallop. It has twin 30-mm. cannon and can carry—for a short-range ground support mission—as much as 2,000 lb. of external stores, or roughly one-third of its normal gross. It can be adapted for carrier use an dwould require no wing folding. More than 25% extra complement of Gnats could be carried.

Thus the Gnat shows promise and proven performance. Its production design has been carefully planned for minimum cost and maximum ease of manufacture. Pilots fall in love with its performance, and technicians praise its concept and detailed engineering.

Five Gnats can be bought for the price of two Hunters, if some of the current figures of fighter cost are correct. In production, a Gnat would sell for between $150,000 and $175,000 ready to go.

Folland, with the highest airframe weight output per man in the British aircraft industry, has established itself as a firm able to guarantee deliveries on a wide variety of subcontracted items. The space is available to build the Gnats.

All Folland needs is the word to go ahead.



Tow Reel Handles Giant Banner Target

High-velocity tow reel, capable of pulling a giant banner target on a two-mile cable at speeds of more than 600 ph., has been developed for USAF by Northrop Aircraft, Inc. The reel accommodates 10,000 ft. of cable and can pull a target totaling more than 400 sq. ft. in area, nine ft. high and 45 ft. long. First reels off the production line will be installed in Martin B-57 and North American B-45 Tornado jet bombers with specially-redesigned bomb-bays. Several reels can be placed in each target-carrying airplane to provide a multiple-target capability.

Rolls-Royce's Pearson Reviews Jet Engine Development Problems

Designers of British civil aircraft who want to use turbojet engines in the next five years should have plenty to choose from. But they may have to tailor the planes to the available powerplants.

If they choose turboprops, they will more likely find engines designed for their particular type and size of aircraft.

The reason, says J. D. Pearson, managing director of Rolls-Royce's Aero Engine Div., is that the impetus for turboprops in Britain has been mainly civil, with the military more interested in turbojets. Delivering the first Albert Plesman Memorial Lecture at Delft, Holland, Pearson said his company's Dart was the first aircraft engine to go into large-scale production for airline use without substantial prior military experience. Nor, is it likely that the Dart will be the last turboprop powerplant that will have to follow this pattern.

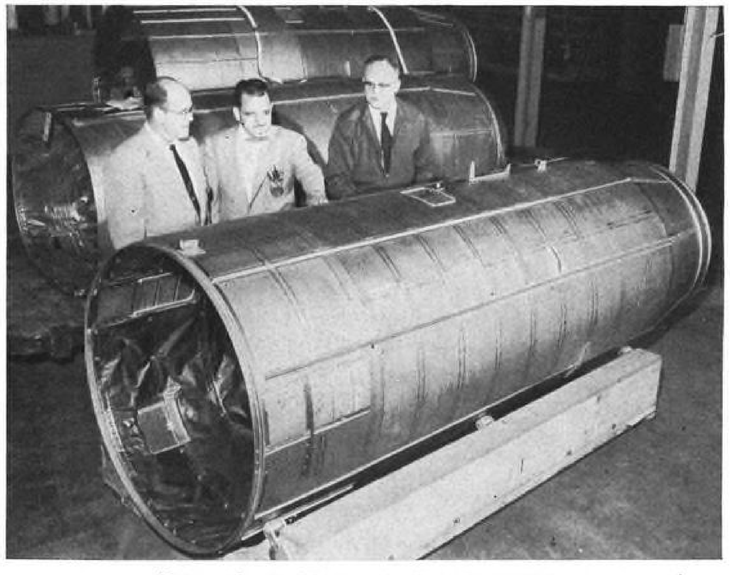
Teething Troubles

"This is unfortunate for the airline operators," Pearson says, "as it seems that they, and not the military, will have to go through the teething troubles of an entirely new engine." It would help if the military took the first production engines of a new series for use in a service transport, or use the civil-developed engines for their own non-transport uses, Pearson says. Since designers cannot rely on this happening, they must assume that turboprop development will continue to be a job for civil aviation for some time.

Pearson did not mention U. S. turboprop development, but undoubtedly was thinking of Military Air Transport Service's turboprop program, which involves the Allison T56 and the Pratt & Whitney T34. The T56 in its civilian version—Model 501 has been ordered to power American Airline's Lockheed Electras.

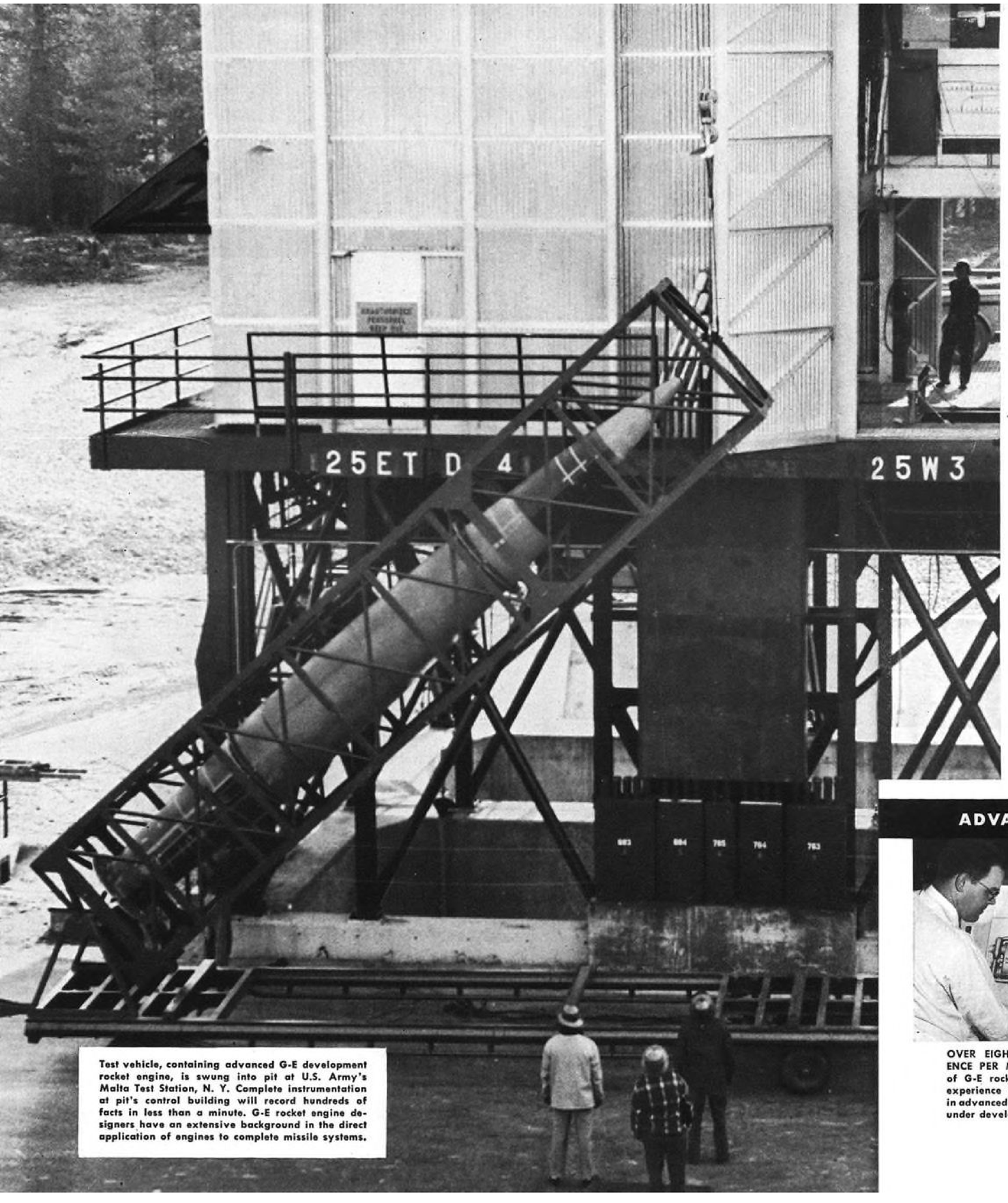
Development of the Rolls-Royce Dart, from the time the design was laid down in 1945 as a 1,000-hp. engine for a single-engine military trainer until delivery of the first production Dart 505 took about 12,000 hours on the bench. There were delays because this was the first turboprop engine to be taken through to production but Pearson says any future new civil engine will not take much less time.

"Any credit for getting cleverer and benefiting from past experience and the knowledge which has been accumulated is balanced by the fact that each



Dimpled Shroud for F-102A

Dimples and ridges rolled into titanium sheet at the forming mill will give greater rigidity and strength to the shroud used on the J57 turbojet engine that powers Convair's F-102A. The new technique also permits use of thinner titanium sheet. This, together with the replacement of rivets by seam and spot welds, cuts the shroud's weight. Convair-San Diego says the F-102A is the first airplane in which the dimpled titanium will be used.



Test vehicle, containing advanced G-E development rocket engine, is swung into pit at U.S. Army's Malta Test Station, N. Y. Complete instrumentation at pit's control building will record hundreds of facts in less than a minute. G-E rocket engine designers have an extensive background in the direct application of engines to complete missile systems.

ROCKET ENGINE PROGRESS AT GENERAL ELECTRIC

Weight Cut More Than 50% In NEW G-E Rocket Thrust Chamber

General Electric has tested an advanced rocket thrust chamber which weighs 50% less per pound of thrust than previous chambers of similar design. This marks another step in General Electric's continuing progress in developing better engines for the aviation industry. The significant weight reduction was achieved without compromising performance and reliability characteristics typical of G-E engines.

General Electric has been cutting rocket engine weight ever since G-E engineers ran the first U.S. tests on German V-2 engines in 1947. For example, the use of lighter materials and the transfer of start-up components from missile to ground are two weight reduction methods G.E. has pioneered. Experiments with new materials and new means of fabrication promise even more improvements on future engines.

Advanced Facilities Speed New Rocket Engine Development

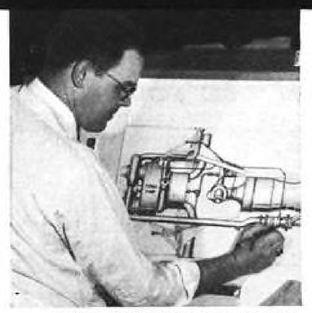
Today, General Electric is able to undertake a wide variety of rocket engine development work. The Company's rocket team, as an integral part of the Aircraft Gas Turbine Development Department, has access to the nation's most advanced privately-owned aircraft engine development facilities, as well as support from other G-E labs.

These facilities spell more and faster development progress for rocket engine programs and they underline G.E.'s increased capability for developing a wide range of rocket systems, subassemblies and components. To find out how General Electric can meet your specific rocket engine needs, contact a G-E Aircraft Specialist through your nearest G-E Apparatus Sales Office. 234-2

Progress Is Our Most Important Product

GENERAL ELECTRIC

ADVANCED ROCKET ENGINE DEVELOPMENT ACTIVITIES AT G.E.



OVER EIGHT YEARS' EXPERIENCE PER MAN is the record of G-E rocket engineers. This experience is now paying off in advanced powerplant designs under development.

STRONGER, LIGHTER ALLOYS being developed at G.E. will give rocket engines greater reliability, higher performance. A technician at the Company's Materials Laboratory checks a new alloy for tensile strength.

PREDICTING ADVANCED G-E ENGINE PERFORMANCE with electronic computer cuts development time, enables G-E engineers to ascertain optimum design characteristics of engines still on the drawing board.

G-E Facilities Available to Support Rocket Engine Programs:

- Component Development Laboratory
- Materials Laboratory
- Research Laboratory
- General Engineering Laboratory
- Combustion Laboratory
- Metals and Ceramics Laboratory

succeeding engine gets more complicated and more difficult," Pearson points out. As an example: The Dart has 12,000 parts; the new R.B. 109 has 20,000 parts.

Indicative of the progress in turboprop development, the R.B. 109 gives nearly three times the horsepower of the first service Darts, without increasing overall diameters and with only 50% greater weight.

Flight Endurance Tests

Flight endurance testing is a major problem with an engine which has no prior military background. The Dart accumulated 14,500 hr. before the first Viscount transport went into regular passenger service. Most—9,000 hr.—was done on the two Viscount prototypes.

Two BEA Dakotas, fitted with Darts, operated 4,000 hr. as freighters. Pearson finds endurance flying by an airline operator the most valuable form of testing.

Supersonic speeds and high altitudes present engine designers with new problems. Flight testing is restricted by weather conditions, lack of suitable aircraft at the stage of the development program when the tests are most needed, restricted risk that can be taken with a flight engine, and the difficulty of making sufficient quantitative test observations in flight.

The alternative is a ground test faility capable of simulating the desired conditions for a complete engine. Rolls is building one with its own funds. The new facility will have a wind tunnel capable of testing models to Mach 4, and be able to handle full-scale combustion tests at high and low pressures, and full-scale compressor test.

Performance Improvement

The turboprop engine lends itself very well to continued performance development, Pearson points out. Improvements in turbine and compressor efficiency show up in magnified form as shaft horsepower—the difference between the power developed by the turbines and the power required to drive the compressor. For example in an engine like the Dart, if the turbines develop 4,500 hp. and the compressor takes 3,000 hp., shaft horsepower is the difference, or 1,500 hp. A 1% improvement in turbine efficiency raises turbine horsepower to 4,545 hp., equal to a 3% increase at the shaft, where horsepower is raised to 1,545 hp. Similarly a 1% increase in compressor efficiency shows up as a 2% increase in shaft horsepower.

Another way of improving the power and reducing specific fuel consumption of turboprop engines is by raising the cycle temperature. Intensive development now proceeding on air cooled turbine blades and air cooled nozzle guide vanes will lead to continuous performance improvement of existing turboprop engines for some time to come, according to Pearson.

In turbojet engines, increase in temperature has no such effect on performance. The thermodynamic efficiency of the cycle increases with temperature is more than offset by the decreasing propulsive efficiency of the jet, Pearson points out. The optimum specific fuel consumption is obtained at a much lower flame temperature at subsonic forward speeds than that at which the engine must be designed for good thrust/weight ratio.

However, improving the efficiency of components or raising the compression ratio by adding stages to the front or rear of the compressor will improve the specific fuel consumption of the jet engine. In one engine, specific fuel consumption has been reduced 8% through these methods, according to Pearson.

The by-pass engine, described as a "half-way house" between the turobprop and the turbojet, can take advantage of higher temperatures, combining the better efficiency obtained at a higher turbine inlet temperature with the improved propulsive efficiency derived

EVER LAND A JET ON A FLATTOP?

U.S. NAVY'S TOUGHEST PILOT-TRAINING PROBLEM MADE EASIER BY WORLD'S SAFEST JET TRAINER.

LOCKHEED **T2V-1**

Once you try it, you know there's nothing trickier than setting down on a carrier at jet landing speed. Add fickle winds to a pitching, yawing, rolling deck, and there's plenty to think about, especially during early training.

That's why the Navy needed the world's safest two-place jet trainer. It's now in production at Lockheed.

The T2V-1 is the slowest-landing high-performance jet ever built—lands at less than 90 knots yet flies at close to 500 knots. It's the first U.S. plane ordered into production utilizing Boundary Layer Control.

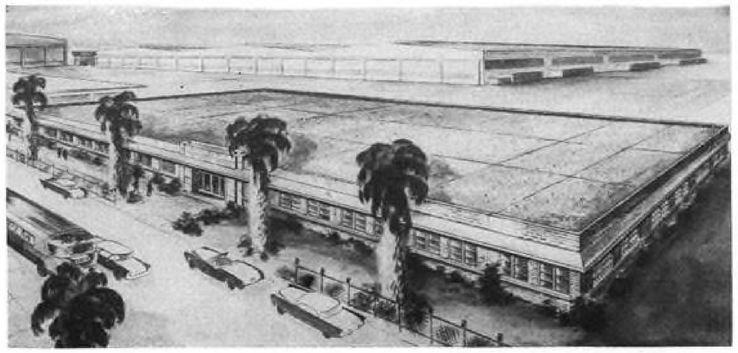
With "BLC," compressed air from the engine is shunted into the wing, then blasted through tiny holes over wing flaps. This causes air flow to hug flap surfaces. *Result:* increased lift for safe landings at lower speed, shorter takeoff runs.

Other innovations of America's first carrier-based jet trainer: aerodynamically actuated slats on the wing's leading edge for better low-speed stability, elevated rear seat for fuller vision, a simplified and roomier cockpit, high-capacity landing gear.

The Navy T2V-1 is a result of Lockheed's unmatched experience in building over 4,000 jet trainers—starting with the T-33, the world's first operational jet trainer.

LOCKHEED
AIRCRAFT CORPORATION
BURBANK, CALIFORNIA

LOOK TO LOCKHEED FOR
JET LEADERSHIP, TOO



Goodyear Aircraft Expands Engineering Facilites

A multi-million-dollar engineering expansion program at Goodyear Aircraft Corp. includes the new electronics' engineering building illustrated here now being constructed at Litchfield Park, Ariz. (AW Aug. 1, p. 7). The one-story brick-and-masonry structure, 60x200 ft., is expected to be ready by the end of the year. Another larger facility—a $3-million engineering and research building planned for the company's Akron center—will be three stories high and measure 400x125 ft. When it opens next summer, this unit will be devoted to research and development in aerophysics and electronics. Both new structures are to be fully air conditioned.

from a lower jet pipe temperature. This gives the by-pass its advantage over the turbojet in specific fuel consumption.

Reverse Thrust

A single-shaft turboprop design, such as the Dart, can provide significant amounts of reverse thrust. Since it handles a large amount of excess air—six times as much as a piston engine with the same power, Pearson says—it has a large pumping power consumption. By allowing the propeller to windmill and drive the compressor, a considerable amount of drag is available during the highspeed part of a landing run. Although this is reduced considerably when the aircraft slows down, it appears to represent a reasonable solution for aircraft of the size powered by the Dart, Pearson says.

With two-shaft turboprop engines, where the propeller is connected to only one of the shafts, available drag is reduced, and a reversible propeller such as used on piston aircraft will be needed.

New Alloy Solving Engine Problems

Use of new N-155 alloy nozzle boxes and collectors seems to be eliminating the chronic problem of nozzle box cracking in Wright 972-TC18-DA3 turbo compound engines that power Trans World Airlines' fleet of Super G Constellations.

Since installation of the new nozzle boxes began last August, unscheduled removal rates of turbines and their components have dropped considerably. TWA figures show that during July, removals of turbines or their components on a fleet of 19 aircraft, came to 226; of these, 156 were removed due to nozzle box cracking.

Corresponding figures for August were 201 and 128, yet the airline flew 1,000 more engine hours.

TWA spokesmen say that of the "several" N-155 units already flying in August, two had to be removed for repair.

The new type nozzle boxes are being installed fleet-wide on an "on-condition" basis.

Rocket Fire Detector

A new rocket fire detector has been designed to detect an incipient, inadvertent rocket ignition in one-half-thousandths of a second and operate the release mechanism in time to eject the missile from the plane before it can ignite the airframe with its 3,000C blast.

Called the Fireye rocket detector and developed by Electronics Corporation of America, the small, quarter-pound unit has been tested by a large airframe manufacturer.

Test experiments have shown that small rockets will burn through steel aircraft structure in less than 400 milliseconds, making it imperitive to eject spuriously-ignited rockets from the plane almost instantly.

This is how the detector works:

A lead sulphide photoconductive cell, developed by ECA for its new aircraft explosion and fire extinguishing systems, detects incipient infrared radiation of a spuriously-fired rocket. The cell's resistance to a constantly applied dc. voltage drops in a fraction of a thousandth of a second. Resist-

OFFSHORE HELICOPTERS—Humble Oil Company's drilling projects in the Gulf of Mexico are being served by three new Sikorsky Aircraft S-55 helicopters. For over-water operations, the helicopters are equipped with special flotation gear. Dependable Sikorsky S-55s, which avoid the hazards of surface transportation, have proved to be highly successful carrying drilling crews, special personnel and equipment between the mainland and offshore rigs.

AROUND THE WORLD WITH SIKORSKY HELICOPTERS

SONAR DUNKER—Versatility of Sikorsky helicopters is again being demonstrated in the Atlantic, where Navy HO4S helicopters now perform anti-submarine missions. By dunking or trailing special sonar gear, the HO4S is prepared to make a major contribution to the job of finding and killing enemy submarines. This HO4S, with rotor blades folded, is pictured aboard the USS Leyte.

COPTERS FOR CANADA—Sikorsky HO4S helicopters are now serving with the Royal Canadian Navy. The first aircraft of an additional order of ten is pictured here during brief delivery ceremonies. Sikorsky helicopters, both military and commercial, are widely used in Canada. The dependable transportation they provide in a wide variety of jobs is especially important in Canada's wilderness areas.

H-34s AT WORK—New Sikorsky H-34 transport helicopters are now on the job at Army aviation centers. Here a group of 12 combat-equipped soldiers at Camp Rucker, Alabama, trains with one of the big helicopters, which are larger and more powerful than the widely-used Sikorsky H-19s. The new helicopters are also built as the Navy's anti-submarine HSS and will also be available as a 12-passenger commercial S-58.

HELICOPTER HISTORY:

FIRST ARMY FLIGHT OF THE VS-300

In July, 1940, the first Army pilot flew a Sikorsky helicopter. He was Capt. H. F. Gregory (now Brig. General), pictured here in the experimental VS-300.

This historic aircraft, America's first truly successful helicopter, led to the manufacture of Sikorsky R-4s, with which the Army Air Corps pioneered helicopter operations during World War II.

SIKORSKY AIRCRAFT
BRIDGEPORT, CONNECTICUT
One of the Divisions of United Aircraft Corporation

ance drop is translated into a pulse and sent to a control section where it energizes a relay to operate the rocket release mechanism.

ECA said that in not one of the tests did the rocket exhaust cause damage to either the rocket package or the simulated aircraft structure.

The system can be installed anywhere it can operate at any place for maximum effectiveness.

Willow Run Gets Long-Life Pavement

A welded wire network embedded in asphalt is designed to increase the life of ramps and taxiways being resurfaced at Detroit's Willow Run Airport and cut down maintenance requirements. This is believed to be the first use of the "fabric-in-asphalt" process for major resurfacing of an airport.

The resurfacing was undertaken in order to improve and extend the life of the original pavement in some areas and increase its stability to carry plane loads of up to 75,000 lb., single wheel. Welded wire fabric reinforcement of the 3-in.-thick bituminous concrete was specified to reduce "reflective" cracking of the new surface over somewhat badly cracked unreinforced portland cement concrete slabs.

