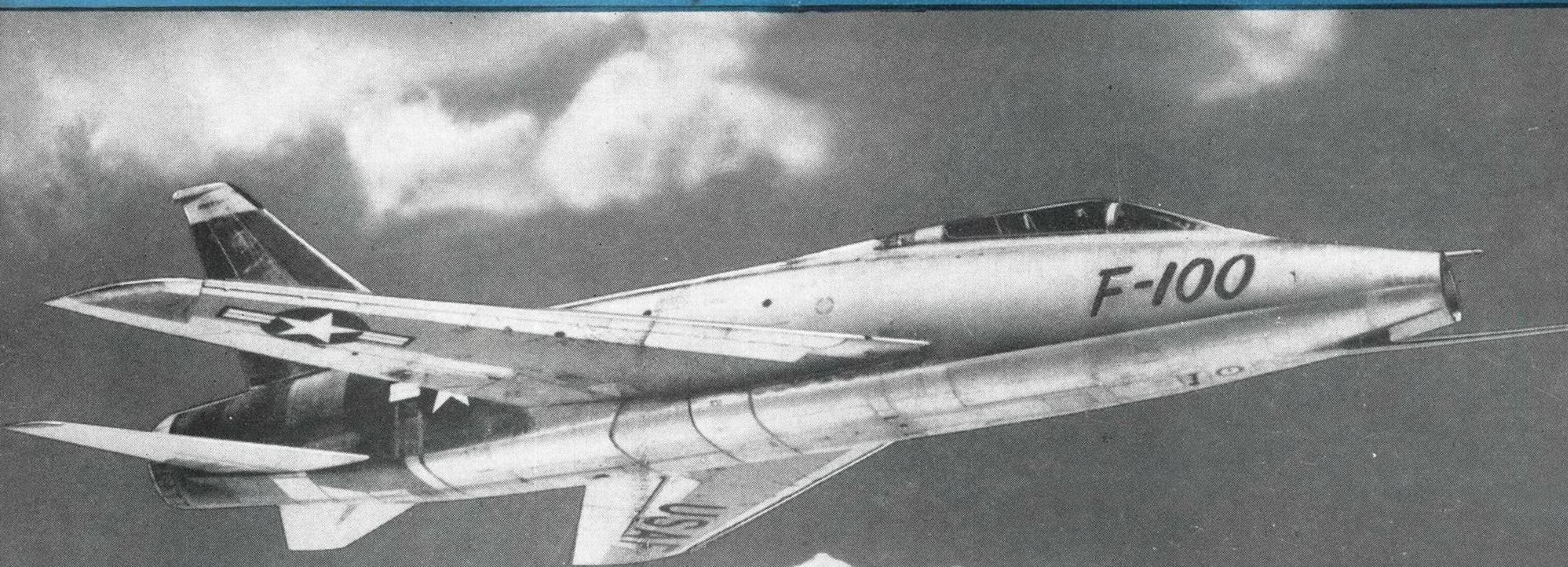


# AVIATION WEEK

A MCGRAW-HILL PUBLICATION

FEB. 7, 1955

50 CENTS



## New Honeywell E-10 Autopilot helps fly the F-100 Super Sabre

**T**HE extremely high performance characteristics of North American's new F-100 Super Sabre—plus the precise missions it will be required to fly—demand an entirely new high performance flight control system.

Honeywell is proud that its new E-10 Autopilot was selected to help fly the autopilot equipped Super Sabres.

Here are some features of the E-10 which make it an outstanding flight control system:

- Mission matching adaptability to a wide variety of command signals—fire control, blind landing, cruise control, radio navigation.

- Extremely rapid response of hydraulic servos.

- Fully coordinated three axes stabilization.

- Constant mach control in dive, climb or cruise.

- Complete air speed compensation providing uniform response at all air speeds.

- Control stick steering.

- All-attitude maneuverability.

Components that make up the E-10 can be combined into highly effective control systems for dive bombing, interception, level bombing or normal cruise control for any high performance aircraft.

The new E-10 Jet Autopilot is another new development from Honeywell. There'll be more, for automatic control is so important to aviation's progress. And *automatic control* is Honeywell's business.

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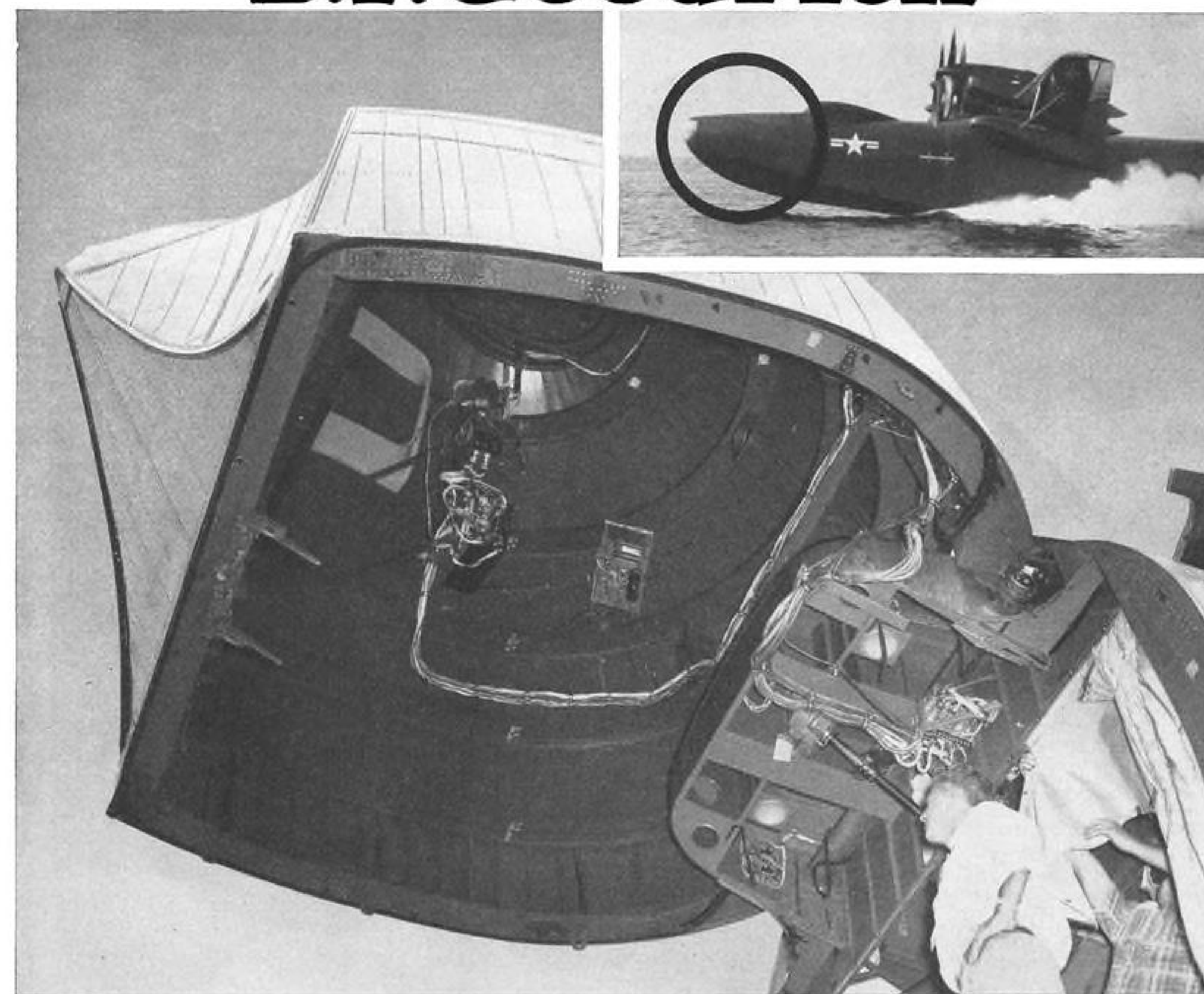
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RESEARCH KEEPS

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FIRST IN RUBBER



## How we keep a flying LST's nose out of trouble

THIS NEW Convair R3Y-2 is the Navy's airborne version of the LST. It's designed to land and taxi right up to a beach. Then lift its nose to load or unload troops, guns, trucks and even small tanks. In the early stages, nose trouble was a problem.

The bow-loader's nose had to be air-tight for flight, water-tight for take-offs and landings. Yet it had to open easily and quickly. Some kind of a seal was needed. But what kind? For the answer, B. F. Goodrich engineers came up with an ingenious seal built inside a U-shaped solid rubber base.

The 38-foot seal is attached to the nose where it joins the plane. When the nose is closed, a diaphragm that rests inside the rubber base is inflated. It lifts against the plane's body to make a 100% seal. It's like blowing up a paper bag. There's full expansion without stretch. Dangerous stretching of the tube wall (like blowing up a balloon) is eliminated. Deflated, it instantly retracts to its original position.

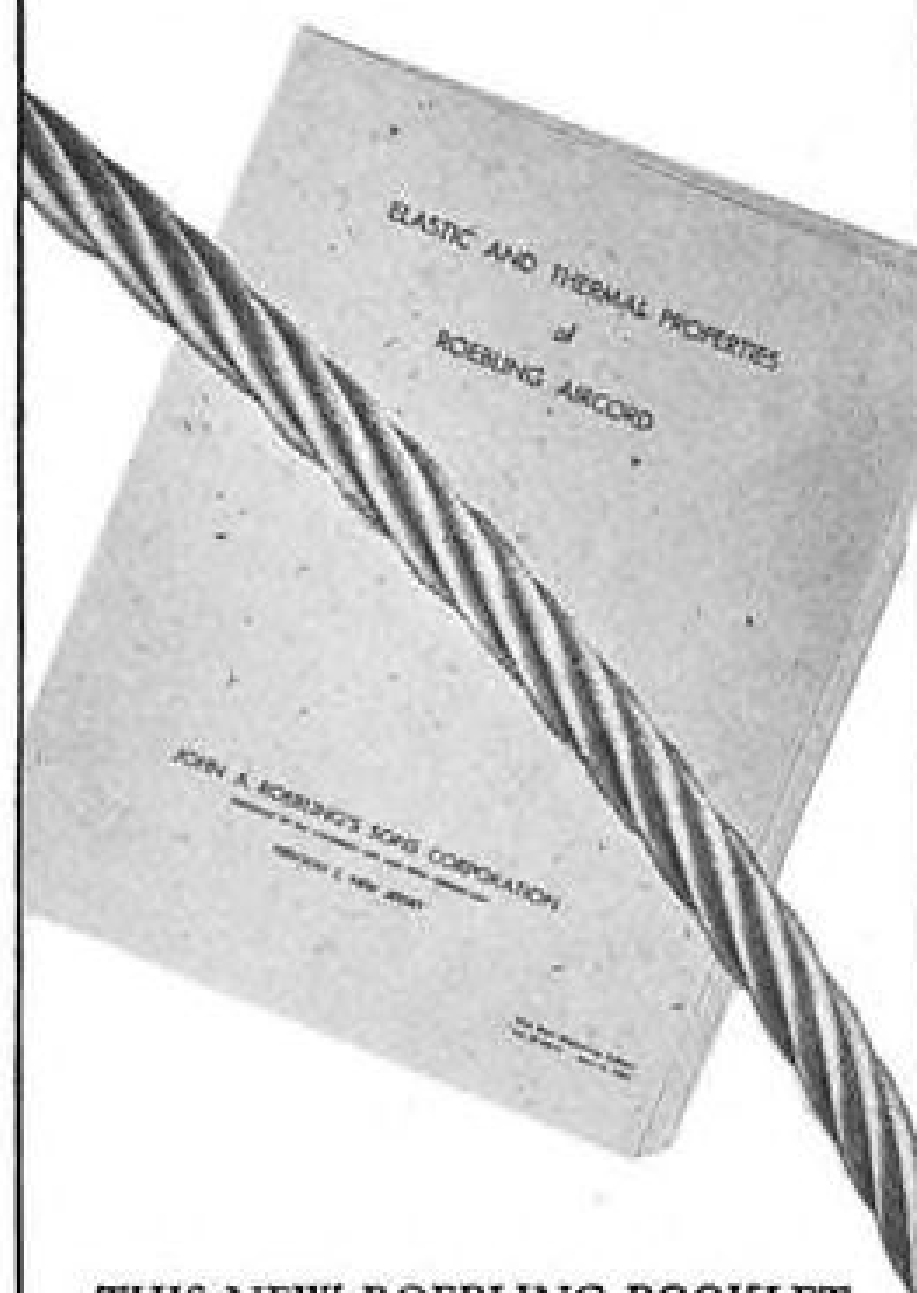
Extensive tests on the shores of San Diego Bay ran without a hitch. A tank could get in, yet air and water could not. A fleet of these flying LST's will see service in 1955.

This inflatable seal is another example of B. F. Goodrich's leadership in aviation research, design and development. Other B. F. Goodrich products for aviation include: tires, wheels and brakes; De-Icers; heated rubber; Pressure Sealing Zippers; fuel cells; Avtrim; Rivnuts; hose and accessories. If you have a design problem, write or phone; The B. F. Goodrich Company, Aeronautical Sales, Akron, Ohio.

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# Aviation Week

FEBRUARY 7, 1955

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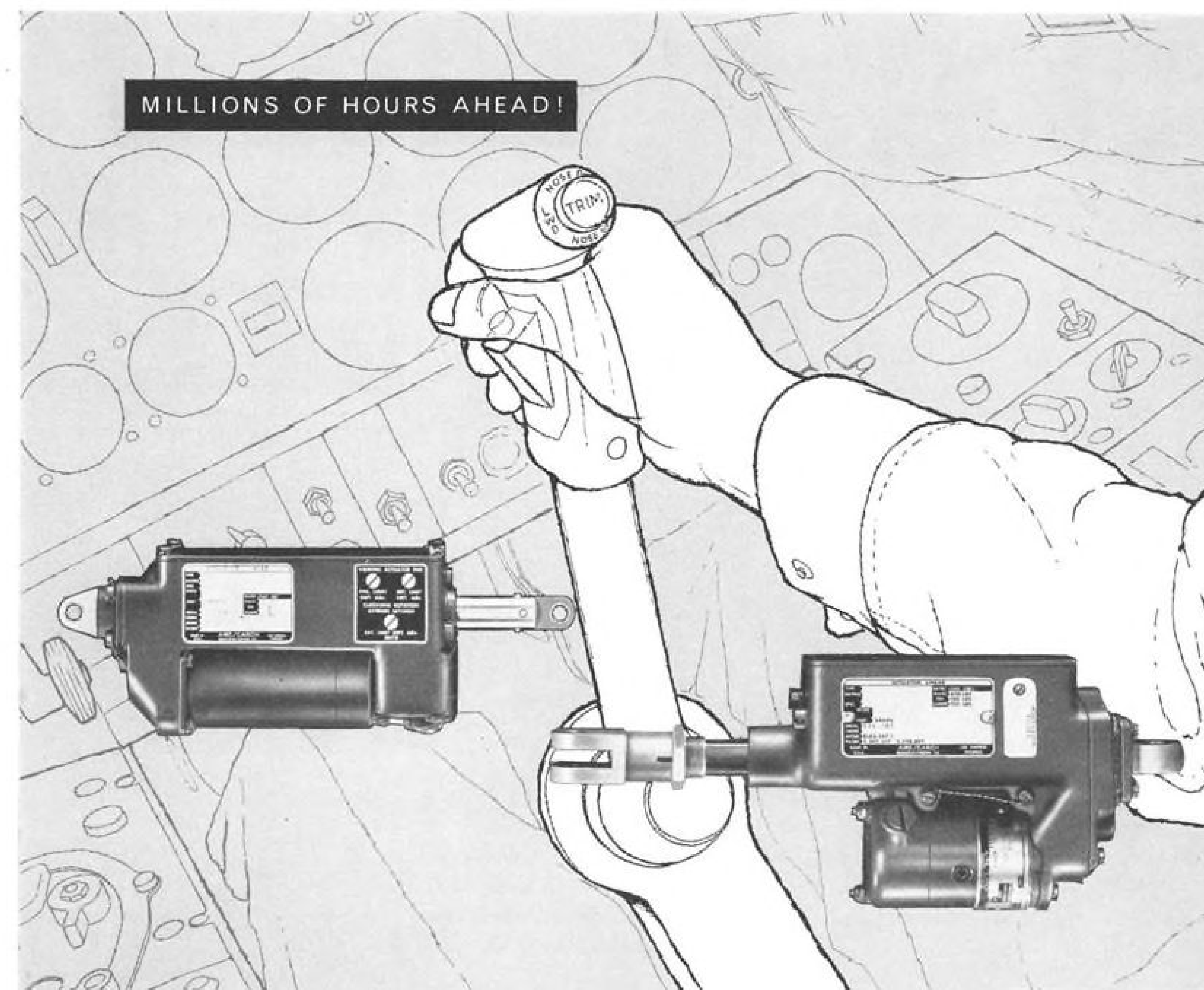
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AVIATION WEEK, February 7, 1955



**Now...stick-feel for jets  
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Aerodynamic pressures generated by the tremendous speed of jet planes made it necessary to power their control surfaces. This left the pilot of the airplane without any "feel" control through his stick.

Actuators were needed to supply this stick "feel"... and they had to be of minimum weight and size.

To meet these requirements AiRe-

search designed highly-efficient units as light as two pounds. Now an even smaller stick "feel" linear actuator has been developed by AiResearch. It handles operating loads up to 150 pounds... static loads to 500 pounds — and it weighs only one pound!

It is the smallest, lightest unit in this field! Again AiResearch shows its ability to top previous performances

with a smaller, lighter power package.

In the past decade AiResearch has developed and produced more than 350,000 actuators for every possible aircraft application. Why don't you put the proved ability of this high-quality engineering and manufacturing team to work on your problems? Your inquiries are invited and will receive immediate attention.

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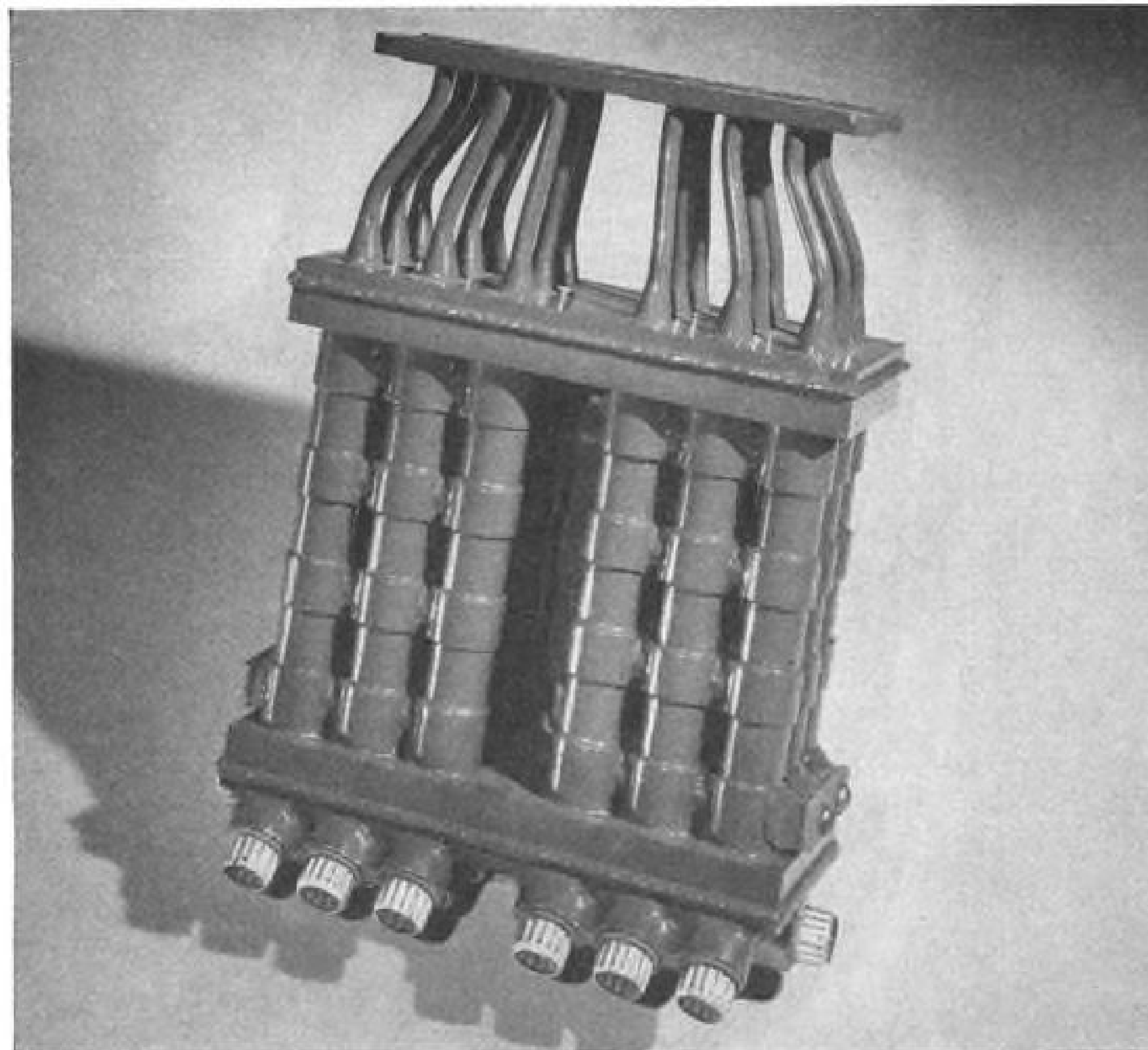
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## New Oil Cooler Design

A Clifford unit is first to use the vaporizing principle in lube oil cooling service. Developed for the Westinghouse J46 turbojet engine this oil-to-fuel heat exchanger provides more heat rejection capacity per unit of fuel flow than ever previously attained.

How to provide sufficient heat transfer capacity in a small space—and at fuel flow rates too low for ordinary oil-to-fuel cooler designs was the problem when Westinghouse developed its J46 turbojet engine.

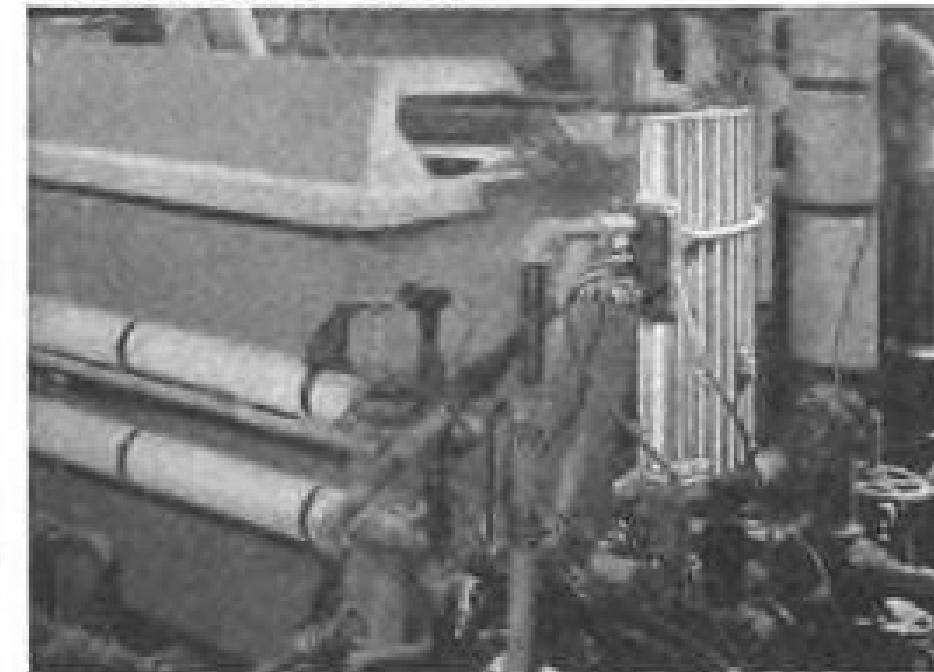
Previous engines used fuel at rates that provided an adequate flow for oil cooling, but lessened consumption in the J46 made necessary the development

of a completely new type of cooler that would provide proper cooling while requiring substantially less fuel flow to carry off the heat.

Basic to the solution of this problem was Clifford's aircraft heat exchange laboratory—the largest, most completely equipped technical facility of its kind. Thermodynamic data empirically developed over many years plus the



Test engineer at wind tunnel control room records data from completely instrumented tests.



Jet engine oil-to-fuel heat exchanger (non-vaporizing type) undergoing performance test.

ability to simulate actual in-service conditions resulted in a cooler that completely met the requirements.

The answer was found in a special new design that took advantage of the greatly increased heat exchange capacity in the latent heat of vaporization.

The new oil cooler, therefore, was designed to vaporize part of the fuel before it entered the combustion chamber.

Other aircraft heat exchange problems for engine oil cooling, hydraulic system cooling and temperature control of cockpit, cabin and other compartments as well as de-icing of wings and empennage are constantly being worked out at Clifford's unique Wind Tunnel Laboratory facility. A few of the resulting heat exchangers and their associated valves are shown at left.

Clifford engineering representatives will gladly consult with you concerning your aircraft heat exchange problems to develop a solution to fit your requirements. Write: Clifford Manufacturing Company, 136 Grove Street, Waltham 54, Massachusetts. Division of Standard Thomson Corporation.

◀ Typical group of aircraft heat exchangers and associated valves. Each represents the solution of a separate problem and meets the requirements of the application as to capacity, characteristics and military specifications where they are involved. 7-4-17



## Air Force Ungrounds Modified Super Sabre

North American Aviation's F-100 Super Sabre is being ungrounded as rapidly as a new vertical stabilizer can be installed and modifications made to the control system to eliminate extreme yaw conditions (AVIATION WEEK Jan. 17, p. 11).

The sweptwing supersonic fighter had been grounded since Nov. 11, 1954.

"These modifications," Air Force says, "are being installed in existing F-100s and will be incorporated in F-100 production lines as soon as possible." The aircraft is manufactured at NAA's Los Angeles and Columbus, Ohio, plants.

### Domestic

XV-3 convertiplane, Bell Aircraft Corp.'s tilting-rotor military design, will roll out of the company's Ft. Worth plant Feb. 10. Developed under a joint Army-USAF contract, the experimental aircraft resembles a conventional monoplane with rotors added to wingtips.

Earl D. Johnson is resigning as president of Air Transport Assn. to join General Dynamics Corp. as a senior vice president. Johnson, head of ATA for a year, will continue with the scheduled airline organization until a successor is appointed. This is expected to take about six weeks.

North American FJ-3 Fury set an unofficial climbing record Jan. 28 at Oceana Naval Air Station near Norfolk, Va., streaking from a standing start to 10,000 feet in 73.2 seconds. The Navy jet fighter, piloted by Lt. Cmdr. William J. Manby, Jr., bettered an 83-second mark set two days earlier by an FJ-3 at San Diego.

Centerline approach system will be installed by Civil Aeronautics Administration on New York International Airport's Runway 4, replacing the double-row sloped line involved in the crash of an Italian Airlines' DC-6B Dec. 18 (AVIATION WEEK Dec. 27, p. 7). Construction is scheduled to begin Mar. 1.

Temco Aircraft Corp. has sold rights to the Luscombe Silhouette, two- and four-place line of personal lightplanes, to Otis T. Massey & Associates, Ft. Collins, Colo. The Dallas aircraft builder acquired the Silhouette when it purchased Luscombe Airplane Co. in 1950, last year the light craft was produced.

Scheduled airline industry plans to equip its transports with radar trans-



## New Converiplane Starts Transition Trials

Twin rotors of Transcendental 1-G convertiplane have been tilted forward about 35 deg. in initial phases of full transition tests being conducted by the firm at New Castle, Del. The single-seat prototype is shown with rotors in vertical flight position. The company earlier conducted trials with rotors in vertical flight and tilted for forward flight on an elevated test stand (AVIATION WEEK Nov. 1, 1954, p. 27). Small electric motors tilt entire rotor hub at each wingtip. Transcendental Aircraft Corp. recently moved its shops and engineering facilities to Glen Riddle, Pa.

ponder beacons for positive identification of aircraft flying under surveillance radar traffic control procedures. The program, expected to cost a total of \$5 million, was set up by representatives of 31 airlines at an Air Transport Assn. meeting in Indianapolis.

Rear Adm. Apollo Soucek, chief of the Navy's Bureau of Aeronautics, is ill at the Naval Medical Center, Bethesda, Md., and is not expected to return to duty. He has been in the hospital for more than two months. Rear Adm. Lloyd Harrison, deputy chief of BuAer, will handle the bureau's budget presentation before Congress.

Pratt & Whitney Aircraft is taking over the Boston engineering office of Chance Vought Aircraft, now withdrawing to consolidate its operations at Dallas. P&WA will employ about 200 engineers, draftsmen and clerks. Approximately 180 persons employed by Chance Vought in Boston have been asked to join Pratt & Whitney.

H. Ward Zimmer, 57, president of avionics maker Sylvania Electric Products, Inc., died Jan. 28 in New York.

### Financial

North Central Airlines reports a record net profit of \$115,043 for 1954 and an all-time-high operating profit of \$170,653. The carrier lost \$114,588 in 1953 and continued to lose an average of \$57,000 monthly during January, February, March and April of last year.

General Dynamics Corp., New York,

has declared a 100% common stock dividend and increased its quarterly cash payment from \$1 to \$1.10. Both will be paid Mar. 10 to stockholders of record Feb. 23.

United Air Lines has declared a regular quarterly dividend of 25 cents on common stock, payable Mar. 15 to holders of record Feb. 15. A \$1.125 dividend on 4 1/2% cumulative preferred stock will be paid Mar. 1 to holders of record Feb. 15.

Ryan Aeronautical Co., San Diego, will pay a 10-cent dividend on common capital stock Mar. 11 to holders of record Feb. 18.