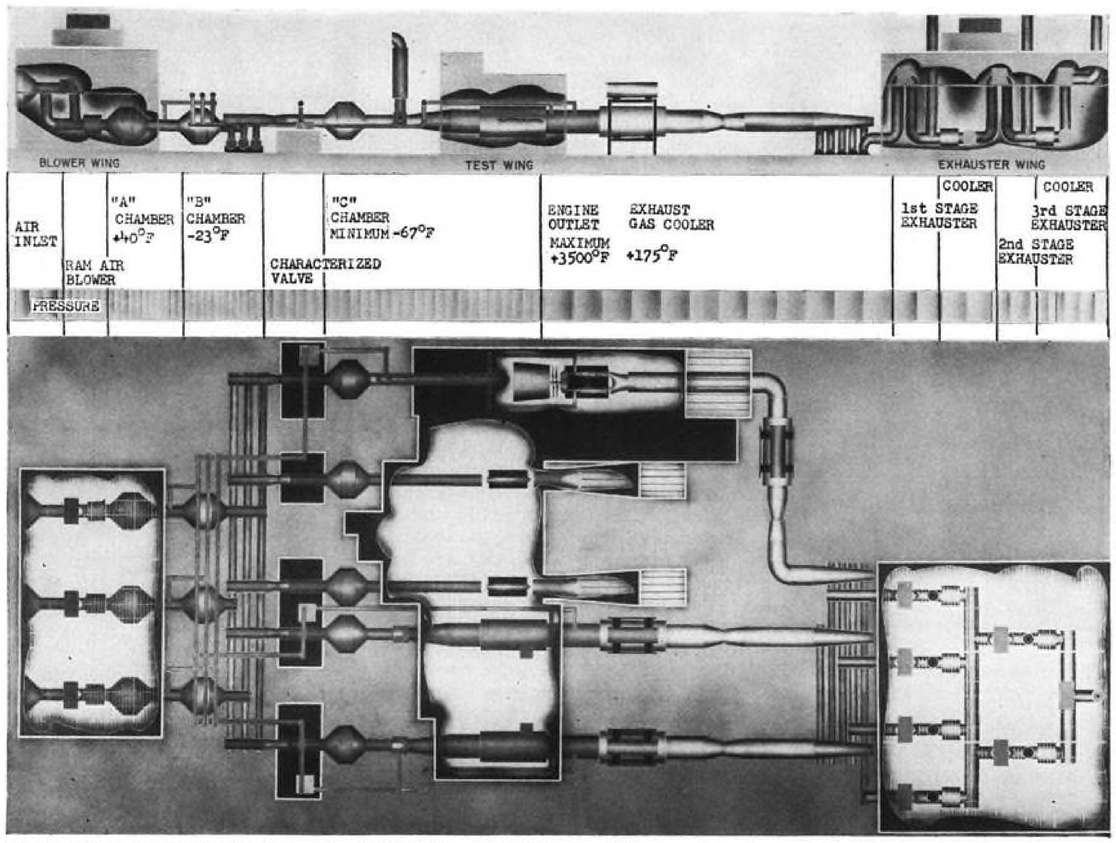
The original airport pavement built early during World War II is 6 to 8 in. thick but was not reinforced due to steel shortages. In certain areas 10x20 ft. slabs were requiring extensive maintenance of joints and cracks. The new resurfacing is expected to reduce maintenance cost by 70%.

Approximate cost of the project was $160,000, with Civil Aeronautics Administration putting up $80,000 to match the total of $40,000 each put up by Michigan State Department of Aeronautics and the University of Michigan. The university is owner of the facility, having purchased it from Defense Plants Corp. after the war.

The entire project, covering approximately 70,000 sq. yd. of pavement, required nearly 90 tons of welded wire fabric and about 14,000 tons of bituminous concrete, and was completed in 21 working days.

Turboprop Test Flights

Two Convair YC-131C turboprop transports have flown a total of 46 hr. 20 min. during a 24 hr. period. The air time was divided evenly between both planes. Aircraft, belonging to 1700th Air Transport Group, MATS, Kelly AFB, Tex., are fitted with Allison T56 turboprop engines and Aeroproducts Props. both YC-131Cs made four flights during the period.



PLAN AND SIDE DRAWING of the Navy's $40-million gas turbine test laboratory shows layout of buildings and equipment.

Navy Opening Giant Engine-Test Facility

By George L. Christian

West Trenton, N. J.—U. S. Navy officials this week are making final preparations for the official opening on Nov. 4 of the new Navy Aeronautical Turbine Test Station—in all probability the world's most complete and powerful facility built specifically for wringing out experimental and prototype turbojets, turboprop, ramjet and pulsejet powerplants.

The $40-million Navy station can simulate altitudes from sea level to 65,000 ft., air speeds from near-sonic at sea level to supersonic at altitude and temperatures from −67 to 150F. In the near future, the high-temperature capacity will be pushed to 350F.

Provisions for silencing alone—for air intake and exhaust mufflers and sound attenuation equipment—cost more than $3 million.

Three Big Jobs

The 65-acre station is designed to conduct three types of testing:

- **Steady state tests,** which will comprise most of the work. This includes engine qualification and calibration testing.
- **Transient tests,** which will determine engine characteristics during acceleration and deceleration.
- **Environmental tests,** which will check engine performance under various severe climatic, temperature and altitude conditions.

The gas turbine engine research and test facility must always be a good jump ahead of industry so there will be no delay in investigating new powerplant developments, Capt. J. E. Dodson, commanding officer of NATTS, pointed out to Aviation Week.

As an example, one of the five test cells recently finished is the only test rig known to Navy that is capable of subjecting complete turboprop engines to wide extremes of altitude and temperature. It contains an inlet throat with a variable orifice which can be adjusted to a wide range of propeller diameters.

Under active study is an "attitude test cell" designed to help solve power control, lubrication and bearing problems associated with powerplants for VTOL aircraft. This structure would accommodate a complete turbojet or turboprop powerplant in any position from horizontal through vertical.

1 Million Cfm.

To simulate ram air conditions met by jet engines, massive machines move huge amounts of air—total compressor capacity is 1 million cfm.—through the facility's trio of buildings, the blower, test and exhauster wings. The structures were erected in a straight line to minimize air flow pressure losses. Total air flow distance is 700 ft.

Air is drawn into the compressor wing and rammed through 48-in. headers to 23-ft.-dia. intercoolers. Here it is warmed or cooled to simulate heat of ram temperature rise or cold of stratospheric flight.

Headers are lined with stainless steel sheet to prevent corrosion, as flake-off could damage engines under test.

Out-size "characterized" valves, which are highly sensitive devices with rapid response and low pressure drop, regulate the air flow.

Air is then blasted to the test cells. After passing through the gas turbine engine which is under test, temperatures (if afterburner is used) may reach 3,500F. This is quickly dropped to 175F by special coolers to avoid heat damage to equipment in the exhauster wing. There three stages of blowers suck air away from test cells to simulate high altitude conditions.

Large capacity refrigeration equipment and a separate heater system make it possible to cold-soak powerplants to −67F to test cold starting and Arctic operating conditions.

Power consumption of the station will begin at 40,000 kw., soon increase to 50,000 kw. and eventually jump to 100,000 kw.

With all the machinery in operation, the test facility has a connected working load of almost 100,000 hp.

Control Center

Heart of the test station is a supervisory control room built on the front of the test wing.

Here, a 35-ft. central control panel equipped with lights, dials, gages and controls allow engineers to supervise the functioning of every part of the laboratory, give permission to operate equipment, and direct air flow.

Controls were designed and installed by Minneapolis-Honeywell Regulator Co. and include more than 23 miles of copper tubing plus 26 miles of thermocouple wiring which focus vital information from all parts of the laboratory on the panel for the engineers to read.

Controls are of the "permissive" type—manual on-off interlocks which prevent any part of the laboratory's machinery from being started until all operating requirements have been satisfied.

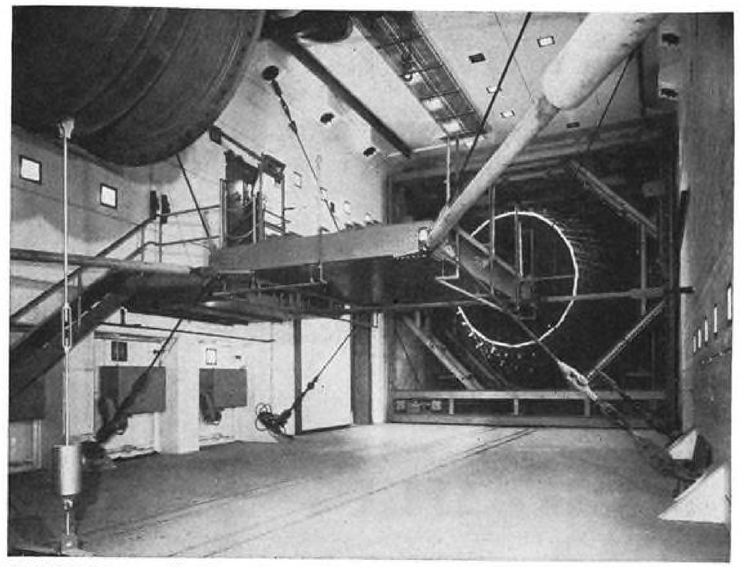
Engineers do not control any of the machinery, they merely give permission to on-the-spot operators to set it in motion. They act as coordinators to assure that all parts of the complex laboratory function as a team.

Any emergency can be spotted immediately in the supervisory control room and pushing a single button can shut down the entire shop.

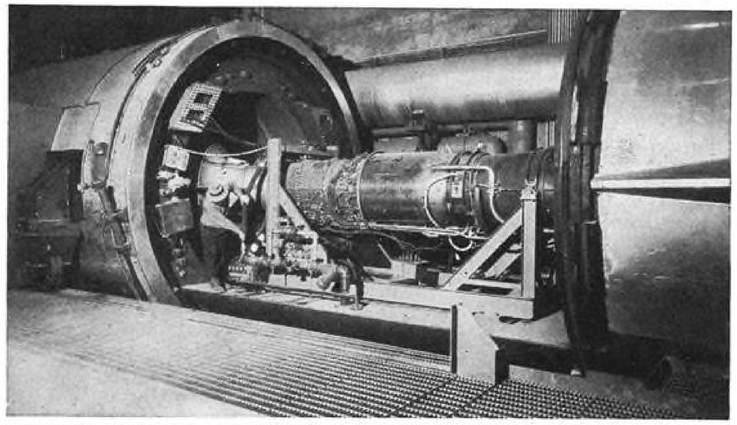
Laboratory personnel in individual sound-proofed control centers located close to each test cell operate the engines, watching the tests both through elaborate instrumentation and physical observation.

The indicators on the control room panel check 348 temperatures throughout the facility. Three hundred other temperatures are easily verified by a standard dial telephone which incorporates a special check system.

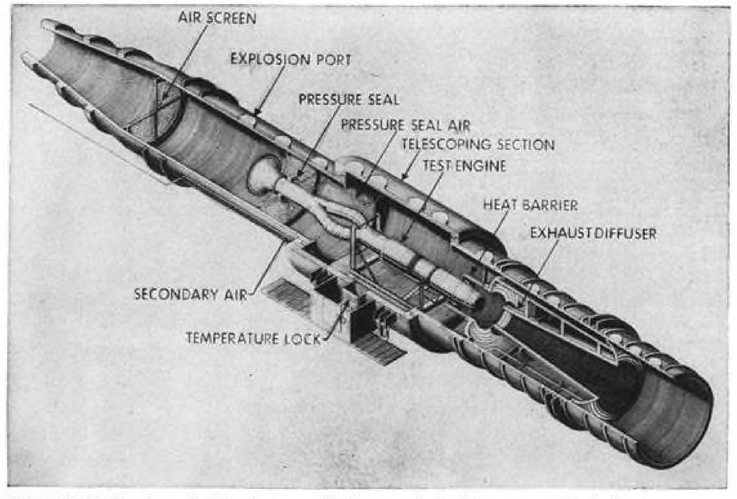
Operating personnel can communi-



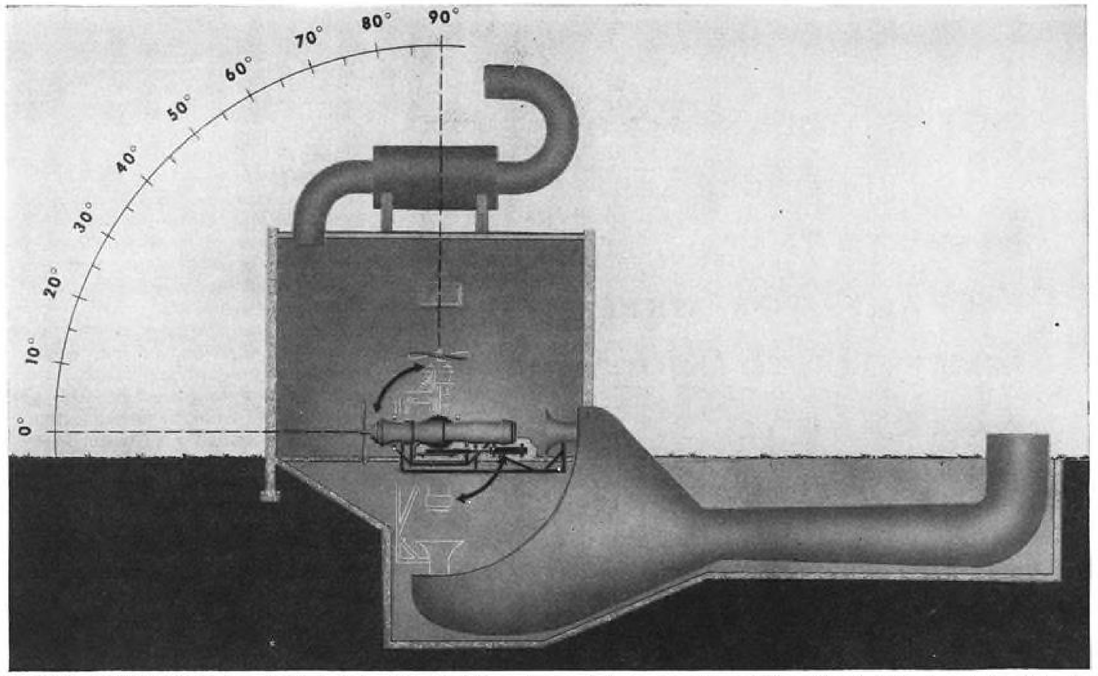
TURBOPROP test cell with engine platform in center, variable orifice inlet throat at right.



ALTITUDE TEST CELL. Open telescoping section shows T-40 turbojet being installed.



CUTAWAY drawing of altitude test cell shows principal features and air flow.



ARTIST'S CONCEPTION of an "attitude test cell." Rendering shows a turboprop engine and the rack and pinion for rotating it to the vertical position (shown in phantom). Air is drawn in through intake and silencer on the roof, exhaust is underground.

cate with each other only by going through the control room. Control engineers can talk with personnel anywhere in the laboratory through a closed loop communications system.

Blower Wing

The blower wing houses three Ingersoll-Rand high-pressure centrifugal blowers.

Air is taken in through intake silencers and filters and is pumped through primary coolers which dehumidify and cool it to 40F. It then passes through secondary coolers which can lower the temperature to —23F.

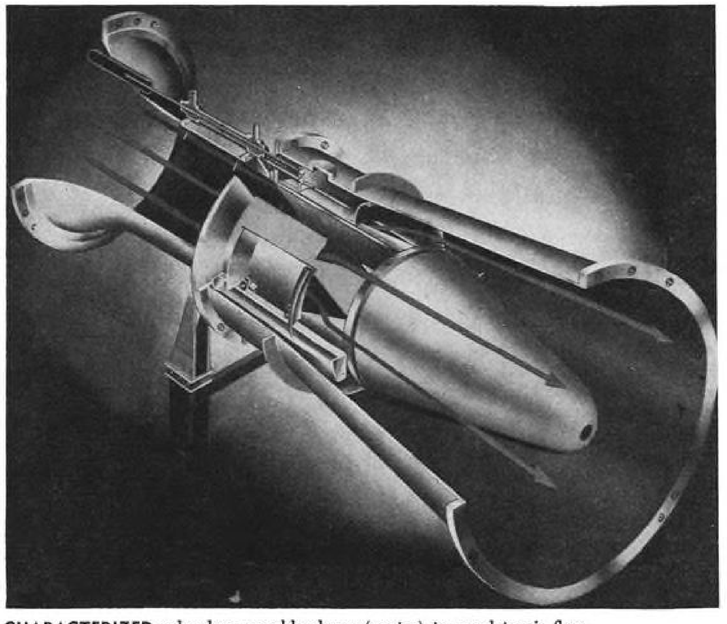
Flooring in the blower wing is mostly open metal grating, supported by steel I-beams which are bolted to the building's primary structure. This makes it easy to pull out entire sections of flooring to facilitate installation of large new machines as they are needed.

Also housed in the blower wing are large Freon and brine machines and associated feeder lines.

From the secondary coolers, air passes into five headers, each having a characterized valve and 23-foot diameter intercooler. The valves may be actuated manually through a pneumatic system or automatically through an electrohydraulic control.

The intercoolers warm or cool air flowing to the test cells to simulate ram heat or altitude cold.

The test wing houses five test cells—two altitude chambers, two sea level test rigs and the turboprop test cell.



CHARACTERIZED valve has movable sleeve (center) to regulate air flow.

Each altitude test cell is a metal cylinder 65 ft. long and 15 ft. in diameter. The center section telescopes over the forward part to allow engine to be mounted on a thrust measuring stand inside the cell. After the engine has been installed and all fuel, ignition, control and instrumentation hook-ups made, the center section is positioned hydraulically and locked to both front and back segments by means of a mechanical, wedge-type lock. Specially designed inflatable rubber seals make fore and aft joints airtight.

A special partition, tailored to the

outside diameter of the powerplant being tested, seals the area between the forward part of the engine and the inner wall of the test cell. This diverts all blower air into the powerplant's intakes and prevents dilution of exhauster suction with ram pressure.

At present, the altitude cell will not handle jet engines equipped with afterburners because of the risk of destructive afterburner detonation. Plans are under way to install water spray curtains to break the detonation and eliminate this deficiency.

The cells can also be used to test engines with air under ambient temperature and pressure conditions. The center sections have air lock doors to permit entry during engine operation.

Deflection caused by mounting heavy jet engines on a cantilever platform about 30 ft. long creates an alignment problem between telescoping center section and fixed front and rear parts. Future altitude cells will have hinged instead of telescoping access sections.

Sea Level Tests

The sea level test cells can also operate on either conditioned ram air or ambient atmosphere and accommodate engines with or without afterburners.

Engine exhaust, instead of being evacuated by exhausters, is dumped into a sound attenuation chamber which deadens the loud roar to the level of an automobile exhaust.

Engine cradles are fashioned of hollow steel tubing. Provisions have been made to circulate cooling water through the tubing in case heat from the engine becomes too intense.

Four water spray rings are directly behind the engine to cool the exhaust and prevent its heat from damaging the sound attenuation material.

The automatic Minneapolis-Honeywell equipment cuts in the first spray ring when temperature reaches 380F. Successive rings go into operation as temperature climbs to 460F, at which point an alarm is sounded.

The turboprop test cell can test engines with conditioned or ambient air and under high-altitude conditions. Propellers turn in ambient air only.

Props draw in air through 30-ft.-high acoustical baffles and a variable-orifice inlet whose circumference at the propeller end can be adjusted from 9 to 20 ft. Purpose is to eliminate inlet buffeting around prop tips. The whole orifice structure can be moved back and forth to accommodate turboprop engines of different lengths.

Engine exhaust is drawn into the exhauster wing. Prop wash is blown through a sound-attenuation chamber where noise is reduced to a level equivalent to hearing the turboprop four miles away.

The engine is mounted on a cable-

LARGE-SIZE refrigeration piping leads to intercooler (left) and test wing (right).

supported stand which is equipped with a thrust-measuring mechanism.

In the area between the test cells and exhauster wing are three specially designed coolers—one for each of the two altitude chambers and one for the turboprop engine exhaust. They can knock temperatures from 3,500F down to 175F in the space of a few feet.

Exhauster Wing

The exhauster wing, which is currently being doubled in size and capacity, contains seven De Laval turbo-exhausters. In the first stage, four machines, each powered by a 4,500-hp. electric motor, can simulate altitudes up to 23,000 ft. In the second stage, two exhausters driven by 3,500-hp. motors, brings the altitude up to 44,000 ft. Third stage, a single exhauster requiring 3,000 hp., takes test cell altitudes to 65,000 ft.

Other equipment in the building includes silencing provisions, coolers and an extensive air circulation system to ventilate the building. All exhauster air pumping equipment is interconnected by large-diameter headers and air flow is controlled by over-size gate valves—some three stories high.

As in the blower wing, almost of the building's flooring is removable metal grating.

New Additions

Navy spokesmen sketched these additional details of expansions, either under way or planned, for NATTS:

• **Blower wing will be extended** to accommodate one additional blower and motor equal in capacity to each of the three now installed.

• **Altitude test cell** currently in the design stage will be somewhat larger than the two existing cells to handle large future engines. Associated equipment will also be able to create higher temperatures—up to 350F—to simulate ram heat rise. Design of the cell itself will differ from existing units in that hinging rather than telescoping action will open the chamber.

• **Environmental test cell** is being planned to submit gas turbine engines to a variety of severe climatic conditions.

• **Accessory test cell,** where engine accessories will be subjected to the same temperature and altitude extremes as the engines themselves, is in the planning stage.

Auxiliary Facilities

Auxiliary facilities of NATTS include a pumping station on the Delaware River two miles away, with capacity of 5,000 gpm. Water is pushed through a 20-in. main to a water treatment plant from which it is piped to a 1.2-million-gal. reservoir. Above the reservoir is a group of 12 water towers, each equipped with a large-diameter cooling fan. With normal ambient temperatures, each tower has a capacity of 5,000 gpm. and can drop water temperature from 135F to 90F. Sixty-inch reinforced concrete pipes bring water to the towers from the facility's various intercoolers, heat exchangers and exhaust coolers under a pressure of 100 psi.

Recirculation of cooling water through the towers means that the pumping station needs only to replenish water lost through evaporation.

NATTS also has an electric sub-station into which 13,200-v. current is piped through underground cables sealed in oil and nitrogen.

This newest Navy aeronautical test lab is under military command; technical coordination under the Commander, Naval Air Development and Material Center, Johnsville, Pa.; jurisdiction under the Fourth Naval District.

School Expands

Rio de Janeiro—The Institute Technologico de Aeronautica, Brazil's version of M.I.T. with the emphasis on aeronautics, has begun an important expansion program. New projects include an airport with two-and-one-half-mile-long landing strips, an all-concrete wind tunnel and an engine division using machinery from a World War II Packard Rolls Royce airplane engine factory in the U.S.

P&W Increases Space

Pratt & Whitney Aircraft plans to double the production space of its North Haven Conn., plant. The company expects the addition—500,000 sq. ft. of production floor space and 100,000 sq. ft. of office floor space—to be ready for occupancy by mid-1956.