### International

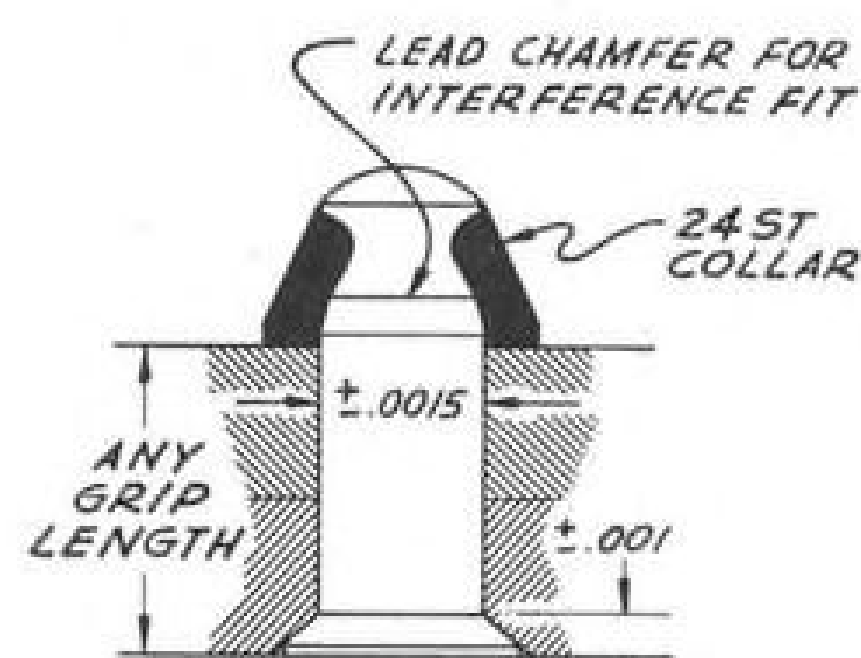
Second Vickers Viscount ordered by Trans-Canada Air Lines was delivered last week at Montreal. The turboprop transport will be used at Toronto to train TCA and Capital Airlines crews.

British Aircraft Exports totaled approximately \$87,910,344 during 1954, dropping from \$118,361,526 in 1953. But overseas shipments of aircraft engines climbed to a new peak of \$58,357,955, compared with \$56,943,440 for the previous year.

First Douglas DC-6B of three ordered by Linea Aerea Nacional de Chile has been delivered to the South American airline. The company plans to use the new transport on routes to Buenos Aires, Montevideo and Lima. It hopes to extend the Lima operation to Panama, Mexico and California.



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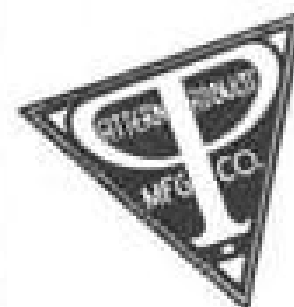


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## New Aircraft Undergo Test In Texas

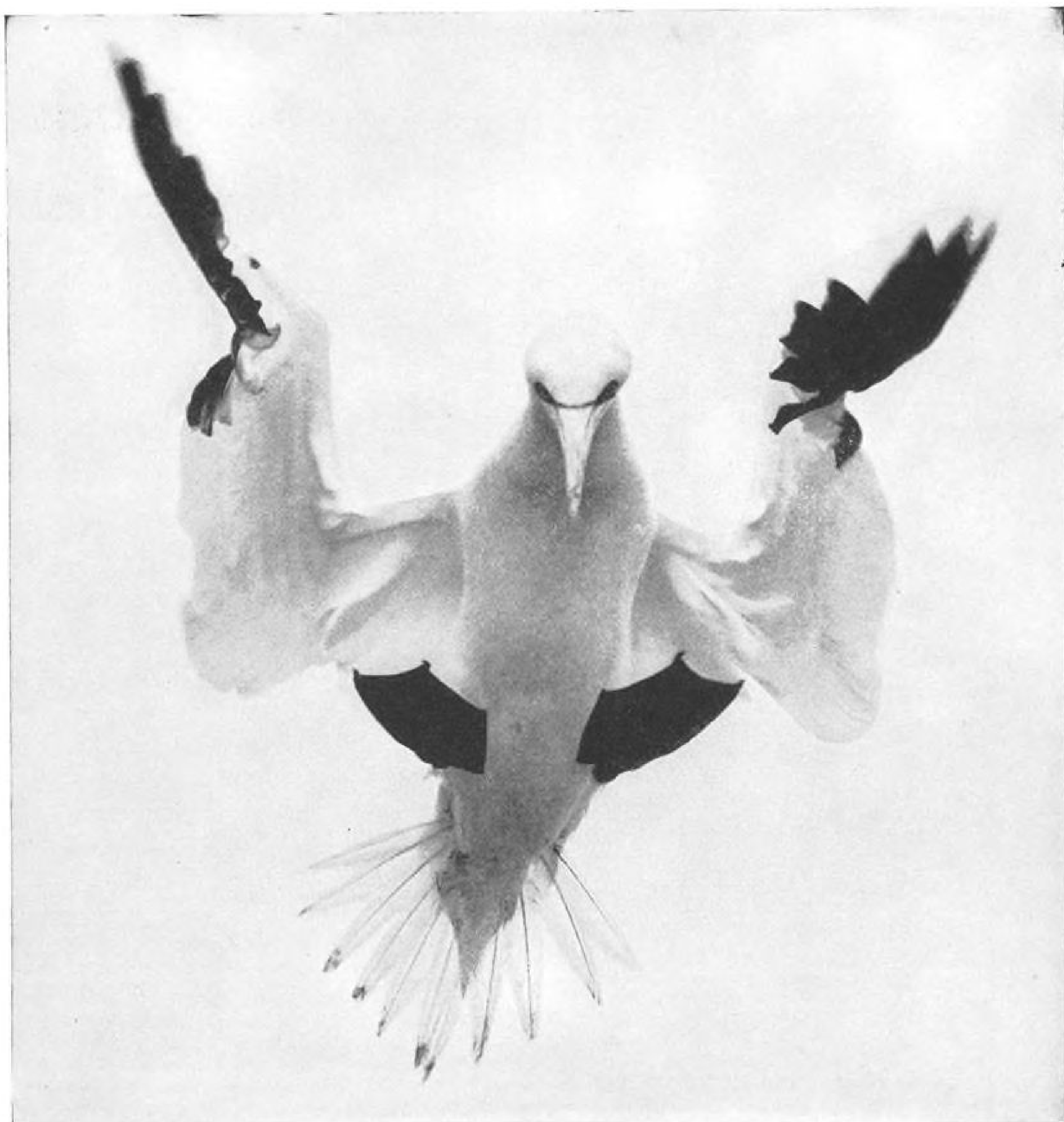


ARMAMENT-TOW ATTITUDE TESTS conducted by Bell Aircraft Corp., Ft. Worth, on its big tandem-rotor HSL-1 involve tilting the anti-sub copter to 45-deg. nosedown in the special rig to gather simulated flight data. Details of these trials are in classified category.



SPRAY/DUST AG-3 has been built by Texas A&M's Personal Plane Research Center under the direction of Fred Weick. Designed in conjunction with the center's agricultural plane development program, the Ag-3 is powered by a 135-hp. Lycoming and can carry 800 lb. of chemicals—two-thirds the load of the earlier, larger Ag-1, also designed by Weick and his staff. The Ag-3 can take off on 920 ft. fully loaded in zero wind. It is fabricated primarily from Piper parts.





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## WHO'S WHERE

### In the Front Office

Barry B. Willis has been named executive vice president and general manager of Pastushin Aviation Corp., Los Angeles.

Robert R. Miller has been elected vice president and executive assistant to the president of Northrop Aircraft Inc., Hawthorne, Calif.

Philip LaFollette, former governor of Wisconsin, is new president of Hazeltine Electronics Corp., Little Neck, N. Y., succeeding Fielding Robinson, who resigned.

Warren G. Knierr, former chief engineer at Northrop Aircraft, Inc., has been appointed vice president-manufacturing and engineering of Longren Aircraft Co., Torrance, Calif.

### Changes

J. Woodrow Thomas, former director of state affairs for Trans World Airlines, is the company's new director of civic affairs, Washington, D. C. W. T. Huff is assistant director.

J. O. Moxness and J. W. Clyne have been named directors, respectively, of domestic and international commercial sales for Douglas Aircraft Co., Santa Monica, Calif. M. E. Oliveau, European division representative, also is a new director.

Kenneth Campbell is manager of Curtiss-Wright Corp.'s new Research Division, Wood-Ridge, N. J., and J. V. Miccio has moved up to general manager of Wright Aeronautical Division.

George Warren Duke is in charge of the recently opened St. Louis branch of J. W. Mull, Jr., manufacturers' representative.

Robert McLarren, former editor of Aero digest, has joined Weber Aircraft Corp., Burbank, Calif., as its Washington, D. C., representative.

Charles R. Chappell has joined the public relations staff of Douglas Aircraft Co., Santa Monica, Calif.

Harold G. Martin, formerly with Grumman Aircraft Engineering Corp., has been named assistant editor of The Ships & Aircraft of the U. S. Fleet.

### Honors and Elections

Terrell C. Drinkwater, president of Western Air Lines, has received the first annual Business Statemanship Award of Harvard School of Business Club of Southern California for leadership in human welfare projects, contributions to community development and success as a business executive.

Ernest G. Stout, staff engineer at Convair-San Diego, is one of 100 alumni of New York University's College of Engineering honored for achievements that have brought distinction to themselves and their alma mater.

## INDUSTRY OBSERVER

► USAF Air Research and Development Command now is studying the possibilities of including such factors as procurability, reliability, maintainability and vulnerability in its design criteria for considering new aerial weapon systems.

► Airlines pilots are plugging for a new safety device that will avoid premature flap retraction by adjusting the rate at which flaps can be retracted to the performance that any particular aircraft can support during its takeoff and landing cycle. Inadvertent and premature flap retractions are unofficially credited with causing the KLM Super Constellation crash at Shannon and the BOAC Stratocruiser accident at Prestwick.

► Watch for fuel stowage in transport aircraft fuselages to become a major safety battle between airline pilots and aircraft manufacturers.

► Civil Aeronautics Administration is watching closely evidence of fatigue cracks in Douglas DC-6s. Although cracks have been discovered, CAA says there is no apparent pattern to their occurrence and does not regard the situation as hazardous.

► Sweden expects to be independent of jet engine imports by 1960 as the result of a new agreement between the air force and Svenska Flygmotor A. B. The Swedish aircraft engine company plans to spend about \$4 million on expansion of facilities.

► Improved traffic control in the New York area is expected to result from installation of new remote VHF station at Philipsburg, Pa., which will extend the New York air route traffic control center's existing peripheral communications so it can talk directly with aircraft that are located almost anywhere in its control area.

► Autopilot-controlled "zero length launching" of a piloted F-84G (AVIATION WEEK Jan. 24, p. 9) using a Lear F-5 has proven satisfactory, and in some respects smoother than when the plane is under manual control, Lear reports. A standard unmodified F-5 autopilot was used, despite high launching accelerations.

► Don't be surprised if the whole NATO lightweight-fighter project evaporates without any action. After wasting months in an apparently endless series of evaluations, NATO officials are confronted by two choices: buy the existing Folland Gnat which was designed primarily as a high-altitude interceptor and has serious limitations as a low-level fighter-bomber (mainly inability to carry tactical atomic bombs), or pick a French or Italian design that still is on the drawing board and five years away from service use. While the North Atlantic Treaty Organization has frittered away more than a year on this project without any tangible results, the Russians on the other hand, have put the MiG-17 fighter successor to the MiG-15 into squadron service.

► Army is buying 10 Cessna T-37A twin-jet trainers, "a service test quantity." (AVIATION WEEK Nov. 22, 1954, p. 46). The side-by-side aircraft is powered by two Continental J69s, each developing 920 lb. thrust. Speed is more than 350 mph. Army will use the aircraft as observation planes in adjusting surface-to-surface missile fire.

► Two Republic F-84Fs have landed wheels up at Langley AFB without damage. Both came in on their external fuel tanks; one pilot claims he didn't know he was wheels up until he got out of the cockpit. He thought he had a flat tire. The planes were jacked up, gear pumped down, fuel tanks changed, and returned to service.

► The Douglas B-66 develops yaw and pitch-up characteristics similar to those of the North American F-100 (see p. 7). Modifications are under way prior to delivery of these tactical bombers. Tactical Air Command wants tanker kits for the B-66s it is to receive. They will need a fast, high-altitude refueling craft to refuel other B-66s or fighter-bombers.



## Washington Roundup

### Hot Potato

Problem of what to do about Gen. O. P. Weyland's Korean war book, "The First Jet Air War," is being bounced back and forth between the Department of Defense and the Air Force. Weyland's book deals with the full story of the Korean air war.

Defense Department public relations reviewed the book, promptly kicked it back to the Air Force and announced that "no final disposition" had been made. Air Force is laying plans for another try at getting it cleared. Air Force, smarting from Army and Navy propaganda that ignores or smears USAF's role in Korea, believes the book by the former Far East Air Force commander would set the record straight.

Besides totaling up the score of who did what to the Communists with airpower in Korea, Weyland's book examines the unpreparedness in training and equipment of the Army to utilize air support at the start of the war, the weird Far East command war plans such as the theater split between Tenth Corps and Eighth Army and the lessons learned in the first jet air war, including a critique of Air Force deficiencies.

Weyland, now Tactical Air Command leader, is pushing the book. He wants it published only if he can tell the full history of the Korean air action. Members of his staff are betting the book won't appear until after he retires—it's too hot for the Pentagon to handle.

### Tacan for Common System?

Possibility that Air Navigation Development Board will rule in favor of the military's Tacan navigation aid over the civil VOR/DME system was detected by Washington observers in an otherwise puzzling action by Civil Aeronautics Administration.

CAA had issued a two-page advance press release on its VOR/DME programs. Next day, CAA's press agents were busy calling newsmen to kill the release. They refused to give a reason.

Observers said CAA apparently figured that taxpayers would be disturbed to read about DME program (now half completed, with 215 commissioned in a program of 432 installations) and learn later that Tacan has been adopted as the civil-military common system. Meanwhile, ANDB's decision on the DME-Tacan controversy is due momentarily after a series of delays.

### Postage Increase?

Postmaster General Arthur Summerfield is using the results of a recent Gallup poll as a weapon to obtain an increase in postage rates this year.

Rep. Edward H. Rees, ranking Republican on the House Post Office committee, inserted Gallup's findings in the Congressional Record. They show that for the first time majority opinion favors an increase of 3 to 4 cents in first class mail, and an increase from 6 to 7 cents for airmail.

### Navy Victory

What at first looked like a strong congressional drive to strike out funds in Navy's budget for a fifth Forrestal-class carrier apparently has died aborning.

Chairman Clarence Cannon of the powerful House

Appropriations Committee announced that he was opposed to the project as soon as it was proposed because he considered carriers "too vulnerable and too expensive."

After Chairman Carl Vinson of the Armed Services Committee volunteered his allout support for the new carrier, however, Cannon announced that he would not try to block funds for it.

### Subsidy in Service Mail Pay?

Sen. Harley Kilgore, a member of the appropriations subcommittee handling Civil Aeronautics Board funds, and possibly its chairman this year, is convinced that the service mail pay rates set by CAB contain a sizable element of subsidy. He will request that the Appropriations Committee hire a special staff to look into the matter.

"If subsidy is justified for air transportation, I support it, but I don't want it going by another name," Kilgore said.

### CAB Penalties

The Civil Aeronautics Board is going to continue its campaign for the right to levy civil penalties for violations of its economic regulations. The Board wants to put some teeth into such regulation. Legislation to accomplish this is high on the list of bills that will be sent to Capitol Hill. Legislation was introduced last year, but it didn't get anywhere.

The Board also is going to ask for the power to issue certificates for "supplemental service." This is a move to do away with the long-term headache provided by the letters of registration under which the nonskeds operate.

The Board never has managed to arrive at any real policy on the matter itself, although the large irregular case, largest ever processed, is reported to be within a few months of an examiner's report. A decision in this case is supposed to decide just where the nonskeds fit in the air transportation picture.

### Air Transport Monopolies

The air transport industry is expected to figure in more than one anti-monopoly investigation in this session of Congress. The first committee to interest itself in a study as to the extent the industry is still open to competition: The Joint Committee on the Economic Report, headed by Sen. Paul Douglas. An influential Democrat on committee is Sen. John Sparkman, chairman of the Senate Small Business Committee and long-time proponent of the right of nonskeds to compete with the scheduled lines.

The two aspects congressional committees can be counted on to look into:

- Domestically, policies concerning new entrants into the air transportation system.
- Internationally, the degree of dominance of Pan American Airways. Reasons for Justice Department's suit against PAA and W. R. Grace and Co., seeking to divest the two firms from control of Panagra, are likely to be reviewed by groups of Capitol Hill.

—Washington staff

# AVIATION WEEK

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## Congress Sets Sights on Missiles, Airlifts

- Symington warns Reds may be ahead in development of guided weapons, says airlift for Army inadequate.

- House subcommittee to probe Navy plane procurement early in scrutiny of Administration's defense program.

By Katherine Johnsen

Congressional scrutiny of the Administration's defense program—expected to concentrate on guided missile development and airlift capability in the months ahead—opened with an investigation by the House Armed Services Committee.

Financed with an initial \$150,000, the committee's investigation into many facets of the program will be performed by a subcommittee, headed by Rep. Edward Hebert.

► **Not 'Happy'**—Already on the subcommittee's agenda for early attention: an investigation of naval aircraft procurement.

This was ordered by Rep. Carl Vinson, chairman of the full committee, following testimony by Navy Secretary Charles S. Thomas that he "had not been happy" with it. Navy's request for plane procurement money dropped from \$1.9 billion for fiscal 1955 to \$750 million for fiscal 1956, he said, because of cancellations and "slippages" in production.

Although Thomas qualified his statement by saying difficulties had largely been solved, Vinson declared that "if the Secretary is unhappy we want to find out what he is unhappy about."

Beginning in July 1957, Thomas said, the Navy would require "greatly increased obligating authority" for aircraft.

The authorizing resolution directs "a full and complete investigation and study of all matters" relating to:

- "The procurement, use and disposition of materiel, equipment, supplies and services . . .
- "Laws, regulations and directives administered by or within the Department of Defense . . .
- "Scientific research and development in support of the armed services."

► **Reds Ahead?**—Meanwhile, in a speech on the Senate floor, Sen. Stuart Symington, former Secretary of the Air Force, expressed concern over the adequacy of the Administration's guided missile program and plans for airlift capability.

He observed: "It may be the Communists already have bombs of greater destruction than we have, just as it may be they are ahead of us in the development of guided and ballistic missiles. After extensive study, I believe they are ahead on missiles."

Pointing to a statement approved by the President that "the Administration is counting on airlift of Army or Marine units as an important part of the mobile forces. . . ." Symington added: "But I have studied the airlift over recent weeks and believe the airlift available to the Army is inadequate; and Gen. Ridgway must know that."

► **'Briefing' Sessions**—The House Armed Services investigation was launched after several days of "briefing" sessions with top Defense Department officials and chiefs of staff.

Highlights of testimony and developments at these sessions were:

- **Congressional sentiment** is strongly opposed to the Administration's plan to make sharp cutbacks in Army strength. The Administration's program: A reduction in Army manpower from a strength of 1.3 million last December to 1,027,000, about a fourth reduction.

Committee members repeatedly expressed their intention to fight the reduction. They had the support of the Army Chief of Staff, Gen. Matthew Ridgway, but not of Army Secretary Robert Stevens, who staunchly defended the Administration plan.

- **Emphasis and priority** in the Administration program is on both strategic retaliatory power and continental defense.

This was put forth clearly in a Presidential statement presented by Defense Secretary Charles Wilson. Democrats, and numerous Republicans, said the Administration is achieving its objectives in these two areas at the "expense" of the Army and Marine Corps, and suggest that the wars of the next decade or so may be "ground" wars.

Symington commented: "If there now is atomic stalemate—a stalemate created by the fact that the originator of a hydrogen attack might in turn be

### Nuclear Aircraft

USAF chief of staff Gen. Nathan Twining told congressmen:

" . . . We believe we will realize great advancements from the aircraft nuclear propulsion program. While the nuclear propelled aircraft presents many difficult engineering problems, we believe that the advances we have made to date have given us the basic knowledge from which we can project practical applications for military weapons systems.

"We have hopes that this will be a truly intercontinental weapon freeing us from the dependence of overseas logistics. We have placed a high priority on the development of this equipment."

destroyed, then it is certain that any new hostilities will result in fighting on land. . . ."

- **Current level of defense**, entailing a fiscal 1956 budget of \$31.4 billion in new money and \$35.9 billion in expenditures, is the level that should be sustained indefinitely, in view of the Communist threat, Wilson testified.

"I cannot at this time foresee any important reduction in the military establishment nor in the total annual military expenditures . . . below the present levels, nor do I see any need for any important increases short of war."

Testimony presented to the House committee included:

### Air Force

Pointing out that the Administration's goal of 137 wings "is less than the former objective of 143 wings," USAF's Chief of Staff, Gen. Nathan Twining, "nevertheless considered it acceptable."

USAF's plan: 131 wings by July 1957 and 137 by July 1958. Air Force increased from 112 active wings to 121 during the past year.

- **Economy Possibility**—Twining reported that USAF's total emergency airlift will be increased by more than 50% by 1960 by "improved utilization of the operating aircraft and through the utilization of more modern aircraft, with no increases in the number of squadrons."

The possibility for major economies through airlifts was highlighted by Secretary Harold Talbott. By cutting the



pipeline length from 270 to 100 days through airlift of engines overseas, he said, the Air Force will be able to accomplish a 25% savings in spare engines alone.

► **Air Buildup**—Twining reported on progress over the past year in the air buildup:

- **B-47 jet bomber conversion program** of the Strategic Air Command is "nearing completion" and will be completed by early 1956.

- **One tactical unit** was equipped with F-100s, and commands in "several" overseas areas received later versions of fighters of the F-84, F-86 and F-89 types.

- **Aircraft inventory** of the 87 Air National Guard squadrons was increased by 45% to 1,368 aircraft, "the majority of which were jets of the F-94, F-86 and F-80 types." During fiscal 1956 USAF will convert 17 ANG squadrons to fighter interceptors for use in continental defense.

- **Air Force Reserve**, now operating some jet aircraft, doubled its inventory.
- **Five continental defense squadrons** were activated over the past year, Twining said, adding that "soon we will have achieved a complete capability for a maximum early warning from any likely area of attack and an increased kill capability in a combat zone of increasing depth."

- **"USAF is losing** daily many valuable service-trained personnel to positions in civilian industry offering more attractive wages and assignment stability," Twining reported. "If this trend continues it will result in lowering our skill level in critical areas to a point where combat effectiveness will be impaired."

- **In air defense**, Twining said, projects include longrange radar, electronic countermeasures, and air-to-air missile developments.

- **Improvements in tactical aviation equipment** being worked on, the general said, include low-altitude bomber equipment techniques, all-weather fighter-bomber capabilities and guided missiles for close-in-support of the ground forces.

## Navy

Navy will operate 10,061 aircraft, increase its carrier air groups from 16 to 17 and have the first of its Forrestal-class carriers in the fleet in fiscal 1956, Secretary of the Navy Thomas reported. Funds to start the fifth Forrestal carrier are being requested in the fiscal 1956 budget.

Navy expects delivery on 2,616 aircraft during the year.

At present strength, the Navy can "adequately cope with any local naval actions with respect to the limited area of the Formosan Straits," Secretary Thomas told the committee. "If a major

## New Control Lab

A new laboratory devoted to flight control research and development has been established at the Wright Air Development Center, Dayton, Ohio, by the USAF Air Research and Development Command.

The new laboratory will absorb flight control development functions from the present armament, aircraft and equipment laboratories at WADC. It will be headed by Col. John L. Martin, Jr., formerly assistant chief of the WADC Aircraft Laboratory.

Branch chiefs in the new laboratory serving under Martin are: instruments, David Stockman; control synthesis, Maj. Constantine Svimonoff; aero mechanics, C. B. Westbrook; and control equipment, H. W. Basham.

conflict should occur now or in the future, this naval program is still designed to withstand the initial onslaught, to contribute immediately to the nation's retaliatory power and to provide a base for full and rapid mobilization."

## Army

Secretary Stevens emphasized that "new ways must be found to make our fighting divisions and units more mobile, more self-contained and capable of sharper and more telling blows against an enemy."

This testimony on the need for mobility probably will be drawn on by Democrats to justify their conviction that more emphasis on airlift is justified.

► **More, Not Less**—Although the total military manpower required by the Army in a future global war probably would be less than in World War II, Chief of Staff Ridgway said he believes that the new technological developments will mean that more, rather than less, men will be required in a given unit.

He gave as reasons for this: A radical increase in the depth of battle—ground forces will be fighting 150 to 250 miles apart instead of the 30 to 50 miles in World War II; the increased need for rapid alternate concentrations and dispersals of troops; greater maintenance requirements.

## Defense

The Administration's defense program is the program of the National Security Council and the President—not that of the Joint Chiefs of Staff, who were "consulted at frequent intervals," Wilson disclosed.

He also revealed that the Navy to a

"minor" extent, as well as the Army, took issue with certain aspects of the program.

► **Carrier Defense**—Although the continental air defense program is being pushed "with all practical speed," Wilson told the committee, "the kind of equipment needed is subject to rapid obsolescence due to the high rate of technological advance in this field. The improvement of the system is geared to the availability of suitable equipment and to the capacity of our forces to use this equipment."

He said "a limited number" of aircraft and radar picket ships already have begun operations and construction of the first Texas tower will begin soon.

Carrier aviation was staunchly defended by Wilson, who declared it "increases the flexibility and dispersion of our retaliatory power."

He predicted that "in the future the Army may be organized into a larger number of smaller but more mobile and self-contained units of great firepower."

By mid-1956, he said, the Air Force will be "almost 100% jet equipped."

## Bell Official Becomes Chairman of AF Board

Dr. Mervin J. Kelly is the new chairman of USAF's scientific advisory board, succeeding Dr. Theodore Von Karman, who resigned effective Dec. 31, 1954.

Dr. Von Karman will continue as chairman of NATO's advisory group on aeronautical research and development. He resigned the USAF post to prevent undue strain on his health imposed by the two positions. Dr. Von Karman was awarded the 1954 Wright Brothers Memorial Trophy for his influence on development of highspeed aircraft in the U.S. (AVIATION WEEK Dec. 6, 1954, p. 7).

Dr. Kelly is executive vice president of Bell Telephone Laboratories, Inc. He has been serving as vice chairman of the USAF board.

## Hamilton Standard Gets \$4-Million Order

Hamilton Standard Division of United Aircraft Corp. has been awarded two Navy contracts totaling \$4,296,071 for propeller assemblies.

Other contracts include:

**Gray Manufacturing Co.**, Hartford, Conn., electronic components, \$1,338,042.

**David Bogen Co.**, New York, components for intercom systems, \$123,230.

**McCulloch Motors Corp.**, Los Angeles, spare parts, \$128,347.

**Curtiss-Wright Corp.**, Caldwell, N. J., sets of propeller conversion parts, \$167,511.

## Expert Calls for Recon Buildup

Gen. Goddard suggests camera-carrying guided missiles for long missions, small drones for tactical service.

Reconnaissance is the most difficult mission of the modern Air Force, but it is a hard idea to sell, said Brig. Gen. George W. Goddard (USAF Ret.).

"You can see and feel the results of guns and bombs, but the intelligence derived from reconnaissance can only be appreciated by the intellect," Goddard told a luncheon audience at the annual meeting of the Institute of the Aeronautical Sciences.

Those intangible results are one reason the importance of reconnaissance is hard to sell. The other: There have been very few reconnaissance specialists at command levels in the Air Force.

► **Changes in Problem**—Since World War II, the problem of reconnaissance has changed, said Goddard, who now heads the Military and Aerial Photographic Division of Bulova Research and Development Laboratories. He listed these changes:

- **Tremendous increases** in firepower have changed the kind of targets an air force must hit, although reducing the amount of detailed knowledge required about the target. Prime targets at the present are strategic bomber bases, not industrial complexes or traffic systems.

- **The Iron Curtain** was lowered on conventional sources of information. Aerial reconnaissance would have to get new target information. Extensive search activity would have to find and pinpoint targets that might represent a threat.

- **Air Force operations** are required over a strange area where maps are not sufficiently available. Guidance or navigational data must be furnished in a common reference system that ties the area together and permits description of any reference point.

► **New Aircraft**—"The technical and operational factors determining the scheme and scope of future reconnaissance may well justify the development of a special reconnaissance vehicle . . . for the purpose of identifying, locating and destroying all those important targets which threaten directly our survival," said Goddard.

His idea of a special-purpose aircraft is one that operates "with plenty of altitude—maybe 60,000 or 70,000 ft." This ideal plane must have speed or altitude capability at the sacrifice of other features, except those of visual and camera lines of sight. This specialized craft should have a high acceleration at low altitudes, be able to cruise at moderate speeds. Its one-man crew—for night work, perhaps three men



GODDARD: Reconnaissance comes first.

would be needed—should have a wide view out of the airplane.

A longrange reconnaissance guided missile would appear to be an excellent solution, the military reconnaissance expert added.

Goddard told AVIATION WEEK that some types of drone aircraft would make excellent tactical reconnaissance vehicles. "A field commander could catapult them off, vector them over the area he wants to photograph, and bring them back for parachute recovery. He could have his pictures in minutes instead of hours. If he lost one, the cost would be negligible compared with losing an expensive airplane and an irreplaceable pilot."

► **Camera Problem**—Parallel to the development of reconnaissance aircraft must go the development of cameras, Goddard said. "The least the Air Force can do is give our flying personnel equipment that will function 100%. . . . Every mission, so far as possible, must be a positive operation. . ." the general said.

In addition to fool-proof cameras, the camera mounts, windows and the airplane itself must be the product of close co-ordination between the camera manufacturer, the aircraft designer and the Air Force.

Goddard feels that aircraft designers are not fully aware of the specialized problems inherent in designing reconnaissance aircraft. Vibration, window shape and location, programmed flight equipment, exact control at extreme altitudes present new parameters for the designer.

" . . . When . . . we design and build this aircraft leaving out the dual bomber

and fighter idea it will result in greatly increased efficiency in accomplishing the reconnaissance mission."

► **Bulova Work**—Goddard's current interest at Bulova is in the development of small cameras, typified by gunsight cameras used to record the effects of firepower. Bulova labs have developed under Goddard's direction a small, lightweight camera designed to fit in the leading edge of a fighter fin, rather than in the smoke-dimmed, vibration-ridden nose or wing positions.

Goddard's name has been synonymous with photography in the Air Force for years. He has invented processes for night, three-D, color and long-range photography currently in use by USAF.

When he retired last July, Goddard was director of reconnaissance, Allied Air Forces in Europe, the climax of a 36-year tour of duty. He earlier had been head of the Photographic Reconnaissance Laboratory and director of research at Wright-Patterson AFB, had served in Korea installing his system of highspeed night photography, and had supervised some of the photographic processes and coverage at the Bikini atom bomb tests. —DAA

## Props Fail to Reverse On 2 Landing DC-7s

Propellers on two United Air Lines' DC-7s failed to reverse pitch during landings at Chicago-Midway Airport recently, forcing the pilot on one to ground loop his plane to stop. The other pilot was able to brake his plane to a halt.

After the first DC-7 touched down, the pilot tried to reverse all four props. Instead of reversing, they went into low, positive pitch—giving forward thrust.

Believing he could not stop in time, the pilot ground looped and blew the four main gear tires, damaging the main wheels. No other damage to the aircraft was reported and all passengers and crew deplaned safely.

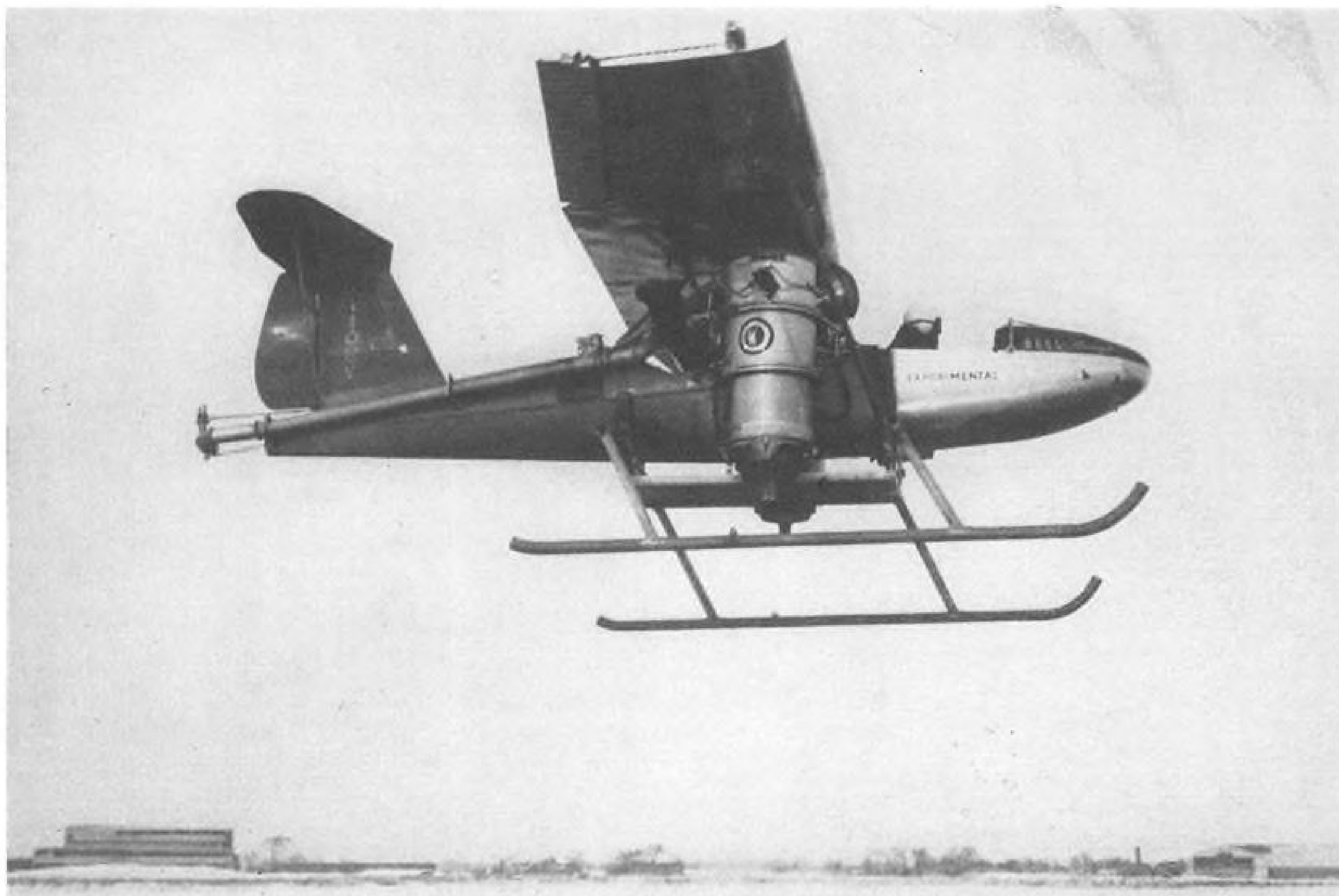
Pilot of the second DC-7 elected to reverse propellers on the two inboard engines only. They failed to reverse and gave forward thrust instead. The pilot was able to stop the transport with brakes, and no damage resulted.

Investigation showed both aircraft had been flying for long periods at temperatures as low as -40F.

United is said to be considering the desirability of drilling a second hole in the propeller piston to circulate more oil through the prop dome, thus keeping oil in the dome warmer.

Hamilton Standard, manufacturers of the propeller, has proposed installation of an insulating prop dome covering to help keep the oil from congealing, according to reports.





**J44 JETS VERTICALLY POSITIONED**, Bell VTO test vehicle hovers a few feet off the ground during test program being conducted at Niagara Falls (N. Y.) airport. Compressed air jets at tail and wingtips supply longitudinal, directional and lateral control.

## Bell Jet VTO Takes Off and Lands Level

Bell Aircraft Corp. is flight testing a new turbojet-powered vertical-takeoff and landing (VTO) airplane that lifts into the air and lets down in a normal level attitude.

The new aircraft has made more than 20 flights since Nov. 20 at the Niagara Falls Airport next door to Bell's Buffalo plant. It is expected to reach speeds up to 100 mph. within the next few months.

A helicopter, lightplane, glider and motorboat contributed parts to the un-

usual design. Power comes from two tiltable Fairchild J44 turbojets borrowed from USAF.

President Lawrence D. Bell says the VTO is "... the most significant single development in aircraft flight since the Wright Brothers' first airplane."

► **Operations**—The Bell VTO takes off and lands in a horizontal attitude, with its jets pointing straight down. Control at the low-speed end of the flight spectrum is done with compressed

air jets that are located at the wingtips and tail.

Air supply for control jets comes from a "Palouste," a modified Turbomeca jet engine whose inlet can be seen just above and behind the pilot's head. Conventional controls take over for forward flight.

At the controls for the flights was David W. Howe, Bell flight test pilot. ► **Test Vehicle**—Bell's TO differs from Rolls-Royce's "flying bedstead" (see p. 17) in several respects. Primarily, it is a more-advanced aircraft than can fly straight and level.

It was built as a test vehicle to prove theories. Construction was quick and cheap. The fuselage was converted from a glider; a commercial lightplane wing was adapted. The landing gear is from a Bell helicopter and the throttle from a motorboat.

The VTO weighs about 2,000 lb., is 21 ft. long and has a span of 26 ft. There is room for the pilot only.

"Our test vehicle is only the starting point," added Bell. "Just as the helicopter brought new maneuverability and utility to aircraft, the jet-powered VTO launches an entirely new era of fixed-wing flight."



**JETS ARE ROTATED** from horizontal to vertical position for a straight-up takeoff. Inlet for modified Turbomeca Palouste used for three-axes control is visible just behind cockpit.

## USAF Gives Army Arctic Mobility

But Exercise Snowbird shows need for better aircraft equipment in true all-weather airborne operations.

By Claude Witze

Elmendorf AFB, Alaska—U. S. Air Force has proved in Exercise Snowbird that it can provide the necessary mobility to America's infantrymen in sub-arctic conditions.

The next step is to perfect mobility of the troop carrier units themselves, a job that will call for full co-operation from the aircraft industry.

► **Operation Lessons**—Col. Marvin L. McNickle, commander of the 314th Troop Carrier Wing of the 18th Air Force, here from Sewart AFB, Tenn., is satisfied that he delivered what the Army wanted in the right place at the right time.

The big lessons learned, he told AVIATION WEEK, are concerned with operation of his aircraft in extreme temperatures. The 314th dropped equip-

ment, supplies and 2,800 airborne troopers in a simulated combat zone at Talkeetna, 66 mi. north of this base near Anchorage.

Three battalions of the 11th Airborne Division's 503rd Regimental Combat Team from Ft. Campbell, Ky., were parachuted accurately into the field with a minimum of casualties. The goal for USAF troop carrier units is true all-weather operational mobility. The Snowbird experience will help reach this goal.

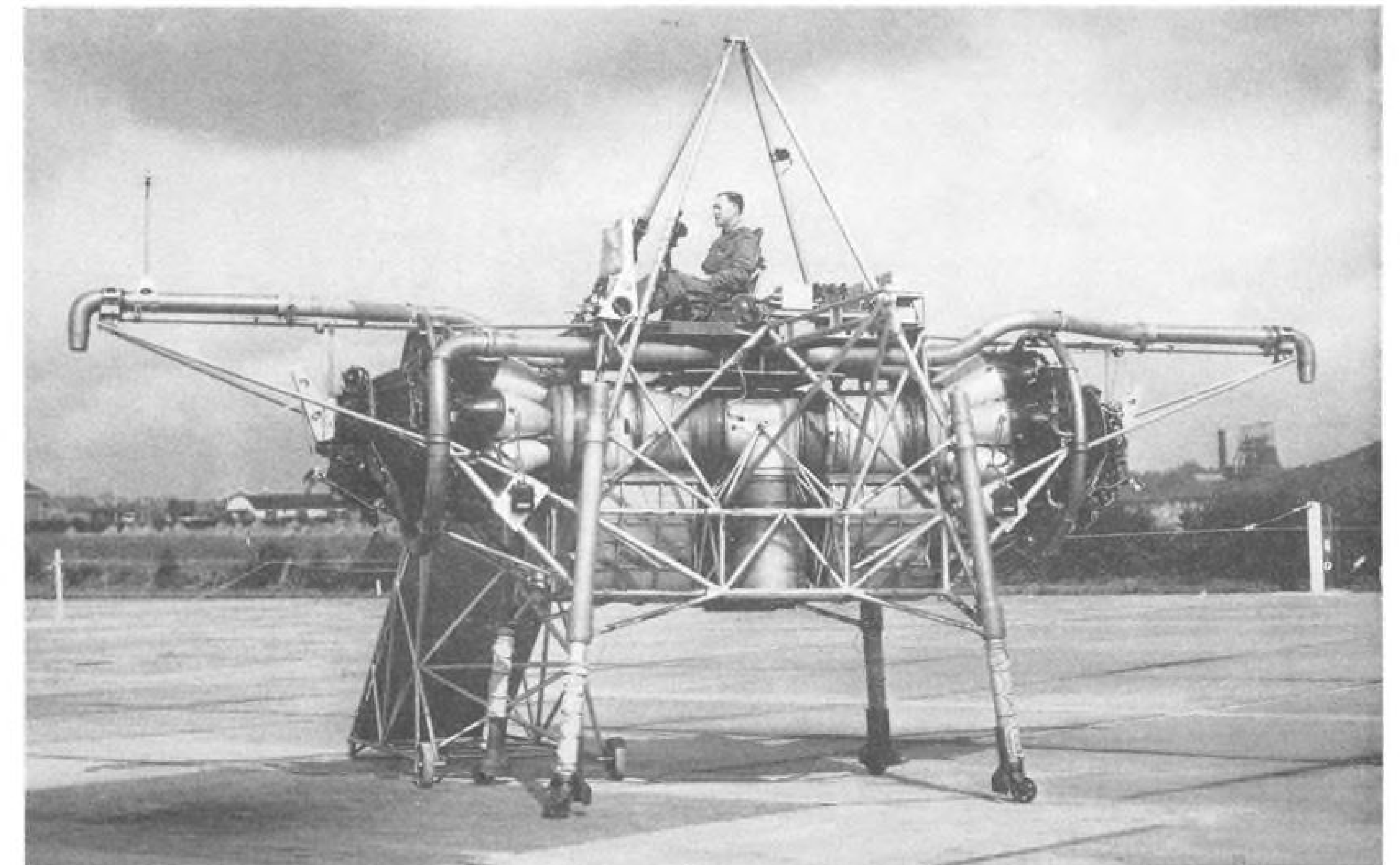
► **Quick Shifts**—Industry will hear about it in specifications from the Air Materiel Command. A good parallel already known to weapons system contractors is Strategic Air Command's acceptance of the fact that a unit operating today from Omaha, Neb., may be told it has 72 hr. to move its operations to Greenland, Japan, Africa or Europe. SAC knows it

may be shifted on short notice to tropical, temperate or arctic regions, and presumably is ready to go.

This Air Force operational mobility now is equally necessary for troop carrier forces to some extent. They are operating today with equipment that was adopted, not designed, to meet widely varying conditions. Enroute here from southern U. S., Col. McNickle's outfit was scheduled for a 12-hr. layover in Edmonton, Alberta.

The fleet of 78 Fairchild C-119s by this time had flown nearly 2,000 mi. and had about 1,600 mi. to go to Elmendorf for Exercise Snowbird. Upon arrival at Edmonton the temperature was -15F. Average stopover for aircraft was stretched to 17 hr. which means that some were put out of commission for at least two days. "It was at Edmonton where the temperature dropped so fast we had to meet our climatization problem," Col. McNickle said.

► **Kit Changes**—The troubles were not big for the most part, but time consuming. Broken doors and handles, fuel line leaks, inoperative actuators and engine troubles made jobs for ground crewmen.



## Rolls-Royce Gives Closeup Look at 'Flying Bedstead' VTO

Close view of design details of Rolls-Royce vertical takeoff research vehicle shows installation of the two horizontally opposed Nene turbojet engines with single tailpipe deflected 90 deg. downwards at the craft's center of gravity. Two fore and aft lateral air nozzles extend downwards to provide stability. The craft takes off from a special ceramic mat that can withstand the jets' heat. It can fly horizontally in any direction at speeds of at least 15 mph. The

company has been flying the vehicle at 15-25-ft. altitudes. Rolls-Royce indicates that future developments probably will use separate powerplants for takeoff and landing and for horizontal flight, with the VTO section comprising a number of relatively small engines. Observers say the firm's small Soar jet is a "distant cousin" of such powerplants. These would be grouped in batteries to provide a reserve margin of power should one or more units quit.



Here was sound experience for Maj. William A. Gibson, materiel chief in McNickle's command. He now knows what changes must be made in the enroute and fly-away kits provided to maintain the aircraft fleet in the field.

The 314th Wing had six prepositioned fly-away kits—one for each squadron—waiting at Elmendorf. Each kit weighs 24,000 lb., contains two Wright R3350-85 engines, in addition to extra tires, landing gear and all other parts that could be needed to maintain the planes for 30 days. Each squadron also had an enroute kit fitted with spares that might be needed on the 3,600-mi. flight.

Maj. Gibson ran short of some items, particularly engines. Special checks on the power units were ordered enroute following four failures which resulted in forced landings or bail outs. To achieve the best possible operational mobility for troop carrier planes, Maj. Gibson now believes it may be necessary to change the system. Instead of a single fly-away kit this arctic experience indicates there should be three kits: a basic kit, an arctic supplement, a temperate supplement. This would provide a type of Fahrenheit flexibility not achieved under the present system.

► **Larger Aircraft**—The cold weather demands, for example, probably would call for a portable shelter to facilitate engine changes and an improved ground heater in the support equipment. The heater must not require a generator for starting in frigid temperatures.

Over and above improved operational mobility, Col. McNickle looks forward to larger aircraft for troop carrier operations.

The Lockheed-C-130 four-engine turboprop that will haul twice the load of a C-119 is a big step in the right direction, he believes. Col. McNickle argues that in bad weather, which caused cancellation of Phase One of this year's arctic exercises, formations of smaller transports are more difficult to operate than larger aircraft. Only rub is that the Army tends to favor planes capable of placing paratroopers in a concentrated area. A large aircraft can necessitate a drop zone up to four times as long as required for present equipment.

► **Runway Techniques**—Major aviation advance demonstrated at Exercise Snowbird is the perfection by Army Engineers of the compacted runway. At Talkeetna they have built a snow strip 8,000 ft. long. Basic technique involves leveling and compacting the surface of the 40 in. of snow in the center of the chosen drop zone. To make it dense and strong, the Engineers first pulverize and slightly melt the snow.

Compaction with a roller and continued reheating give a surface of sufficient strength to support a fighter aircraft or medium transport. A strip of

## Aviation Procurement Obligations

The three military services had approximately \$7.4 billion in unobligated funds for procurement of aircraft and guided missiles on hand Nov. 30. During the first five months of fiscal 1955, the services obligated approximately \$2.3 billion for aircraft and guided missiles.

The obligational figures include contract costs plus a small allocation of government expense entailed in procurement activity. The figures are net, reflecting gross obligation less contract cancellations.

### The Obligations:

AIRCRAFT							Unobligated Balance
	July	Aug.	Sept.	Oct.	Nov.	Total	Nov. 30
Army.....	.008	.006	.001	106.2	.013	106	104.2
Navy.....	101.9	37.8	110.5	455.6	38.5	744	1,012.7
USAF.....	99.2	31.9	523.4	123.3	340.1	1,118	5,373.4
Total.....	201.1	69.7	633.9	685.1	378.6	1,968	6,490.3

GUIDED MISSILES							
	July	Aug.	Sept.	Oct.	Nov.	Total	
Army.....	2.1	.245	189.8	8.6	10.8	212	152
Navy.....	4.2	9.69	6.2	12.7	17.6	50	148
USAF.....	7.5	.815	13.1	16.5	15.3	53	596
Total.....	13.8	10.7	209.1	37.8	43.7	315	896

this type can be used for resupply of ground forces or as a forward base for fighter squadrons. Main disappointment to both Army and Air Force officers at Exercise Snowbird was the unseasonable warm weather at Talkeetna during the drop. Last month was the warmest in 27 years for Alaska. At dawn on the day of the first paradrop, temperature was only -5F. The afternoon high was nearly 15F.

Army had expected temperatures in the neighborhood of -30F.

## New Bristol Olympus Hits 11,000 lb. Thrust

(McGraw-Hill World News)

London—Takeoff rating of 11,000 lb. thrust and continuous cruise power of 9,600 lb. are claimed for the Bristol Olympus 101, making it the most powerful type-tested engine in the world, according to the British.

Yet, Dr. S. G. Hooker, chief engineer of Bristol Aeroplane Co.'s Engine Division, says of the engine: "As far as I'm concerned, this is obsolete."

Britain will use the twin-spool Olympus in production versions of the four-jet Avro Vulcan delta-wing bomber for the RAF, and the powerplant also is being considered for the delta Gloster Javelin all-weather fighter, now fitted with two Armstrong Siddeley Sapphires.

Weighing 3,650 lb., the new Olympus has a specific weight of 0.33 lb., compared to the single-spool 10,000-lb.-thrust Rolls-Royce Avon's 0.28 lb.

► **Fuel Consumption**—At the 11,000-lb. rating, the Olympus has a specific fuel consumption of 0.79. At 9,600 lb. thrust, fuel consumption is about 0.74.

Olympus has six low-pressure compressor stages and seven high-pressure stages. From just aft of the low-pressure compressor, the engine is all steel; from this point forward, makeup is zirconium-magnesium alloy.

At junction of tailpipe and engine there are two metal bellows providing a flexible joint to permit some movement of the long jet pipes installed in the Vulcan. The engine takes in one ton of air every 12-15 sec.

Hooker points out that while the twin-spool turbojet presently has a higher weight than a comparable-power single-spool engine, it pays off in superior performance at altitude.

► **Light Weight Later**—He believes the twin-compressor engine of the future will be lighter in absolute terms than the single-compressor jet for this reason: Using two compressors, maximum efficiency can be obtained in both low and high pressure stages, rather than having to compromise over the range in the single-stage compressor. This means fewer stages for the same compressor efficiency, with the only net weight added being the additional concentric shaft required for the twin-spool engine.

The Olympus has a 22.5-kw. generator in the front part of the engine. Ducted air to cool the generator is not permitted to pass through the compressors and turbines, but is bypassed to the exterior combustion area and contributes to cooling of this section.



technical bulletin

# a New MOTOR

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in a guided missile



## SPECIFICATIONS ★ TYPE D-638

Weight: 17.5 pounds ★ Maximum Capacity: 6.5 HP  
Volts: 200 A.C. ★ Amperes: 20 at 6.5 HP ★ Cycles: 400  
Duty cycle: 3.0 seconds at 6.5 HP  
15.0 seconds at 1.5 HP  
Continuous rating: 5 HP at 2300 r.p.m., 15.8 amperes, 200 volts.

EEMCO Model D-638 was designed and produced for a leading airframe manufacturer for use in guided missiles where greatest power output per pound of weight is imperative. Specifications called for a 400 cycle A.C. motor operating on 200 volts, 20 amperes, at 2250 r.p.m. and a continuous duty cycle of 3.0 seconds at 6.5 HP and 15.0 seconds at 1.5 HP. EEMCO's D-638, weighing 17.5 lbs., was the answer. It also has a continuous rating at 5 HP of 2300 r.p.m., at 15.8 amperes. Complies with U. S. A. F. specification #32590 for 400 cycle A.C. motors. We invite your inquiry on adaptation of Model D-638 for other uses.

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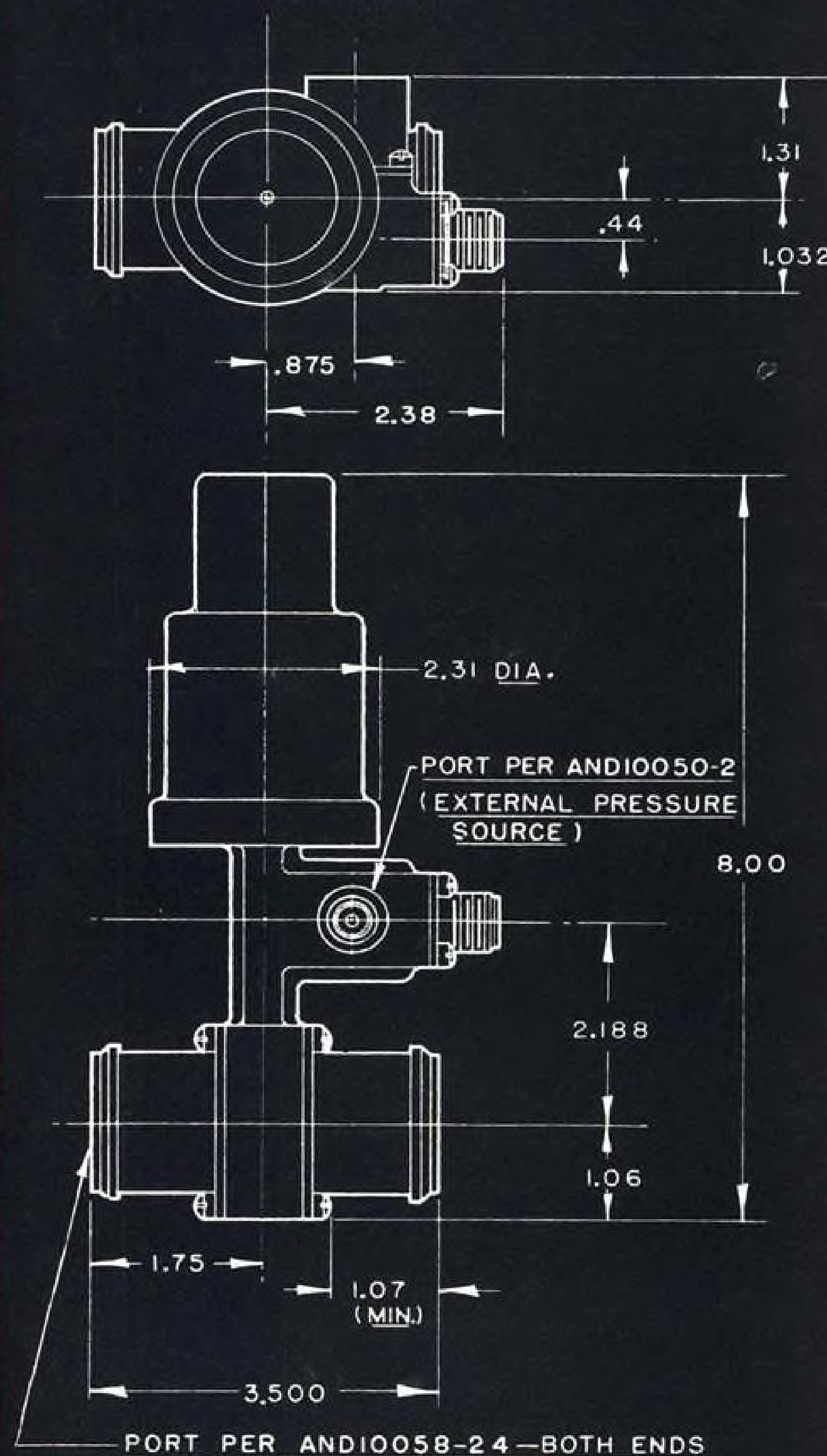


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## News Sidelights

Convair YC-131C turboprop-powered version of 340 Convairliner has been delivered to the 1700th Test Squadron (Turbo Prop), established last Sept. 14 at Kelly AFB, Tex. The squadron's mission is to test, under routine conditions, the fleet of six turboprop-powered transports being modified by three manufacturers. These will comprise: Two Boeing YC-97Js with P&W T34s and Curtiss props; two Lockheed YC-121Fs with T34s and Hamilton Standard props and two YC-131Cs with Allison T56s and Aeroproducts props. The Allison YT56-A-3s now fitted to the YC-131Cs are rated at 3,250 eshp., but the nacelles are designed to allow for installation of later T56s of about 4,000 eshp.

New method of helicopter air-rescue, utilizing a scoop-net for picking survivors out of the water, has been tested by the British in the English Channel. The net is attached to a tubular D-shaped frame which is lowered from the copter, straight-edge downward into the water, where it is stabilized by a drogue. In tests, more than 100 live pickups were made, at times at the rate of 12 in 20 min.

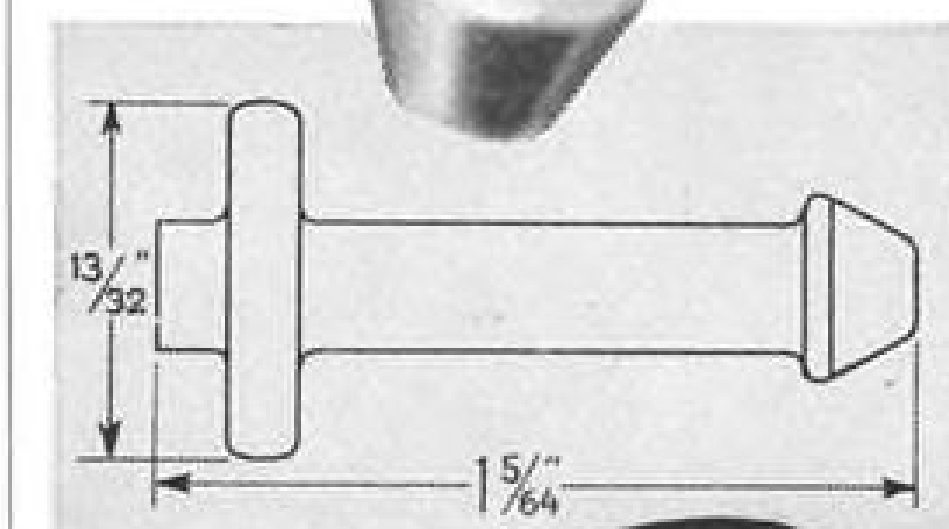
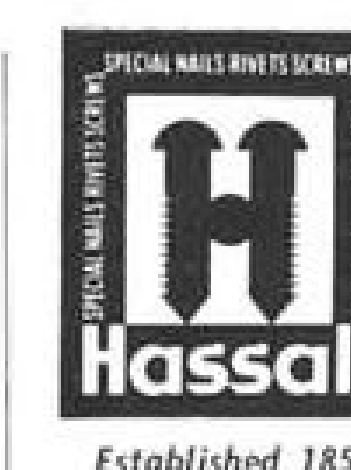
Official opening of \$15-million Isla Verde International Airport, Puerto Rico, now has been set for the first week in April by the Transportation Authority.

North American F-51 Mustang fighters, sold to Costa Rican government by U. S. to overcome rebels' airpower advantage in recent "invasion," were taken into combat by commercial airline pilots from Lacsa following one day of ground instructions, McGraw-Hill World News reports. None of the airline pilots previously had fighter-plane training or experience, yet made successful low-level ground strafing and bombing missions after brief indoctrination.

Human engineering design of the new four-jet Martin XP6M-1 Sea-Master's flight deck and crew quarters was handled by Butler-Zimmermann, New York industrial design consultants working closely with Martin's equipment engineering group.



FORERUNNER of newer, larger and faster carrier-based attack planes is this currently operational North American AJ-2 Savage, powered by two P&W R2800 piston engines and an Allison J33 turbojet. Here an AJ-2 gets set to be taken to the flight deck of the USS Midway by a deck-edge elevator. Wings and tail are folded to conserve space while it was hangared. Sweptwing, twin-jet Douglas A3D Skywarrior is slated to replace AJ-2 as Navy's longrange nuclear-weapon bomber.