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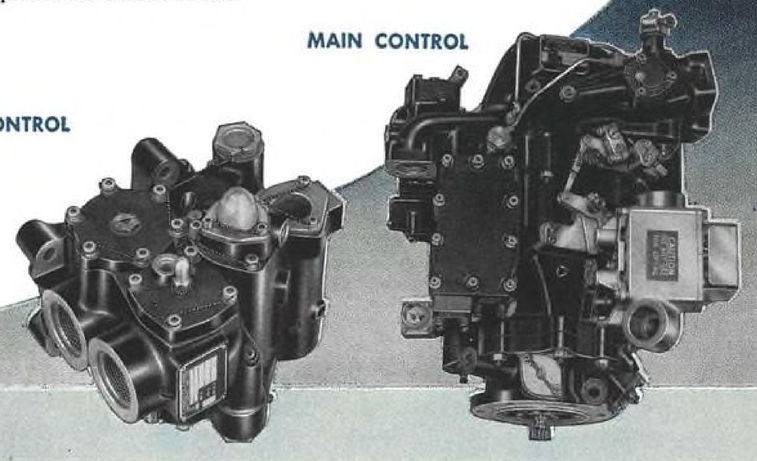

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High-Temperature Receiving Tube Introduced by General Electric

By Philip J. Klass

General Electric last week announced the development of a tiny (about the size of a transistor) ceramic-titanium receiving tube capable of withstanding the extremely high temperatures and shock found in supersonic aircraft and missiles.

Although the first tube-type available, the 6BY4, is aimed at the television-receiver market, GE officials plan to develop a full line of micro-miniature ceramic tube types for avionic and military electronic applications. Some of these units could be available in 12 to 18 months, a company spokesman told AVIATION WEEK.

The unit is a high-mu, low-noise triode capable of operating up to 900 mc. Samples have been operated successfully at 500C for more than 500 hr. Subjected to standard noise and microphonic tests, the 6BY4 has failed to yield any measurable microphonic output, GE says.

However, it is the 6BY4's high-gain, low-noise, high frequency characteristics which makes it attractive for use in UHF television tuners, GE says. The new tube is expected to cost TV manufacturers around two dollars, a company spokesman says.

Stacked Construction

In external appearance, the new GE tube resembles the stacked ceramic receiving tube developed by Eitel-McCullough (AW Aug. 22, p. 61). The GE version is considerably smaller than the Eimac tube since it must operate at higher frequencies and has a lower power rating.

The 6BY4 measures only $\frac{7}{16}$ in. in diameter and $\frac{3}{8}$ in. long; the Eimac twin-triode measures about $\frac{3}{4}$ in. in diameter and $\frac{3}{4}$ in. long. However, future low-frequency, higher-power versions of the GE tube may be somewhat larger than the 6BY4.

The tube is built up from three ceramic spacers which support and insulate two titanium "washers" and a titanium end-cap which functions as the tube's anode (see photo, p. 72). The titanium washers serve as a means of support and external electrical connection to the tube's electrodes.

GE is secretive about the processes, developed by its research lab, which are used to weld the ceramic and titanium and to evacuate the tube. However, a spokesman says that the seals remain airtight at temperatures above 700C.

Titanium finds its first use in vacuum tubes for two very important reasons:

- **Easily de-gassed.** GE discovered that titanium, unlike many other metals, need only be heated to 700C for a short period to release all internal gas.

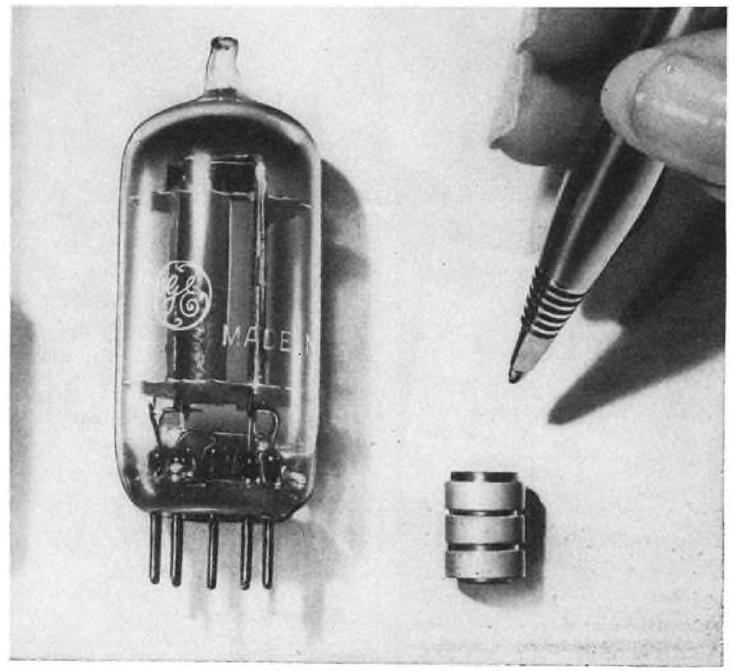
Thereafter, increases or decreases in temperatures produce no further gassing. This is important because gas sealed into a vacuum tube, or released after sealing, causes deterioration of the cathode oxide coating, shortening tube life.

- **Excellent "gettering" properties.** Titanium eliminates the need for conventional "getters" because it absorbs gases within the tube.

Characteristic Advantages

Many of the 6BY4's advantages over its glass-envelope predecessors stem directly from its microminiature size and novel construction. For example:

- **Reduced inductance** at very high frequencies stems from the short, direct connection to internal electrodes made possible by the titanium washers. This eliminates the long leads running from electrodes to base pins employed in conventional tubes.
- **Reduced coupling** between cathode and plate results from effective shielding provided by the grid and its titanium support.
- **Reduced inter-electrode capacitance** results from the use of extremely small electrodes.
- **Rapid electron transit time** results from the extremely close electrode spacing. For example, when the tube is operating, spacing between grid and cathode is only 0.0006 in. However, a GE spokesman says, this spacing may have to be increased for tubes designed

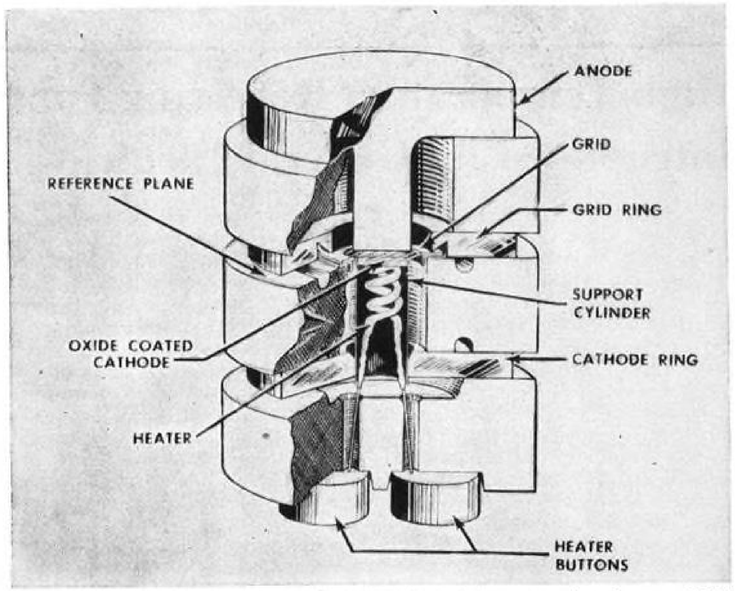


CERAMIC RECEIVING TUBE (at right) is dwarfed by conventional miniature tube (left).

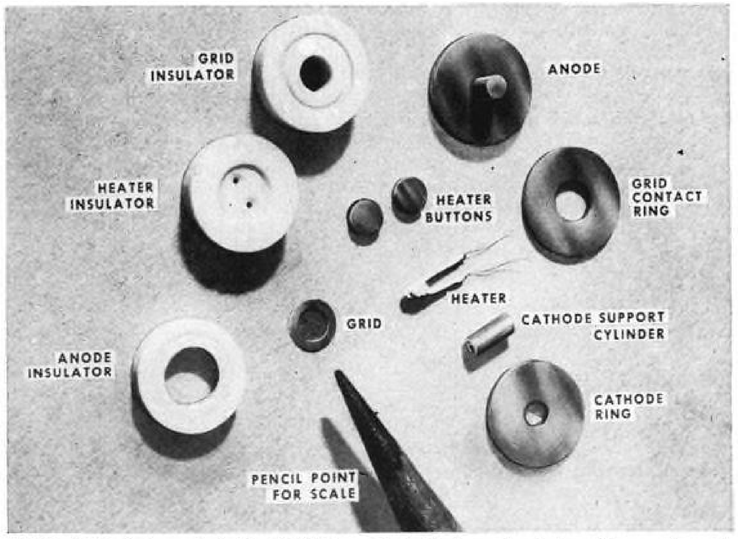
Far From Dead

"Since the revolutionary development of the transistor, there has been a tendency in some quarters to assume that the vacuum tube is a dead duck. Other thoughtful persons have expressed concern that research and development on vacuum tubes might become neglected in favor of semi-conductor research.

"But the remarkable achievement of miniature ceramic vacuum tubes, with their exceptional capabilities at microwave frequencies—and their phenomenal high-temperature tolerance—which the transistor can not even approach, shows that the vacuum tube art is far from dead."—Dr. C. G. Suits, vice president and director of research, General Electric.



INTERNAL CONSTRUCTION DETAILS of GE micro-miniature ceramic tube, type 6BY4.



SMALL SIZE of elements in the 6BY4 is emphasized when placed alongside pencil point.

to operate under vibration and shock encountered in aircraft and missiles.

GE has released following figures on performance characteristics of its 6BY4, measured at 900 mc., in a grounded-grid circuit, with 10 mc. bandwidth:

- **Power gain:** 15 db.
- **Noise factor:** 8 db.
- **Amplification factor:** 100
- **Transconductance:** 6,000 micromhos
- **Plate voltage:** 200 v.
- **Filament:** 6.3 v.

Future Plans

GE officials say future plans for avionic and military microminiature ceramic tubes includes low- and high-mu types, as well as power amplifiers, in both triode and multi-element types.

Another project on the GE agenda is to develop mechanized assembly techniques and machines for fabricating its ceramic tubes, which at present must be assembled under microscopes.

Both from the standpoint of size and internal construction, the GE ceramic tube appears less easily adapted than the Eimac and Sylvania ceramic tubes to mechanized assembly.

However, from the standpoint of mechanized placement of the completed tube in printed circuit boards, the GE tube appears to have a very slight advantage over its two competitors.

VITAL TECHNICAL INFORMATION ON ENGINE PERFORMANCE is gathered by G-E tech reps at military bases in 26 countries. Their regular reports, sent back to G.E., include operating record of each engine, servicing problems encountered, recommendations for improving reliability and performance.

A new G-E record—J47 engines on F-86F's are now accumulating . . .

33,000 hours per in-flight shut-down

Another record for reliability has been set by General Electric J47 jet engines.

From January, 1953–December, 1954, *all* J47's powering North American F-86F's amassed a total of 33,000 flight hours for *each* incident requiring engine shut-down. Indicative of G-E powerplant dependability, this mark was set despite casualties in Korean action.

In the same two-year period, the J47 enabled Boeing B-47 Stratojets to run up a cumulative 24,000 engine operating hours per shut-down. During this time, B-47's logged a total of over 1,700,000 hours in the air.

Compared to commercial and military piston engine operations, this new record shows that the J47 averages about twice as many engine flight hours per shut-down. Such reliability, plus simple design, points the way to more and more applications for G-E jet engines.

5,500,000 MILES A DAY—Each day at USAF bases around the world, G-E J47's are flying over 5,500,000 miles, or the equivalent schedule of an airline with 340 four-engine transports.

Analyzing, recording and applying this unmatched operating experience (see below), General Electric has been able to deliver steadily better production engines to our Armed Forces and—most important—faster development of new powerplants.

Looking ahead, for example, G.E. is now testing an engine designed for supersonic speeds. And even more advanced powerplants, both jet and atomic, are in early development stages—another reason why, at General Electric, "Progress is our most important product." 232-13

Progress Is Our Most Important Product

GENERAL ELECTRIC

WHY J47 OPERATING RECORDS MEAN BETTER G-E JET PERFORMANCE

BATTERY OF IBM MACHINES CONSOLIDATES FIELD REPORTS which are then analyzed by G-E statisticians. Complete information on each part of all operational engines enables G-E engineers to improve existing powerplants, as well as recommend long-range design advances.

DESIGN IMPROVEMENTS ARE QUICKLY APPLIED TO HARDWARE at G-E engine plants. Over 20,000 such improvements have been made in the J47, raising allowable time before overhaul to 1200 hours on some models. Field service analysis has been a major factor in achieving this record.

INCREASED AIRCRAFT AVAILABILITY, reduced maintenance time and costs are important benefits of G-E engine analysis. Top Air Force operational engine, the J47 will have logged over 9,000,000 flight hours by December, 1955.

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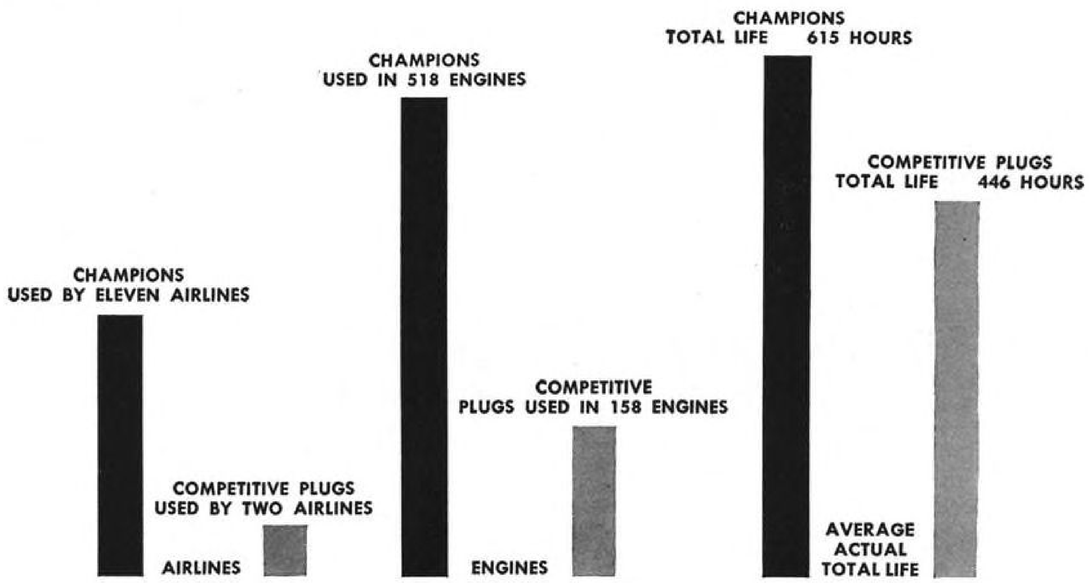
DELTA C&S	DC-7	10	Champion	40	....
EASTERN	DC-7	9	Other	....	36
	L1049C	16	Other	3*	61
NATIONAL	DC-7	4	Champion	14	2*
NORTHWEST	L1049G	4	Champion	16	....
PAN-AMERICAN (Atlantic Div.)	DC-7	9	Champion	26	10*
TRANS-WORLD	L1049G	20	Champion	80	....
UNITED	DC-7	25	Champion	100	....
KLM	L1049C	12	Other	2*	46
AIR FRANCE	L1049C-G	18	Champion	69	3*
TRANS-CANADA	L1049C	7	Champion	28	....
SEABOARD & WESTERN	L1049D	4	Champion	16	....
LUFTHANSA	L1049C	4	Champion	16	....

*Evaluation Test



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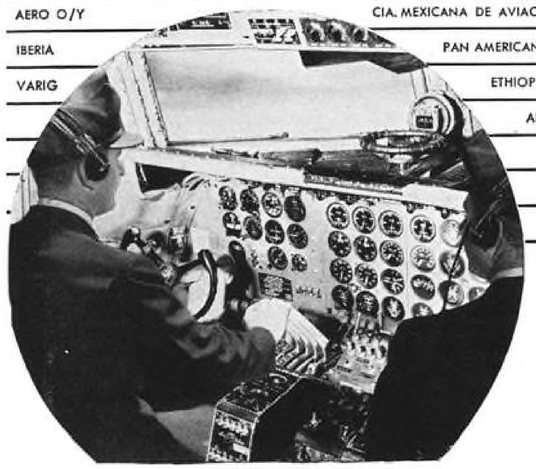

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New Avionic Equipment Proposed As Aids for Air-Traffic Control

Washington—Confronted by the certainty of even greater airspace congestion, delegates to the Radio Technical Commission for Aeronautics here, proposed and examined new avionic equipment and techniques for safely controlling the increasing numbers of new and faster aircraft. Among the various proposals:

- **Development of new light plane** VHF receivers incorporating a wider range of channels to speed up tower-to-plane communication.
- **Modification of flow-control** procedures to give planes with the greatest number of communication channels priority.
- **Continued expansion** of the Civil Aeronautics Authority's "peripheral," or remote, VHF facilities enabling air route traffic controllers to talk directly with aircraft several hundred miles away.
- **Development** of an air traffic control signaling system (ATCSS) capable of transmitting instructions, weather maps, etc., to individual aircraft.
- **ATC transponder beacons** to improve the potential of ground radar as an air-traffic-control device.
- **Installation of autopilot** approach couplers that automatically fly an airplane down the ILS localizer and glide slope beams (United Air Lines already has a number of these installed in their planes).
- **Formation of an air traffic control** advistory team to assist Air Navigation Development Board engineers on a continuing basis.

(The proposal for the establishment of an air traffic control advisory team was made by Sam P. Saint, veteran airline pilot and consultant to the Air Navigation Development Board. For detailed account of his views on the problem of traffic control—and the equally-strong ones of Lt. Gen. Joseph Smith, commander of the Military Air Transport Service—see AVIATION WEEK Oct. 10, p. 15.)

Frank C. White, a member of the Air Transport Association's air navigation and traffic control group, called for the development of new communications' equipment for light planes.

Pointing out that the airlines are fast equipping their fleets with new VHF receivers with 50 kc. channel spacing to double or quadruple the number of channels available, White told RTCA that the lightplane operator who wants to fly into congested terminal areas under instrument (IFR) conditions must be able to increase the number of available channels in his radio equipment.

Most of today's lightplane radio transmitters have only six to eight communications channels as compared with the 360 channel sets the airlines are now buying, White said.

A lightplane entering a congested terminal area must communicate successively with approach control, local control and, sometimes, precision radar control operations. At each shift, the lightplane operator must re-tune his VHF non-crystal controlled receiver manually, frequently asking the tower for a "voice count" to be sure it is properly tuned. The result is increased delays in the entire system, White said.

Industry Challenge

White challenged the avionics industry to develop a low-cost $300-400), light-weight private flyer VHF set, crystal-controlled, capable of operating at each and every 100 kc. channel between 118.1 and 126.7 mc. Recognizing that this would probably require the use of crystal-saving circuitry, now employed in the more expensive airline-type equipment, White said that an acceptable alternative would be a 20-channel set whose channels could be changed easily to any required frequency merely by plugging in new crystals.

He also proposed a modification of the present flow-control, used under adverse IFR conditions, in which aircraft may be prohibited from entering or leaving a congested terminal area until the traffic control system "catches up." White suggested that flow control might first be exercised on the basis of an individual aircraft's communications capability i.e. a plane with more communications channels would be given priority over one with only a few channels.

This, White believes, would not only ease congestion of over-crowded radio channels, but would provide incentive to lightplane operators to increase their radio capabilities.

Max Karant, of the Aircraft Owners & Pilots Assn., replied that it should be possible to expand communications capabilities of private aircraft to meet their operational needs, but he cautioned against mandatory increases in channels for all private operators. Karant pointed out that private flyers have bought nearly 35,000 VHF sets from two major manufacturers and that these should not be obsoleted arbitrarily.

John H. Hilton told the RTCA that the increasing use by the CAA of long

Tacan Status Report

Two major investigations which may determine whether Tacan becomes the nation's Common System navigation aid are scheduled to be completed within 60 days, according to Col. J. F. Taylor, Jr., director of the Air Navigation Development Board. In his status report to the RTCA, Taylor said:

- **Determination of the number of interference-free Tacan channels, under way at Airborne Instruments Laboratory should be completed by Nov. 1.**
- **Airspace coverage nav-aid requirements to provide airways-type service from sea level to 75,000 feet and area type service from 18,000 to 75,000 ft. is complete. Studies of area-type service down to the earth's surface is under way. These results have not been made public pending completion of the number of available interference free channels.**
- **Channel requirements for Tacan to enable it to provide the desired airways and area type service is under study by the National Bureau of Standards and should also be ready by Nov. 1. In making the determination, NBS must establish what Tacan performance may be expected in the 1965-70 period, including the performance from low-power Tacan stations with ranges of 30 and 100 miles. Characteristics and performance measurements which can be used to predict this performance, for both airline and private type equipments, are being obtained by AIL and NBS engineers.**

Taylor reported that the Joint Chiefs of Staff has furnished ANDB with a statement which, in effect, reaffirms the military requirement for Tacan to meet the needs of the continental air defense system.

The CAA's Technical Development Center is redesigning the military Tacan ground station equipment (URN-13) to make it suitable for common system use, including such things as provision for dual equipment with automatic switchover in event of failure, Taylor reported.

He said he believes that the omnirange and DME functions of Tacan should be made available to civil users on a separate-function basis, and that a lightweight, low-cost Tacan receiver should be developed. (Federal Telecommunications Labs has demonstrated such a unit.) However, Taylor cautioned that the increased bearing accuracy available from Tacan should not be seriously comprised in such low-cost models.

range radar for traffic control makes such direct communications even more important.

Present CAA plans call for the installation of 64 additional peripheral VHF (and UHF) stations by 1960. Another 46 "high-site" installations are planned to give maximum possible line-of-sight range.

Each individual VHF frequency, Hilton said, will be paired with a discrete UHF frequency (used by the military services).

This will enable pilots to hear all communications between ground controllers and other aircraft in the area, both civil and military.

"Private Line"

Vernon Weihe reported that an air traffic control signaling system (ATCSS), capable of transmitting routine instructions, weather maps or a snapshot view of a ground radar scope to individual aircraft, relieving overloaded voice channels, is now in the embryo stage. The information will be displayed in the cockpit on a bright storage-type cathode ray tube, such as those developed by Hughes, Radio Corporation of America, Farnsworth and Raytheon.

The Melpar ATCSS system can operate with conventional VHF equipment, through the addition of suitable adaptors, Weihe said. Information transmitted from the ground is suitably "addressed" to the individual aircraft for which it is intended and is not displayed in the cockpits of other aircraft.

Weihe indicated that the airplane's ATCSS adaptor could be set up to transmit back to the ground information on the plane's bearing, distance and altitude when suitably interrogated.