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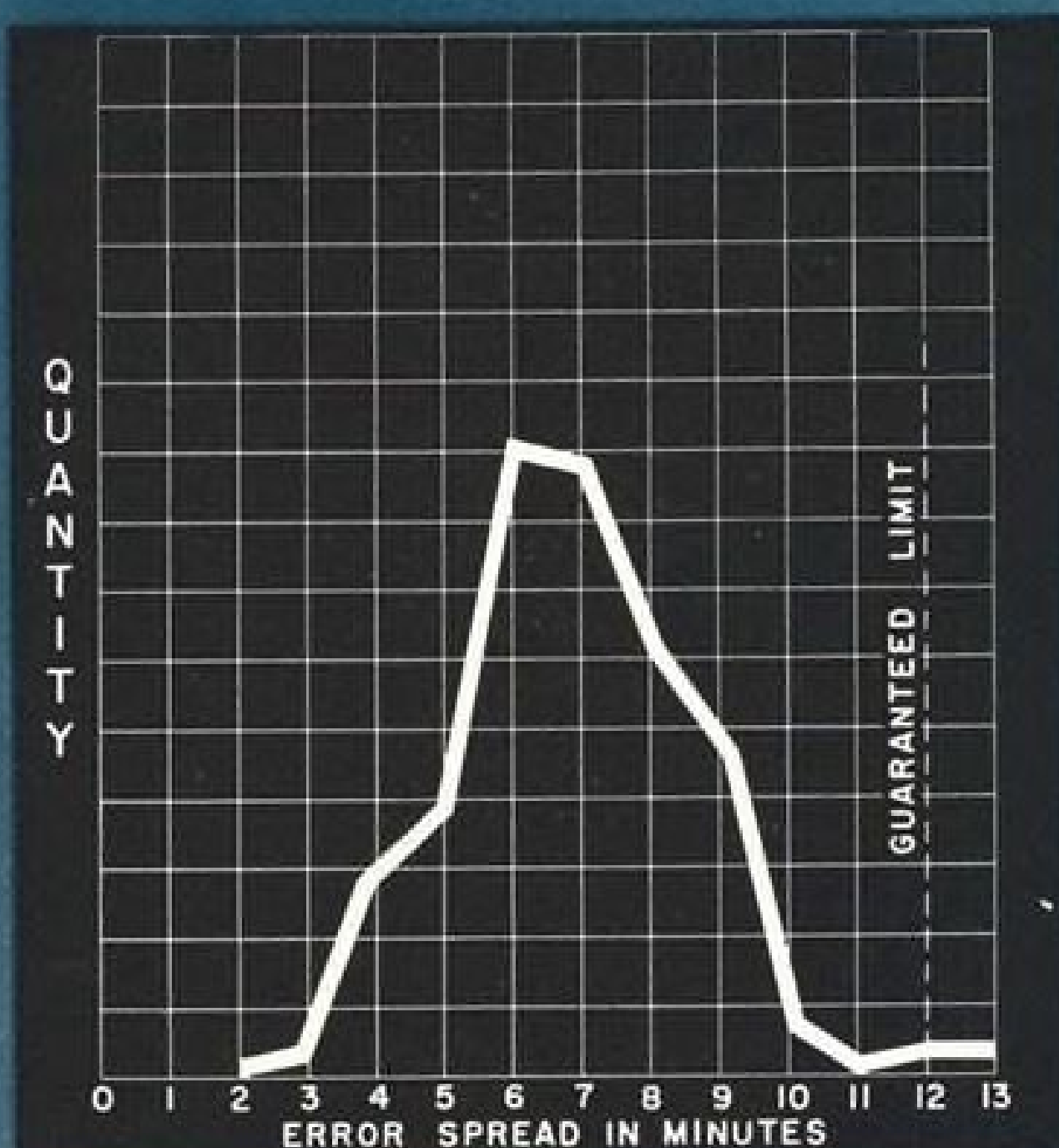


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## LETTERS

### VFR Traffic Law

In the Jan. 17 issue of AVIATION WEEK just received, on page 110 is a letter signed A. G. W., Executive Pilot, under the caption "VFR Traffic Law." There is much to be said in favor of the validity of the arguments of A. G. W. concerning improvements in the control of flying operations aimed at removing the risk of mid-air collisions.

A. G. W.'s approach, however, boils down to his wanting to give the sky and all the airspace over to the IFR gent and to restrict VFR operations to whatever extent may be necessary to accomplish this.

The future of aviation and the aviation industry would certainly not be well served by such restrictions on VFR operation. There is a great deal more flying done, including business flying, under Visual Flight Rules than under Instrument Rules. Even A. G. W. will be obliged to concede this point. A. G. W. lists a number of answers to the problem and states that while his recommendations may appear to be too strong for some that they nevertheless do not affect the pilot whose interest lies in safeguarding his passengers and himself. I am obliged to take strong issue with this statement. My own skin and that of my family and business associates and other passengers riding with me is just as important to me as A. G. W.'s skin is to him. There are VFR "Dilberts," as he states, but there are also IFR "Dilberts," who fly along the airways with their own heads "up and locked."

There is one point upon which I agree with this other writer, however, and that is in the abolishment of the 700-ft. airway boundary. Excepting under conditions of extraordinarily good visibility, none of us has any business anymore either on airways or off airways as close as 700-ft. to the ground. This is due, of course, to the man-made obstructions, largely in the form of TV antennae which are being constructed here and there about the country on the top of the highest knoll, sticking up 1,000-ft. or more above that knoll into the sky. This situation and the growth in number of these obstructions make it almost mandatory for the pilot of aircraft operating VFR to observe and maintain minimum en route instrument altitudes, except during daytime hours when visibility is absolutely unrestricted.

Consider a situation which I encountered recently flying the 20-mile stretch between two major large city airports at a time when ceiling and visibility were officially being reported at exactly the minimum VFR conditions which A. G. W. recommends—namely, 1,500-ft. and five miles. Our aircraft was in the control of our destination airport tower flying VFR, even by A. G. W.'s new definition of that term, and cleared to enter the traffic pattern. We were maintaining the prescribed 700-ft. light aircraft pattern altitude when to our astonishment and horror a shadow above us caused



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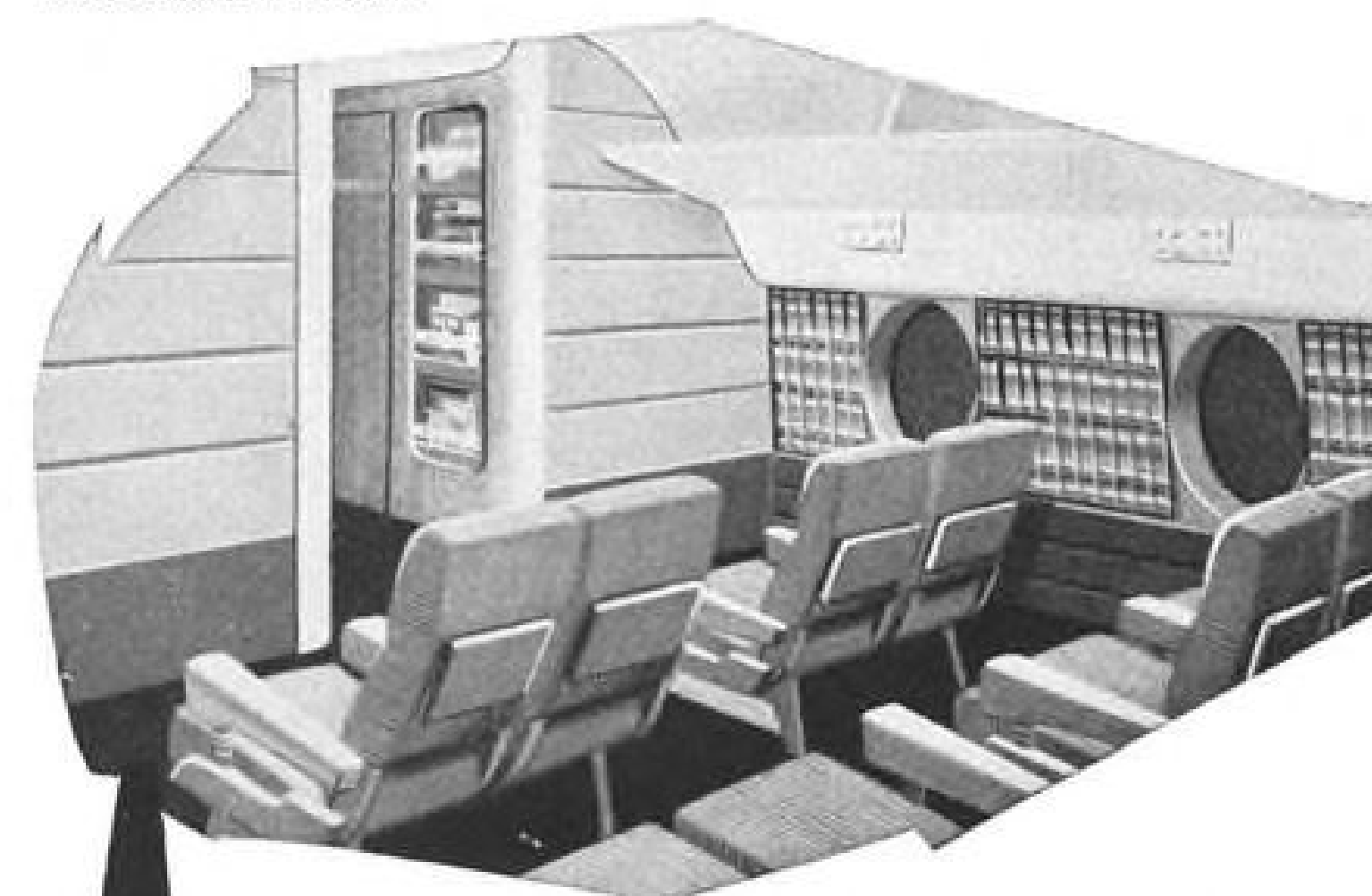


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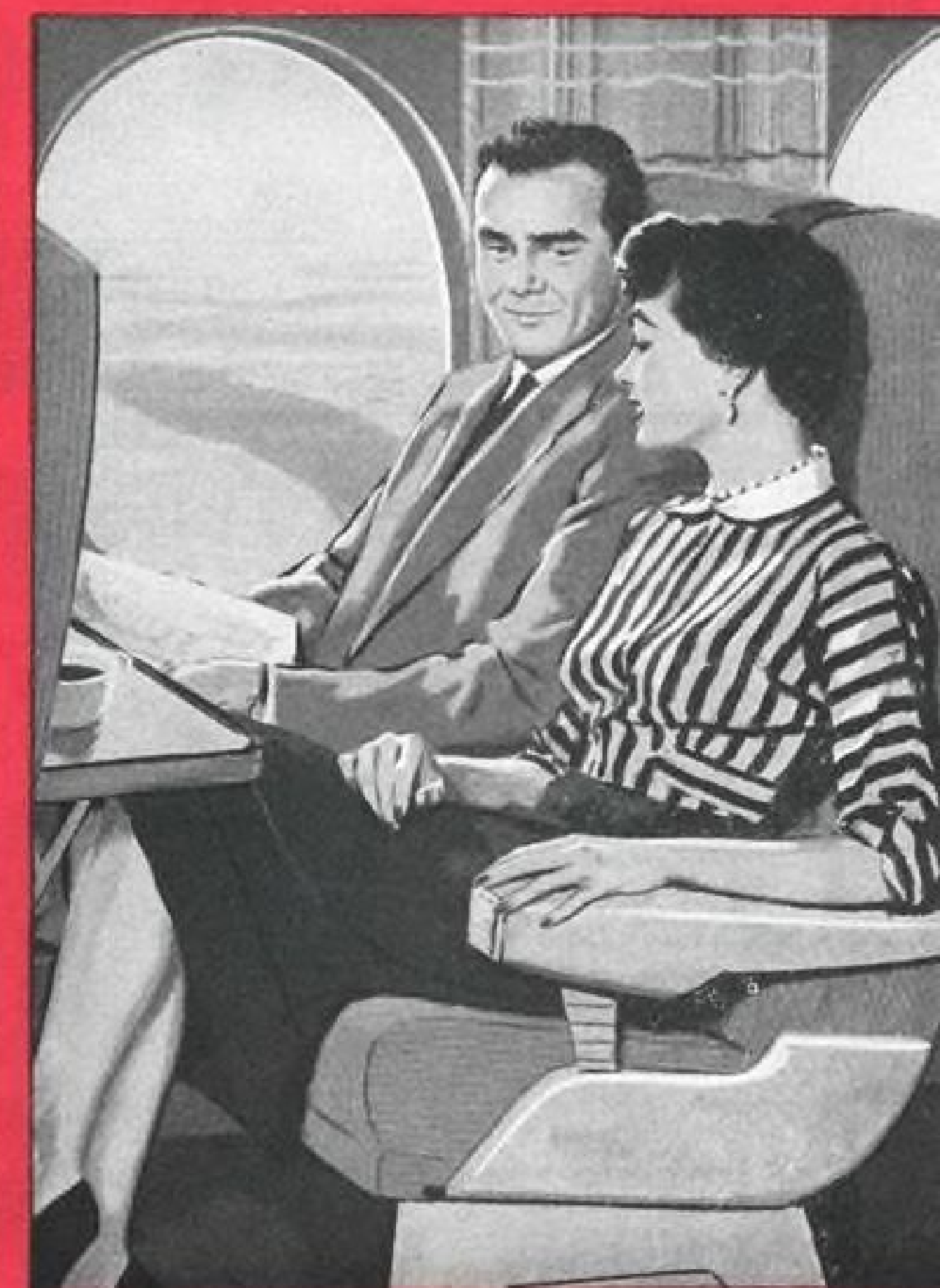
\*Pronounced Vi-Count



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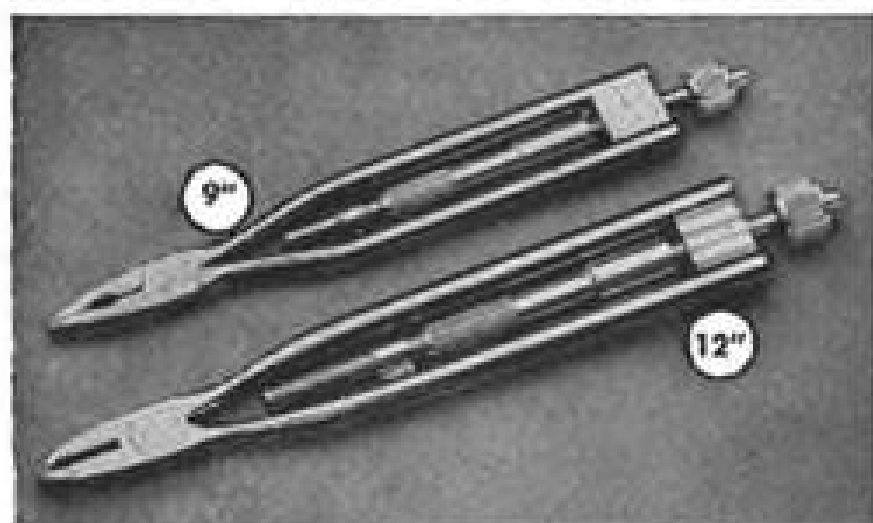
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## LETTERS . . .

us to look into the wheel wells of a Convair approximately 100-ft. above us and headed in the opposite direction. Subsequent investigation proved that the Convair was working approach control at the airport we had just left and was, of course, on different frequencies; its presence was unknown to the control tower of our destination airport and to us, and the Convair had just broken contact in the course of a properly authorized standard range approach. We missed one another by something less than 200-ft., and had we collided, both our VFR operation and the Convair's IFR operation would have been perfectly legal even by the more strict VFR minimums proposed by your correspondent. The above-described situation was more horrifying to me and my passengers than it was to the Convair pilot and his passengers for the simple reason that we had one brief glimpse of his ugly underside while no one aboard the Convair was even aware of our presence directly beneath them.

Consequently, we should like to propose a very simple remedy for our own complaints and those of your Jan. 17 issue correspondent and those of traffic controllers, control tower operators, CAA Safety Agents, all flying personnel everywhere . . .

A. Abolish the differentiation between VFR flight and IFR flight as governing the movement of aircraft on airways and in control areas.

B. Require that all aircraft in these airspaces file flight plans, make position reports, and conduct their flights in accordance with previously issued traffic clearances.

If the above suggestions were carried out, the only difference between IFR and VFR would be the actual weather itself. The pilot assigned a reserved portion of airspace for his flight who lacked an instrument rating or who lacked the proper instrument equipment to fly in a cloud or on actual instruments would then be obliged to alter his flight plan or accomplish a landing if he found himself unable to proceed in accordance with his traffic clearance without going on actual instruments. This method would afford all aircraft the same treatment and the same protection regardless of size, ownership or registration.

The basic principle upon which CAR has been written seems to be that any one of us as individuals has the right to risk our own necks but we do not have the right to endanger the life or property of others. This principle is still a good one and it would appear that both of your correspondents agree on this subject.

WARNER H. KIMBALL  
President  
Diversified Products Co.  
Detroit 38, Mich.

## AIEE Shows Interest

The "Filter Center" of the Jan. 10 issue claimed that the AIEE takes a dim view of aviation. As a member of both the IRE and the AIEE, I think that a closer examination will show that this is not the case.

It is the practice of the AIEE to have



**Olin Mathieson's DC-3...A sub-zero Canadian night...In one engine—  
New Koolmotor Aero Oil...In the other—another brand...**

**...and here's what happened!**

The pilot was Neil Fulton, the firm: Olin Mathieson Chemical Corporation, Baltimore, Maryland. Assignment: take a DC-3 through Canada in sub-zero January weather.

Before leaving, Fulton conceived an interesting and profitable experiment. In one engine he placed the aviation oil that was standard for Olin Mathieson's operation at that time. In the other, he put Cities Service New Koolmotor Aero Oil.

Then came the night he had to leave his DC-3 out on the bitter-cold ramp of Toronto Airport. Next morning, with the thermometer reading eight below zero, Fulton climbed into the plane to start the engines. Trouble? . . . trouble you bet . . . trouble starting. But the first engine to

kick over was the engine using Cities Service New Koolmotor Aero Oil!

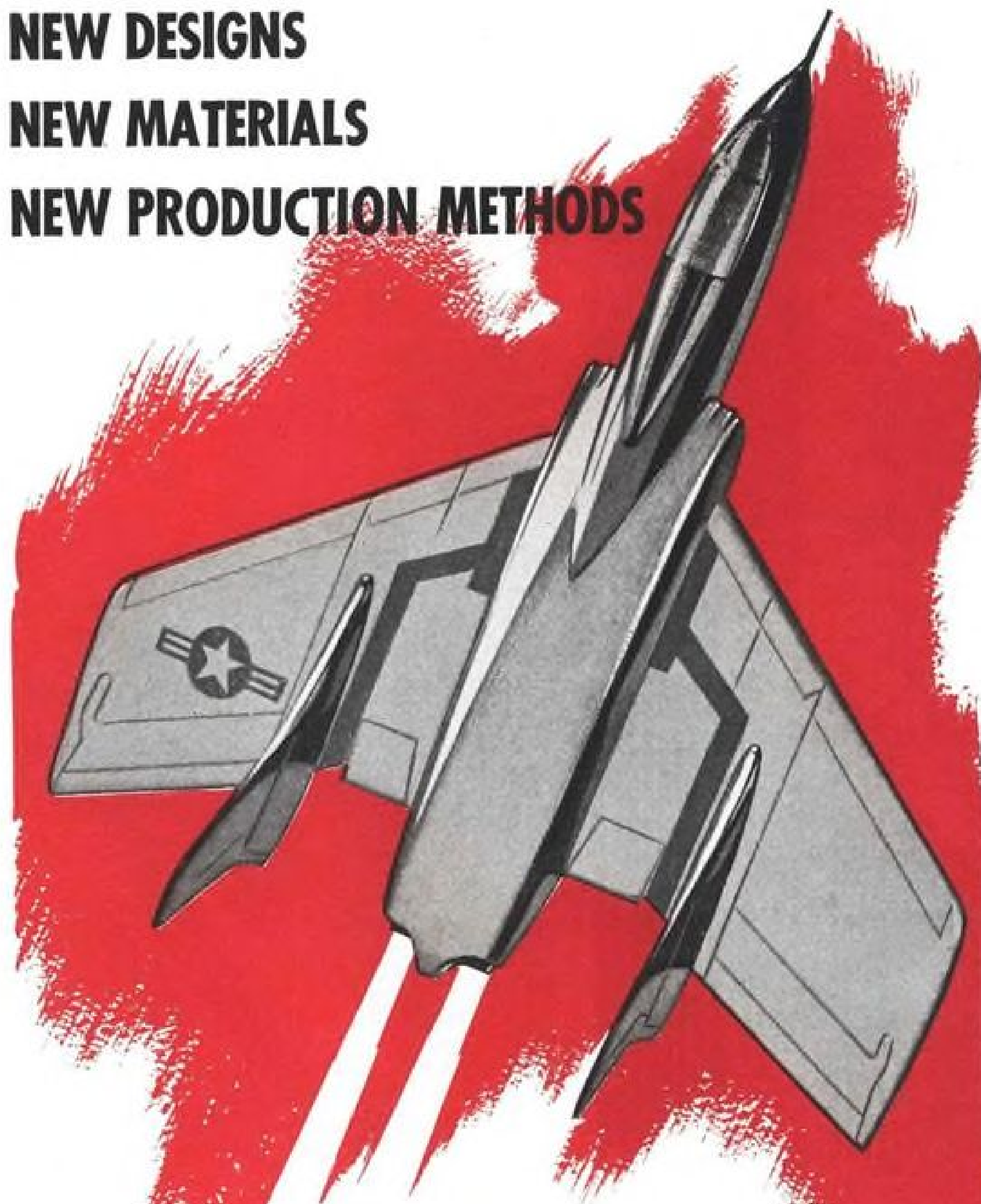
That was enough to sell Neil Fulton on New Koolmotor Aero Oil . . . and he's used nothing else ever since! Summing up his experience, he says: "Cities Service New Koolmotor Aero Oil provides far more satisfactory results in any weather and has enabled a substantial reduction in oil consumption and general maintenance expenses."

Results such as Neil Fulton's are not the exception, but the rule, with New Koolmotor Aero Oil. This improved aviation oil can produce similar results for you. Why not try it? You'll find it wherever the familiar emblem of Cities Service Aviation Products is displayed.

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## LETTERS . . .

individual conferences for certain specialized groups. Aviation is one of these.

The Air Transportation Committee met during the Fall General Meeting in Chicago, Oct. 11-15, 1954. At that time, there were eight sessions on aircraft subjects, with 34 papers, more than on any other subject.

The Aircraft Technical Committee of the Seattle Section of the AIEE has monthly meetings at which time papers of interest to aircraft electrical engineers are presented. The IRE has no such program.

It is not the abundance of papers presented at one general meeting that determines the relative activity of a professional organization in a specialized field; it is the organization that has the largest number of papers presented to the most men. On this basis, I feel that the AIEE exceeds the IRE in aviation activity.

W. W. LLOYD II, Assoc. Member AIEE  
Engineering Designer  
Boeing Airplane Co.  
Seattle

In 1954 the American Institute of Electrical Engineers scheduled Air Transportation sessions at two separate meetings. There were Air Transportation sessions at Los Angeles, at our Summer General Meeting in June, and more recently at our Fall General Meeting in Chicago in October. At the latter meeting we held eight half-day sessions with four to five papers presented at each.

Past experience has shown us that we cannot get as good attendance at the New York meeting because of the multitude of sessions held there. For this reason we hold Air Transportation sessions at two meetings a year elsewhere and get overflow crowds . . .

N. F. SCHUB, Chairman  
Lima Section AIEE  
American Institute of Electrical Engineers  
Lima, Ohio

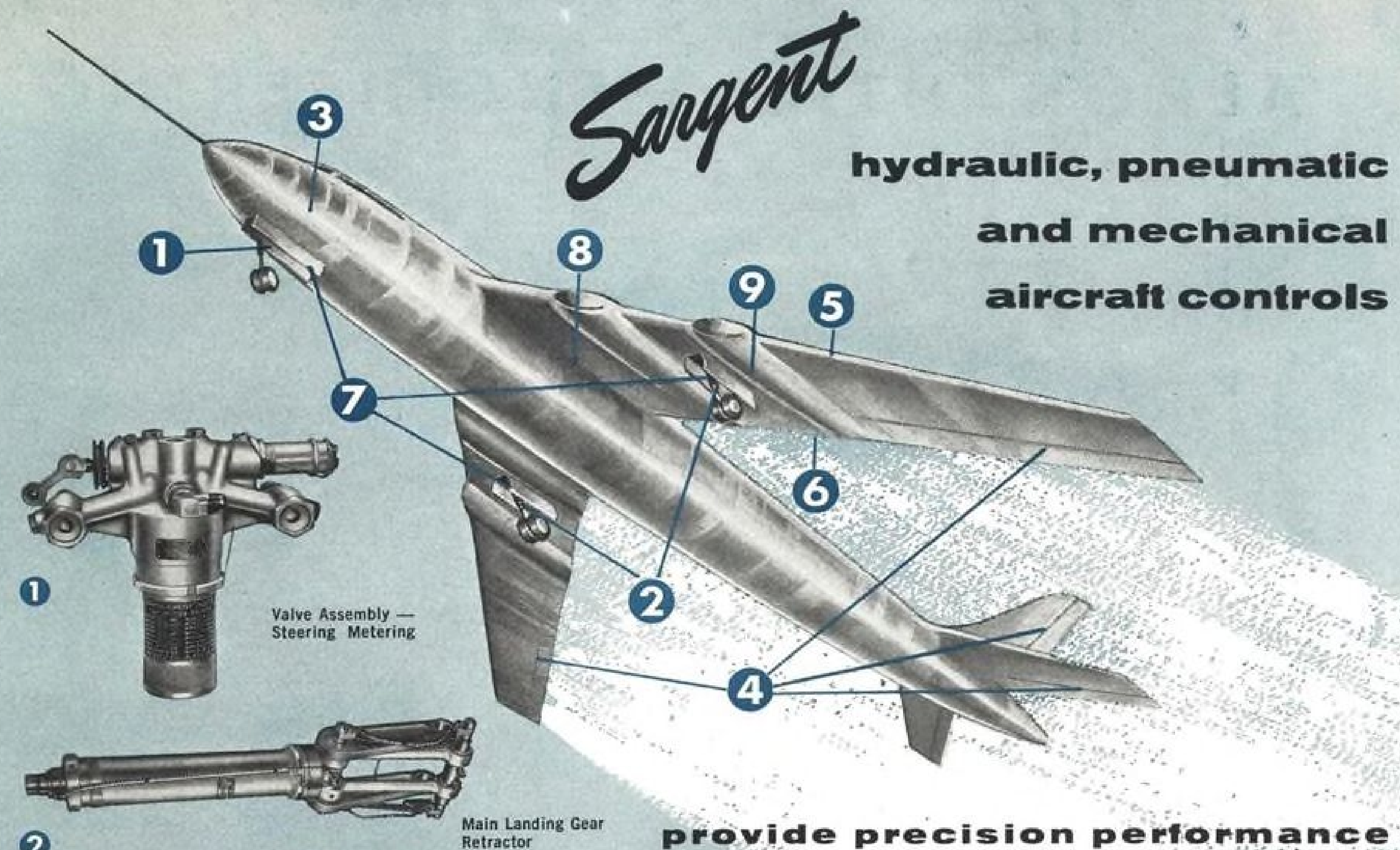
(Similar letters of protest, describing the activities of the AIEE's Air Transportation Committee, were received from the following: Dwain E. Fritz, Cleveland, Ohio; Richard K. Walter, San Diego, Calif.; Joseph W. Allen, Teterboro, N. J.; Ernest F. Kotnik, El Cajon, Calif.)

(AVIATION WEEK intended no slur on the excellent activities of the AIEE Committee on Air Transportation, nor at the AIEE as such. AVIATION WEEK's avionics editor has been an AIEE member (in good standing at last report) for much longer than he has been a member of IRE.)

(Despite the abundance of papers presented by the AIEE Air Transportation Committee at the fall meeting in Chicago, the summer meeting in Los Angeles and the conference held the year before in Seattle, the number of East Coast airframe and avionics firms would seem to justify at least one technical aviation session out of the 90 sessions scheduled for the winter AIEE meeting in New York.)

(By contrast, the IRE has held two national conventions devoted exclusively to aviation in the past year at Dayton and Baltimore. However, this did not prevent IRE from scheduling three aviation sessions out of the 55 meetings to be held at its New York convention in March.)