The Melpar ATCSS system requires a bandwidth of 800 to 3,000 cps., depending upon the quality of picture required in the cockpit for presentation of maps and similar information.

Although Weihe did not indicate how far off the operational use of ATCSS might be, Frank White estimated that the "private line" is "at least five to seven years away—even if we could reach agreement today on what the system should be."

Radar Beacon Progress & Problems

Although all civil and military agencies agree in principle that ATC transponder beacons hold considerable promise of improving the usefulness of ground radar for air traffic control, certain problems must first be solved before the new aid can get into widespread use, S. B. Poritzky, of Aeronautical Radio Inc., told the group.

Poritzky read a CAA statement which reported that "significant unresolved problems (will) . . . control the actual dates of implementation." The CAA's Technical Development Evaluation Center currently is attempting to work out some of the problems. If they are successful, three trial installations on ASR radars in the New York area should be in operation by September 1956, with ASR installations to follow at Chicago and Washington.

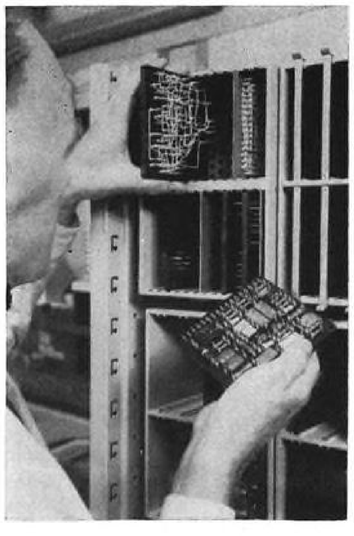
Trial beacon installations on long range traffic control radars at N Y. International, Washington, and Norfolk are also planned.

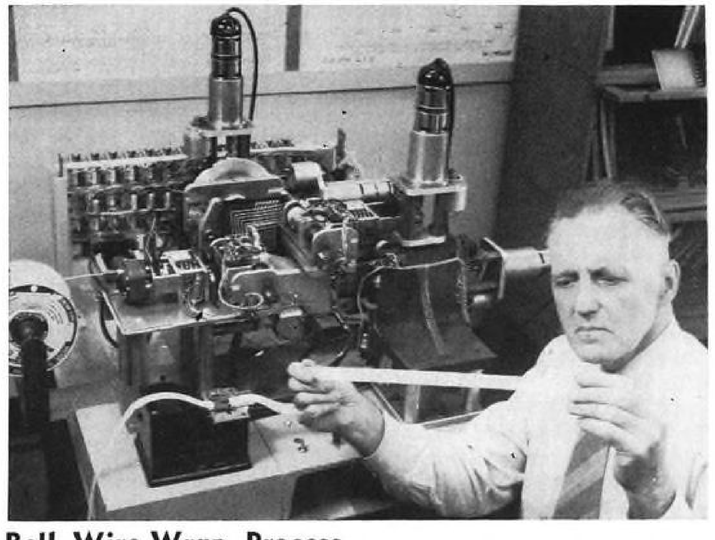
Moving Cautiously

If the CAA appears to be moving cautiously, some of the beacon system problems which Poritzky discussed show why. For example, in congested terminal areas, airborne transponders will be interrogated by several ground radars, which may overload the transponders, effectively incapacitating them. For the same reason, replies to the interrogation of one ground radar will be received by all others in the area and will appear on the latter's scopes as interference pulses.

Another problem stems from the fact that the beacon system operates at 1,030 and 1,090 mc., right in the middle of the band assigned to Tacan. This may lead to Beacon-Tacan interference unless Tacan vacates these two, and possibly adjoining channels.

A report on the results RTCA's Special Committee 18 studies and United Air Lines operational experience with autopilot approach couplers suggests that more airliners and business aircraft will be equipped with these aids in the near future. The joint report came from E. A. Post, superintendent of nav-aids





Bell Wire-Wrap Process

A new approach to the automation of electronic equipment developed by Bell Telephone Laboratories makes use of BTL-developed solderless wire-wrap process of attaching wires to terminals. Patchwork of conventional wiring (above, left) is automatically installed by "M-4" ambidextrous machine (right) operating under instructions from punched tape. Machine uses two rotating spindles—one pulls wire from reel to a connecting terminal; the other automatically cuts wire to desired length. Each spindle then removes insulation from wire ends as it whip-wraps the bare wire around board terminal. Afterwards, spindles pick up new wire supply and make next connection. The BTL approach to automation was first revealed by Aviation Week (Mar. 8, 1954, p. 44).

for UAL and head of RTCA's SC-18.

Post reported that UAL has equipped nearly all its aircraft, except DC-3s, with autopilots and approach couplers. For nearly a year United has been using the combination (at a number of selected airports with good approaches and high intensity approach and runway lights) down to minimums of 200 ft., ½-mile visibility, whereas manual approaches are permitted only to 300 ft., ¾ mile minimums.

On the strength of UAL's experience, Post said he saw no reason why auto-approach minimums "should not be lowered in steps to at least 100 ft., ¼ mile, or the equivalent slant range visibility, as bugs are worked out of the aircraft systems and SC-18's recommendations are implemented."

The SC-18 report, when it is released, will recommend certain permissible sensitivities, linearities and alignments for localizer and glide slope beams, as well as the use of improved automatic monitors to continuously check these characteristics. A large number of the CAA localizer and glide slope beams already fall within the prescribed tolerance, Post said.

CAA's Edgar B. Franklin, chief of EHA Air Carrier Safety Division, indicated that his agency already has taken steps to ease previous low-altitude limitations on the use of autopilots and approach couplers, consistent with what it deems to be safe practices. New CAA proposals for flight testing autopilots and approach couplers under simulated malfunction conditions have been submitted to the ATA and Air Line Pilots Association, as well as other industry groups, for comment.

FILTER CENTER

► **Bearing-Only Tacan**—Federal Telephone & Radio may produce a private-flyer Tacan receiver providing bearing information only, comparable to service provided by VOR receivers (see p. 79). The device is expected to sell for under $1,000. The DME portion of the receiver could be purchased and added later. Private flyer versions of the full Tacan receiver, providing both bearing and distance, will be marketed first and will become available for purchase early next spring, an FTR spokesman says.

► **Praise For Lear VGI**—Navy evaluation of the 3-inch Lear remote vertical gyro indicator (VGI) calls the unit the "finest small attitude gyro ever evaluated in jets at the Naval Air Test Center." The report praises the unit's readability and recommends its use on all future Navy fighter and attack air-

craft. USAF's Eglin AF Base reportedly has recommended the Lear VGI's use in all fighters

► **Emerson Eyes Interceptor Field**—Emerson Electric, which has concentrated its fire control activities in the bomber defense field, is eyeing the interceptor fire control field. The move is a hedge against the possibility that supersonic bombers of the future may not carry active defense such as tail turrets.

► **Transistor Standardization**—New diffused-base technique for making transistors holds promise of enabling silicon transistors to cover the bulk of circuit requirements, including both high power and high frequency, Dr. J. A. Morton, Bell Telephone Labs, told the recent Western Electronics Convention. Morton reported that diffused-base silicon transistors have been developed which can deliver 5 watts power at 5 mc. Morton estimated that pilot production of diffused-base transistors is at least a year away.

Avionic Bulletins

● **Tape resistors** and their application to miniaturization are discussed in four-page Bulletin HEC-1, available from Hansen Electronics Co., 7117 Santa Monica Blvd., Los Angeles 46, Calif.

● **A 400-cycle Vernistat,** a device which reportedly combines the best features of an a.c. potentiometer and a variable autotransformer, is described in four-page bulletin which includes design principles and spec. Perkin-Elmer Corp., Norwalk, Conn.

● **High-temperature capacitors** employing "XC" plastic film dielectric, for operation at temperatures of —65C to 165C, are described and engineering specs are given in six-page folder, XC-201-4. Gudeman Co., 340 West Huron St., Chicago 10, Ill.

● **Electronic punched-card sorter,** capable of handling alphabetic, numeric, blank, and special code punched cards at the rate of 48,000 per hour, is described in 6-page folder, TM-156, available from local Remington Rand sales offices or by writing Remington Rand Div., Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y.

● **"Methods of Potting Cannon Plugs"** is the title of new 12-page bulletin which shows step-by-step method employed to pot and seal connectors against moisture. Ask for Bulletin PM-1. Cannon Electric Co., 422 W. Avenue 33, Los Angeles 31, Calif.

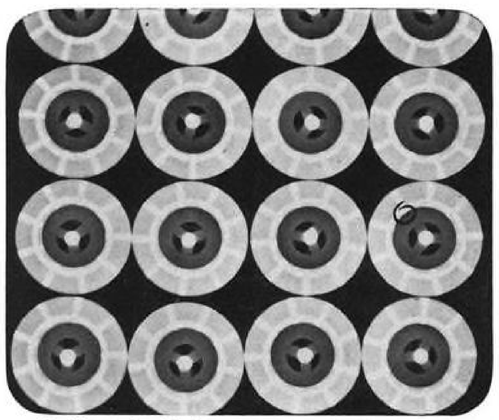
● **Magnetic servo amplifiers** and output stages, in several types, are described and application data given in 8-page folder. Feedback Controls, Inc., 1332 No. Henry St., Alexandria, Va.

A Painter's Friend

An H-19 helicopter came to the rescue recently when a Bendix Aviation Corp. radar servicing crew needed to paint the almost-inaccessible top of a radome at Thule AFB in Greenland. After other proposed routes were found wanting, the helicopter from the 55th Air Rescue Squadron lowered the painters onto the fabric-covered radome (above) and then whisked them away again once the job was completed.

SPINS LIKE "BLAZES"—

so Radiography checks each one



Radiograph of oil scavenger rotor in variable displacement pump for aircraft hydraulic systems.

"BLAZES" is not the word—but suggests the maker's shorter expression for the rate at which this rotor spins. Fact is, rpms are so high that the soundness of the casting is important in terms of safety as well as serviceability.

So radiography goes to work and plays its unique part. With no damage to the product, radiography looks inside the part and checks each rotor's structure. Only flawless parts will meet the strict requirements of service.

Proving soundness with x-rays has become common practice with more and more suppliers of quality castings. They know it helps build reputations for delivering only good work.

If you'd like details on how radiography can improve your operations, get in touch with your x-ray dealer—or write us for a free copy of "Radiography as a Foundry Tool."

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another important example of Photography at Work

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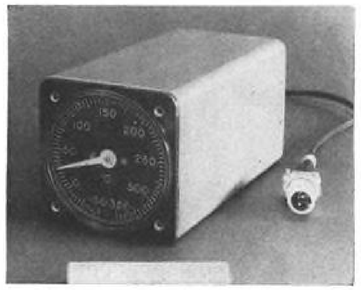
NEW AVIONIC PRODUCTS

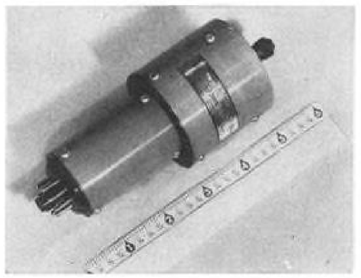
Instrumentation

● Self-balancing potentiometer, Model EMP-NS2, completely self-contained, can be used to indicate temperatures during flight, operating from ther-



mocouple signals, or to indicate acceleration, operating from strain gages. Complete unit, including amplifier and indicator, weighs 3 lb. **North American Aviation, Inc., Missile and Control Equipment Dept., Downey, Calif.**

● Pressure-to-frequency transducer, Series P400, available in absolute, differential or guage types, for FM/FM telemetering unit. Unit converts pressure measurement into a temperature-controlled varying inductance which in turn varies the frequency of an FM oscillator built into the same case.



Transducer can be supplied for any standard sub-carrier frequency, between 1.7 kcps and 70 kcps, with deviations of 7½% or 15%. Model P512 (not shown) is designed for measuring transient pressures. It also contains a built-in FM oscillator. **Datran Engineering Corp. 3613 Aviation Blvd., Manhattan Beach, Calif.**

● Rotary sampling switch, Model AE-00007, for use with the AN/AKT-10 FM/FM telemetering system, consists of two poles of 60 contacts each rated at a sampling speed of 5 rps. Unit is driven by a 28 v.d.c. motor with governor. Other models are available in other sampling speeds of 1 to 30 rps,

A HOT OPERATOR

... in sub-zero climates!

Photo courtesy
Herman Nelson Division, American Filter Co., Inc.

THIS HEAT EXCHANGER *of stainless steel for the Herman Nelson Portable Air Heater, "Aviation's cold weather friend", is another precision fabricated assembly made by Lavelle for military aircraft application. At Air Force bases everywhere, the BT-400 Heater provides a ready source of heat for pre-heating engines, cockpits, and for countless maintenance jobs . . . wherever reliable space heat is required to help keep America's defense planes airborne.*

Heat Exchanger Stainless Steel 16" dia. x 18"

Extensive fabricating facilities, plus Government Certified welding technicians has enabled Lavelle to produce over 6,000 of these complex assemblies, each requiring 16 separate airfoil section heat exchanger tubes. To assure close tolerances and speed production of the many component parts of the unit, special tools were designed and made at the Lavelle plant. Complete inspection includes pressure testing of each unit prior to shipment to Herman Nelson. Simple or complex, Lavelle has the capacity to fabricate the precision parts and assemblies you need . . . wherever you need them.

A new brochure describes Lavelle's specialized fabricating services. Write for a copy without obligation.

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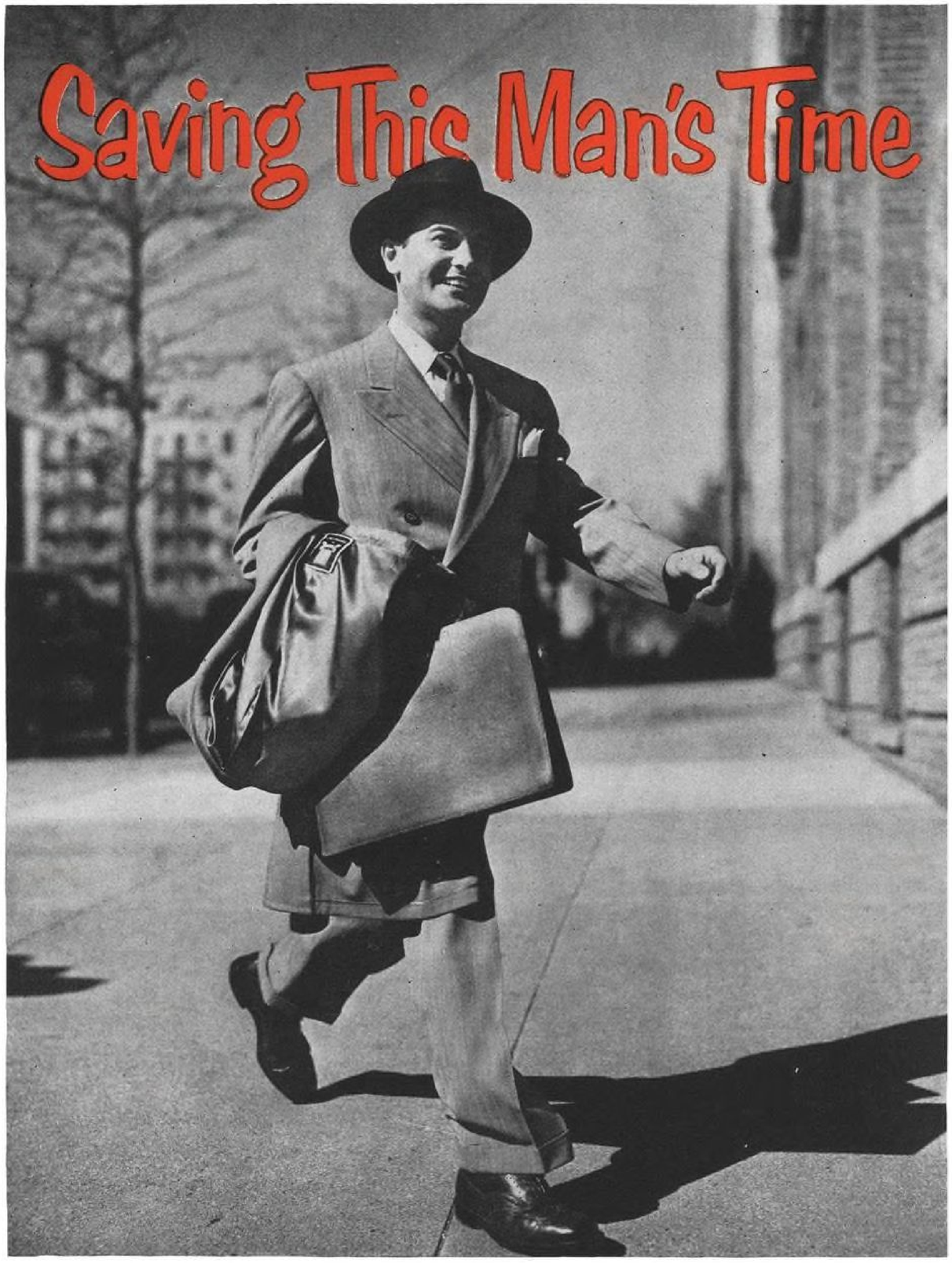
LAVELLE AIRCRAFT CORPORATION • NEWTOWN, BUCKS COUNTY, PA.



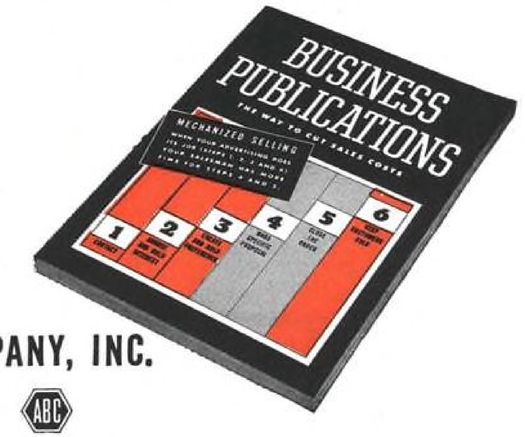
Saves Sales Dollars

There just aren't enough hours in a day for a salesman to do an adequate selling job without help. In addition to time spent on office work and awaiting interviews, the growth and decentralization of industry has brought problems of increased travel time, more buying influences and more difficult access to plant personnel.

When you advertise your product or service, consistently, in business publications your prospects look to for help with their jobs, you multiply the calling power and increase the productivity of your sales staff. Business paper advertising can talk to thousands of prospects . . . can arouse interest in, and create a preference for, your product . . . at pennies per call.

Just as high speed machines cut production costs, well-planned business publication advertising cuts sales costs. It "mechanizes" the first three steps of a sale and lets the salesman concentrate his valuable time and talent on the all-important job of making the proposal and closing the sale.

Ask your McGraw-Hill man for a copy of our 20-page booklet, "Orders and How They Grow." Also about our new sound-slide film, "Plateau of Progress" which is available for showing at sales and management meetings.



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with a choice of drive motor, number of contacts, poles, and percent duty cycle. **Applied Science Corp. of Princeton, P. O. Box 44, Princeton, N. J.**

Components & Devices

● Lightweight servo motors, in size 11, 15 and 18, for operation at temperatures of 125C or higher, are now available in reduced-weight versions. Typical weight reduction in the size 18 is 3 oz. **G-M Laboratories, Inc., 4300 No. Knox Ave., Chicago 41, Ill.**

● Miniature high-speed valve solenoid, reportedly requires only 5 milliseconds to reach saturation at any altitude. Unit operates over temperature range of −65F to 200F, and can be internally pressurized at 3,000 psig. **Carruthers & Fernandez, Inc., 1501 Colorado, Santa Monica, Calif.**

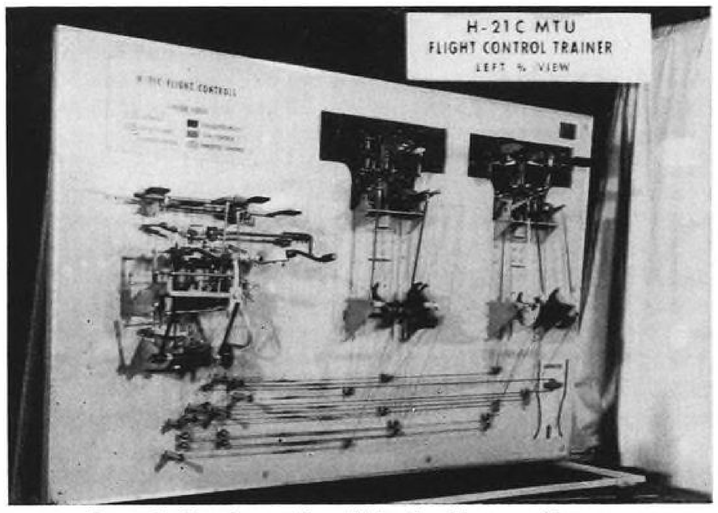
● Silicon rectifiers, available for operation at 50, 100, 150 and 200 volts, have forward current rating of 8 amps with natural convection cooling at 25C, up to 40 amps with forced cooling. **Westinghouse Semiconductor Dept., 356 Collins Ave., Pittsburgh 6, Pa.**

● Auxiliary power supply, miniature, encapsulated, with no vacuum tubes, operates from 115 v., 60 or 400 cycle line and provides two unregulated d.c. outputs: 150 v., at 6 ma., and 6.3 v.a.c. (center-tapped), at 0.6 amps. Ripple is kept below 1 millivolt at 400 cps., below 5 mv., at 60 cps. Unit measures $2\frac{5}{8}$ x $3\frac{1}{16}$ x $4\frac{1}{4}$ in. **Trio Laboratories, Inc., 3293 Seaford Ave., Wantagh, L. I., N. Y.**

● Capacitor induction motors, for 60 and 400 cps. use, are available in $\frac{1}{10}$ to 1/100 hp. sizes for operation at all standard voltages—single, double or three-phase. Units measure $3\frac{7}{8}$ in. dia. for continuous duty, $3\frac{1}{8}$ in. for fan or intermittent duty. Maximum motor weight is less than 5 lb. **Eastern Air Devices, Inc., 389 Central Ave., Dover, N. H.**

● High-temperature sub-miniature trimpot, Model 160, can be operated at temperatures of −65F to 350F, with power rating of 0.6 watt at 100F, and 0.4 watt at 200F. Resolution as low as 0.25% can be obtained over 25-turn adjustment range. Resistances of 10 to 10,000 ohms in standard values are available. Unit measures $\frac{1}{4}$ x $\frac{1}{8}$ x $1\frac{1}{4}$ in. **Bourns Laboratories, 6135 Magnolia Ave., Riverside, Calif.**

● Miniature annunciator, Model HCM $\frac{3}{4}$, a D'Arsonval type indicator for use as a null-indicator in autopilots and servo systems or as a flag alarm, measures $\frac{3}{4}$ in. dia. x $1\frac{3}{8}$ in. long and weighs 1.3 oz. Device is hermetically sealed and is available in typical instrument ranges. Annunciator is said to meet vibration requirements of MIL-E-5272A, Procedure I. **Marion Electrical Instrument Co., Manchester, N. H.**



Panel Trainer for Work Horse Copter

This panel demonstrating operation of the Piasecki H-21C Work Horse flight controls is one of a set developed for the Army. Other panels show the electrical system, hydraulic system, transmission and special tools required for H-21C maintenance. The mobile maintenance trainer was built by Burton-Rodgers of Cincinnati before its recent merger with Technical Training Aids, Inc., Tulsa. Sets have been delivered to the Army Transportation School, Ft. Eustis, Va., and Camp Rucker, Ala.

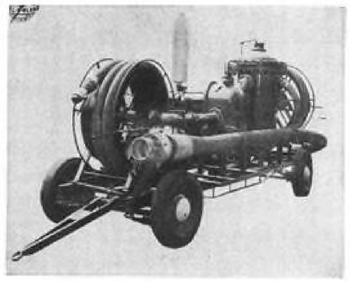
NEW AVIATION PRODUCTS

Motor Handles Pitch Trim

New 1.5-lb. brake motor designed for driving elevon pitch trim system of Douglas' supersonic F4D Skyray, has a holding torque of 2 in.-lb.

The unit is a ⅓ hp. reversible motor operating at 11,000 rpm. on the 115/200-v. system, producing a holding torque of two in. lb. The unit has been tested in accordance with MIL-M-7969.

Air Associates, Inc., Teterboro, N. J.



Refueler Tests Fuel System

Fuel-A-Plane portable fuel system tester, designed for the Lockheed Aircraft Corp., permits the operator to test the single-point fuel manifold system of either new or repaired aircraft at low pressures and flow rates. This is done without danger to the manifold or fuel tanks in case of malfunction of any component part. If the fuel system checks out, the unit is used for filling the plane's tanks.

The tester and refueler is equipped with filter, air eliminator, drippage and expansion pressure relief receptacle, fuel-flow meter and static bonding cable reel, in addition to the air starter-equipped diesel-engine-driven pump, air compressor, exhaust silencer, fuel hose reels and vacuum and pressure gages.

Harman Equipment Co., 3605 E. Olympic Blvd., Los Angeles 23, Calif.

Open-Type Aircraft Motor

Open-type aircraft motor which weighs 3.5 lb. and delivers ¼ hp. continuously at 7,200 rpm. provides a lightweight drive for blowers, pumps and actuators.

The motor functions at altitudes up to 40,000 ft. with starting torque of 4.0 in.-lb. Mounting bracket and take-off shaft are standardized in accordance with military specifications. Designated Type A, the motor is designed for three-phase, 400-cycle, 200-v. operation.

U. S. Electrical Motors Inc., Aircraft Division, Box 2058, Terminal Annex, Los Angeles 54, Calif.

Pressure Regulator Valve

Absolute pressure regulator valve for pneumatics handles flows up to 40 cfm. and maintains constant pressure at inlet temperatures as high as 550 F. The unit can be placed on any jet bleed line to air turbine power packs, compartment pressurization and cooling systems or fuel tank pressurization and relief systems.

Century Controls Corp., Allen Blvd., Farmingdale, L. L., N. Y.

Gage Measures .000001 In.

Capable of direct linear measurements to within one-millionth of an inch, the Link Fringecount micrometer utilizes the wave-length of light as basis of measurement.

The micrometer may also be employed as a precision comparator with a 2-in. range of movement from the set position.

The Link Fringecount unit consists of three separate units: a measuring head, control box and bi-directional digital counter which displays the dimension of the part being measured. The equipment can be used in measuring such items as gage blocks, plug gages, ball and roller bearings and precision instrument parts.

Link Aviation, Inc., Binghamton, N. Y.

Lear-Romec Makes New Pump

In a description of a new electric motor driven centrifugal fuel booster pump, Model RG-11280-1 (AW Sept. 26, p. 78), the manufacturer's name and address was inadvertently omitted. Manufacturer of this item: Lear, Inc., Lear-Romec Division, Elyria, Ohio.

Starter Fits Under Super Sabre

North American Aviation, Inc., is using a new jet engine starter that is built so low it can be driven underneath the F-100 Super Sabre and start its P&WA J57 engine in 14 sec. Unit can also be used as a plane tug.

Power is taken directly from a gasoline engine and transmitted to the turbojet via a hydraulic torque converter which provides a shockless power train. The unit also can provide 28-v. d.c. and 400-cycle a.c. power for aircraft.

The starter has four-wheel drive and steering and has a 160-in. turning radius. Weight is 3,500 lb. Dimensions are 30 in. high, 144 in. long and 65 in. high.

The starter was planned by NAA industrial engineer Dan Coleman and prototypes have been built by Kurtis Kraft Corp., Los Angeles, and Electric Service Engineering Co., Joliet, Ill. Five units are being used by North American's F-100 flight operations department, and the company plans to get four more for other departments.

North American Aviation, Inc., Los Angeles 45, Calif.

ALSO ON THE MARKET

Self-lubricated bearing material for missiles and aircraft, Sinite D-10 has proved successful in liquid oxygen and JP-4 fuel bearing problems, maker says. The material is self-lubricating from —90 to 500F.—Booker-Cooper, Inc., 6940 Farmdale Ave., N. Hollywood, Calif.

Nylon-rayon aircraft seat belt is adjustable, 2-in. type. Buckle latch has disk cut-out for flush-mounted insigna. Available in dark blue, dark green, beige, gray and tan.—Air Associates, Inc., Teterboro, N. J.

Shock-resistant plastic package for bearings can be mailed safely under all conditions and re-used indefinitely, it's claimed. Plastic vacuum-formed shell contains the bearing, set into an outer shipping sleeve of spiral-wound fiber.—Cargo Packers, Inc., Brooklyn, N. Y.

Wire twister with a diagonal grip-head and slender nose was especially designed for work in narrow, hard-to-reach places. The new model is available in 12-in. length for assembly line work and 9-in. length for bench and subassembly work.—Ralph C. Robinson Co., Box 494-P, N. Sacramento 15, Calif.

Motor induction coupling drive provides stepless, variable speeds over ranges from 2:1 to 34:1 with constant torque output. Unit features high response, maintains accurate rpm. and requires minimum maintenance. Motor sizes start at ¾ hp. at 3,400 rpm. and extend to 75 hp. at 1,700 rpm.—American Electric Motors Inc., 2112 Chico Ave., El Monte, Calif.

Temflex 105, a vinyl plastic tubing meets fungus and heat requirements of MIL-I-631B. The tubing is used by electrical equipment and electronic manufacturers and for continuous operation at temperatures to 105C.—Irvington Div., Minnesota Mining & Mfg. Co., 6 Argyle Terrace, Irvington 11, N. J.

Turret-type device for automatically loading work pieces between centers and removing the pieces when ground can be adapted to a variety of small parts that can be rolled by gravity on inclined rails, permitting the operator to attend a battery of machines . . . . Type CMS-1 semi-automatic **multi-wheelslide cylindrical grinding machine** plunge grinds multiple diameters simultaneously on workpieces that do not lend themselves to grinding on conventional multi-wheel machines . . . . 48F Hyprolap **high production lapping**

machine is designed for single or parallel face flat lapping. The unit can be arranged for a plain, timed cycle; automatic continuous feed, or semi-automatic continuous feed.—Norton Co., Worcester 6, Mass.

Chemical balls quickly free open areas of hazardous ice and snow. Ice-Foe will not damage metals, concrete, asphalt or shoes, the maker states.—Walton-March, 1935 Sheridan Rd., Highland Park, Ill.

Quartz spring kit contains five extremely thin precision quartz springs. Load maximums range from 5 gm. to 50 gm. with maximum extension of 5 cm. throughout. Helical springs are all supplied with hook-end attachments.—Houston Technical Laboratories, 2424 Branard, Houston 6, Tex.

Boring bar is reported to reduce bending or bar deflection while making deeper cuts with heavier feeds by as much as 50%. It is constructed of steel and tungsten carbide in sizes ranging from ⅜ to 1½ in. diameter.—Cyma Corp., 3581 Kipling Ave., Berkley, Mich.

Oil level sight glasses for helicopter transmissions are shatterproof, resistant to corrosion and aging. Made of Kel-F plastic, the sight glasses are standard equipment in all helicopters produced by Sikorsky Aircraft Corp.—Nichols Engineering, Inc., Shelton, Conn.

Scale-free welding couplings for aluminum piping eliminate the risk of pumping corrosion products or welding scale and icicles into aircraft fuel tanks during servicing operation. The scale-free coupling consists of two forged halves with hub ends that fit pipe and welding fittings.—Tube Turns, Division of National Cylinder Gas Co., Louisville, Ky.

Gripspring, recently developed in Germany and now being manufactured in the U.S., fastens hubs onto a shaft without the use of splines or keyways. Device is wedged between hub and shaft under heavy pressure hand tools. Outer ring expands and the inner ring contracts.—U.S. Automatic Corp., Amherst, Ohio.

Nicrobraz paste is a stainless steel brazing alloy paste for the joining of heat- and corrosion-resistant alloys by torch, induction and similar methods. Its properties include excellent flow and brazing characteristics on stainless steels, nickel base alloys and cobalt base alloys, as well as low alloy and carbon steels, copper and similar alloys; melting point is above 1950F. . . . **Green Stop-off** prevents flow of

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Chief Project Pilots, Tom Lloyd and Fred Hughes, join on the ground, prior to debriefing, following an afternoon air-to-air gunnery check on a fighter armament system.

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brazing alloy across the surface of parts; applied by brushing, spraying or dipping.—Stainless Processing Div., Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich.

Precision bench center, weighing 16 lb., indicates shoulder deviations on a small (2½ in. long) machined part when placed upright against angle surface plate and set up with commercial feeler gages.—Transicoil Corp., Worcester, Montgomery County, Pa.

Semi-automatic heat sealer with single sealing length of 40 in. handles coated or laminated materials to government specifications regardless of wrinkles or splices in the material to be sealed. It contains an automatic tripping device that controls the heat-sealing cycle and requires simple preliminary hand settings for time, heat and pressure.—Product Packaging Engineering, 5747 Marilyn Ave., Culver City, Calif.

Single pilot-operated hydraulic valves for automatic control of hydraulic circuits is the sub-plate type for panel mounting, designed for full 3000 psi. It is available in ¼, ¾, 1, 1¼ and 1½ in. sizes. The new solenoid is the heavy, continuous duty type, shock resistant and features low power consumption.—Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.

Hermetically sealed float level indicator for control or indication of levels of various liquids, weighs 0.9 oz. F-8685 indicator has no exposed metal parts and may be used with solvents, oils, acids and other chemicals. The switch is enclosed in a nylon stem and is actuated by permanent magnets imbedded in the free float. Eighteen-gage nylon-jacketed leads extend through the threaded mount.—Revere Corporation of America, Wallingford, Conn.

Solenoid operated shut-off valve is 4.67 in. long, 2.03 in. wide and 3.5 in. high. Available in tube sizes from ¼ to ½ in. the valve features low current drain, fast action, explosion-proof, operating range 0 to 5000 psi., temperature range −65 to 275 F, flow rates from 0 to 10 gpm.—Mar Vista Engineering Co., 5420 W. 104 St., Los Angeles 45, Calif.

Drafting templates provide electronic and electrical symbols. Made of amber coated vinyl plastic, they are .025 in. thick.—E. F. Twomey Co., Inc., 728 W. 10th Pl., Los Angeles, Calif.

Auto-Tran unit, a straight-line type indexing chassis, provides a standard application to both automatic and semi-automatic assembly operations. Available with 48 to 72 carriers; 3, 6, 9 or 12 in. index travel, and with either

vertical or horizontal mounting surfaces on the carriers. Work carriers attached to a double roller chain have ball bearings mounted in both horizontal and vertical planes, guided in tracks mounted on the chassis frame.—Swanson Tool & Machine Products Co., Erie, Pa.

Aluminum foil laminated to a layer of improved bonding material makes **"Speedy-Cals" nameplates.** These nameplates will stick tightly to any smooth, cohesive surface such as porcelain, glass, plastic and metal or to painted surfaces and will not crack, peel, chip or tarnish.—North Shore Nameplate, Inc., 214.27 Northern Blvd., Bayside, N. Y.

Unitized perforating units, known as "Unipunch," feature a two-piece punch and small button die which provides substantial reduction in the cost of replacement parts. Unit also features a mounting pilot pin, which is concentric with the center-line of the punch and die. The pilot pin is a constant ⅜-in. diameter regardless of the size of the punch or die or whether the punch is round or shaped.—Punch Products Corp., 3800 Highland Ave., Niagara Falls, N. Y.

Aeroscreened lanterns radiate scarcely any light above the horizontal, thus preventing the risk of incoming aircraft confusing street lighting with airport approach and runway lighting. Lanterns can be spaced 120 ft. apart and, in some cases, 150 ft. as compared with 90-100 ft. spacing employed with normal "cut-off" lanterns.—General Electric Co. Ltd., Magnet House, Kingsway, W.C.2, London, England.

Semi-elevated, water wash paint spray booths for production spraying have an elevated wash chamber, in which much of paint residue is knocked down and safely contained.—M&E Manufacturing Co., 2571 Winthrop Ave., Indianapolis, Ind.

High speed nameplate marking machine for serial numbering and detail markings, Model MS can put consecutive serial numbers as well as interchangeable legends on two or more bosses. Either hand level or air operated feed mechanism can be used.—Cadillac Stamp Co., 17315 Ryan Rd., Detroit, Mich.

Constant voltage welders available in 500, 750 and 1,200 amp., allow the operator to select the desired arc voltage, which remains constant during the entire welding cycle. The constant voltage feature insures uniform deposit; rod speed and travel rate all remain constant.—Harnischfeger Corp., Milwaukee 46, Wis.

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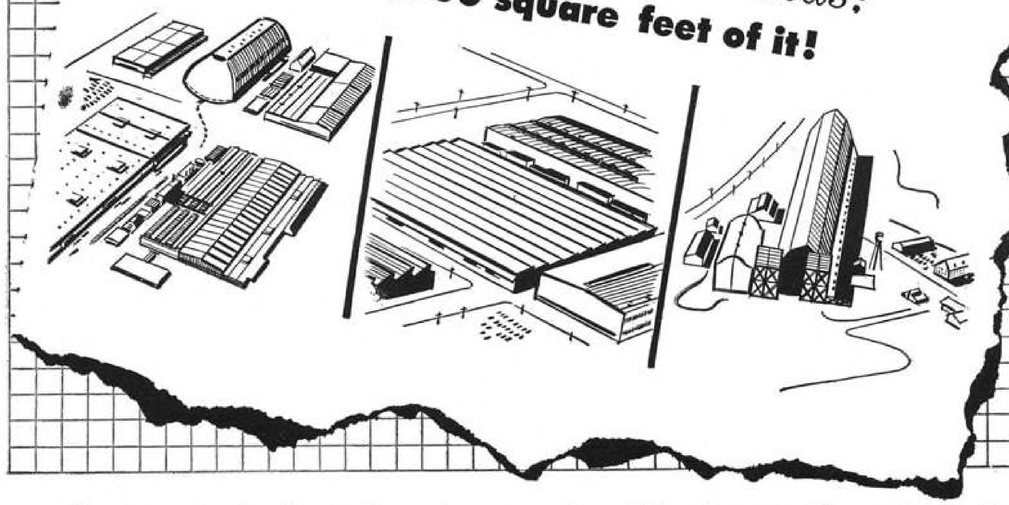

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WHO'S WHERE

(*Continued from page 9*)

E. M. Deckman, commercial sales manager-aircraft engines of Allison Div., General Motors Corp.

Jerre Manning, manager of transistor division of Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

L. E. Tollefson, Washington representative of Douglas Aircraft Co.; **Edward Curtis,** director of contracts.

W. H. D. Hanchet, contracts and service manager of Doman-Fleet Helicopters Ltd., Fort Erie, Ont., Canada.

W. R. Miller, manufacturing director of Longren Aircraft Co., Torrance, Calif.

Jack H. Sheets, works manager of Curtiss-Wright Corp. Also promoted: **Leonard S. Wiener,** chief rocket design engineer of the Propeller Div.; **G. I. Sundstrom,** assistant general manager of Metals Processing Div.; **Melvin Isaacson,** general sales manager; **John G. Rombough,** industrial relations manager.

Robert F. Schulz, manager of microwave and industrial products dept. of Communications & Electronics Div., Motorola Inc. Other appointments: **Leonard G. Walker,** commercial sales director; **James Stewart,** chief of export and special accounts sales.

Howard Capes, publicity director of Decca Navigator Co. Ltd., London, England.

Lee H. Smith, chief of military relations and customer service, Northrop Aircraft, Inc.

Francis A. Oliver, manager of Data Storage Devices Unit of J. B. Rea Co.

Charles T. McKinnie, assistant sales manager, Pratt & Whitney Aircraft Div.

Emerson W. Conlon, assistant to the general manager for future technical product planning at Fairchild Engine Div.; Also promoted: **Elwood D. Bryant,** director of development engineering; **L. Paul Ahlers,** director of quality; **Edward C. Leeson,** director of customer relations.

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R. E. Cassatt, commercial sales manager, York Corp., York, Pa.

V. L. Spinney, central region manager, Allis-Chalmers Mfg. Co. Also promoted: **R. L. Halsted,** manager-processing machinery department; **N. W. Landis,** New York district manager; **A. J. Mestier, Jr.,** Detroit manager.

William J. Kent, sales office manager for Leach Relay Div. of Leach Corp.

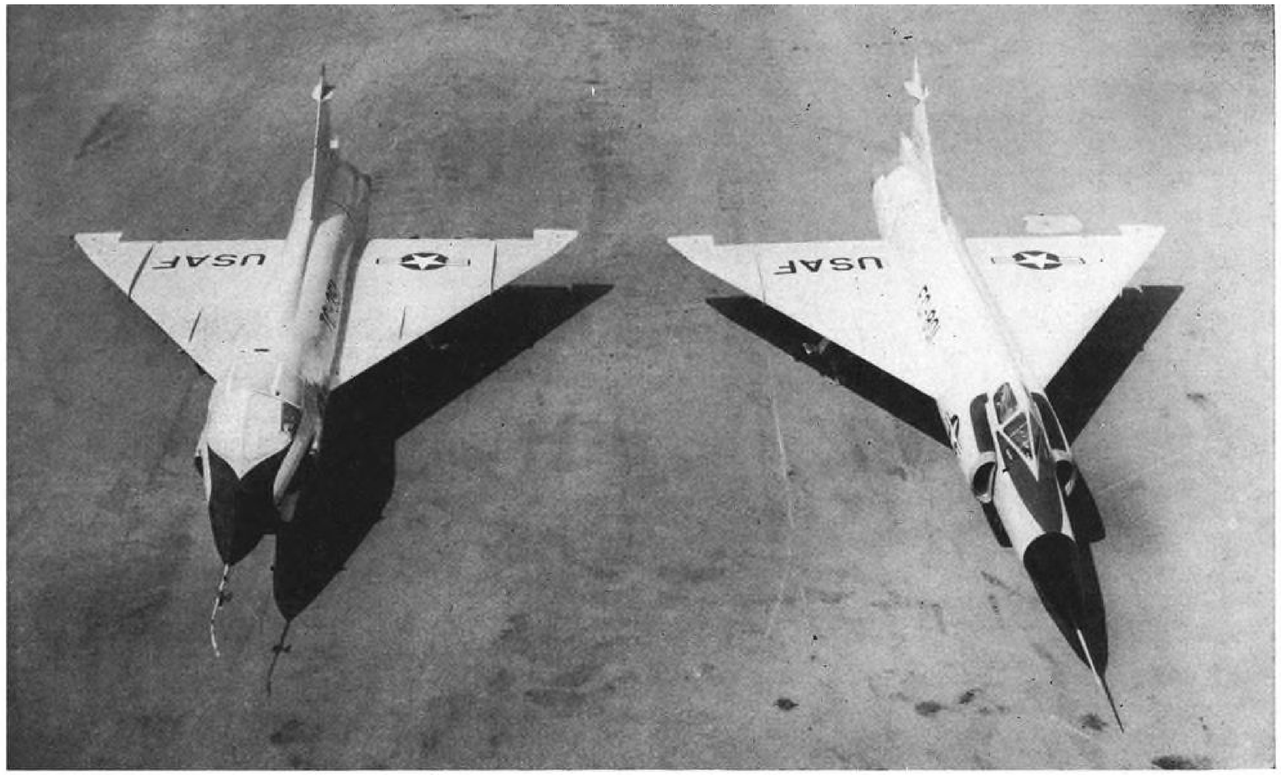
John F. Ortner, assistant sales manager, Durez Plastics Div. of Hooker Electrochemical Co.

Ralph W. Updegraff, chief industrial engineer of Timken Roller Bearing Co. Also promoted: **Ross Russell,** divisional industrial engineer of Steel & Tube Div.

Kevin P. Moore, aviation sales engineer, AC Spark Plug Div. of General Motors.

George Stevenson, sales coordinator of Circuit Instruments Inc.; **Ernest W. Yonick,** Eastern sales manager of Circuit Instruments, Inc. and Hycor Co., subsidiaries of International Resistance Co.

R. B. Link, United Air Lines manager of ground services at Youngstown, Ohio.



TF-102A:
Trainer-Interceptor

Convair's TF-102A trainer, with side-by-side seating, is the company's answer to the knotty problem of familiarizing a prospective interceptor pilot with flying and fighting a complex unit of a supersonic weapons system.

It also may be the company's answer to the criticism of the one-man all-weather fighter, because the trainer also can be flown as a full-tactical weapon by either one or two men.

Length and contours of the original nose —which looks ample for a tandem cockpit— were changed drastically to make the side-by-side layout. This approach adds to the belief that the modified version was designed from the start to serve as a two-man interceptor as well as a trainer.

From the cockpit aft, the trainer and the fighter are identical, their fuselage lines sculptured by the area rule (AW Sept. 12, p. 12). Forward section, although much bulkier, is apparently tailored to the same principle of gradual area buildup. But the shortness of the nose means an "ideal shape" of lower length-diameter ratio had to be chosen for the area control. Such a shape must have a higher drag, and therefore the trainer version—while still a supersonic airplane—must be somewhat slower than the one-man fighter.

AVIATION SAFETY

CAB Accident Investigation Report

Shop Error Behind UAL Crash

THE ACCIDENT

A Convair 340, N 73154, owned and operated by United Air Lines, Inc., made a wheels-up emergency landing six miles southeast of Dexter, Iowa (30 miles west of Des Moines), January 19, 1955, at 1625.[1] A few of the 36 passengers received minor injuries; there were no injuries to the crew of three. The aircraft was substantially damaged.