AVIATION WEEK, February 7, 1955



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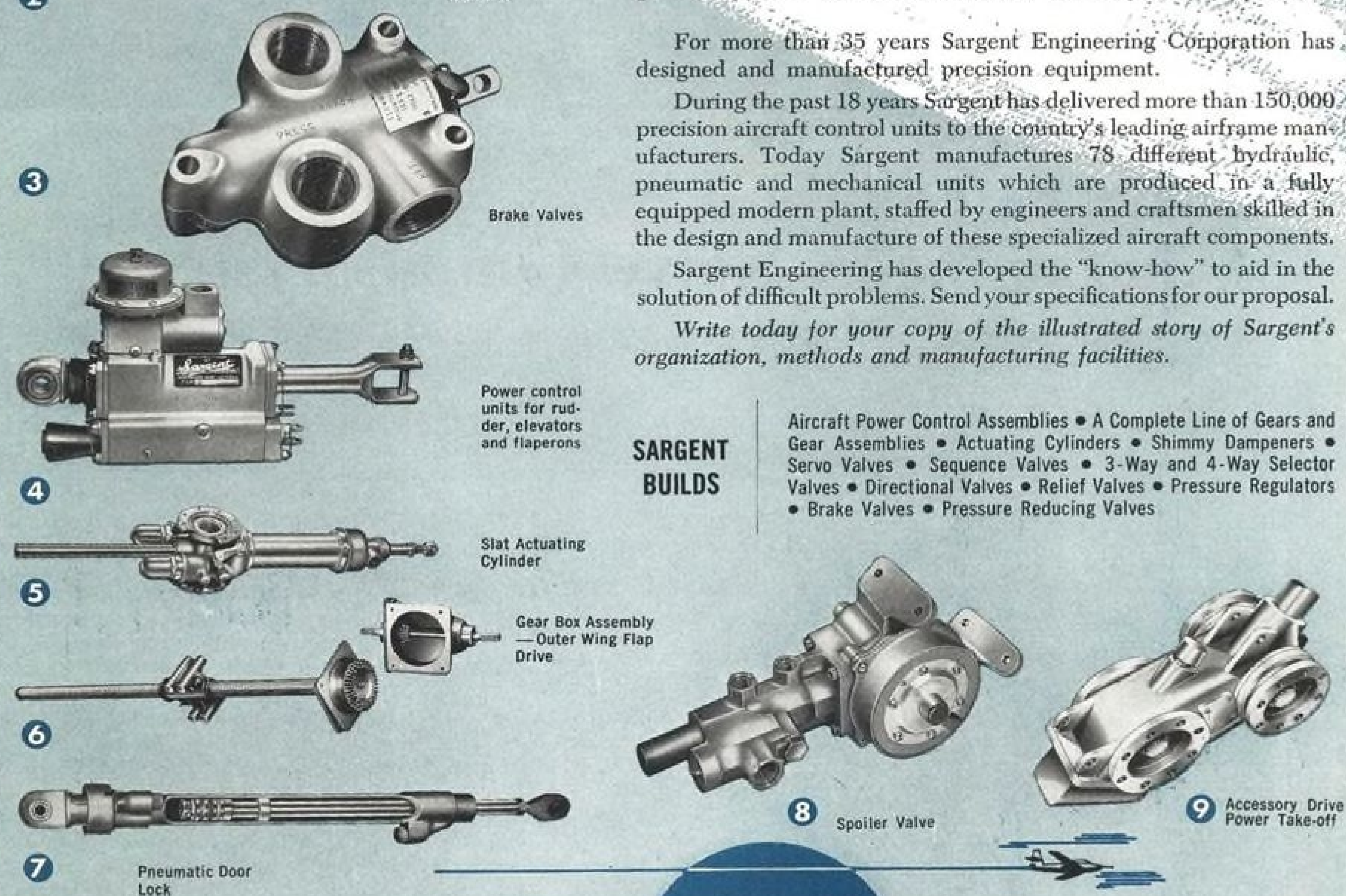
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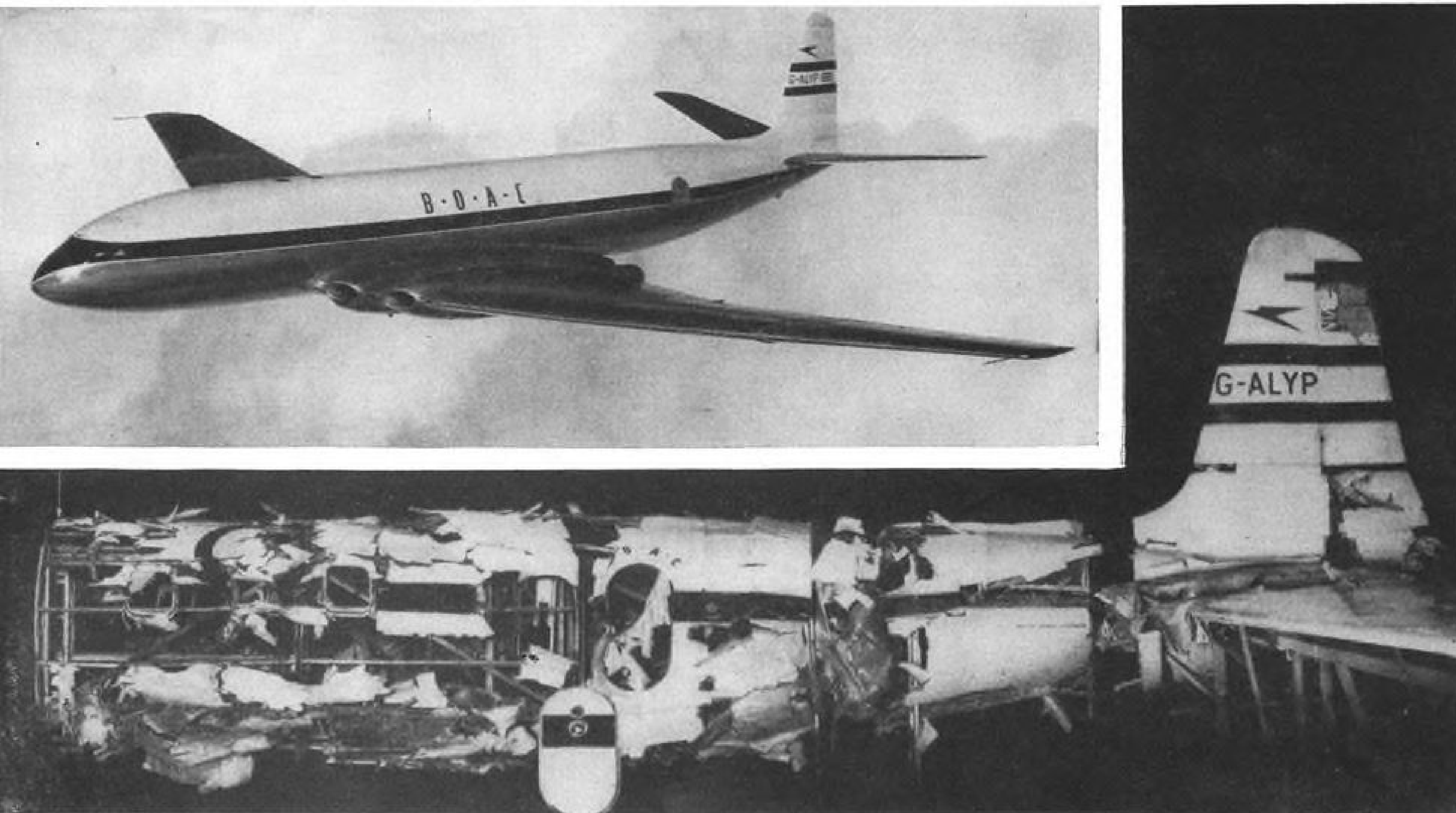


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# AERONAUTICAL ENGINEERING



COMET CORPSE is reconstruction of fuselage from wreckage recovered after disaster to world's first jet transport off Elba.

*Scientific Detection Helps . . .*

## RAE Engineers Solve Comet Mystery

By David A. Anderton

The Royal Aircraft Establishment's analysis and deduction of the probable causes of the two Comet disasters stand as a high-water mark above the flood of investigation which followed the accidents.

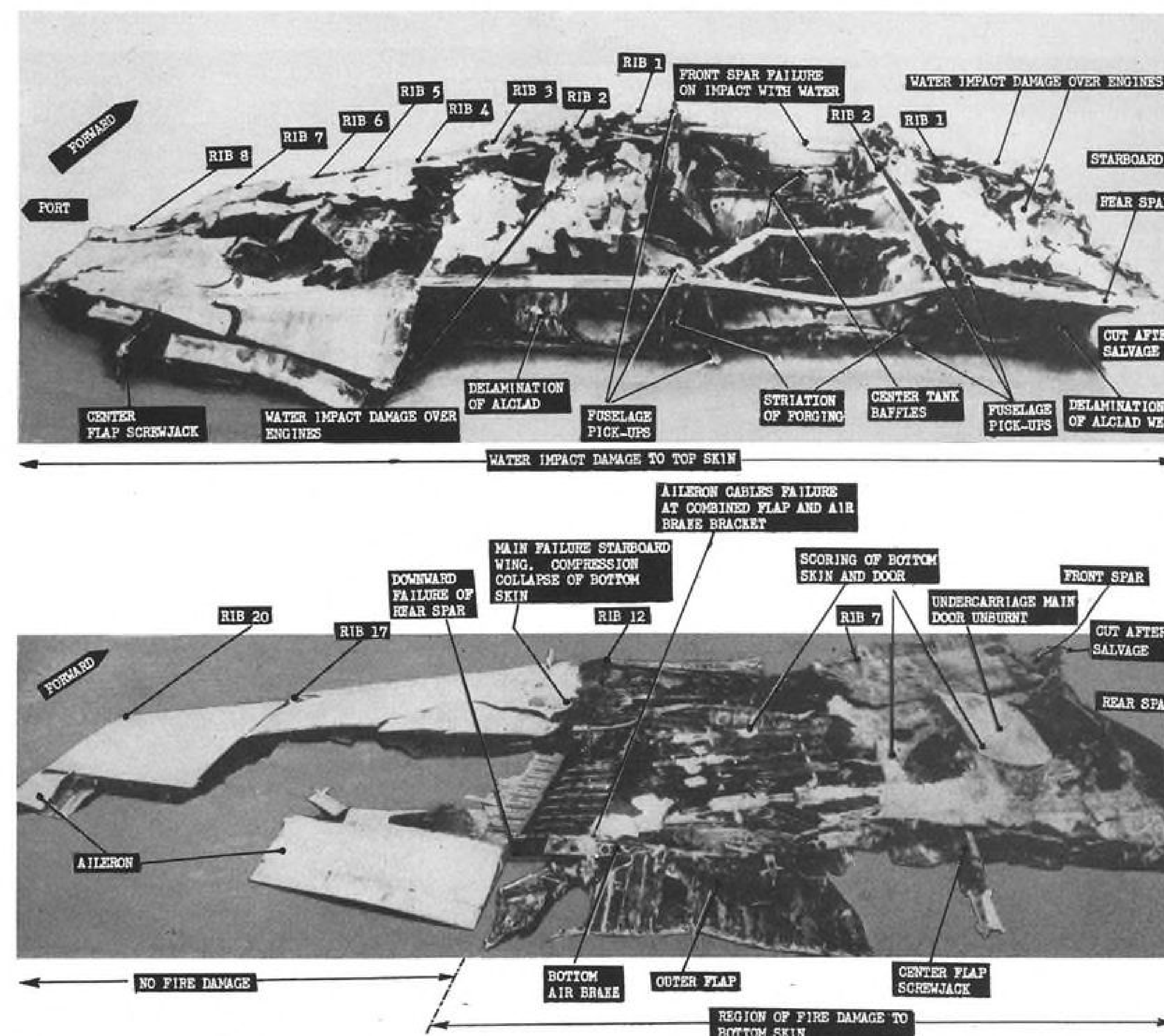
Cited as "... one of the most remarkable pieces of scientific detective work ever done," RAE's effort was the product of minute examination, probing analysis and deliberate deduction, held together through tortuous hours by British tenacity and national pride.

It took the better part of a year's work by hundreds of scientists, technicians and laborers. At one time or another, the entire RAE staff at Farnborough was working on the job.

"I drove my staff, and incidentally myself, well beyond normal limits," said Sir Arnold Hall, RAE's director. "... We had a very large deployment of industrial labor working 80-hr. weeks and we had a large number of men that we drove to 100- and 120-hr. weeks in order to get this matter forward."



TANK TEST was one phase of intensive investigation at RAE Farnborough. Complete Comet fuselage was submerged; protruding wings were loaded to simulate flight plan.



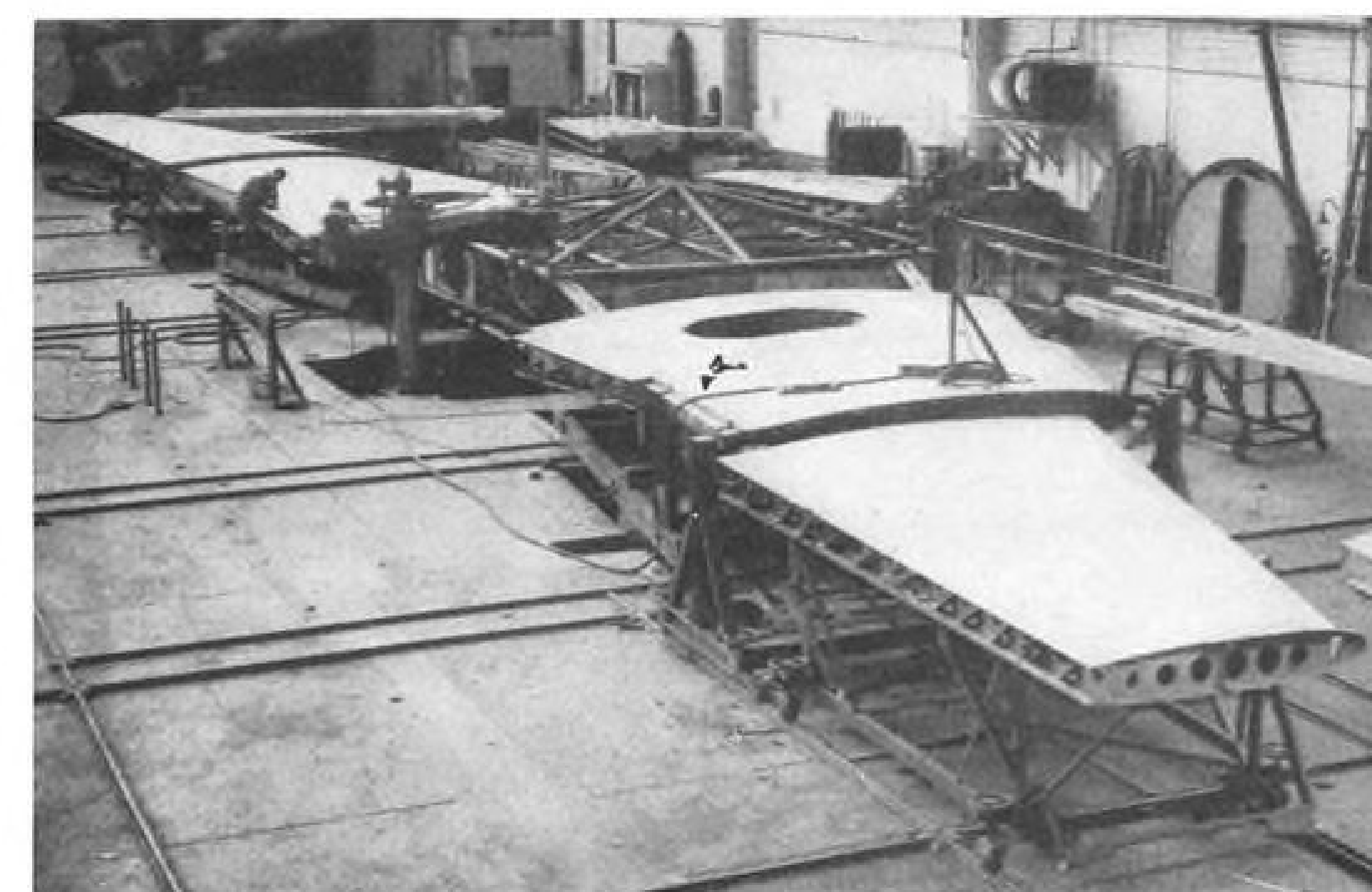
WING WRECKAGE gave first clue: port wing and center section (top) showed scoring from burst cabin. Starboard wing is shown below.

RAE's part was finally summed in a mammoth report, pointing a finger at metal fatigue as the probable cause of the failure, and ruling out a horde of other possibilities. The report—Accident Note 270, September 1954—became one of 145 exhibits placed in evidence during the 22-day hearing which concluded the investigation.

This is the story behind that report. ► **The Beginning**—This was the status when RAE was called in:

Two de Havilland Comets on regularly scheduled service with British Overseas Airways Corp. had been destroyed and lost with all passengers under similar and mysterious circumstances. Both were less than an hour out of Ciampino airport at Rome, both climbing for altitude. Both disappeared without much trace.

The first Comet—G-ALYP—was the prototype airplane and was lost on Jan.



FOR COMPARISON: Comet wing, bottom surface up, shown on assembly fixtures in factory.



10, 1954, near Elba. An investigation followed, while attempts were being made to recover wreckage. The Comet fleet, grounded after the accident, was released again for operations Mar. 23.

On Apr. 8, a second Comet — G-ALYY—was lost near Naples. The fleet was grounded again, and Sir Arnold was asked by the Minister of Supply to start an investigation.

► **Little to Go On**—Hall was not optimistic about the chances of finding out much. The only wreckage then recovered was the engines, a few parts of the fuselage and some flotsam. The water was hopelessly deep off Naples, and the location of the wreck uncer-

tain. Off Elba, things were little better. The pieces were on the bottom about 600 ft. down, and near a known minefield, still unswept and unsweepable.

There had been previous Comet tests, too. Fatigue tests of the wings had been made in 1951 and 1952 at Farnborough, and the Comet's wings—which showed some indication of early fatigue—had been modified and reinforced. BOAC had conducted a thorough investigation of its own after the Elba accident, under the direction of C. Abell, deputy operations director for the airline. RAE and BOAC had been collecting gust data in flight for two years, using counting accelerometers

mounted in a Comet on routine operations.

"When I was asked to take on this job," said Sir Arnold, "I think that if I had said, 'No, it is beyond what one could reasonably be asked to do,' I would not have been blamed."

But Sir Arnold's scientific curiosity and his understanding of the great need for a solution ruled out any refusal. The job began.

► **Wrecks and Wreckage**—There are two parallel paths to an investigation of this kind. First, you look at the wreckage to deduce what might have happened. Second, you look at an undamaged airplane, test it, analyze its properties to see what could happen. In a sense, you go from the lab to the wreckage and back again, in a continuous feedback loop.

At the start, there was little wreckage. By luck, the Elba wreckage was resting on a fairly hard bottom, in company with a freighter from the first World War, a Greek winejug or two, and some armed mines.

Four British ships and chartered Italian trawlers tirelessly plied the water, while one of the British boats searched with underwater gear for echoes from wreckage. Hearing one, the crew would drop a buoy to mark a spot for further investigation by divers or underwater television.

Salvage operations continued during bad weather, from late January well into August. Snow fell for the first time in 20 years near Elba. The water was murky, limiting the underwater TV to 12-ft. range and sometimes less. The first piece was trawled out of the deep on Feb. 12; successive bites of the bottom were made with a special "grab" bucket and the long recovery began in earnest.

As the pieces came out of the sea, they were returned to England. The engines went to de Havilland; all the rest of the wreckage went to RAE Farnborough, consigned to Eric L. Ripley, head of the accident investigation section.

► **Giant Jig-Saw**—Ripley and his staff pieced together hundreds of torn metal fragments into a three-dimensional jig-saw puzzle the shape of the Comet. Slowly the tattered skin of G-ALYP took ghostly form on wooden bones.

There are three phases to the study of wreckage:

• **Reconstruct the wreckage.** This shows each part in relation to the whole assembly and shows discontinuities in damage. By these clues, the investigator can say whether the plane was on fire when it broke up or afterward; whether damage was caused by the initial accident or by impact with the ground or water.

• **Determine the kinds of major failures.** Metal failures, like criminals,



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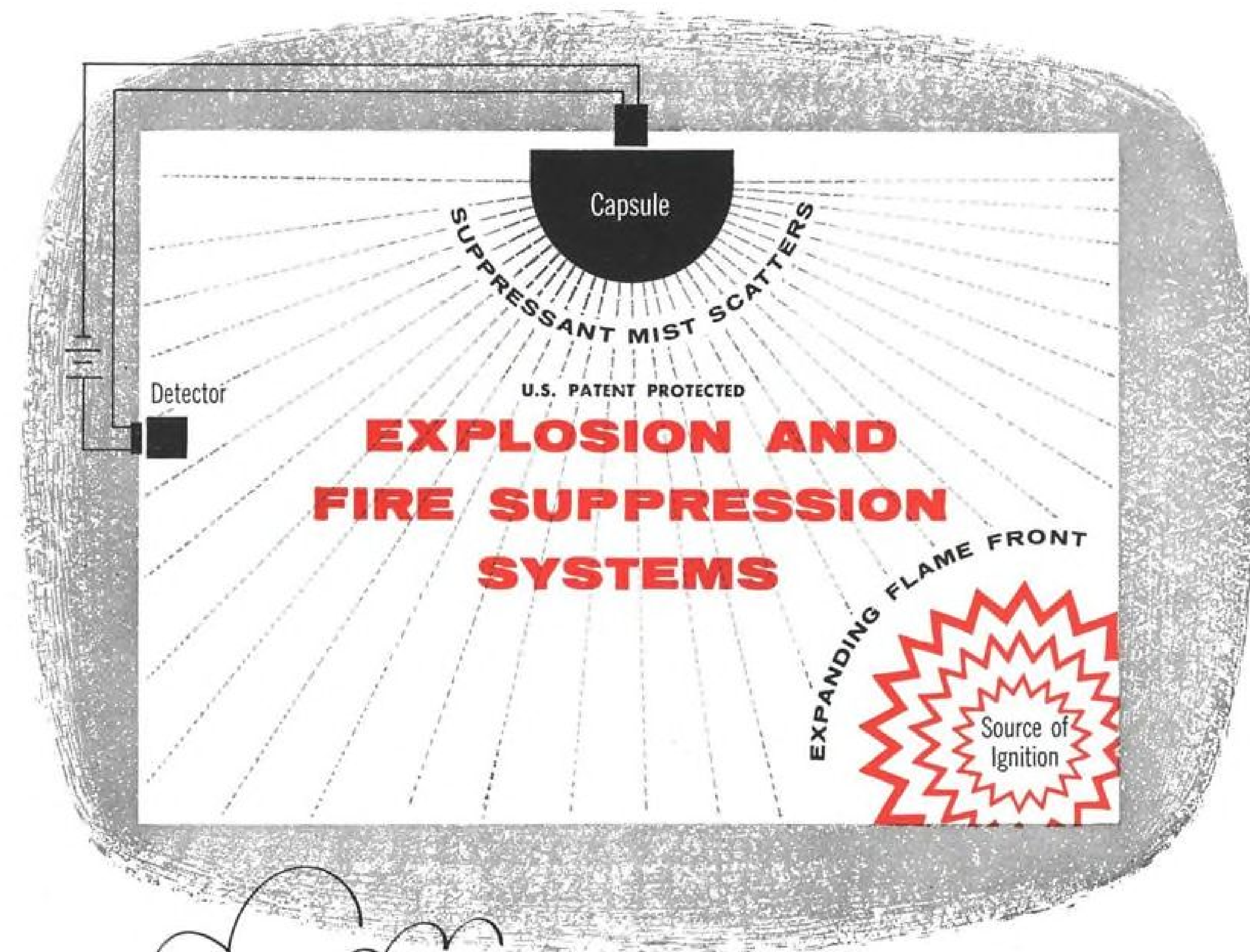
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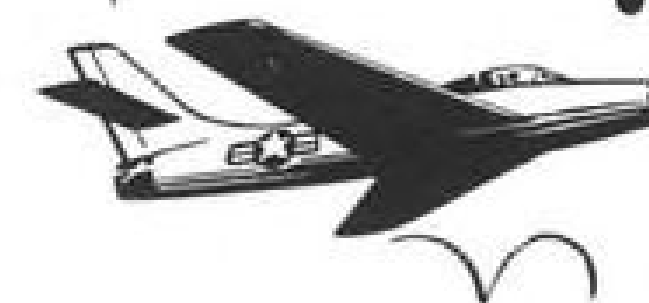
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Simmonds Explosion and Fire Suppression Systems are covered by U.S. Patent #2693240; others pending.

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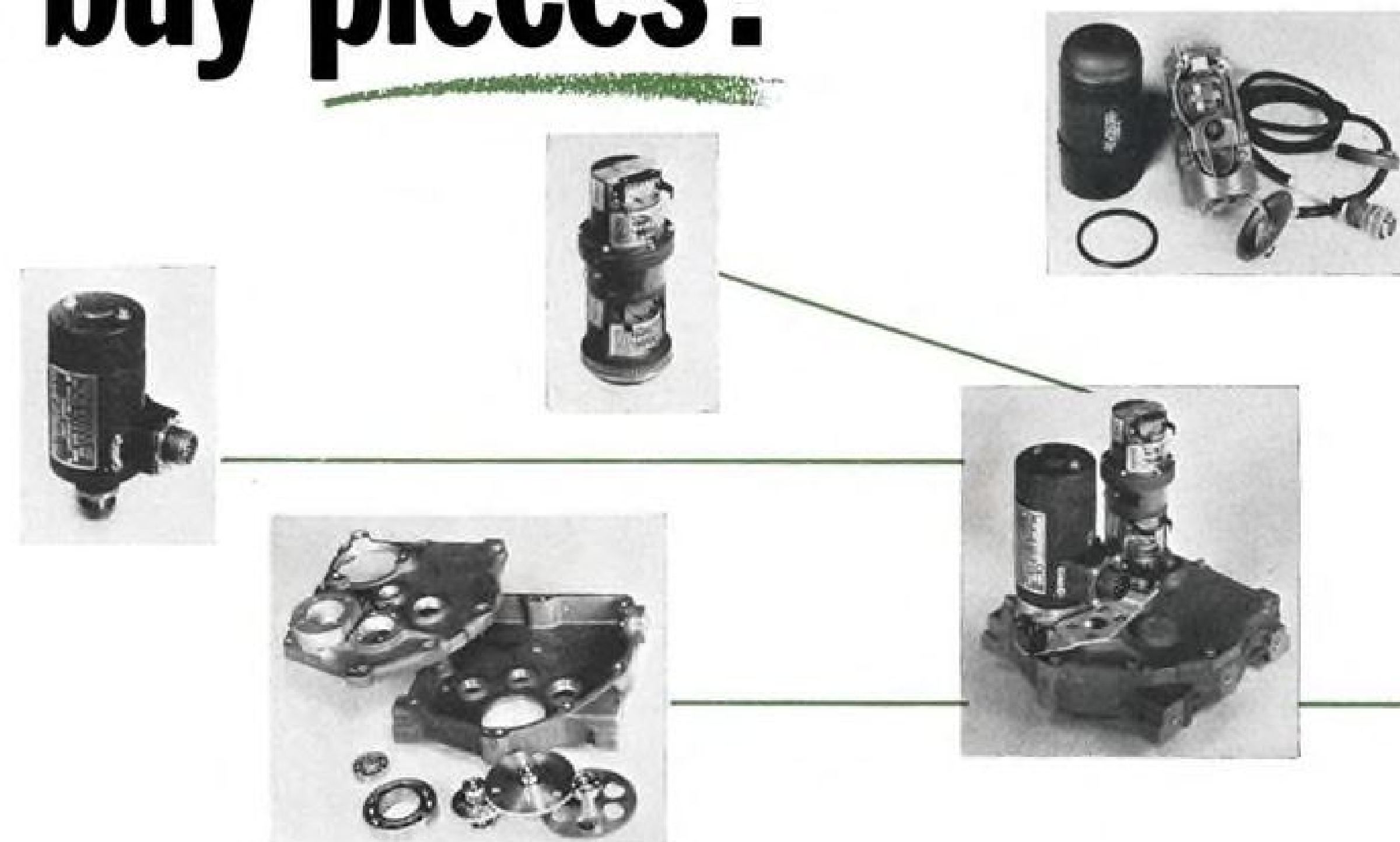


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AVIATION WEEK, February 7, 1955



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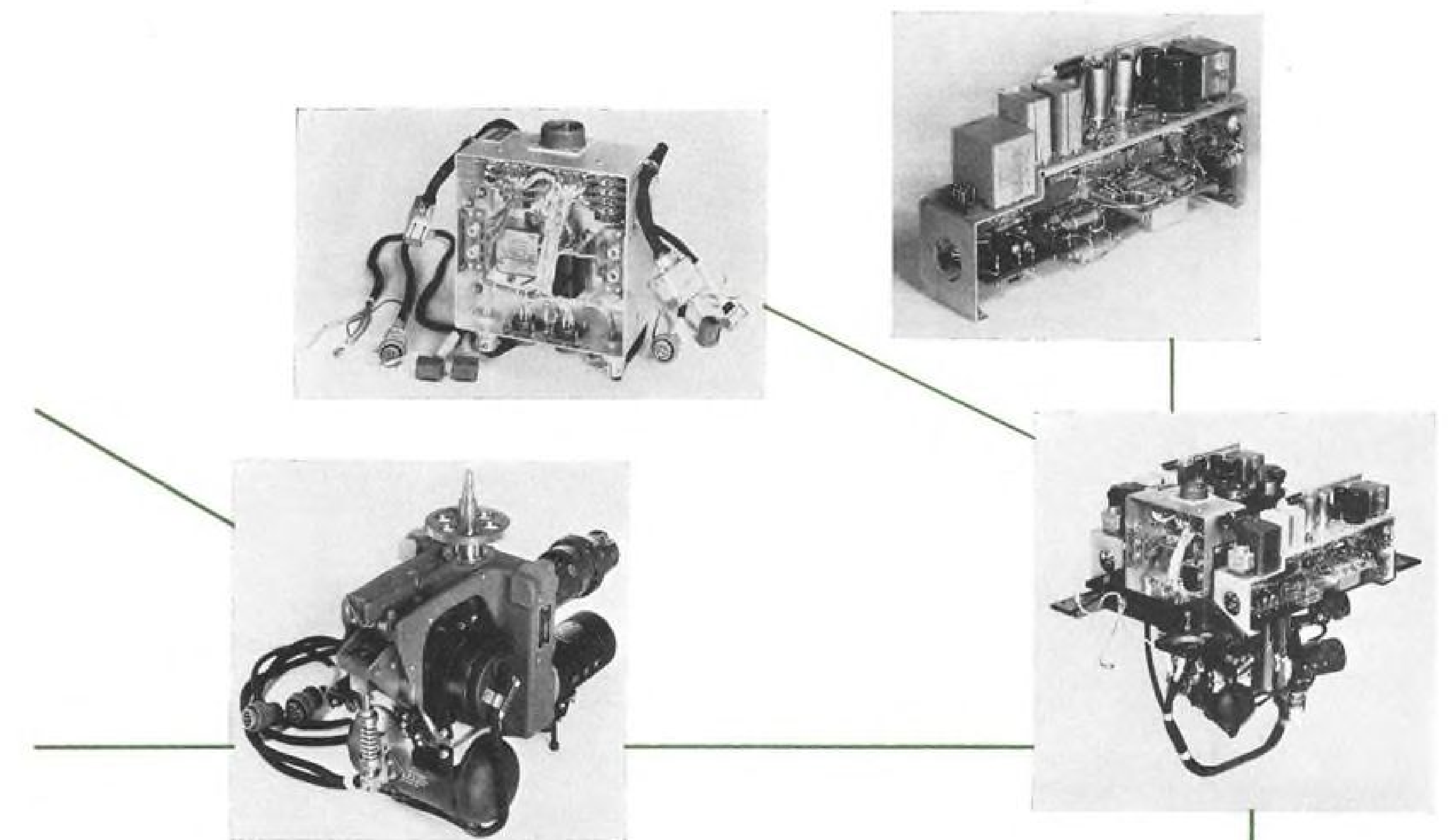
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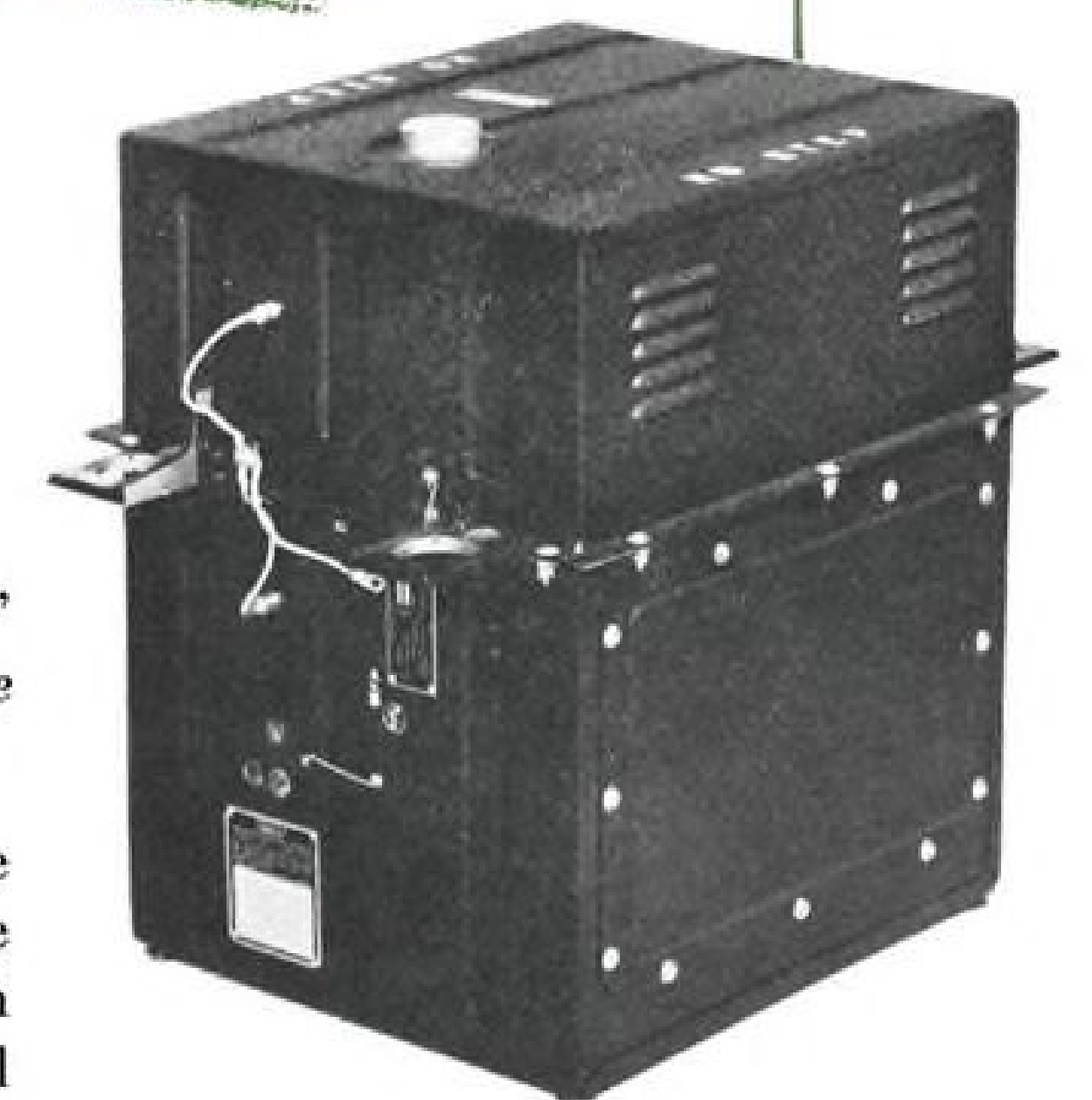


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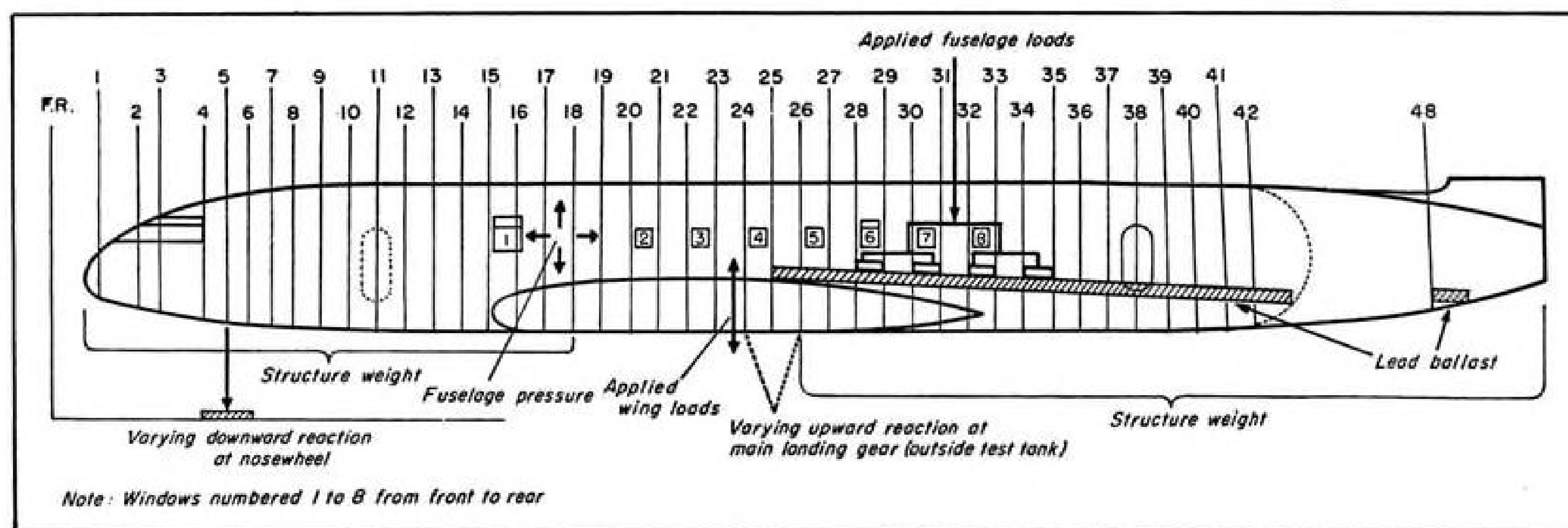
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**FUSELAGE LAYOUT** of DH Comet shows application points for loads during water tank tests made to check integrity of pressure cabin.

have characteristics as individualistic as fingerprints. Fracture analysis lets the technician decide that this joint failed in tension, this in shear, this in torsion, and these in fatigue.

• **Determine the sequence of the failures.** This is the crux of the whole study, and depends on the recognition of the footprints of motion as one part moves over another in break-up.

This was Ripley's task; he and his crews worked the broken bits into recognizable shape, watching each piece

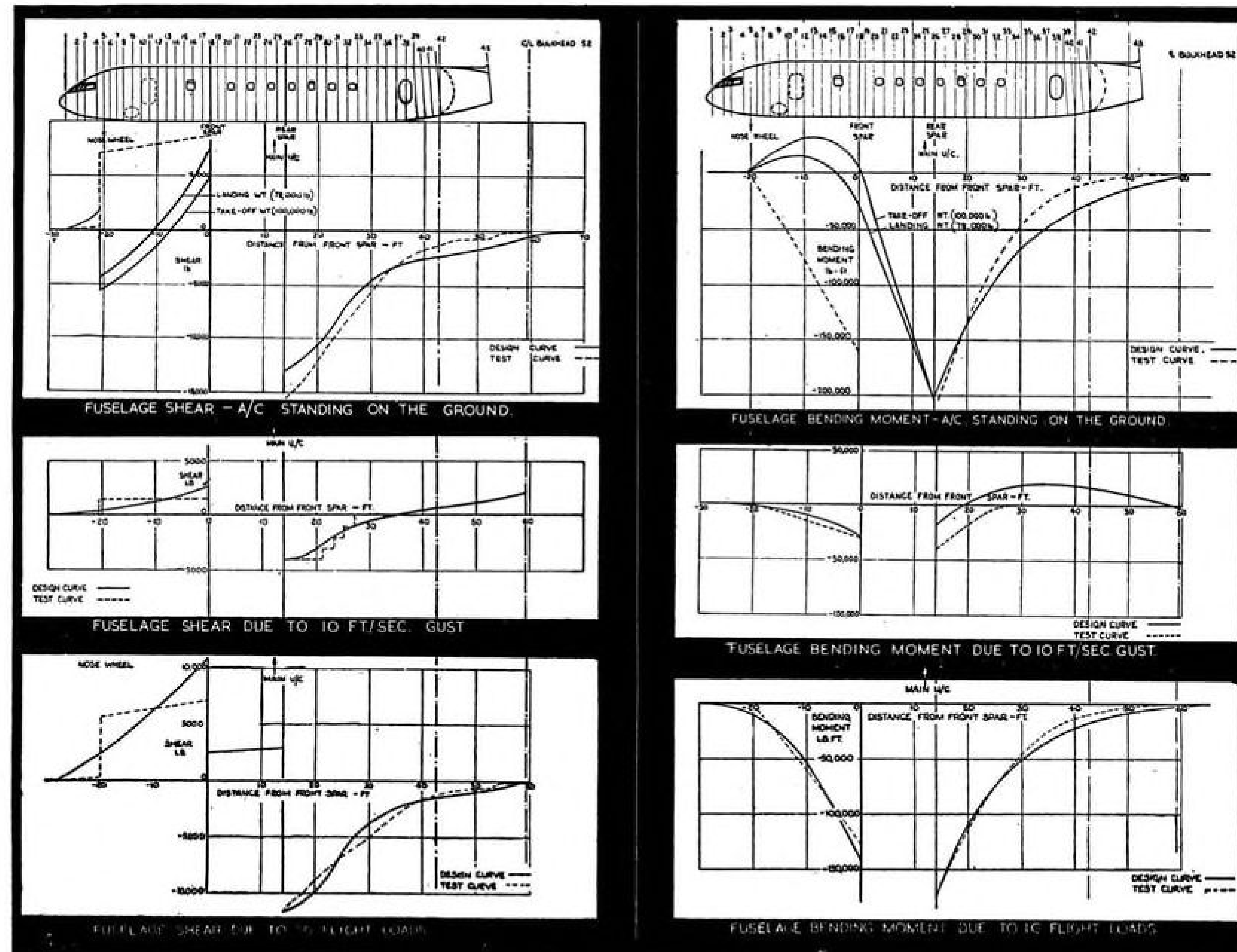
for the telltales of death.

► **Theoretically**—Dr. P. B. Walker, head of Farnborough's Aircraft Structures department, had another approach. Without knowledge of the wreckage, and after the Naples crash, he became suspicious of fatigue of the pressure cabin.

There was one objection as Walker said during the inquiry: "... I think it was quite incredible at the state of knowledge then that fatigue of a pressure cabin could occur after such a short time."

To test his theory, Walker proposed water-testing a complete Comet fuselage. In April, Sir Arnold decided to build the tank and arranged to get another BOAC Comet—G-ALYU—to test to destruction.

G-ALYU was stripped down of all accessories that could be water-damaged. All non-structural fittings were removed for better inspection of the skin and structure. The vertical and horizontal tails were taken off, and Yoke Uncle was wheeled into its final



**Flash butt-welding of mill-rolled sections will save \$186,888.00 this year for one jet engine manufacturer**

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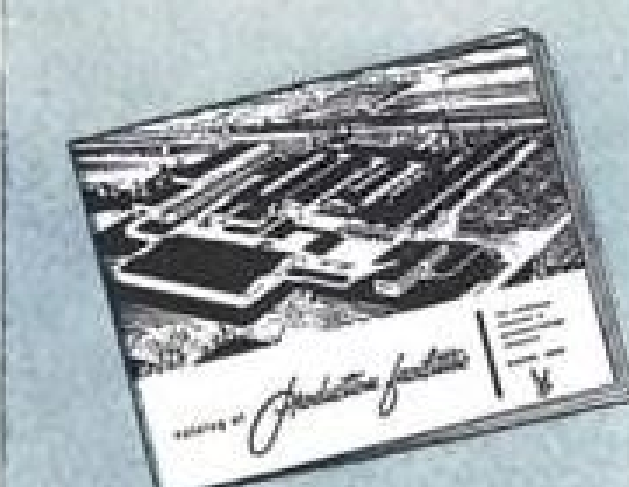
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Advertising Research Foundation uncovered this fact and a host of others about how AVIATION WEEK is read—how editorial material is read—how advertisements are read—how readers influence purchasing—in Study Number Six, The Continuing Study of Business Papers, just released. Together they make up one of the most impressive stories ever told about readership in the aviation industry.

This study was conducted by Advertising Research Foundation, because of its industry-wide importance, on behalf of some 190 leading advertisers, agencies and media—including the American Association of Advertising Agencies and the Association of National Advertisers—which compose the Foundation's membership. Findings were secured through methods developed and tested by ARF during two years of experimental research and used in actual studies of five other leading business publications. Because of these painstaking procedures and their absolute freedom from bias, Advertising Research Foundation studies are considered to be the most valuable research on magazine readership available today.

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flights—made under water.

The tank was completed around the plane, with air-inflatable seals over the wings. The tank and the Comet were filled with water, and pressure was applied inside the fuselage.

Outside the tank, hydraulic pistons lifted the airplane to simulate the equilibrium of level flight, then fed in fluctuating loads representing gusts during an average flight. Cycling rate was fast, and a complete flight took only five or six minutes. The data for the gust rate came from records of the earlier flight tests in a BOAC Comet, when counting accelerometers were used.

►In the Air—A third phase of the Comet investigation was proceeding at a feverish pace. BOAC Comet G-ALAV was instrumented for flight test in record time. The aim: investigate flutter and vibration "as near to the tiger" as possible.

Loaded with more than 100 specialized flight instruments and chased by a Canberra, the Comet was to be flown to 40,000 ft. unpressurized for 15-min. tests. Duration of the tests was set by the physical limits of the crew, operating as they did on oxygen only, at an extreme altitude.

Later, these tests were to be expanded to include aerodynamic problems and fuel-venting runs. The crew, made up of RAE test pilots—RAF officers assigned to the station—were trained by BOAC and de Havilland. More than 20 scientists, a woman among them, were to log more than 100 flight hours in short increments during a three-month period.

►And Still Other Tests—Backing up the major phases of the investigation were a host of other special tests, made with ingenious models or apparatus. In general, they were done to prove a point deduced from examination of wreckage or from theoretical considerations.

One example: Medical evidence of Prof. Antonio Fornari, an Italian specialist who performed post-mortem examinations on 14 of the 15 recovered bodies, indicated the passengers all died in the same way. They had been thrown violently upward and forward, fracturing skulls and thoraxes; their lungs showed evidence of explosive decompression. How could the violent motion of the passengers be demonstrated?

It was done finally with 0.1-scale dynamically similar transparent models of the pressurized cabin, complete with scaled-down chairs and dummies. The model was pressurized in an evacuated tank and ruptured. In the complete disorder that followed, passengers, chairs and cabin wreckage blasted out of the hole in the roof. Study of high-speed camera frames showed the motion to be exactly the kind necessary

another filter problem solved . . .

## R-F NOISE REMOVED FROM ELECTRIC DRILL



Photo courtesy The Black & Decker Mfg. Co.

**PROBLEM**—R-F interference caused by portable electric hand tools was once quite a problem for the military. To suppress the noise from such small equipment, engineers tried outboard filters and shielded line cords. But these proved to be expensive, bulky, and generally inconvenient. In addition, leakage current from line to tool frame was increased—in some cases to a hazardous extent.

**APPROACH**—The Black & Decker Manufacturing Co., maker of the drill illustrated above, submitted the problem to the Radio Noise Suppression Laboratories of the Sprague Electric Company in Los Angeles.

**SOLUTION**—Sprague designed a tailor-made filter which meets all the requirements of size, weight, and performance. Eliminating all radio noise, the filter is still small enough to be installed in the drill housing.

**FILTER PRODUCTION SCHEDULES** for this drill and small electric hand tools made by other manufacturers are regularly met by Sprague plants on both coasts. Perhaps we can solve your problem too. Write, wire, or phone Sprague Electric Co., 11325 W. Washington Blvd., Los Angeles 66, Calif. (TEexas 0-7491) or North Adams, Mass. (MOhawk 3-5311).

Sprague on request will provide you with complete application engineering service for optimum results in the use of radio noise filters.

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## THE NIGHT BEFORE THE PROXY FIGHT

Harrison Wells settled himself in the comfortable seat of the company's newly-overhauled plane — *his* company's plane, he reflected. His company, too, for that matter. He had built it, at the first, by single-handed effort. Now, he was flying home to do battle for its control.

This year, a new group of stockholders was challenging him. The show-down was set for tomorrow — 10 A.M. in the company's board room. Harrison Wells patted the sleek side of his brief case. He thought of the neat pack of proxies he had rounded up in a hurried, cross-continent tour of some 5,000 miles.

Make *him* the chairman of the board — kick *him* upstairs? Not *this* year! The plane flew steadily eastward.

Flights of this kind can be quickly planned and safely completed if engines are routinely rebuilt by Airwork. The personalized service and the engine exchange program offered by this unusual organization make possible factory-new performance for the privately-owned plane. Nowhere else, except in the shops of large, scheduled air lines, will you find such production-line techniques, equal to those of the original manufacturer.

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INTERIOR of Comet G-ALAV shows some of the 100-plus special flight-test instruments.

to produce the injuries Fornari found. Another example: Skin burns were found on some of the bodies. Did they occur before or after death?

Dr. R. D. Teare, assistant pathologist at St. George's Hospital and member of the Royal College of Physicians, wondered about this point. In checking over Fornari's report, he was in complete agreement with the observa-

tions and deductions. But the question could not be ruled out.

Teare made some tests with human skin, covering it with clothing and setting it in water with burning kerosene on the surface. The recovered skin was burned, even though the cloth was unhurt. The burns must have occurred after death.

► **Fire and Ashes**—Pieces of the wreckage showed that they had been burning for considerable time before being extinguished by the sea. How long had they been afire?

Duplicate structures were built and burned in intense fires corresponding to those following aircraft accidents. A wing spar section took about three minutes to burn through to the point of resemblance to the wreckage. Therefore, reasoned the Farnborough staff, the wreckage had been falling for about three minutes after it broke up and caught fire in the air.

Next question: Where was it when it broke up and how did it break up so that the fall took so much time.

Again they resorted to dynamically similar models. Dozens of them, built to 1/36th the scale of the Comet, were made to come apart in the air in sequence. They were designed with major assemblies fastened together with loose pins. To each pin was attached a string of varying length.

The engineers took the models to the roof of one of the Farnborough hangars and catapulted them into flight. The strings, attached to a pin at the launching point, pulled the model apart in a predetermined sequence.

The wreckage pattern on the ground was compared with the position of the pieces recovered from the sea until good agreement was obtained.

Other similar models were dropped

### 800,000-WORD MONUMENT

The Comet inquiry was summed finally in 22 days of formal hearings, with the written and spoken testimony of 68 witnesses making a transcribed stack of paper 800,000 words long and 10 inches high.

There has never been an investigation like it before and the unvoiced prayer of every aircraft engineer and designer is that there never need be one like it again.

It was an astonishing job to recover, reconstruct, analyze and deduce specific causes for the deaths of two de Havilland Comets over the blue Mediterranean early in 1954. Outstanding among the many unusual aspects of the entire study was the part played by the Royal Aircraft Establishment, its engineers, scientists, technicians and laborers.

That effort was formally reproduced in Accident Note 270, a huge compendium of trial and error, of deductive reasoning and empirical proof, of blind alleys and open highways to the final answer.

Now, there is nothing to do but wait for the final and formal findings of the inquiry, expected to confirm the verdict of RAE's study: fatigue failure of the pressurized cabin.

This article is the first of two which will tell the story behind that verdict.

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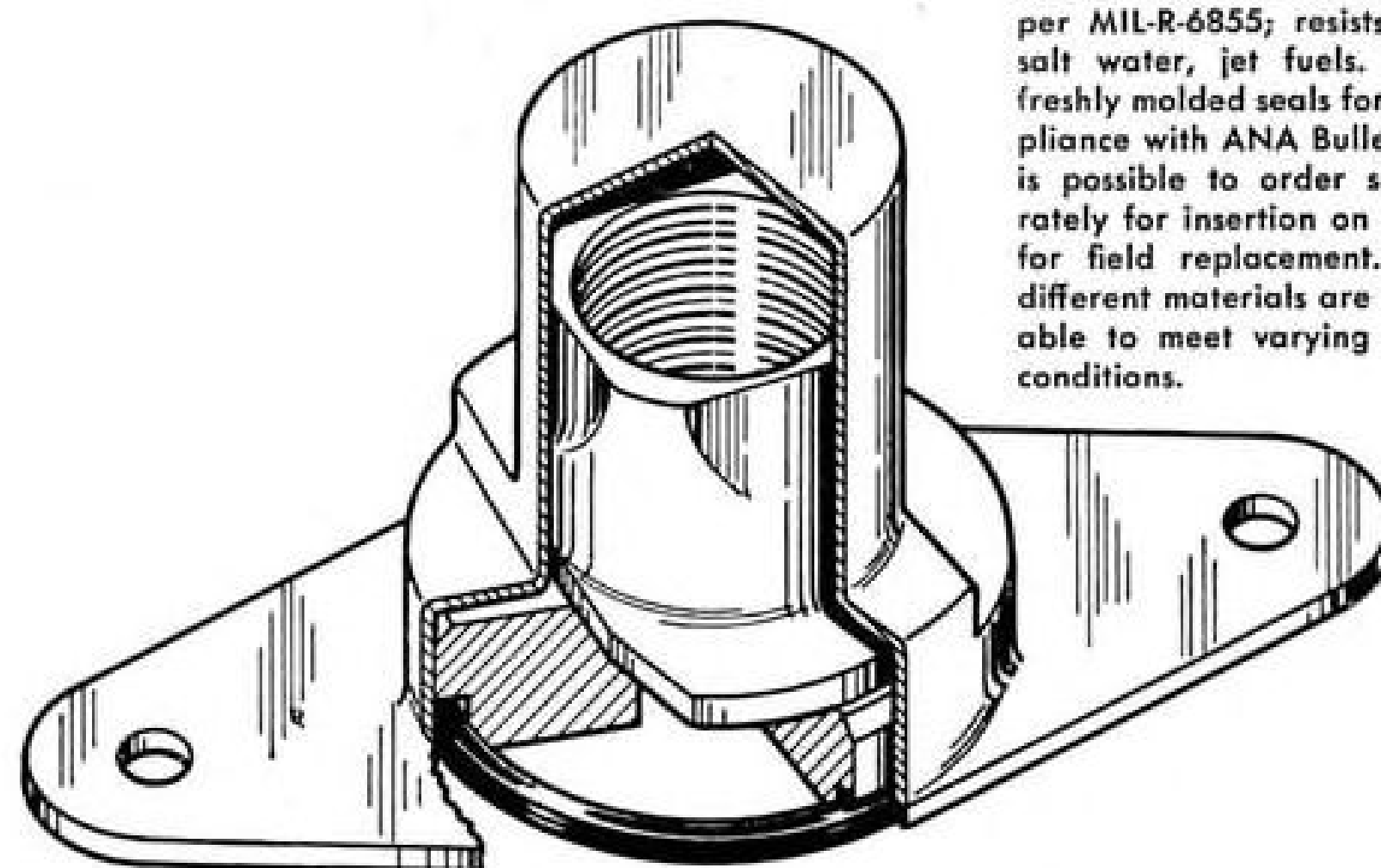
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## FASTENER PROBLEM



Sealing ring of new ESNA type A2500 nut meets all requirements per MIL-R-6855; resists gasoline, salt water, jet fuels. To insure freshly molded seals for easy compliance with ANA Bulletin 410, it is possible to order seals separately for insertion on the job or for field replacement. Rings of different materials are also available to meet varying operating conditions.

## Leakproof self-locking fasteners for integral fuel tanks

Aircraft designers have eyed the space-saving possibilities of "Wet Wing" or integral fuel tanks for some time. But . . . the "wet" section of the wing must be fastened in such a way that highly volatile aviation fuels will not leak under the base of the tank fasteners or seep out along their bolt threads.

ESNA has just developed the first completely practical answer to this problem. The new ESNA type A2500 floating anchor cap nut (see diagram) is a self-locking anchor nut with an "O"-ring seal in its base. In tests, the nut has maintained a perfect seal against pressures above 50 psi on either side, regardless of structural strain, vibration, or temperature changes. The seal is effective whether the bolt is installed or not. It is not destroyed by repeated bolt installations.

The type A2500 is the lightest nut of its type; 100 1/4-28 size nuts weigh only 1.2 pounds. It meets AN-N-5 specifications for operation between -80° F. and +250° F. and can be used for extremes beyond these limits by varying its component materials such as the "O"-ring. It provides .050-inch maximum floating action allowing quick assembly in spite of slight misalignment of bolt holes. *The A2500 is 100% seal tested prior to shipment.* The basic design has been approved by the USAF. Sizes range from 10/32 through sizes 1/4-28, 5/16-24, 3/8-24, and 7/16-20. A gang channel strip providing a series of regularly spaced A2500 nuts has also been designed.



The new Boeing 707 Jet Transport is among the first aircraft equipped with integral wing fuel tanks fastened with the new ESNA type A2500 leakproof nut.

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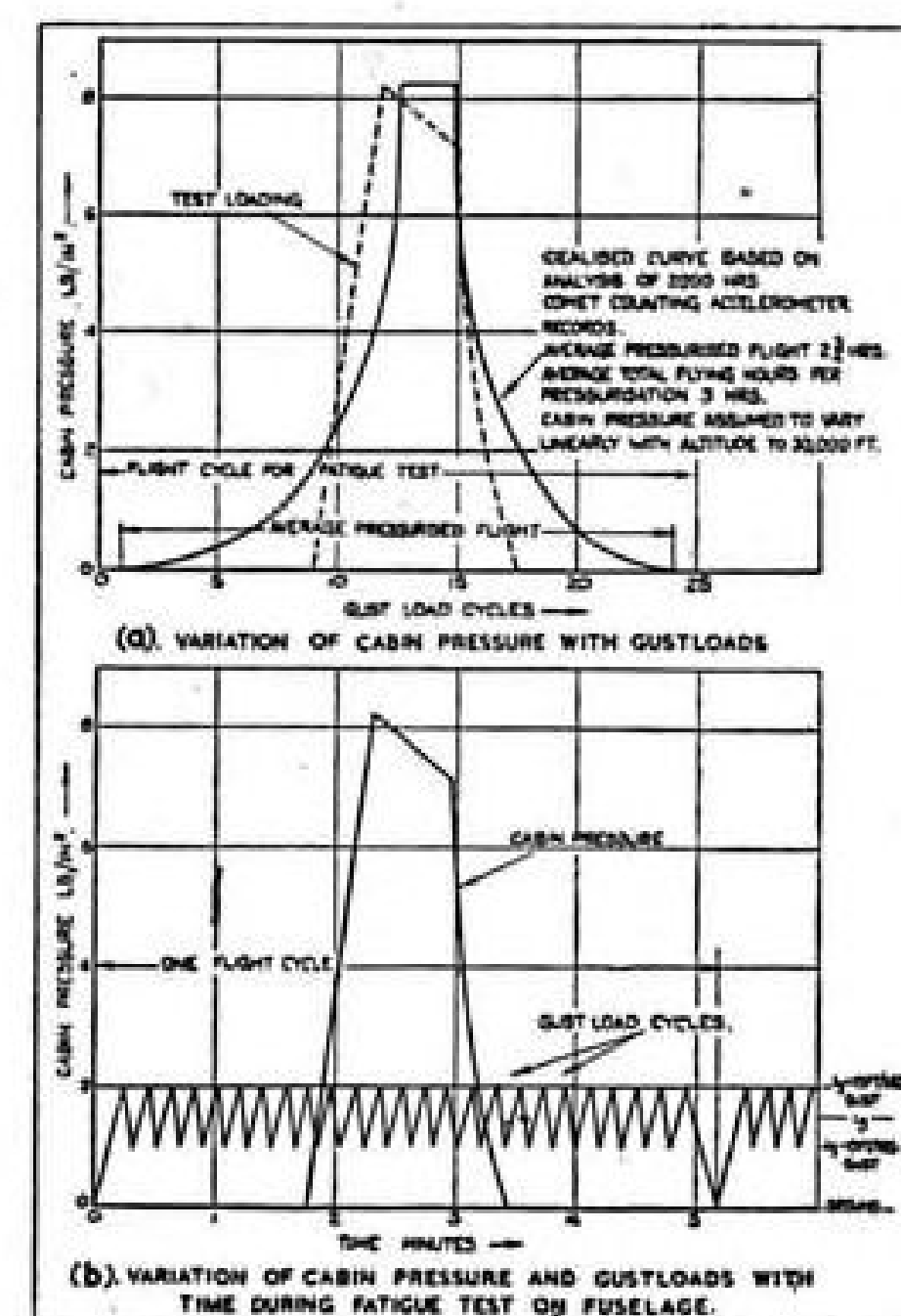
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at altitude, and broken up in the same way. They took two and a one-half minutes to come to earth, checking roughly the estimates of fall time made from examination of wreckage. Working backwards with the laws of dynamic similarity, engineers deduced the Comets were at about 35,000 ft., or just at the top of their climb, when the accidents occurred.