HISTORY OF THE FLIGHT

United Air Lines Flight 329 of January 19, 1955, originated at Newark, New Jersey, with its destination Lincoln, Nebraska, and with intermediate stops scheduled at Allentown, Pennsylvania; Youngstown, Akron, and Cleveland, Ohio; Chicago and Moline, Illinois; Iowa City and Des Moines, Iowa, and Omaha, Nebraska. It departed Newark at approximately 0703 and was routine to Chicago.

At Chicago a customary crew change was made. The new crew consisted of Captain Earl W. Andreason, First Officer Thomas D. Boyle and Stewardess Enid Patricia Johnson. The aircraft departed Chicago at 1330, and the segments of the flight to Moline, Illinois, and Iowa City and Des Moines, Iowa, were normal; no mechanical or operational delays occurred.

Flight 329 departed Des Moines on a VFR (Visual Flight Rules) flight plan at 1608 for Omaha, Nebraska. The gross weight of the aircraft was 45,215 pounds, 1,685 pounds less than the allowable 46,900 pounds. According to company records, the load was properly distributed with respect to the center of gravity of the aircraft.

The climb to 5,000 feet was uneventful but at that altitude the crew noticed vibration and a slight fore-and-aft movement of the control column. The climb was continued to 6,000 feet, where the aircraft was leveled off and power was reduced. As the vibration was still present at this time, the captain attempted to dampen it by engaging the autopilot; however, this was unsuccessful and it was immediately disengaged.

The first officer next lowered the flaps, first to 5 degrees and then to 15 degrees, without any noticeable effect. The "Fasten Seat Belt" sign was turned on and the captain told the first officer to advise the company of their difficulty via radio.

About this time a sudden failure in the control system was felt and it was with extreme difficulty that any semblance of elevator control was maintained. The first officer again tried lowering the flaps, this time to the 24-degree position, but as this did not help to maintain control he returned them to the 15-degree position, where it was found the most favorable results were attained. Accordingly, the first officer transmitted "Mayday" (distress call) on the radio and said that they were attempting to return to Des Moines but were experiencing control trouble.

The buffeting became so severe it was then necessary for the copilot to help the captain hold the control column. However, the buffeting lessened, and the captain advised the first officer to depressurize the aircraft and tell the stewardess to prepare the passengers for an emergency landing. This was done.

By that time, the aircraft had descended below 3,000 feet. Both throttles were retarded in turn to see if the trouble could possibly be caused by one of the engines. This also proved to no avail. The vibration built up to high level and suddenly another failure, in the control system was felt, and the airplane went into a steep climb. As it seemed that a stall was imminent, the captain quickly moved the propellers to a high r. p. m. and pushed the throttles forward until about 50 inches of manifold pressure was seen on the gauges. The airplane then nosed over and began to dive at a very steep angle.

During this rapid descent the captain reduced power and headed toward open

[1]All times herein are Central Standard and are based on the 24-hour clock.

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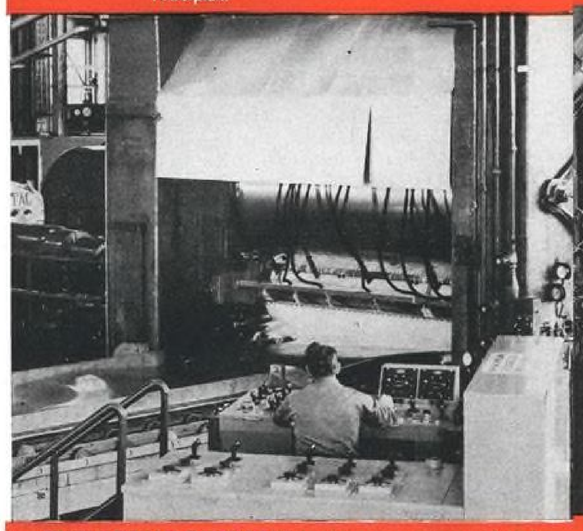
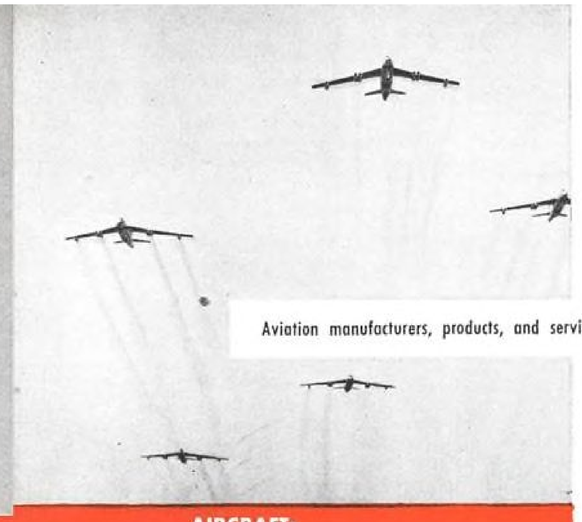
Powerplant



SUPPORTING GROUPS: Data systems computers, punch-card systems etc., Electrical, Ground equipment, Hardware, Hydraulics, Instrumentation, Materials including fuels, chemicals, plastics, metals, etc. Tooling including machine tools, optical jigging systems, hand tools



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AIRCRAFT:
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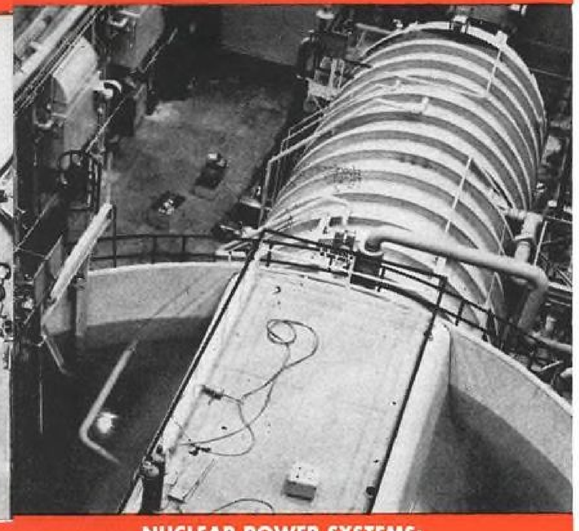
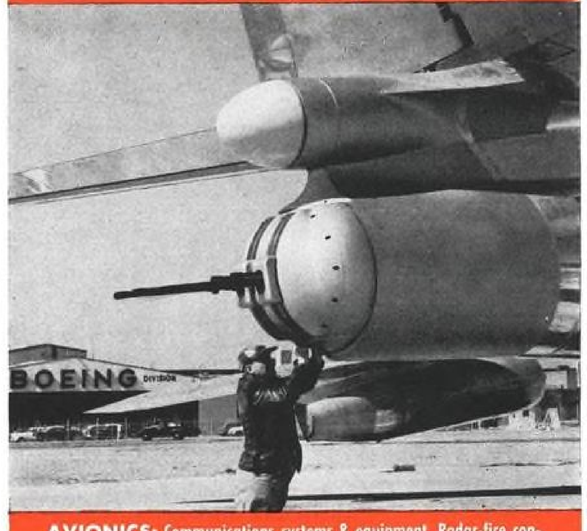
Armament, Fixed equipment



NUCLEAR POWER SYSTEMS:
Accessories and components
Design services
Reactor fabrication

AIRLINES AND AIRPORTS:
Scheduled carriers, Non-scheduled
carriers, Cargo carriers,
Ground equipment, Lighting



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country to his right. When the aircraft reached 500 feet above the ground the captain was successful in flaring the aircraft, and it struck the ground in a flat attitude. All occupants were quickly deplaned as soon as the aircraft stopped.

INVESTIGATION

The aircraft came to a stop heading 195 degrees magnetic and in an upright position with its wheels retracted. It was in a level, snow-covered cornfield approximately six miles southeast of Dexter, Iowa.

From marks on the ground it was determined that the tips of the propeller blades and the antenna attached to the bottom of the fuselage made first contact with the ground. At this time the aircraft was approximately level laterally, and slightly nose-high. The next ground contact was about 900 feet from the first marks found. At this point the aircraft struck the ground and bounced over a barbed-wire fence. It again struck the ground with severe force about 390 feet farther on, hurdled another fence, and skidded in a slight right curve for an additional 1,485 feet. Minor wreckage was strewn along the path.

The underside of the fuselage was crushed upward and the top of the fuselage was badly damaged. All cabin and cockpit seats remained intact. Leading edges of the wings were dented somewhat; the flaps were extended about 15 degrees. All propeller blades were broken. Both engines were still attached to the airplane but their mounts were severely damaged. The snow, which was uniformly five or six inches deep on the ground, considerably lessened the damage the aircraft received during its slide.

Because of the nature of the accident, attention was immediately directed to the empennage and control system of the aircraft. The empennage section was intact and virtually undamaged by ground contact. During the examination of the elevator torque tube assembly, it was observed that there was a vertical fracture of the right side. This completely disconnected the right elevator from the main torque tube assembly, and the pilot could no longer operate this elevator by means of the elevator control system. The left elevator was still attached to the torque tube assembly, however, and partial elevator control could still be effected.

The left elevator servo tab was found hanging in the full down (nose-up) position, with the rear terminal of the aft push-pull tube attached to the tab horn.

Internal inspection of the servo tab assembly revealed that this push-pull tube had broken transversely about 12 inches forward of its rear terminal. The rear portion of the broken tube showed evidence of abrasion over most of its exterior surface, caused by its rapid and violent movement within the elevator. The interior surface of the elevator skin in the area of the tab push-pull rod was seared and abraided, and the skin was punctured in several places.

The inspection doors were opened, and it was found that the servo tab idler was completely detached from its support in the elevator. The ¼ x 3½-inch close tolerance support bolt was fractured about one inch from the head end, and this end of the bolt was found in the lower rear flange of the stabilizer 20 inches outboard of the

idler. The remaining portion of the idler rear spar support bolt was found in place in the idler with its fractured end flush with the inboard face of the idler; its broken end was battered. A ¼-inch castellated nut and two washers of the size and type used with the support bolt were recovered from a fold in the seal balance curtain. No cotter pin was found.

The hinge cutouts on the tab were torn rearward, indicating there had been a violent oscillation of the tab resulting in considerable overtravel.

The elevator closing spar was crushed and deformed upward by action of the servo tab horn and push-pull rod. The inner face of each idler link support bracket was severely battered and abraided near and downward from the support bolt bushing.

It was determined that the aircraft was properly dispatched and that weather was not a factor in this accident.

A study of the maintenance records disclosed that on January 18 and 19, 1955, this aircraft underwent a 1,500-hour inspection at the company's line maintenance base at Newark. After completion of this inspection, the aircraft flew approximately five hours before the accident occurred.

To understand better the chain of events that occurred with respect to work performed on this aircraft, it was advisable to examine the line of command with respect to personnel at the Newark base, and their working hours. The base is headed by a station manager, who has under him a chief mechanic, supervisors of mechancial services (crew chiefs), inspectors, lead mechanics, and mechanics. There are three 8-hour shifts daily beginning at 12 midnight, with personnel reporting for duty 30 minutes before each shift. Top supervisory personnel above the crew chief level are a part of each shift or are available by telephone if needed.

The card system used in the allocation of work comprises a work control record, a routine job card and a nonroutine job card. The work control record is a master card that lists all the work to be performed. Routine job cards are distributed among the mechanics according to the number of areas necessary to be covered for each individual inspection. Nonroutine job cards are made out and initialed by mechanics when they encounter work necessary to be done other than that specified on the routine job card.

N 73154 was in the shop ready for a 1,500-hour check at the start of the 8:00 a.m.-4:00 p.m. shift the morning of January 18. During the inspection of the empennage, which involved a detailed inspection of the horizontal stabilizer, elevator and related control system components, it was found that there was excessive play in the elevator servo tab. A nonroutine job card was made out by the mechanic but no corrective action was taken because of the proximity of a shift change. The crew chief going off duty briefed the crew chief on the afternoon shift on the required work. The card indicating that repair of the servo tab was necessary was then given to another A & E mechanic.

The idler linkage was disassembled to determine the cause of the play and it was found that the idler support bolt was considerably worn. The mechanic left the bolt with his crew chief for examination and returned to his work. This particular type

bolt was not in stock, and an emergency order was issued requesting that it be sent immediately from the company's base at San Francisco. This emergency order was written up on the nonroutine job card.

The mechanic later testified that the worn bolt was returned to him by the lead mechanic with the instruction to put it back in the idler assembly loosely (finger-tight). The worn bolt was then replaced but not safetied. No explanation was written on the nonroutine job card covering this temporary installation. This was contrary to the company's maintenance instructions.

When the midnight shift came on duty there was a heavy workload and the new crew chief (who was the only one assigned on that shift—normally there are two) was not briefed with respect to the worn bolt.

The work on the aircraft continued, in a normal manner and, when completed, the supervisor noticed that the subject nonroutine job card had not been signed off as completed. At this time, however, the mechanic assigned to the job reported to the supervisor that he could not find any excessive play in the servo tab assembly. Accordingly, an inspector was requested to check and determine if this was so. He returned in a short time and said that he also could find none.

The supervisor then went to the job with the inspector and from the ground watched while the tab was checked for free play. Observing no excessive play, the supervisor initialed the nonroutine card, adding the notation "OK for service."

ANALYSIS

Correlation of known physical facts with crew testimony indicates the following sequence of failure. The unkeyed castellated nut which fastens the idler assembly support bolt in its brackets backed off because of vibration. This permitted the bolt to come out of the outboard bracket.

With the idler supported only by the bolt through the inboard bracket, forces were exerted which broke the bolt one inch from its head. This allowed the idler to drop down and the servo tab began to oscillate, causing a forward and rearward movement of the cockpit control column. Loads were then induced in the rear push-pull tube causing it to fail. With the then unrestrained tab oscillating, the left elevator was also affected so that it, too, oscillated about its hinge line.

The resultant loads caused by the left and right elevators being out of phase broke the right side torque tube connector plate, eliminating the right support for the torque tube assembly and preventing cockpit control of the right elevator. Without the right support, forces deformed the torque tube assembly forward about the left support, resulting in almost negligible control of the left elevator from the cockpit.

A thorough study of the company's line maintenance procedures, encompassing its record control system, was made during the investigation of this accident.

As a result of this study, and the testimony of the witnesses called at the public hearing, it was determined that the carrier's maintenance program and the detailed procedures set up to it were adequate.

In this instance, however, the procedures broke down because of the frailties of the human element. The system provided safe-

guards, one of which required that an explanation of all work performed be written on the respective nonroutine job card; another, that the outgoing crew chief at the time of the work shift brief, in as much detail as necessary, the relieving crew chief concerning the work accomplished during the foregoing work period. These company procedures were not followed in this case.

When the final inspection for play in the servo tab was made, no excessive play was found. It was testified to that, if the worn support bolt was replaced and by chance turned from its position when removed, a manual test for play might result in none being found.

However, since the nonroutine job card was written up for work to be done and was not signed by the mechanic to indicate that the work had been accomplished, it is believed that the inspector making the final inspection should have gone beyond the normal instructions and actually examined the servo tab system. If this had been done the mistake probably would have been discovered before the mechanic was told to close all inspection covers and doors.

The critical omission was the failure to write an explanation on the job card that the bolt had been removed and replaced only finger-tight pending the arrival of a new bolt.

As a result of this accident, the company has increased the number of both supervisory personnel and mechanics.

The Board believes the crew was confronted with an extremely hazardous situation and that it was only by employing the utmost judgment and skill that a disaster was avoided.

FINDINGS

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

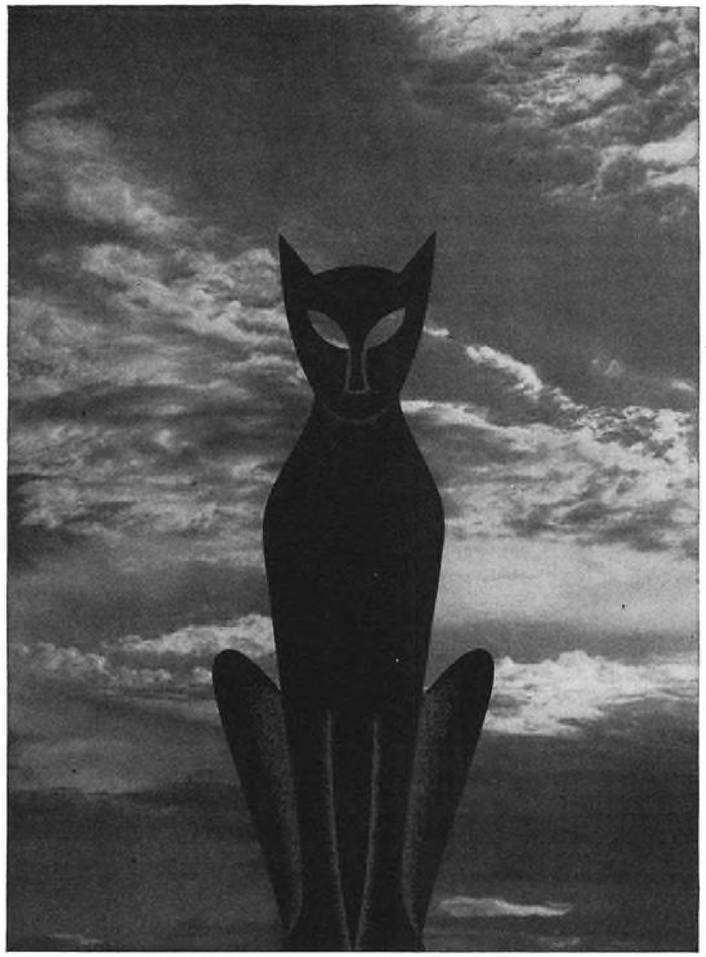
1. The crew, the aircraft, and the carrier were currently certificated.
2. The aircraft was under its allowable gross weight and the load was distributed so that the center of gravity was within approved limits.
3. The aircraft was properly dispatched.
4. Weather was not a factor.
5. During a routine maintenance inspection of the aircraft an explanation was not written on the nonroutine job card that the bolt had been removed and replaced finger-tight pending the arrival of a new bolt.
6. Final inspection of the servo tab system failed to disclose its unairworthy condition and the aircraft was released for service.
7. Vibration backed off an unsafetied nut in the servo tab system, resulting in a sequence of structural failures that ended in almost complete loss of control of the aircraft elevators.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was a series of omissions made by maintenance personnel during a scheduled inspection which resulted in the release of the aircraft in an unairworthy condition and an almost complete loss of elevator control during flight.

By the Civil Aeronautics Board:

ROSS RIZLEY
JOSEPH P. ADAMS
JOSH LEE
CHAN GURNEY
HARMAR D. DENNY



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12	34583	Vickers
8	AA37001	Vickers
1	A380000	Vickers
207	AV 1B 1174	G. E.
8	12782	Saval
81	AA14543	Vickers
54	AA14542	Vickers
3	AA14548	Vickers
498	AA17001A	Vickers
6	TCD 15008	Thompson
6	MD38300	Thompson
141	35801-3	Koehlers
5	14517-2	Adel
1500	AC37D6210	Koehler
3	AN4103-2	Clifford
174	AN5830-1	Whittaker
24	AA31400	Vickers
8	AN6017-1	
32	AN6018-1	
4	AN6200-4A	
27	AN6200-8A	
340	AN6207-8	
9	AN6207-10	
567	AN6207-12	
140	AN6209-4D	
131	AN6209-8	
50	AN6213-2	
2	AN6214-2	
3	AN6245-A4	
14	AN6245-AB4	
3	AN6249-4	
2	AN6277-6	
6	AN6278-4	
5	AN6279-8	
3	AN6280-4	
8	AN6280-6	

ELECTRONICS & INSTRUMENTS

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16	30686	Air Tron—Wave Guide
19	753A	Rhodes Lewis—Intervalometer
30	TOE-8A-6P	Bendix—Oscillator
28	TOE-8A-6N	Bendix—Oscillator
16	TOE-8A-2N	Bendix—Oscillator
148	TOL-4A	Bendix—Oscillator
57	T-200	Melpar—Transmitter
73	TTO-1A	Bendix—Position Meter
120	5103112-003	Hayden—Timer
20	TA 12B	Bendix—Transmitter
35	RA 10DB	Bendix—Receiver
4	AN5753-1A	Eclipse—Pioneer—Amplifier
5	T-2100-3A	Kearfott—Directional Gyro
1	XW 8610	Kearfott—Vertical Gyro
79	MT5	—Transformer
139	MT6	—Transformer
12	15701-1A	Eclipse—Pioneer—Controller
47	254BK-6-052	Kollsman—Diff. Pressure Ga.

ACCUMULATORS

Pieces	Part No.	Manufacture
2	MOD AC450	Aircraft Products
2	S369-50-H2	Sprague
2	S369-100-H2	Sprague
4	Mod R118	Airborne
50	AN6230-1	Bendix
40	AN6203-3	Bendix
56	AA14002A	Vickers
2	AA14005A	Vickers
11	AA14007A	Vickers
3	AA14008B	Vickers

SWITCHES

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70	AN3213-1	Scintilla—Ignition
66	M86A	Pollack—Master
148	PG208-AS1	Honeywell—Air Ram
40	PG208-AS7	Honeywell—Air Ram
20	M101B	Aerotec—Pressure
5	M102	Aerotec—Pressure
349	M826	Aerotec Pressure
93	4401W	Aerotec—Fuel
22	417	Meletron—Actuator

TRANSDUCERS

Pieces		
2	46131CN-G-250-20	Giannini
10	47114-D2.0-20	Giannini
2	47114-D4-20	Giannini
2	47132A-2.0-20	Giannini

PROPELLER PARTS

Pieces		
20	72400	Hamilton Standard—Reversing Control
4	X836-1C2-0	Curtis—Blades
25	4350F	Curtis—Blades
76	4350	Curtis—Blades
60	4350F1	Curtis—Blades
1	129945	Curtis—Propeller Assy.

COMPONENT PARTS

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100	NEA-3	Eclipse—Generators
150	981280	Kidde—CO^2 Cylinders
407	SF9-LN2	Scintilla—Magneto
29	NEP-2	Eclipse—Aux. Power Unit
16	LER-30D	Eclipse—Aux. Power Unit
419	450	Skinner—Filters
149	10966A	—Dash Unit
34	AN6025-96	Kidde—Fire Extinguisher
99	TCD14900-2A	Thompson—Cock
8	AA16801A	Vickers—Hyd. Transmission
273	AN6220-4	Aeroquip—Coupling
1	81075	Airesearch—Turbine Heat Exchanger
4	180011-1	Airesearch—Water Separator

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21	2E258SA	Pesco
8	1E 621	Pesco
2	220048-021-01	Pesco
3	141082-22-01	Pesco
120	MF9-713-15H	Vickers
124	PF12-713-25BCE	Vickers
327	PF4-713-20BCE	Vickers
30	MF45-3911-20Z	Vickers
5	67WF300-1	New York Air Brake
2	67WF300	New York Air Brake
6	610-2C	Eclipse
4	5B204A296	General Electric
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(Continued from pages 128 & 129)

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Telling the Market

Alite sintered metallic oxides, bulletin, Alite Div., U. S. Stoneware Co., Akron 9, Ohio. . . . **"Variation of Load at Yield of Type 304 Stainless Steel Tubing When Held by Crawford Swagelok Tube Fittings,"** charts, Crawford Fitting Co., Cleveland 10, Ohio. . . . **Precision needle rollers,** Catalog No. 61, Kaydon Engineering Corp., Muskegon, Mich.