► **Fuel and Overfueling**—There were some feelings that a fuel explosion in the fuselage tank had caused the accidents. This was thoroughly checked and rejected, as was the theory that the wings had been damaged to the point of breakage by overfueling with the pressure-refueling system developed for the Comets.

Someone suggested that the tires had exploded, with an effect like a bomb at the wing root. This was thrown out after seeing the wreckage. Those who had read detective thrillers saw the chance of a bomb in one of the lavatories. There was no indication in either the wreckage or on the bodies that an explosion of any kind had taken place.

Letters poured in. Perhaps the Redux adhesive had failed under the pressure. No, said the RAE engineers, because the wreckage showed that any Redux failures occurred on impact with the water after the accident. Perhaps there had been sabotage. No, said the investigators; no evidence.

Letters suggested collision with a meteorite and even deliberate destruction by Martians in a flying saucer. Straight-faced, the scientists repeated there was no evidence in the wreckage, unless of course, their ammunition was considerably different from the conventional.

► **The Frame of the Picture**—This was the way the investigation went. Any

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avenue, regardless of how ridiculous it seemed at first glance, was explored. When a theory needed proof, tests were made. Expense was not considered.

As the days dragged into weeks and months, there was little positive evidence to support any hypothesis. True, there was enough to rule out many of the alternates, but not enough to put the finger on any one.

The break finally came in June, when Ripley and Hall were looking at the wreckage together. The inner port wing was scored on its upper surface with spanwise lines extending almost to the ailerons. Something had impacted on the wing and been forced or dragged out sideways. It must have been moved by a considerable force to stay on the wing for such a great distance in the highspeed slipstream over the wing.

Ripley and Hall agreed that either a piece of the cabin had been projected along the wing by explosive means, or by an extreme state of yaw.

On June 21, a piece of the port cabin structure was recovered. Its jagged edge matched the scratches in the wing; it had been the piece that blew out along the span, leaving its trail to be found months later.

Three days later, the first failure occurred in the tank when the fuselage blew out at a fatigue fracture. In a few more days, Hall and his staff were certain that the first fracture on the Elba Comet must have taken place on the top of the fuselage.

The Admiralty was asked to reorient their search for wreckage. Toward the end of August, the sea bottom gave up the last link in the chain—the upper fuselage section near the ADF “windows,” lacerated by fatigue fractures. The final goal was in sight.

(This is the first of a two-part article dealing with the Comet investigation. The second instalment will appear in the near future.)

## THRUST & DRAG

Several people have asked where they can get copies of Hans Mueller's book, “First and Last I Flew for the Fuehrer Because Flying Is My Life.” Copies could have been obtained while they lasted from the publishers:

Hassenpfeffer u. Glockenspiel Verlag G. m. b. H.

Untergrundbahnhofseingang Zwei  
Zusammensetzung-an-der-Tafel  
Germany

Unfortunately, the entire original printing of eight copies was sold out (to Mueller's relatives) and the publishers do not plan any further printings.—DAA.

## AIRCRAFT ENGINEERS

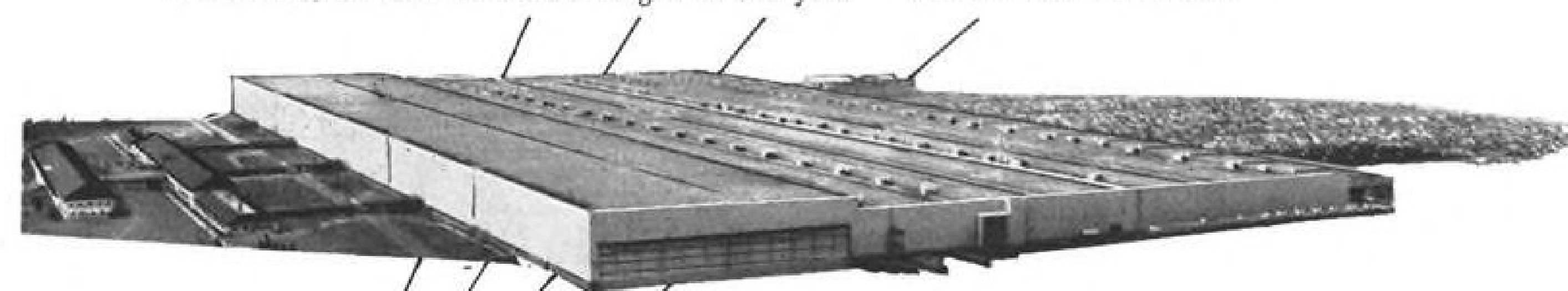
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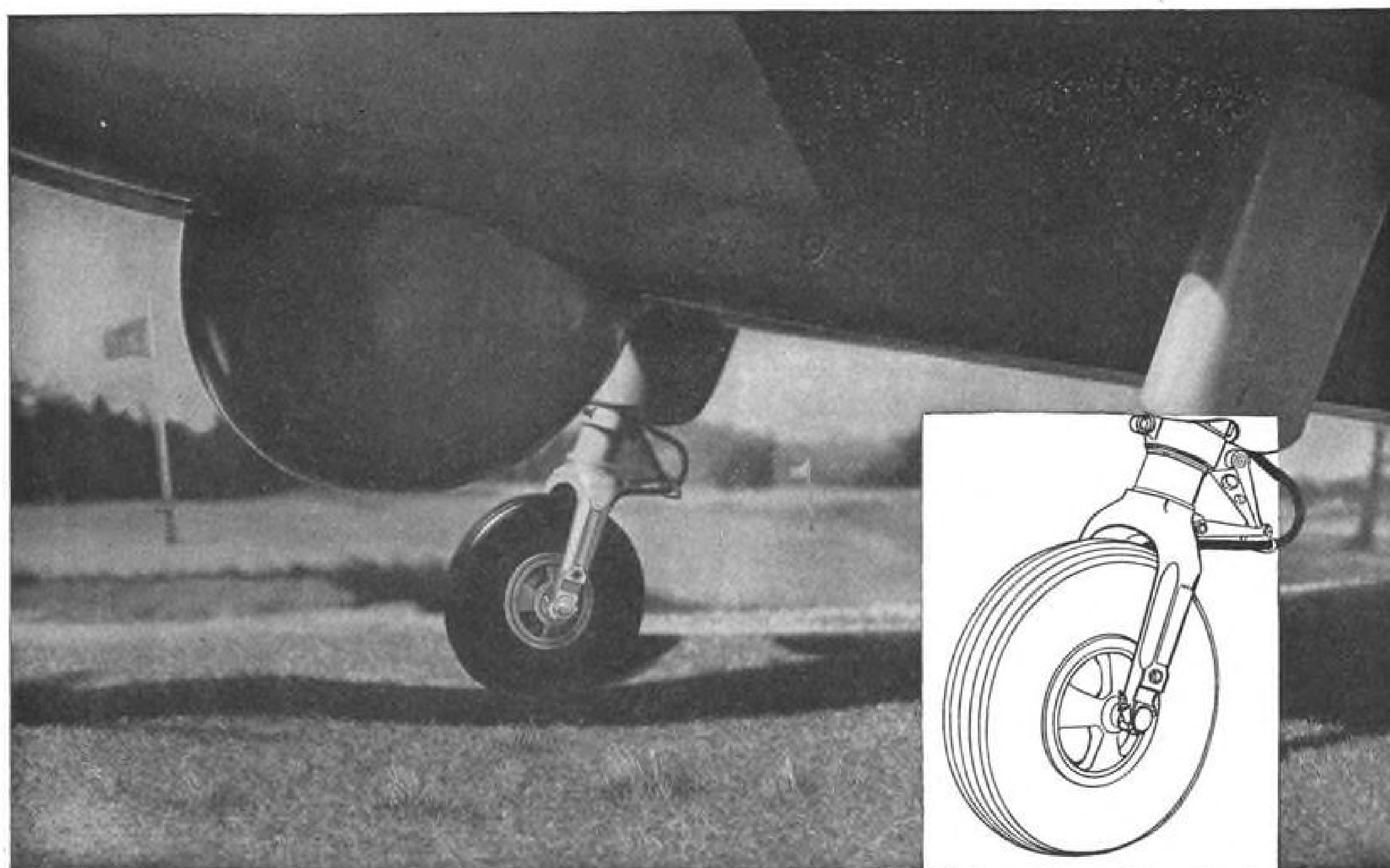
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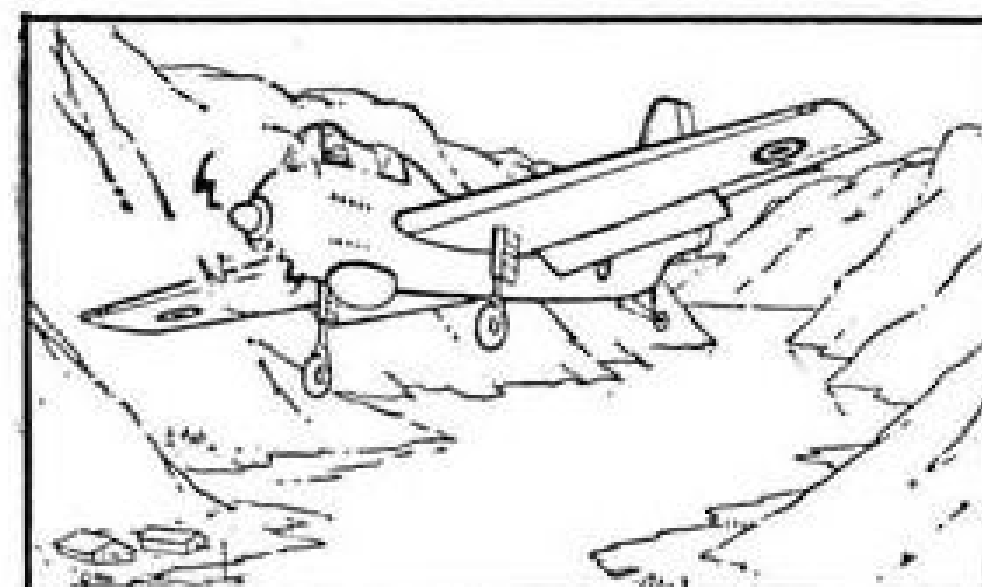


## Golf course fairway — Seamew runway



**Seamew** — a tough, economical, all-weather submarine hunter. In adverse weather — submarine weather — the Seamew can be airborne after a short take-off from an emergency strip . . . can conduct a radar search and low-level attack . . . and can land back safely almost anywhere (even on a golf course!)—due to its slow approach speed and shock-resisting undercarriage.

Whether on soft or rough ground, sand or grass, the Seamew can alight in an extremely small area because of its low landing speed and long oleo leg travel. Tyre sizes can be easily changed to suit terrain.

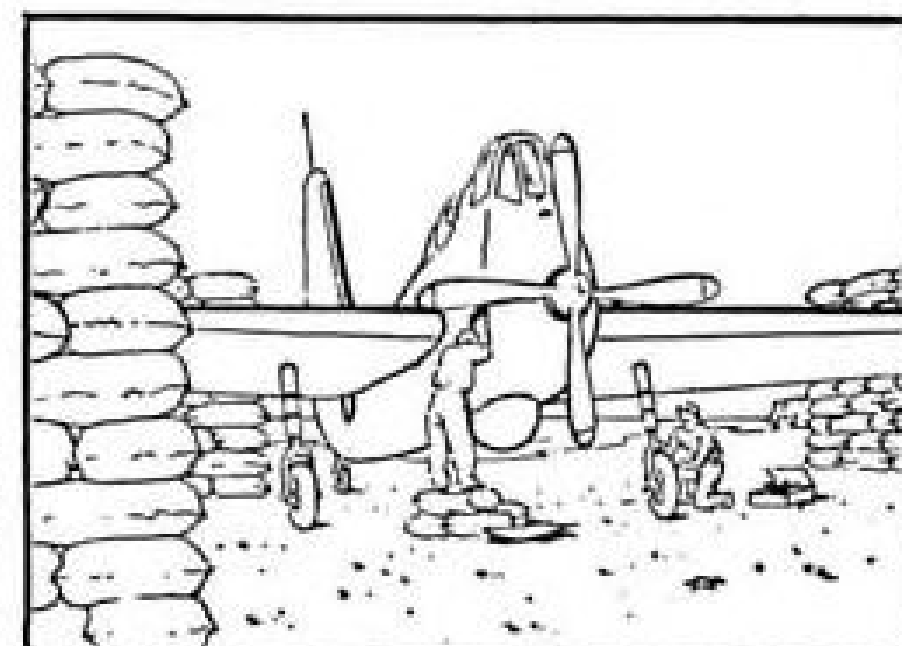


The extremely good handling characteristics of the Seamew combined with simplicity of construction and clear vision make it an excellent aircraft to fly, even for pilots with little experience of this type.

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Economy of manufacture is paralleled by economy of maintenance, in terms of man-hours and spare components.



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## WHAT'S NEW

### Telling the Market

Titanium tubing is described and aviation applications provided in Bulletin 43 published by Superior Tube Co., Norristown, Pa. . . . Wet abrasive precision cleaning and finishing are dealt with in 18-page Bulletin 541-D, available from American Wheelabrator & Equipment Corp., 1001 S. Byrkit St., Mishawaka, Ind. . . . Standard precision index tables for fast production are described in Catalog 300. It contains assembly drawings, load ratings and dimensions of over 150 models. Obtainable from Ferguson Machine & Tool Co., Roller Gear Division, P.O. Box 191, St. Louis 21. Complete line of air and hydraulic cylinders; valves and packaged fluid power devices is covered in 120-page data book from Modernair Corp., 400 Preda St., San Leandro, Calif.

Production Digest is 60-page handbook of coated abrasive grinding and polishing techniques assembled from 20 technical papers prepared by methods engineers of Behr-Manning for periodicals. Write the firm at Troy, N. Y. . . . Installations of Trav-Lift cranes in industry are pictured in Bulletin C-51 to provide hints on how users may apply equipment in their plants. Also covered: crane rectifier brakes. Available from: Harnischfeger Corp., 4615 W. National Ave., Milwaukee 46.

Doors for aviation and industry are described and outstanding installations detailed in new catalogue distributed by International Steel Co., Marketing Services Division, Evansville, Ind. . . . Laboratory and production rolling mills, rotary gang slitters, levelers and accessories, including "revolutionary" combination mill that can be converted from two to four high for greater processing versatility, are shown in Brochure 210 available from Stanat Manufacturing Co., 47-28 37th St., Long Island City 1, N. Y.

### Publications Received

- The Observer's Book of Aircraft, by William Green and Gerald Pollinger, foreword by Peter Masefield. Published by Frederick Warne & Co., Ltd., London and New York, 1955. 287 pp., 309 illustrations. \$1.25. Cloth-bound pocket manual covering all available details of 216 military and civil aircraft.
- The Gyroscope Applied, by K. I. T. Richardson, Philosophical Library, Inc., New York, 1954. 384 pp. \$15.00. Sections cover gyroscope fundamentals and marine, aeronautical, military, and other applications. A mathematical appendix deals with the elements of gyro dynamics.

AVIATION WEEK, February 7, 1955

## Flexonics Ducting Components absorb thermal expansion at 1400° F. in the Douglas C-124 heating system

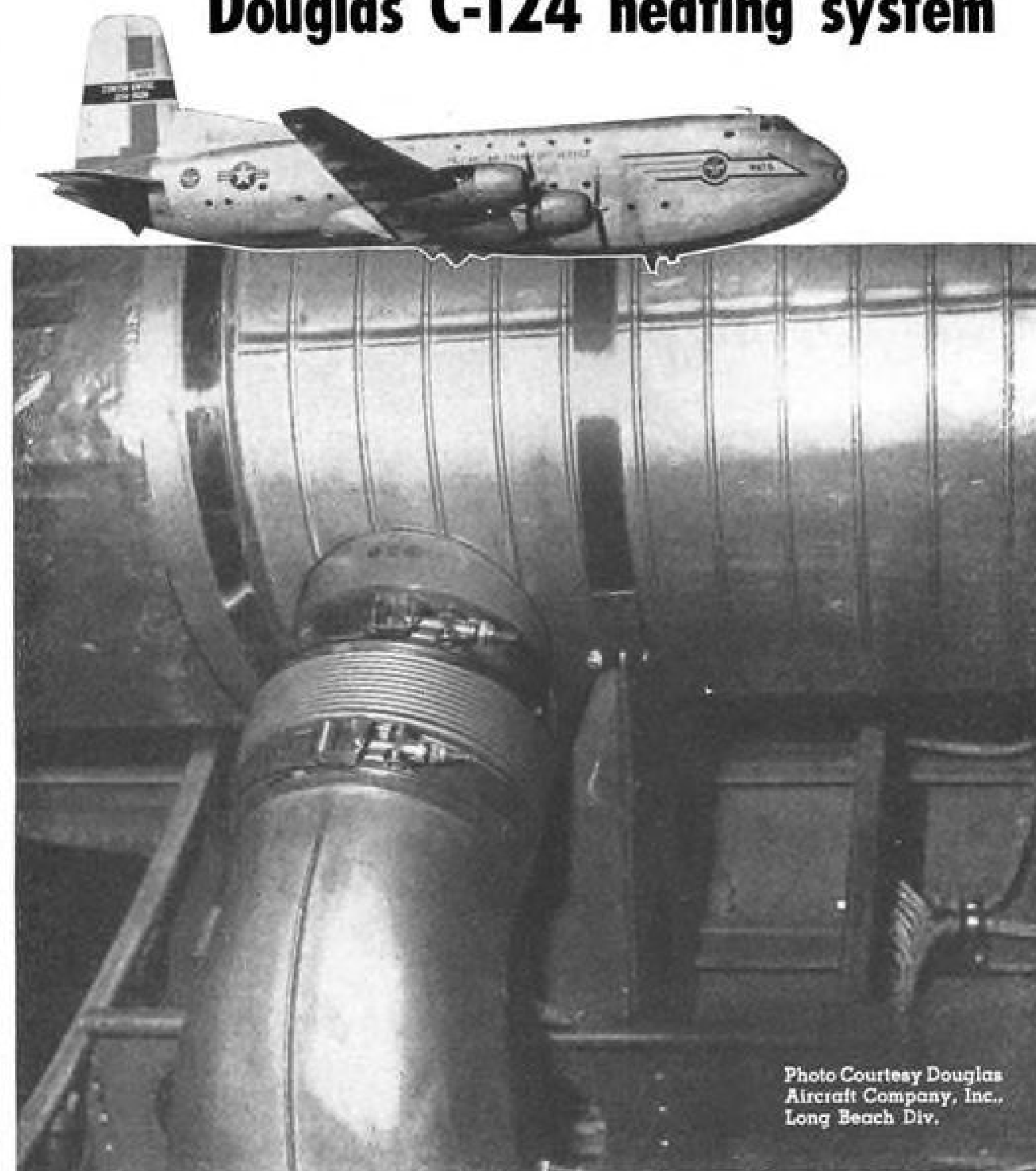


Photo Courtesy Douglas Aircraft Company, Inc., Long Beach Div.

### CHECK FLEXONICS FOR ANY OF THESE COMPONENTS, TOO—

**FLEXON DUCTING** is available in thin wall and heavy wall types in a complete range of sizes with or without insulation. Elbow forming and rib reinforced types can also be supplied.

**FLEXON METAL HOSE** is manufactured in the broadest variety of sizes and types for all aircraft applications.

**FLEXON BELLOWS** are made in an almost unlimited range of sizes and types to meet the most advanced requirements.

Thermal expansion, at 1400° F., accompanied by vibratory motion created a design problem in the exhaust line of the main cabin heater of the Douglas C-124. A connection was necessary that would absorb expansion and vibration at very high temperature and seal exhaust gases at 30 psi. The problem was solved with a 6" I.D. FLEXON Rex-Flex Type RF-40 assembly designed for .4375" compression and equipped with a stainless steel liner. Rex-Flex Type RF-40 is an annularly corrugated, stainless steel flexible section particularly suitable for high temperature expansion control.

Whenever connections must be made to absorb expansion and vibration, specify FLEXONICS Ducting Components. There is a size and type for every need. For specific recommendations, just send an outline of your requirements.

## Flexonics Corporation

Flexon identifies products of Flexonics Corporation that have served industry for over 53 years.

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## PRODUCTION



**F-100 WING STRUCTURE** reveals large forged root rib, leading edge spar with piano hinge, and rugged intermediate members.

## Production of USAF Fighter Ace Hums



**INSIDE FUSELAGE**, looking aft toward breakpoint, where man crouches.



**TAIL SECTION** gets finishing touches before hookup.



**AFTERBURNER-FITTED J57 JET** extends from fuselage as it is lowered over wing of the Super Sabre in major assembly job.

In volume production as the replacement for the North American F-86, the company's F-100, fastest USAF operational fighter, recently has been placed in squadron service.

Supersonic in level flight, the F-100 was in production when the prototype first flew. Actual quantities have not been announced but it is known that large numbers will be built.

Photos here show various features in the fighter's makeup. Fuselage has distinguishing flat bottom, is fitted with Pratt & Whitney 10,000-lb.-thrust J57 jet engine plus afterburner.



**ALMOST COMPLETED**, F-100 shows its sleek profile as side is prepared for marking.



**ROLLOUT AREA** is spotted with the fighters getting final adjustments. Plane in left foreground has fuselage split at breakpoint.



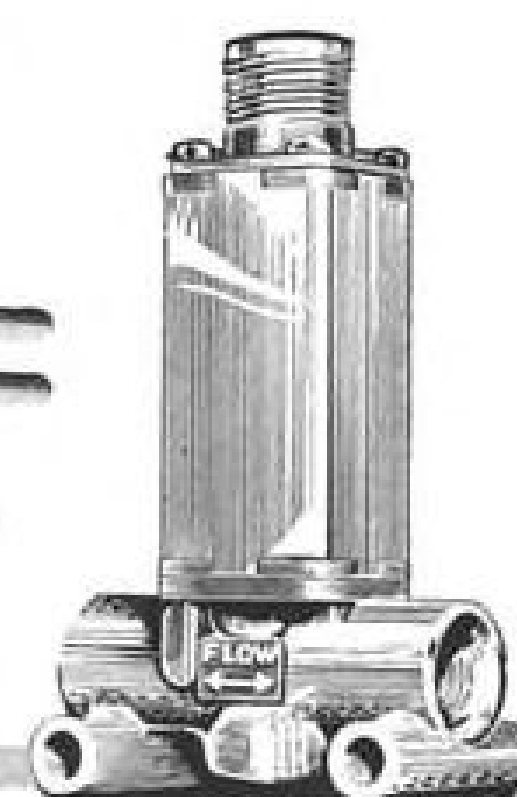
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V-6800	Normally Open	300 psig
V-8400	Normally Closed	200 psig
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V-8300	Normally Open	500 psig
V-7000	Normally Closed	500 psig

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**PRODUCTION BRIEFING**

► **Ryan Aeronautical Co.**, San Diego, Calif., has successfully tested its new \$175,000 jet engine test cell. Acoustic vibrations caused some minor instrumentation difficulties, but the exhaust silencer chamber proved particularly effective, with normal conversations possible immediately outside the test cell.

► **Boeing Aircraft Co.**, Seattle, Wash., has included Tucson, Ariz., as a prospective site for new aircraft modernization facilities.

► **Link Aviation, Inc.**, Binghamton, N. Y., has purchased two buildings comprising 18,000 sq. ft. in this city and will occupy the property by Mar. 1. Link's current operating area totals 350,000 sq. ft.

► **Atomic Energy for Industry, Inc.**, is a new firm formed by Dr. Charles H. Lutz, specialist in aircraft and guided missile development, to concentrate on industrial and commercial applications of radiography, tracers, thickness gaging and quality control using radioactive chemical elements such as cobalt. The new firm will be located in Cleveland, Ohio.

► **Robert Goldsmith Co.**, has been formed to represent aircraft and instrument manufacturers in metropolitan New York, New Jersey and Connecticut. Address is 114 E. 32 St., New York.

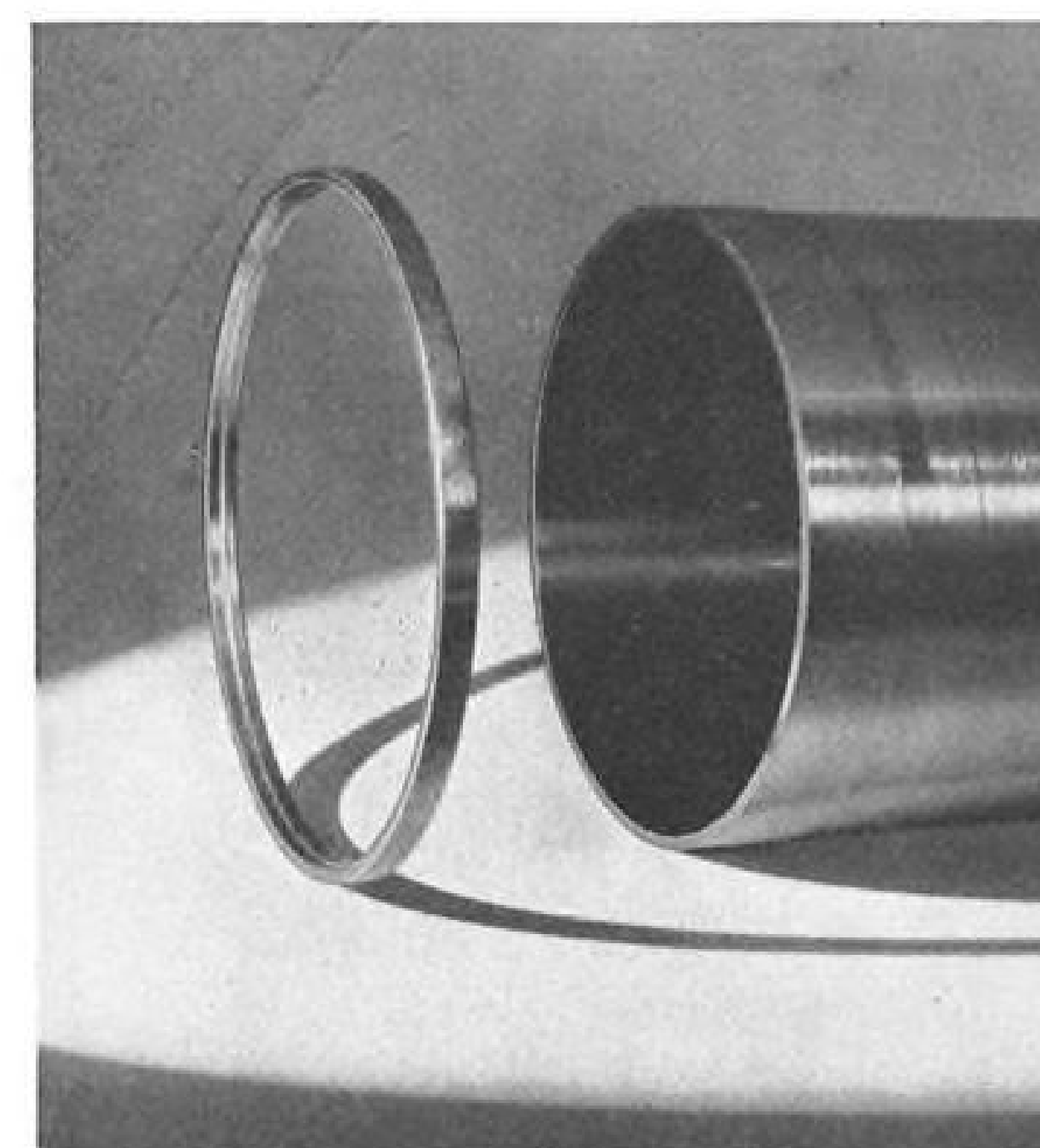
► **Gordon B. Hamilton & Co.**, aircraft repair and modification firm, is completing a 10,000-sq. ft. plant at Tucson (Ariz.) Municipal Airport.

► **Sundstrand Machine Tool Co.**, Rockford, Ill., plans to erect a new plant of about 150,000-sq.-ft. floor space on the outskirts of Denver to help increase output of aircraft constant-speed transmissions. Plant is expected to employ 500.