"Copper Base Alloys in Rod Form," catalog, Mueller Brass Co., Port Huron, Mich. . . . **Automation and systems engineering,** Brochure C 901, Dept. HR-26, Barkley Division, Beckman Instruments, Inc., 2200 Wright Ave., Richmond 3, Calif. . . . **Aircraft wire and cable** condensed specifications, bulletin, Electric Auto-Lite Co., Wire & Cable Div., Port Huron, Mich. . . . **Service tips for pyrometer users,** Bulletin F. 7259, Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill.

"Controlled-Air-Power Devices," Bulletin ML-3, Bellows Co., 222 W. Market St., Akron, Ohio. . . . **Bellows type expansion joints** and pressurized Hydropads, Catalog No. 52, Cook Electric Co., 2700 N. Southport Ave., Chicago 14, Ill.

Brochure on qualifications, personnel, **equipment and facilities at Inland Testing Laboratories,** 1457 W. Diversey Parkway, Chicago 14, Ill. . . . **Editorial Index of "Planes"** from January 1952 to June 1955, Aircraft Industries Assn., 610 Shoreham Bldg., Washington 5, D. C.

Production processing and service facilities, booklet, Allied Products Div., Hamilton Watch Co., Lancaster, Pa. . . . **Gage brochure,** Freeland Gauge Co., 9940 Freeland Ave., Detroit 27, Mich. . . . **Silicone-rubber insulating system** for utilization in motor and generator stator windings, leaflet, Allis-Chalmers Manufacturing Co., 1234 S. 70 St., Milwaukee, Wis.

Brazing and processing stainless steel, brochure; **Nicrobraz,** a heat- and corrosion-resistant alloy for brazing stainless steel, data file; Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich. . . . Properties, characteristics and **applications of aluminum alloys,** brochure, Peter A. Frasse & Co., Inc., 17 Grand St., New York 13, N. Y. . . . **Precision tools** available for multiple-spindle ma-

chines, Bulletin 6-50, Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill. . . . Binotrol **punched tape control system,** brochure, Barnes Engineering Co., 30 Commerce Road, Stamford, Conn.

Installation, performance and maintenance of **Dynamatic electronic control,** Bulletin EC-1, Dynamatic Div., Eaton Manufacturing Co., Kenosha, Wis. . . . **Aerial photographic equipment,** data sheets, Gordon Enterprises, North Hollywood, Calif. . . . **Modernized gap frame double crank presses,** Bulletin 65C, Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.

How spectrophotometry is solving metals analyses problems, Data Sheets DU-36-M (**lead determinations**) and DU-39-M (**tungsten assay**), Beckman Div., Beckman Instruments, Inc., Fullerton, Calif. . . . **Aluminum trucks,** folder, Magnesium Company of America, Tobey Aluminum Div., East Chicago, Ind.

Precision, miniature and snap-acting switches, catalog, Unimax Div., W. L. Maxson Corp., 460 W. 34 St., New York 1, N. Y. . . . **Self-aligning spherical bearings** and rod ends, catalog, Kahr Bearing Div., Aetna Steel Products Corp., 812 S. Flower St., Burbank, Calif. . . . **Industrial Enclosed Switches,** Catalog 83, Micro Switch, Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill.

Publications Received

- **Airman at Yalta**—By Gen. Laurence S. Kuter—Pub. by Little, Brown & Co., 34 Beacon St., Boston 6, Mass. $3.00; 180 pp. An airman's account of the Yalta conferences.
- **'Sound Barrier'**—by Neville Duke and Edward Lanchbery—Pub. by Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y. $4.75; 129 pp. Revised edition of a history of the evolution of highspeed flight.
- **Fifth Symposium (International) on Combustion**—Pub. for Combustion Institute under the auspices of Standing Committee on Combustion Symposia—Pub. by the Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. $15.00; 802 pp. Outstanding papers presented at this symposium held in 1954 at the University of Pittsburgh.
- **The First Five Million Miles**—by Byron Moore—Pub. by Harper & Brothers, 49 East 33rd St., New York 16, N. Y. $3.75; 276 pp. An airline captain tells the story of his 30 years of flying.
- **An Introduction to the Theory of Aeroelasticity**—GALCIT Aeronautical Series—By Y. C. Fung—Pub. by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $10.50; 490 pp. Fundamental principles of the theory of aeroelasticity.

Slim Profit Margins Plague Airlines

Sir William Hildred tells IATA meeting of traffic growth, increases in costs, postal rate problems.

By Craig Lewis

New York—Traffic on the international air transport system is growing at a healthy rate, but small operating profits are still a major airline worry, Sir William P. Hildred, Director General of the International Air Transport Assn., said here today.

Reporting to the Tenth Anniversary General Meeting of IATA, Sir William said that, while traffic showed substantial increases in all categories, the IATA airlines' operating margin was about 3%. Operating profit for all the world scheduled airlines was about $71,000,000 last year—the level it has maintained since 1952.

In his report, Sir William criticized world postal administrations for cutting revenues by forcing the airlines to accept rate cuts up to 30%, then failing to pass the savings on to the public.

The IATA Director General forecast continued gains in passenger and cargo traffic, with passenger development tied to promotion of tourist operations.

Capacity Gains 15%

Last year, IATA airlines flew more than 1.25 billion aircraft-miles and carried 59 million passengers over 32.5 billion passenger-miles. Cargo traffic was 682 million ton-miles; mail traffic 198 million ton-miles. These figures show increases of 14% in passenger traffic, 8% in cargo and 18% in mail.

At the end of 1954, the member airlines were operating about 2,500 aircraft, 1,100 four-engine and 1,400 twin-engine.

The overall total increased by 25 aircraft, but the four-engine total increased 100 planes. The result is a 1% increase in operating units and a 15% increase in capacity.

IATA experts report that ton-mile cost is generally stationary, the result of two opposite trends. While costs continue to rise, capacity continues to increase, and the cost can be spread over a larger base. Sir William calls this balance "precarious" since some costs rise with output and there are limits to efficiency improvements.

This precarious balance may continue for a few years if traffic gains are maintained and no unforeseen demands are made on the carriers, according to the Director General.

Sir William points out that the industry has to live on expansion, and that capital expenditure on long-haul aircraft was $200 million last year. He predicts that the same amount will be spent this year.

Narrow Margins

With such expenses, the airlines can muster an operating margin of only 3%—$71 million. Sir William compares this profit of world aviation with the $67 million profit of U. S. domestic aviation and reports an operating profit of $4 million for international aviation—¼ of 1%.

In his forecast, Sir William said that the airlines are hampered in their development by having to work with narrow margins and by requiring subsidies. These factors limit airline freedom as business enterprises to handle their development. As costs are kept down, the fare level is also kept down, according to Sir William, because "A man must have bread even if you double the price of the loaf. It is not so with air travel, and we allow for that at all times."

The Director General described tourist operations as the key to the future of passenger traffic. He said this has been "triumphantly demonstrated" on the North Atlantic where traffic has increased "by leaps and bounds" since tourist service was introduced. Of last year's 550,000 North Atlantic passengers, 70% flew tourist, and there were 50,000 more tourist passengers than the total of all passengers in 1951.

Cargo Education

"Undoubtedly," said Sir William, "a certain percentage of these passengers would have travelled had tourist services not been available, but since it is our aim to bring air travel to anyone who can afford it, we should not concentrate on the question of diversion and look instead at the overall financial results.

"By those standards the results are good, and there is no doubt that passenger revenue is currently much higher than it would ever have been had no tourist services been introduced," he said.

The development of air cargo is viewed by Sir William as largely a case of producing a simple, economical rate schedule and then educating the shipping public to the many advantages of shipping by air. He said the carriers expect to tap a mass cargo market as soon as they can solve these problems.

SIR WILLIAM P. HILDRED

The prospect for increases in mail revenues are not good, according to the report. The airlines have been forced to accept substantial rate cuts, and mail volume hasn't developed sufficiently to make up the difference.

Sir William points out that while the volume of foreign mail carried by U. S. flag carriers increased 15% in 1954, foreign mail revenues dropped 1%.

Postal Rate Problems

He also expressed disappointment that the postal administrations of the various nations have generally failed to pass savings from airline rate cuts along to the public in the form of reduced postal rates. It was hoped that such reductions would increase air mail traffic, he said.

Sir William called for a firm stand by the airlines against any attempt to further reduce rates at the 1957 Postal Congress at Ottawa. He said airlines are asking for a fair deal, but they doubt they will get it and, as public servants, are unable to do anything about it. If the governments concerned prefer a postal profit and an airline deficit, there is nothing the carriers can do about it, he said.

"If, however, governments are interested in an accurate assessment of the economic cost of each sector of their economy, they might give the matter study at the highest level in order to maintain a healthy balance between interests of the airlines and interests of postal authorities—bearing in mind that

it is, after all, the interest of their public, their taxpayers, which they should try to protect," Sir William said.

In reference to the relationship between governments and airline rates and costs, the Director General observed that practically every time a government takes an interest in the airline business in general, the result is increased costs or reduced revenues. Government restrictions and requirements for forms and information, and government tinkering with the IATA rate structure inevitably result in disruption and in increased costs to the industry, he said.

Subsidy and Supervision

Sir William told the delegates he would like to see subsidy regarded and discussed with a better sense of proportion. He points out that many other industries are subsidized by their governments to a greater extent than the airlines. The subsidy for American international operations for the current fiscal year is quoted by Sir William at $30 million, a third of the amount Americans are spending for comic books and two thirds of the U. S. government expenditure in 1954 for peanut price supports. France spends less to support air transport than the $60 million annual subsidy for the growing of beet root.

Airlines not only get government aid but are subject to "the scrutiny of layer upon layer of government experts," Sir William said. He pointed out that airline practices are closely watched and regulated, and that such supervision is not conducive to the sane development of an industry.

"Unfortunately, the close regulation and scrutiny to which the airline is subjected does not produce among its scrutineers a realization of what the industry really needs," he told the meeting.

The rising trend toward user charges for airports and navigational facilities was criticized by the Director General in his report. He said that there is currently too much preoccupation with the costs and revenues of airports and too little concern with the benefit they bring to the community.

Navigation Needs

Since it became apparent that the airlines are not in dire financial shape, many governments have moved toward a policy of charging for the use of navigational facilities, according to Sir William. International Civil Aviation Organization is preparing a study on navigational facilities, having just completed one on airport charges.

The airlines realize there are certain facilities, such as communication facilities with commercial application, which they should pay for, according to Sir William. But the carriers also believe that the provision of facilities for safety and regularity of flight is an essential public service to be paid for out of public funds, he said.

Sir William also pointed out that a new class of bigger, faster airliners will be flying in a few years and considerable effort must be applied to promoting adequate navigational facilities to handle such operations.

The Director General outlined a number of factors he feels are essential for the healthy development of aviation and a satisfactory relationship between airline and government.

Sir William said the airlines would like to have the governments take a less mechanical and arbitrary approach to their needs. They would like to have their problems better understood and be treated as a responsible industry capable of maintaining its position and planning its development.

The airlines would also like to have equal treatment with other forms of transportation, to have the same kind of regulation and follow the same commercial principles as the railroads and steamship lines.

The airlines would like to be considered an asset to the community and a contributor to community development, and they would like to receive subsidies when they are necessary to support uneconomical public services, Sir William concluded.

International First Class Fares Increased 10% on Major Routes

A fare increase of 10% for some international first class services has been agreed upon by the International Air Transport Assn. There is no change, however, in the basic international air tourist fares.

The new rate schedules were worked out by the IATA Traffic Conferences in a three-week session at Miami Beach, Fla.

Subject to approval by about 40 nations, they will become effective Apr. 1, 1956.

Other changes made at the IATA meeting include:

- **Slight increases** in general air cargo rates in some areas.
- **An extension** of the recently simplified cargo rate system on the North Atlantic route through 1956.
- **Extending the family fare** plan on the North Atlantic, which starts Nov. 1, through the winter of 1956-57.
- **Abolishing** the open-jaw discount, a procedure that permits a passenger to use a different terminal for return on a round-trip flight.

Under the terms of the agreement there will be a 5% increase in first class fares between Europe and India and over Pacific routes and a 10% increase elsewhere with the exception of North and South America or on routes from Australia to South Africa, Tokyo and New Zealand.

The key international fare between New York and London will become $440 one-way and $792 for round-trip during the on-season and $742 round-trip off-season for first class. Sleeper surcharges for berth accommodation on all first class services will also be increased 10% to $55.

Only increase proposed in tourist fares is an additional $10 on the mid-Atlantic route between Central and South America and Europe. At the same time, the wide range of reduced fares for night services will be maintained inside Europe while in the Middle East the number and extent of "B" class fares will be increased.

A wider distinction between tourist services and first class with additional "luxury" governed the decision to raise international first class fares. Hugh B. Main, chairman of the IATA Conferences, said, "While we have succeeded in holding the price line for basic transport service on tourist aircraft, we have had to increase the charge for first class service in order to meet the demands of those passengers who want more luxury and who can afford to pay for it." He added, "If a service costs more to produce, we've got to charge more for it."

An example cited for improving first class service is the substitution of sleeperettes for normal seating. However, such an arrangement reduces the number of passenger accommodations in many aircraft types by as much as one-fourth.

IATA found no acceptable standard

New Atlantic Fare

A 40% reduction in international tourist fares has been proposed by Pan American World Airways and Trans World Airlines for U. S. military personnel, effective Nov. 1. The new low rates apply on only travel from Europe to the U. S. and return, and only for members of the armed forces on furlough, traveling at their own expense.

An example of the proposed rates is a round-trip fare of $354.40 between Frankfurt, Germany, and New York compared to the normal on-season round-trip fare of $590.60.

formula for tourist seat accommodations that will fit all the variations of existing and prospective aircraft. As a result, the conference was forced to agree upon stipulating minimum seating charts for 29 different aircraft types.

Exceptions to the maintenance of present air cargo rates is an approximate 5% increase on the South Atlantic route, routes between Europe and the Middle and Far East (excluding Australia and New Zealand) and (southbound only) from Europe to Africa.

A number of IATA study groups were appointed at the conferences to report on these subjects:

- **Expanding air cargo.**
- **New promotional measures** to increase off-season passenger traffic over the North Atlantic.
- **Integration of helicopter services** into the existing commercial network.
- **Simplification of fares** and regulations.
- **Remedies for the problem** of "no-shows" and late cancellations.

One phase of the simplication program which was adopted by IATA at Miami Beach is a new reservations interline message procedure. The system is called AIRIMP and was jointly arranged by IATA and the U. S. Air Traffic Conference. AIRIMP offers a uniform system of abbreviations and sequence of elements in reservations messages that can reduce a 35 word message to a series of seven short abbreviations. AIRIMP gets by with only 99 abbreviations compared with the old system that required 340.

TWA Helicopter Plan

Trans World Airlines last week announced that it will offer helicopter transfer service between the three major New York airports beginning Nov. 1 for passengers arriving for and departing from trans-Atlantic flights.

The shuttle service, which is subject to Civil Aeronautics Board approval, was provided for in an arrangement between TWA and New York Airways and is similar to a previously announced plan by Pan American Airways (AW Oct. 10, p. 115). The airline will also continue to provide ground transfer services between the airports—New York International, LaGuardia and Newark—for its trans-Atlantic passengers.

New MATS Contract

Transocean Airlines has received a contract from the Military Air Transport Service for a number of roundtrip flights between the West Coast and Japan. The westbound flights will carry cargo and the return flights will be divided between passenger and cargo movements.

CAB Reduces Subsidy Estimates For Second Time in Eight Months

Washington—For the second time in less than a year, the Civil Aeronautics Board has surveyed the airline subsidy situation and made sharp reductions in subsidy estimates.

In reports issued in February and September, CAB estimated that the airlines will get less subsidy and less total mail pay in present and future periods. The reports also revealed several airline operations which no longer require subsidy.

In the latest report, subsidy needs for Fiscal 1956 and 1957 are set at $48.5 million. This amount is 33% less than subsidy for Fiscal 1954 and 13% under the Fiscal 1955 subsidy.

The new estimate is $4 million less than Congress appropriated for airlines subsidy this year. Most of the reductions in the estimates were made in the international operations.

Two trunk carriers—Braniff Airways and Continental Air Lines—are off subsidy for the first time this year, although Continental still receives support for the local service routes it took over when it acquired Pioneer Air Lines this year. Colonial Airlines and Northeast Airlines remain on subsidy.

In the international area, trans-Pacific operations of Pan American World Airways and Northwest Airlines are subsidy free for the first time. Trans World Airlines has operated without subsidy on trans-Atlantic routes since 1953, and Pan American draws $2.5 million on trans-Atlantic operations not comparable with TWA's.

In Latin American operations, Pan American, Braniff, Panagra and Caribbean-Atlantic still require subsidy, although the amount is substantially reduced.

CAB Subsidy Estimates

	Fiscal 1956	Fiscal 1957
	(000 omitted)	
Domestic trunks	$2,193	$2,187
Local service ..	24,088	24,008
Helicopters ...	2,814	2,803
States-Alaskan operations ..	3,343	3,325
Intra-Alaskan operations ..	3,723	3,674
Hawaiian operations	293	293
Trans-Atlantic operations ..	2,454	2,294
Latin American operations ..	9,811	9,862
Totals.....	$48,719	$48,446

Subsidy requirements for local service and helicopter operations remain stable at $24 million and $2.8 million respectively.

Operations between the United States and Alaska are reported to require about $3.4 million and intra-Alaska operations $3.7 million.

The figures quoted by CAB are estimates, since rates of some of the airlines covered in the report are not final.

CAB Chairman Ross Rizley attributed the reductions to seven factors:

- **High level** of economic activity.
- **Expansion** of air transportation services, particularly the sharp increase in low-cost aircoach services both domestically and on a world-wide basis.
- **Air transportation** is a good buy for the consumer's dollar.
- **Excellent safety** and dependability record of the airline industry.
- **Increased volume** of military mail moving by commercial air carrier.
- **Effect of these factors** on the improved economic condition of the airlines and reflection of such improvement in rate orders of the Board.
- **Increased efficiency** of the airlines.

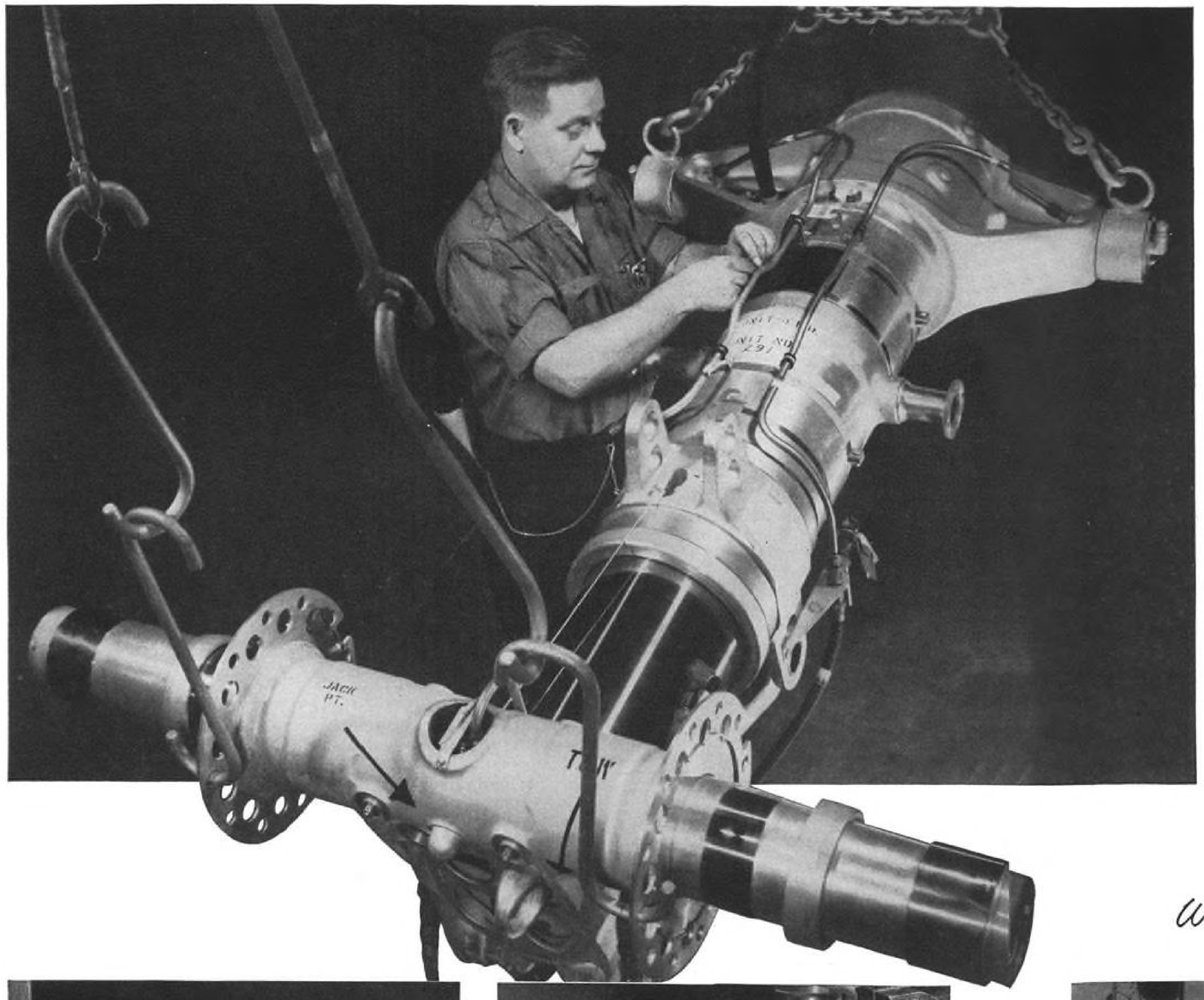
SHORTLINES

▶ **Braniff International Airways** is purchasing an electronic reservations system that will keep track of seats on all flights 31 days in advance and automatically notify the airlines sales agents of seat availabilities.

▶ **Mohawk Airlines** has purchased its fourth Convair 240 from Northeast Airlines. The addition brings the present Mohawk DC-3 and Convair fleet to 15 aircraft.

▶ **North Central Airlines** passenger boardings during September exceeded by 59% the boardings for the same month in 1954. The airline carried 45,535 revenue passengers in September 1955.

▶ **Severson Air Activities, Inc.,** Cut Bank, Mont., has been licensed by the Canadian Air Transport Board to operate a non-scheduled air charter service to Brandon, Winnipeg, Moose Jaw, Prince Albert, Regina, Saskatoon, Calgary, Edmonton, Lethbridge, Medicine Hat and Vancouver, Canada. The aircraft to be used over the routes are restricted to payloads of less than 6,000 lb.



Alloy Steels soften the shock of a 100-ton sock

And here's proof. Shock-absorbing landing gear struts and component parts, like the one illustrated, are made from alloy steels. The toughness of alloy steels helps these struts withstand the shock, impact, strain and vibration of up to 180 tons of aircraft hitting the runway at better than 100 miles per hour.

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The coupon will bring you more information by return mail.

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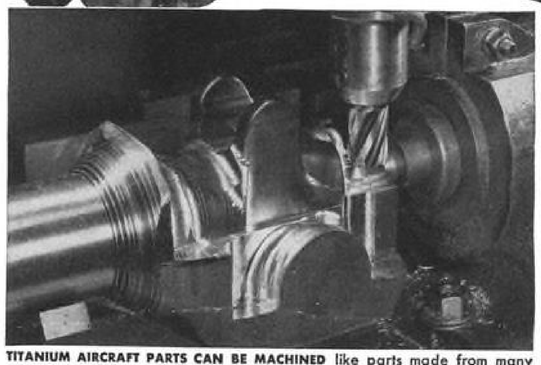
ENDURO STAINLESS STEEL DOES MANY AIRCRAFT JOBS EFFICIENTLY AND ECONOMICALLY. Here ENDURO is used in a bellows that goes between jet engine and exhaust tubes because of its heat-resistance and ability to expand and contract uniformly. There are other advantages—like increased structural strength without added weight, corrosion-resistance, high physical and chemical properties. Republic metallurgists will help you use ENDURO to best advantage.



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Flying Tigers to Abandon DC-6s Upon Lockheed 1049H Delivery

Los Angeles—Flying Tigers, Inc., will dispose of its entire Douglas DC-6 and DC-4 fleet when it takes delivery of ten Lockheed 1049H Super Constellation air freighters in 1957.

This was announced last week by president Robert Prescott when he outlined the modernization program under which the air freight firm plans to finance its $20-million order.

In a speech before the Aviation Writers Assn., Prescott said his firm will dispose of its present aircraft on this schedule:

• **The company will trade four DC-6As,** now leased to Northwest Airlines, to Lockheed Aircraft Corp. for $7-million, $5-million of which will be used to pay off a bank loan and the other $2-million set aside for financing of the Super Constellations. Northwest retains the aircraft, with Lockheed taking over lease.

• **Before June 30, 1956, the firm will sell** the three DC-6s it is now operating. These will be sold for delivery to the buyer about March, 1957, tying in with delivery dates on the Constellations.

"The market indicates we can expect about $3½-million, all of which will be applied to the new financing program," Prescott said.

• **The six Flying Tiger DC-4s** will be sold in the same way as the DC-6s and are expected to bring about $2¼-million.

• **The company expects to derive** $500,000 from sale of six or seven DC-4s.

"The net effect of these plane dispositions is to increase our book value from approximately $7-million to $10¼-million," Prescott said. "In addition we have $2¼-million in outstanding bonds which are subordinate to bank borrowings on new equipment."

This will give the Tigers an effective net worth of $13-million insofar as its borrowing power from the banks is concerned, the president said. "If conditions so warrant it, we will sell additional equity securities. We will be borrowing between $12 and $14-million from the banks for this."

Prescott pointed out that such a program not only will finance the Super Constellation purchases but also dispose of obsolete equipment. It will leave the air freight firm with only two types of aircraft to maintain, the Super Constellation and the C-46, which the company will continue to use as a feeder.

Prescott said one of the important factors in choosing the Super Constellation freighter was the delivery date. "We will get the planes starting early in 1957, a year before we could receive any other equipment," he said. "As you know, that is highly important to us. One of the very real problems of a new company such as ours in a field that already has established competition is the time-lag between ordering and getting equipment."

Another deciding factor was the aircraft itself.

"We like the airplane," Prescott said. "It will carry nearly one-third more than the DC-6A, and it will fly 10% cheaper. On our transcontinental schedules, we estimate it will cut two hours from our coast-to-coast operation. It will be cheaper because of its ability to fly larger loads faster, thus enabling us to give better service and, therefore, generating additional traffic from high freight potential centers."

He gave this comparison:

The DC-6A has a productivity of 4,800 ton-miles an hour times the load, 16 tons. This is nearly two-and-one-half times the productivity of the C-54. The Super Constellation will have a productivity of about 7,000 ton-miles an hour. Thus, one 1049H will do the work of more than three C-54s or one and one-half that of the DC-6As.

The need for this type of aircraft has been demonstrated in the acceptance of the new Flying Tiger direct New York-Los Angeles service. This schedule moves freight from New York to Los Angeles in 11 hours with no intermediate freight stops and only one refueling stop.

"It is too soon yet to accurately gauge the results," Prescott said. "But the first week's operation has been most encouraging, for we have been flying with nearly 100% load factors in both directions."

During August and September, he said, the airline operated at the highest level of common carriage air freight traffic in its history.

CAB ORDERS

(Sept. 29-Oct. 5)

GRANTED:

Flying Tiger Line an exemption to perform two flights from Baltimore, Md., to Hamburg, Germany, pursuant to a contract with the Caribbean Atlantic Steamship Co.

Northwest Airlines leave to intervene in the North Central Airlines Permanent Certification Case.

United Air Lines permission to serve Chicago through O'Hare Airport, providing O'Hare and Midway Airport are not served on the same flight.

Leave to intervene in the Erie-Detroit service case to City of Bradford, Pa., Aviation Commission, and the Dearborn, Mich., Chamber of Commerce. Petitions of County of Chemung, N. Y., City of Elmira, N. Y., City of Jamestown, N. Y., Aviation Commission, Lancaster, Pa., Airport Authority, City of Ogdensburg, N. Y., City of Worcester, Mass., and the Zanesville, Ohio, Airport Commission are denied.

Pan American World Airways an exemption to conduct air transportation at Tafuna, American Samoa, from Suva, Fiji, in addition to its Honolulu-Australia services via Canton Island, for one year.

Delta Air Lines permission to serve Chicago through O'Hare Airport, providing O'Hare and Midway Airport are not served on the same flight.

Flying Tiger Line an exemption to perform 36 flights from London, Paris, Brussels, Bremen, Hamburg, Munich, Linz, Milan, Rome and Athens to New York pursuant to a contract with the Intergovernmental Committee for European Migration.

Leave to intervene in the New York-Nassau case to the Bahamas Development Board, the Bahamas Chamber of Commerce and the Bahamas Hotel Assn., Ltd., Nassau, Bahamas Islands.

Trans World Airlines permission to serve Chicago through O'Hare Airport, providing O'Hare and Midway Airport are not served on the same flight.

APPROVED:

Agreements between Trans World Airlines, Los Angeles Airways and various other carriers relating to inter-carrier arrangements.

Resolutions between various carriers adopted by the International Air Transport Assn. which enable Eastern Air Lines, Braniff Airways, National Airlines, Pan American World Airways and Pan American-Grace Airways to arrange for delayed inaugural flights over their newly instituted interchange services between the U. S. and Latin America.

ORDERED:

Investigation of the United Air Lines 10-day round trip excursion fare between various points which includes automobile rental.

DISMISSED:

Eastern Air Lines' motion to make final the portion of the examiner's decision in the Northeast-Southwest Service Case which would remove Eastern's "closed door" restriction at Pittsburgh on Route 6.

Ozark Air Lines' applications for a certificate, for suspension of Lake Central Airlines' certificate and for acquisition of Lake Central Airlines, at the request of the applicant.

Braniff Airways' applications for service to Saskatchewan, Canada, Santa Cruz, Bolivia and Denver, Colo., at the request of the applicant.

DENIED:

Eastern Air Lines' petition for reconsideration of CAB action awarding Ozark Air Lines a temporary route between Paducah and Louisville, Ky., via Owensboro.

National Airlines and Pan American World Airways' joint petition for reconsideration and approval of a proposed National-Pan American interchange plan.

Aero-Copters, Inc. petition for reconsideration of CAB action extending operations of Okanagan Helicopters Ltd., in the State of Washington.

Airline Traffic—August 1955

	Revenue Passengers	Revenue Passenger Miles (000)	Revenue Passenger Load Factor	U. S. Mail Ton-Miles	Express Ton-Miles	Freight Ton-Miles	Total Revenue Ton-Miles	Per Cent Revenue to Available Ton-Miles
DOMESTIC TRUNK								
American Airlines	629,571	389,995	**67.95**	1,458,861	1,020,573	6,167,911	45,837,590	**60.07**
Braniff Airways	134,889	50,597	**58.79**	155,440	124,616	318,701	5,441,693	**53.40**
Capital Airlines	238,652	74,401	**58.53**	254,960	274,966	352,830	7,994,368	**44.42**
Colonial Airlines	40,983	10,096	**49.74**	13,512	7,828	33,748	994,906	**49.09**
Continental Air Lines	*	21,021	**53.29**	64,606	24,452	111,718	2,213,366	**45.28**
Delta Air Lines	170,074	76,302	**60.92**	251,155	241,244	572,829	8,380,219	**56.35**
Eastern Air Lines	517,254	254,590	**60.20**	801,824	493,329	1,164,901	28,199,170	**46.90**
National Airlines	86,237	57,390	**60.06**	214,371	45,517	308,271	6,387,663	**59.86**
Northeast Airlines	78,867	15,750	**66.25**	11,893	18,778	33,797	1,490,768	**62.22**
Northwest Airlines	125,435	89,727	**71.77**	399,897	249,832	567,894	10,010,847	**62.98**
Trans World Airlines	344,822	278,489	**68.67**	1,025,745	777,783	2,149,230	30,612,480	**62.71**
United Air Lines	542,704	382,908	**73.64**	1,980,693	1,153,216	4,078,692	43,978,494	**63.71**
Western Air Lines	105,564	52,000	**64.89**	195,350	80,617	212,412	5,454,625	**58.08**
INTERNATIONAL								
Braniff Airways	3,251	6,858	**45.85**	25,397	.....	62,832	861,136	**46.05**
Caribbean Atlantic Airlines	11,898	923	**59.24**	964	.....	2,621	86,825	**55.29**
Colonial Airlines	2,914	2,259	**62.32**	92	.....	3,623	245,298	**66.15**
Delta Air Lines	5,032	5,759	**57.57**	7,287	.....	47,965	647,767	**45.45**
Eastern Air Lines	17,899	24,258	**73.61**	53,002	.....	81,973	2,698,589	**63.47**
National Airlines	9,953	4,717	**53.05**	7,477	3,081	49,632	541,063	**49.25**
Northwest Airlines	10,227	20,381	**63.84**	821,024	19,187	546,754	3,538,229	**68.31**
Pan American World Airways								
Alaska	9,567	11,326	**70.28**	35,719	.....	417,961	1,575,355	**60.17**
Atlantic	92,487	121,717	**66.23**	802,906	.....	1,457,631	14,904,760	**64.56**
Latin America	100,671	94,313	**70.08**	296,173	.....	2,493,392	11,736,609	**64.21**
Pacific	22,910	69,020	**76.70**	1,031,866	.....	923,579	9,125,405	**73.20**
Pan American-Grace Airways	11,858	14,044	**58.66**	39,575	.....	185,611	1,713,138	**53.40**
Trans World Airlines	27,449	71,299	**70.21**	709,689	.....	661,662	8,802,177	**71.98**
LOCAL SERVICE								
Allegheny Airlines	37,658	6,025	**46.22**	7,291	18,901	.....	600,637	**46.68**
Bonanza Air Lines	10,520	2,203	**46.51**	3,194	1,921	4,681	221,223	**41.73**
Central Airlines	8,069	1,180	**25.83**	3,773	1,643	4,927	123,873	**23.58**
Frontier Airlines	18,091	4,720	**52.15**	15,212	8,622	58,887	533,473	**61.90**
Lake Central Airlines	12,330	1,799	**34.60**	3,311	12,699	.....	178,719	**32.62**
Ozark Air Lines	23,162	3,438	**34.92**	7,617	16,103	.....	345,016	**35.54**
Piedmont Aviation	33,147	6,430	**53.85**	12,051	12,408	15,634	654,995	**53.50**
Southern Airways	15,184	2,498	**39.91**	8,529	12,529	.....	259,810	**38.31**
Southwest Airways	27,814	5,457	**62.41**	6,103	5,658	9,716	541,212	**60.74**
Trans-Texas Airways	13,455	3,020	**37.85**	12,936	5,837	14,612	321,019	**35.20**
West Coast Airlines	21,584	3,807	**51.61**	4,280	2,150	7,006	357,026	**51.53**
HAWAIIAN CARRIERS								
Hawaiian Airlines	50,906	7,139	**70.96**	3,316	.....	157,204	797,889	**60.13**
Trans-Pacific Airlines	23,707	3,073	**64.01**	858	36	12,261	239,082	**58.23**
CARGO LINES								
Aerovias Sud Americana	.....	.....	.....	.....	.....	531,079	531,079	**47.44**
Flying Tiger Line	2,532	3,772	**88.11**	.....	.....	4,240,753	4,617,945	**77.15**
Slick Airways	1,560	6,411	**76.52**	31,669	.....	5,314,716	5,987,437	**78.20**
Riddle Airlines	.....	.....	.....	266	.....	952,588	952,854	**88.06**
HELICOPTER SERVICE								
N. Y. Airways	2,680	53	**55.20**	1,036	1,268	417	7,455	**56.67**
Los Angeles Airways	637	20	.....	4,757	1,653	.....	8,377	**41.63**
Helicopter Air Service (Chicago)	.....	.....	.....	2,682	.....	.....	2,682	**42.00**

*Not available.

Compiled by AVIATION WEEK from airline reports to Civil Aeronautics Board.

Safety With Sense

Comes the fall of the year and advice to pilots blossoms forth on posters, handbills and memos by the ton. Via cartoons, catchy sayings, morals, codes and poems we are saturated by all manners of reminders aimed at safer flying. All good stuff understand. But the language! Eminently more suited for solo students (or the high school English class) than for the pro who faced the same glop last year.

The pilots of American Airlines were recently subjected to a bit of thinking of a different sort. It was written in creditable language so it got read. This reader found the material worthy of further circulation. Here is AA's Directory of Flight, Captain W. W. Braznell's memo to his pilots:

"A landing minimum is not a yardstick by which a captain's ability may be measured or one captain's ability measured against another when such minimums exist. The best captain is one who operates at all times within his personal limitations, his crew's limitations and his ship's limitations. A captain's limitations may change and frequently do from day to day. The same can be said for the limitations of his crew and the limitations of his ship.

Captain's Limitations

"Some of the factors varying a captain's (or other crewman's) limitations are: (a) physical or psychological factors such as mind troubled or untroubled—body rested or fatigued, everybody feeling good or there has been too much flying and waiting around, too much golfing, swimming or working on the farm, not enough sleep, too much of most anything. (b) Degree of familiarity with ship's operation (all hands). Degree of familiarity with airport and procedures.

"Some of the factors varying the ship's limitations are: (a) Everything working right?, or the vitally necessary clear windshield in the marginal category, or a horizon (or other control instrument) has not been behaving as it should, or a power plant giving trouble, or some part of the navigation or communications gear in the questionable category. (b) The weather situation—turbulence, ice. (c) The runway situation, icy, slippery with rain, nasty crosswind or questionable tailwind component.

Another Man's Poison

"So the old saying 'What is one man's meat is another man's poison' really applies to shooting minimums. Because the trip ahead of you 'gets in' does not necessarily mean you must 'get in' or even make the attempt. The other guy's situation may be considerably different from your own. Then, of course, there is the matter of rapidly varying ceiling and visibility conditions. (Rumor has it that weather reports sometimes do not keep up with the actual weather conditions prevailing.)

"A captain will never be criticized for not gaining access to an airport, even though the trip ahead and the trip behind lands. 200-½ means an approach must be more precise in execution than for 300-¾ or the higher minimums. Use these low minimums when the factors are in your favor for sound approach execution. Discontinue the approach should the degree of precision fall short of your expectations or whenever the weather conditions as viewed through your windshield do not meet (a) authorized minimums or (b) your requirements, which ever is the higher."

This information is good for several reasons:

First, because it was written by a fine pilot; Second, because he did not make the mistake of assuming his audience was composed solely of happy little sunbeams dancing around the sky and, Third, it has the courage to be practical. This combination makes the memo speak words that are genuine value to every pilot.

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—OCTOBER 17, 1955

EDITORIAL

Every Five Seconds

"Every five seconds day or night an aircraft is taking off for a regularly scheduled flight somewhere in the world." This theme of a booklet published jointly by the International Air Transport Assn. and the International Civil Aviation Organization provides a dramatic measure of the progress achieved in air transport during the past decade.

The scheduled airlines of the world are now carrying 23 times as many passengers as they did before World War II plus 70 times as much cargo and a thirteen-fold increase in mail. About 85% of current world airline traffic is carried by the 74 airlines flying under 40 different flags that have voluntarily banded together in the International Air Transport Assn. Today IATA begins its Tenth Anniversary General Meeting at the Waldorf-Astoria Hotel in New York under the presidency of Juan T. Trippe, a pioneer of international aviation and president of Pan American World Airways.

Delayed Honor

IATA embraces all kinds of airlines from globe-girdling giants such as Pan American, BOAC and Air France to tiny operators such as Cyprus Airways and Flugfelag Islands H. F. of Iceland. It also has no political distinctions. The Communist Czechoslovak Airlines (CSA) is a member although Russia's Aeroflot has not joined.

Juan Trippe's presidency and New York's playing host to IATA are long-delayed honors. Mr. Trippe was elected president of IATA's prewar predecessor, the International Air Traffic Conference, in 1939, and New York was scheduled as the annual meeting site for the fall of that year. Outbreak of war in Europe cancelled those plans which have waited until now for fruition. Actually this is the second time post-war IATA general meetings have been held in the United States. San Francisco was the site in 1950 when Warren Lee Pierson, board chairman of Trans-World Airlines, was president of IATA.

IATA can look back on a decade of solid achievement since its first post-war meeting in Havana. Perhaps the most significant is the fact that these national flag carriers have voluntarily spun their routes into an international network that enables an air traveller or shipper to arrange a trip or cargo shipment to any of the 3,500 cities on the air transport map with a single ticket. IATA activities involve an endless erosion of national barriers that prevent free flow of travel and commerce around the globe. The so-called "spirit of Geneva" prevailed in its councils long before it became a popular international political doctrine.

Although international air traffic is increasing steadily, the future outlook for operating airlines is not universally rosy. As Sir William Hildred, director general of IATA, emphasized in his annual report, the squeeze of rising operating costs against total airline revenues poses the gravest problem for healthy economic growth of the air transport industry.

Airline Problems

The air traffic control problem, already acute in the United States, also is an international problem. Unless the individual governments face up to their responsibility in providing adequate navigation and traffic control facilities, there will be serious limitations on traffic volume and severe economic penalties on use of new, technically improved gas-turbine airliners already in prospect for international routes.

Governments, Sir William indicates, are a major contributor to rising airline operating costs through imposition of new taxes such as users charges for airways facilities, higher airport landing fees and transportation taxes. Here IATA and its member airlines face a bitter battle if they are to prevent tax increases from further hacking away at the present narrow 3% margin of total world airline operating profit.

Future Growth

Future growth of international air traffic lies clearly in two directions:

• **Continued expansion of the tourist fare.** Nearly 70% of the 1954 record total of 550,000 North Atlantic air travellers flew on low-cost tourist service and their volume exceeded by 50,000 passengers the total North Atlantic traffic of only four years earlier. The growth of low-fare service and the promotion of tourist travel represent the greatest single area for international air traffic growth in the immediate future.

• **Establishment of efficient international air cargo service.** Air cargo offers its greatest dividends to shippers on long hauls and cargo aircraft that offer economical operations are now beginning to fly. This field offers a slower rate of growth in the immediate future but a long term potential far in excess of possible passenger traffic expansion. In expanding air cargo operations, the national walls of red tape present more formidable obstacles than sales and operations problems.

In its long fight to make swift international travel economically attractive to the people of the world and to erase unnecessary national barriers to the free flow of people and goods, IATA and its member airlines are making an enormous practical contribution to the cause of international understanding and peace.

—Robert Hotz

AMERICAN AIRLINES

America's Leading Airline

chooses Allison Turbo-Prop Power for 400-mile-an-hour luxury travel

New Lockheed Electras to give America the world's fastest, smoothest flights

AMERICAN AIRLINES has ordered Allison Turbo-Prop engines to power its new fleet of Lockheed Electra four-engine airliners to give America the world's finest air travel.

The Allison Turbo-Prop engine was chosen because it is the most advanced propeller-type aircraft engine available here or abroad – and the first Turbo-Prop to receive Civil Aeronautics Administration approval for commercial service.

The Lockheed Electra has been specially designed to take advantage of this new concept in aircraft power, and represents another major advancement in air transport.

These great new 64-passenger airliners will fly at speeds of more than 400 miles per hour–saving up to an hour on popular flights. They will operate from any airport now served – with much shorter take-offs and landings. And they will bring remarkable new standards of smoothness and comfort to air travel. These new luxury airliners are scheduled for delivery in 1958.

General Motors salutes American Airlines on this important step in continuing the advance of American aviation–and we are proud of our contribution to the progress of American-designed and American-built aircraft.

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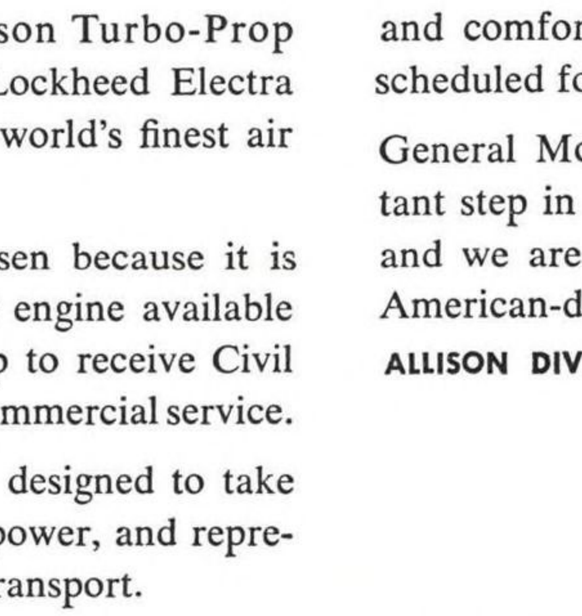
The Allison Turbo-Prop engine is backed by more than six million hours of turbine engine flight time– experience where it counts most –in the air!



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