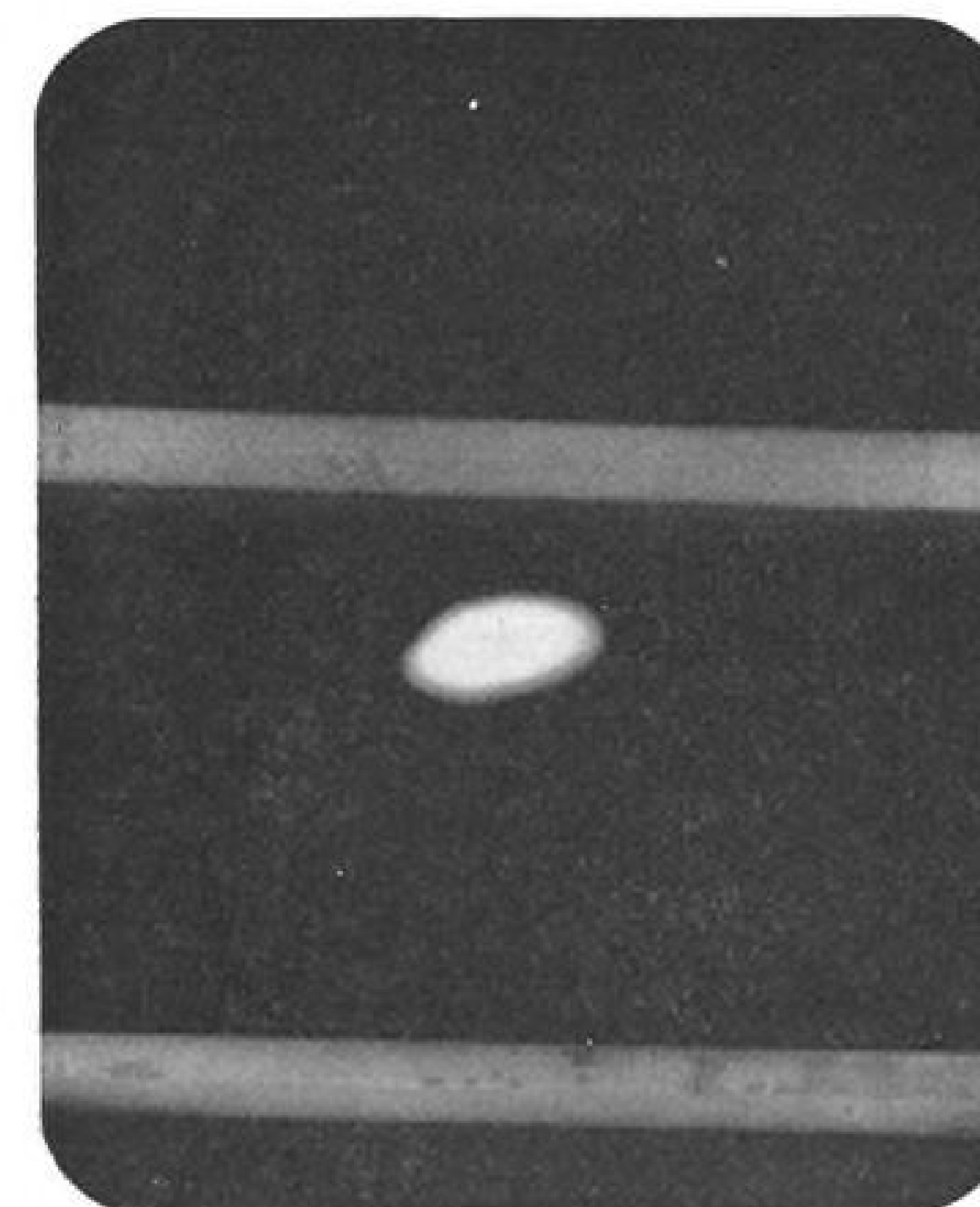
► **Steward-Davis, Inc.**, Gardena, Calif., has received a \$200,000 contract to update 1,425-hp. Wright R1820-C9HD engines for installation on Lear Learstar business and executive plane conversions.

► **Scott Atwater Manufacturing Co.**, Minneapolis, has acquired controlling interest in Gray & Hulegard, Inc., Los Angeles, which does research and development on devices for aircraft and the armed forces, such as actuators, electric motors, blowers, test instruments, generators, armament components, valves and control equipment.

**RADIOGRAPHY reveals...**



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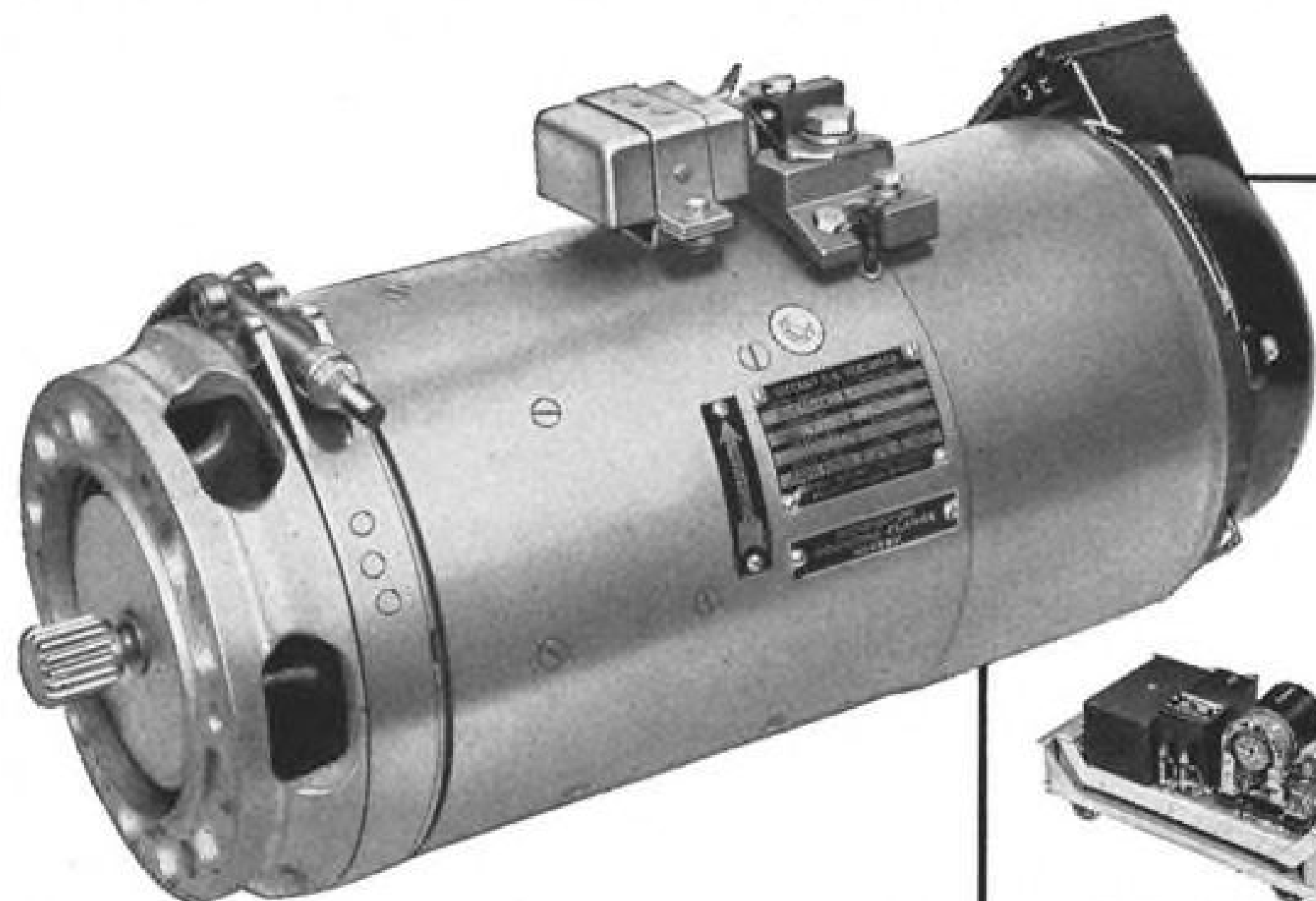
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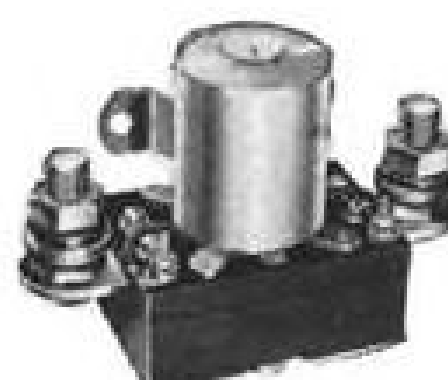
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1345	50	4000-8500	30,000	14.25	
30E22	50	4000-8500	30,000	16.25	
30E14	75	4000-8000	25,000	24.5	N75-2RA
30E16	100	2500-4500	50,000	40	52B6538
30E20	150	4000-8000	65,000	45	
30E17	200	2870-8600	Ground Power	40	
30E07	200	3000-8000	50,000	45	AN-3632
30E18	200	4000-8000	50,000	38	MS-25009
30E19	250-350	1600-7500	Ground Power	98	
30E02	300	3450-8500	25,000	64	
30E15	300	4000-8000	50,000	50	AN-3623
30E05	400	3000-8000	50,000	68	AN-3634
30E10	400	3100-8000	60,000	67	AN-3624
30E11	500	4000-8000	50,000	75	
30E13	500	3500-8000	50,000	86	

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## AVIONICS

New Techniques May Show Designers . . .

# How to Predict Equipment Reliability

By Philip Klass

In the near future designers should be able to predict the reliability of new electronic equipments while they are still in the drawing board or bread-board stages, M. M. Tall told the recent National Symposium on Quality Control and Reliability in Electronics, held in New York (AVIATION WEEK Jan 31, p. 51). This is a result of work in progress at the Vitro Corp.

Extensive analysis of field failures in Navy shipboard electronic equipment, under BuShip sponsorship, indicates that guide lines which Vitro is developing to predict reliability will account for more than just the number of tubes and components used in an equipment.

The type of component and how it is used also will be important determinants in assessing equipment reliability in advance, Tall said. (V. Harris of Vitro co-authored the paper.)

► **Revealing Findings**—Analysis of 15 types of shipboard radar, communications equipment and sonar, widely used in the fleet, reveals that:

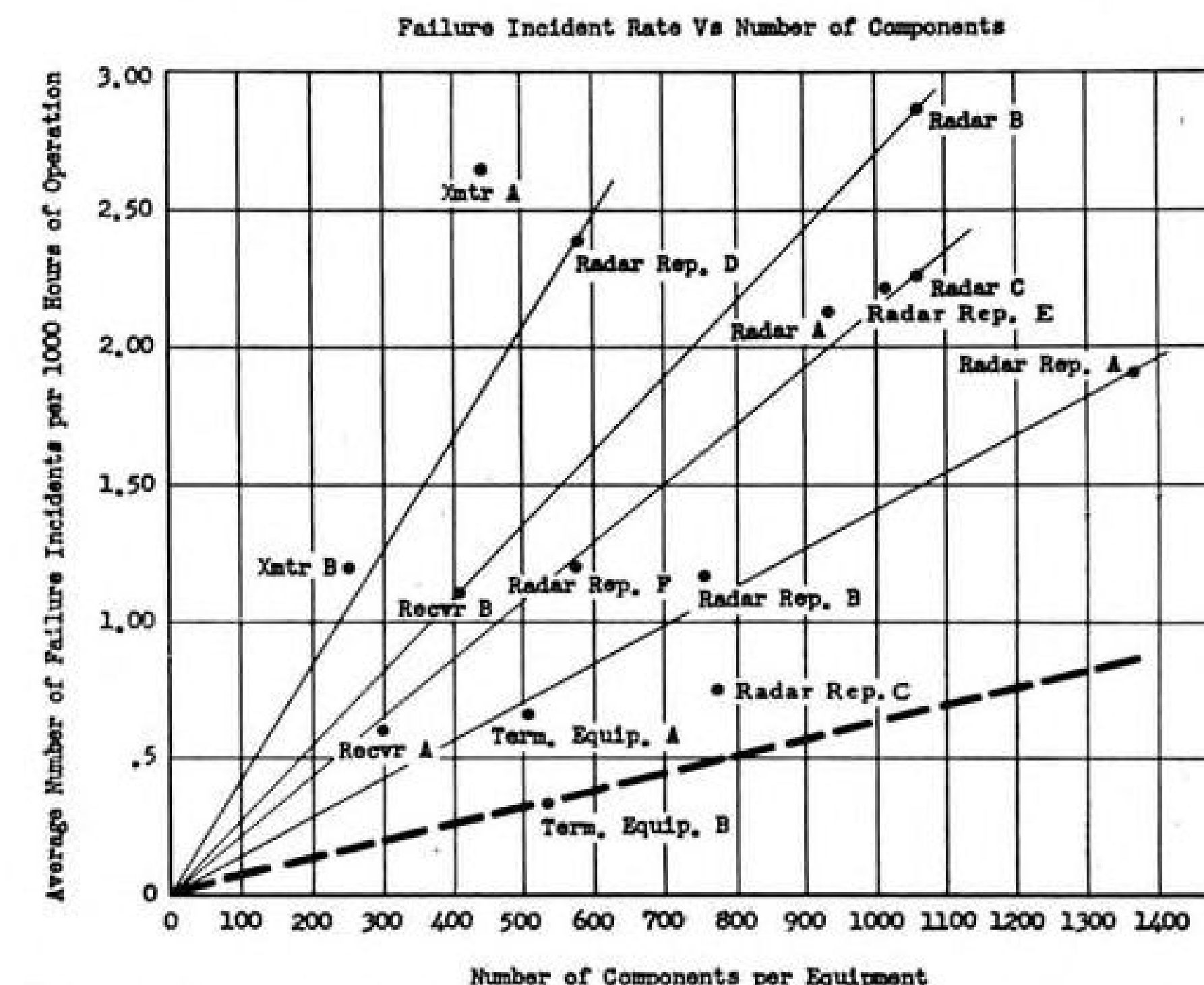
- 2% of the resistor applications are responsible for approximately 57% of the resistor replacements.
- 1% of the capacitor applications account for about 30% of the capacitor replacements.

This indicates that equipment reliability could be greatly improved merely by preventing or correcting the causes of failure of a relatively few number of components.

► **Numbers Not Everything**—The Vitro data also provides convincing evidence that the number of components used in an equipment, while an important factor in determining its overall reliability, is not necessarily be the deciding factor. Comparing various types of equipments on the basis of the number of failures per tube used, or per component used, reveals that:

- One transmitter type suffered 18 times more failures than a teletype equipment, per tube used. On a per-component-used basis, the transmitter suffered 10 times more failures.
- One teletype equipment failed twice as often as another functionally similar teletype unit on both a per-tube and a per-component basis.

This is underscored by a plot of equipment failure rates as a function of the number of components used in



**FAILURE RATE** of 15 electronic equipments plotted against number of components used indicates a direct relationship, yet shows other factors influence reliability.

each type, as shown in the graph on this page.

Radial lines are drawn through the origin to represent equal levels of failure rate per 100 components. The fact that several equipments group themselves along any one radial, indicates the strong influence of the number of components used on overall equipment reliability.

However, the fact that all equipments do not lie along a single radial shows that there are other important factors to be considered. For example, radar repeater D has roughly the same number of components as repeater F, yet it suffers twice the failure rate.

► **Digging Deeper**—Further analysis shows that even within a single type of equipment, there is considerable variation in component failure rates in different portions of the equipment, Tall reported. For instance, in one receiver type, there were 60 times more capacitor replacements in the power supply than in the IF/AF section, and 13 times more than in the preselector.

Vitro considered the possibility that different failure rates between equipments might be due to different operating environments. However, this was rejected as a factor because all were widely used in the fleet and were sub-

jected to essentially the same shipboard environment, Tall said. Nor was there any evidence that varying failure rates were due to different ages of the equipments involved.

Vitro's program and analysis is based on data obtained from more than 45,000 Navy electronic failure reports, plus detailed information provided by company engineers aboard aircraft carriers and at shore installations, Tall said.

► **A Few Culprits**—Tubes, resistors and capacitors, which represent only 75% of the component population in the equipments studied, account for about 95% of the replacements, Tall said. He concluded that the number of components responsible for high failure rates is "always small compared to the total number of components in the equipment."

These few culprits Vitro terms "selective" replacements, in contrast to "random" replacements which represent the normal level to be expected in a particular equipment type.

Random replacement rates themselves may vary considerably between equipments, depending upon such things as the internal ambient temperature. For example one receiver, whose random resistor replacement rate was more than twice that of any other



equipment surveyed, is the only one which has no ventilation provisions, Tall said. As a result, resistor body temperatures measured in this receiver were above the average for those in other equipments.

The selective, or abnormal-type component failures which Vitro has investigated so far have been found to involve poor design practices, such as critical circuitry or high body temperature. The latter may be due to poor internal ventilation which fails to cool the critical component, or else to its use at too high a percent of its rated power or voltage.

► **Cutting Failure Rates**—The major role which the selective-type component failures play in raising equipment failure rates is illustrated by two examples:

• One transmitter model suffered a very high rate of 2.58 failures per 1,000 operating hours, primarily because of excessively high failures of 2C39 tubes. If this one source is excluded, the figures for the same transmitter would show a failure rate of only 1.02 failures per 1,000 hours, making it comparable in reliability to another transmitter with only half as many components.

• A redesigned version of a radar repeater suffered only one-third as many failures as the original model. If malfunctions caused in the original model by selective-type failures of composition resistors are excluded, the two have nearly equal failure rates.

► **Percent of Rating Important**—Vitro's analysis confirms on a quantitative basis what most electronic designers have long suspected on an intuitive basis: that the life of components is a direct function of their actual operating voltage or dissipation relative to their rated values.

For example, analysis of limited data indicates that 0.5-watt carbon resistors suffer the following failure rates during a 5,000-hour operating period:

- 0.06% at 0 — 25% rated dissipation.
- 0.21% at 26 — 50% rated dissipation.
- 0.32% at 51 — 75% rated dissipation.
- 1.50% at 76 — 90% rated dissipation.

These figures exclude selective-type failures and secondary failures caused by the malfunction of another component.

An analysis of capacitor failures shows similar trends (see chart).

► **Program Continuing**—Continued work at Vitro since the paper by Tall and Harris was written has provided additional data which confirms the earlier conclusions, Tall has told AVIATION WEEK. The analysis of component failures as a function of their application and operating point relative to

rated value has been expanded to include data from seven different types of equipment, instead of the three which Tall reported on to the symposium.

Tall is optimistic that the Vitro studies will provide the first quantitative relationship between equipment design and failure rate. The company

expects to complete its BuShips program this summer and make public its results at that time.

Although shipboard environment generally is less rigorous than that found in highspeed aircraft and missiles, the data should nevertheless prove extremely useful to designers of airborne avionics.

## Resistor Failure Rates

(0.5-watt carbon composition resistors)

EQUIPMENT MODEL	PERCENT OF RATED DISSIPATION	RESISTOR SAMPLE	NUMBER OF FAILURES	5,000-HOUR FAILURE RATE (PERCENT)
Xmtr B.....	Up to 25	23,265	11	.09
	26-50	4,935	10	.40
	51-75	775	0	.00
	76-90	0	—	—
Recvr A.....	Up to 25	42,720	12	.03
	26-50	6,408	5	.09
	51-75	2,136	8	.33
	76-90	0	—	—
Radar A.....	Up to 25	23,360	11	.06
	26-50	1,760	2	.14
	51-75	480	1	.25
	76-90	160	2	1.50
Totals for the three models....	Up to 25	89,345	34	.06
	26-50	13,103	17	.21
	51-75	3,321	9	.32
	76-90	160	2	1.50

## Capacitor Failure Rates

CAPACITOR TYPE	EQUIPMENT MODEL	PERCENT OF RATED VOLTAGE APPLIED	CAPACITOR SAMPLE	NUMBER OF FAILURES	5,000 HOUR FAILURE RATE (PERCENT)
PAPER.....	Xmtr B	Up to 25	7,050	3	.08
		26-50	5,640	0	.00
		51-75	4,835	10	.39
		76-90	0	—	—
		91-100	1,410	4	.55
	Recvr A	Up to 25	2,136	2	.19
		26-50	1,424	5	.70
		51-75	2,136	4	.37
		76-90	0	—	—
		91-100	0	—	—
	Radar A	Up to 25	6,720	5	.09
		26-50	3,840	2	.06
		51-75	4,800	13	.33
		76-90	480	1	.25
		91-100	640	3	.76
CERAMIC (FEED-THROUGH TYPE)	Xmtr B	Up to 25	9,870	27	.53
		26-50	2,115	5	.46
		51-75	2,115	9	.83
	Recvr A	Up to 25	11,392	25	.26
		26-50	4,272	18	.50
		51-75	0	—	—
	Radar A	Up to 25	21,262	52	.38
		26-50	6,387	18	.49
		51-75	2,115	9	.83
	Totals for the three models	Up to 25	21,262	52	.38
		26-50	6,387	18	.49
		51-75	2,115	9	.83

SOURCE: Vitro Corp Study.

VITRO CORP. DATA, obtained from analysis of Navy failure reports, provides quantitative evidence that component life depends upon its conservative application.



## National Seamless Tubes "back-up the blast" of Navy Jet's guns



NATIONAL USS Stainless Seamless Tubes are being used as gun blast tubing on the F2H-3, a McDonnell jet interceptor. The actual gun openings shown on the photograph are castings. But directly behind them, mounted over the machine guns' muzzles, are the gun blast tubes.

The job of the blast tube is to restrain high pressures caused by the firing of the gun, and to prevent the backflow of muzzle gases into the plane itself. These gases are highly explosive, and must be kept from the inside of the plane.

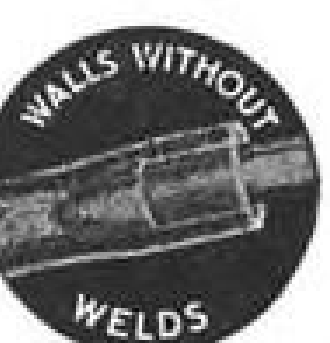
Previously, the 1 1/8" OD x 1 1/8" ID gun blast tubes were machined from bar stock. National Seamless Tubing, however, pierced from solid billets of USS Stainless Steel affords the absolute uniformity of wall strength required for such a heavy-duty application.

Shelby Seamless Tubing, made by National Tube, is ideal for all types of aircraft applications—landing gears, engine mounts, wing spars, longerons, fuselage struts, tail assemblies, etc. Shock-absorbent Shelby Seamless combines to the highest degree the desirable qualities of strength, safety and workability. It is uniform throughout and dimensionally accurate, possessing excellent machining and superior welding properties. Available in a wide range of diameters, wall thicknesses, various shapes and steel analyses, Shelby Seamless is produced to exacting standards by the world's largest manufacturer of tubular steel products. Bring your tubing problems to our engineers. They are here to help you.

NATIONAL TUBE DIVISION  
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(Tubing Specialties)  
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS  
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

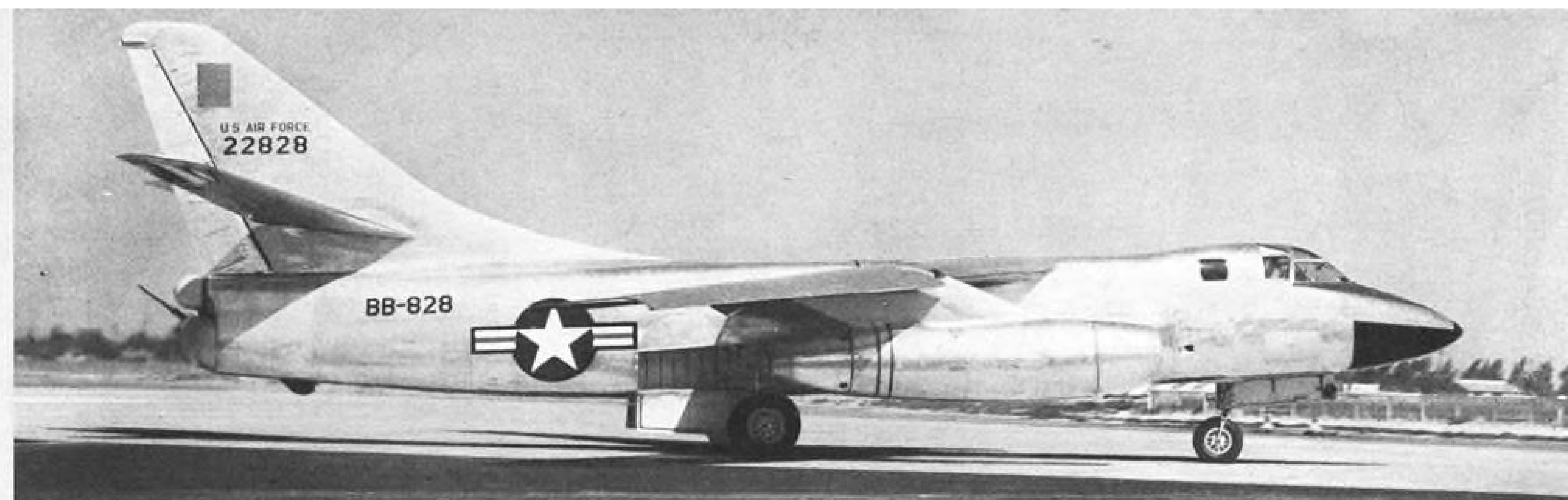


## SHELBY SEAMLESS Aircraft Tubing



UNITED STATES STEEL





Side view of bomber shows sleek lines. It is first production aircraft to have an elevated ambient temperature a-c electric system.

## Latest Air Force bomber has new G-E engineered power-generating electric system

**NEW GENERAL ELECTRIC ENGINEERED SYSTEM MEETS DOUGLAS B-66 OPERATIONAL DEMANDS FOR HIGHER AMBIENT TEMPERATURES**

A new a-c electric power-generating system has been developed by General Electric, and is now operating on the Air Force's newest light bomber, the Douglas B-66. The system consists of three major components: high-efficiency alternators, static voltage regulators, and generator control and protective panels.

### DESIGNED FOR HIGH PERFORMANCE AIRCRAFT

With a generator that can operate at high ram-air temperatures of high speed flight, the new G-E system is designed for long life and reduced maintenance time. Its static voltage regulator has no moving components to wear out, and under laboratory testing it has withstood 5000 hours of operation without maintenance.

Regulation is preset, and requires no pilot adjustment of voltage or load division. The control panel supplies the automatic control of start-up, shut down, and maximum

protection against ground fault, over and under excitation, and open phase.

### SPEEDS TAKE-OFF, SPARES PILOT

The new equipment begins operating as soon as the pilot starts the engine. The system contains only two toggle switches, which may remain "on" at all times, even when a fault develops. This eliminates a series of pilot functions and sharply reduces the time required to become airborne. Under normal conditions, fault clearing and resetting are fully automatic.

### SINGLE SOURCE FOR COMPLETE SYSTEMS

General Electric offers a single source for complete a-c or d-c power generating systems and constant speed drives for most aircraft. For more information, contact your nearest G-E aviation specialist, or write Section 210-92, General Electric Company, Schenectady 5, N. Y.

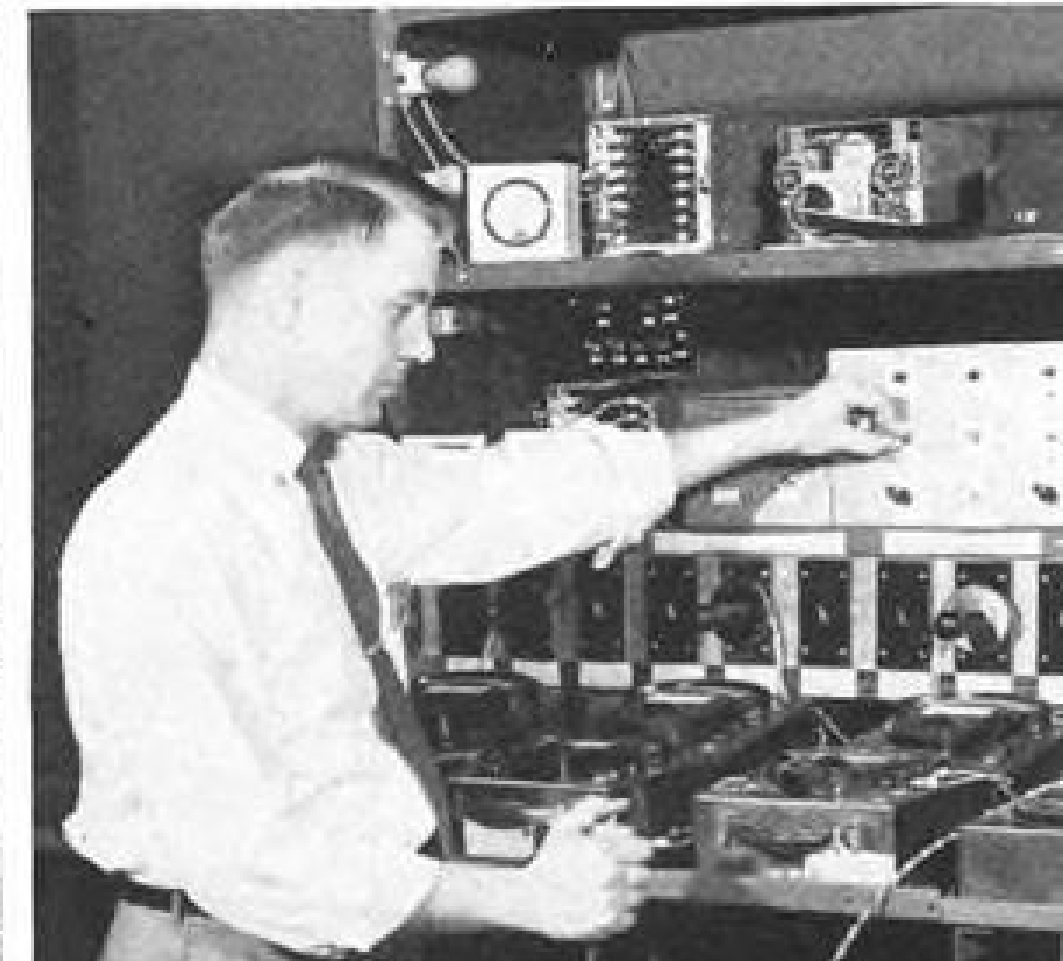
*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**

Static regulator (left) maintains constant alternator output voltage. Control and protective panel (right) helps locate and isolate faulty generation.

New G-E high-efficiency a-c generator has no harmonic over 1%; produces full rating when exposed to high temperatures in high speed aircraft.

Tests of system showed better protection against over voltage, over and under excitation, ground fault, anti-cycling, difference current, and open phase.



Douglas B-66 takes off at Long Beach, California, for its test run. Its electrical system was designed by G-E application engineers to deliver rated load with 80° C cooling air.

**GENERAL  ELECTRIC**





1922 — Roll-out of a Boeing-built fighter

1954 — Roll-out of America's first jet transport, the Boeing 707

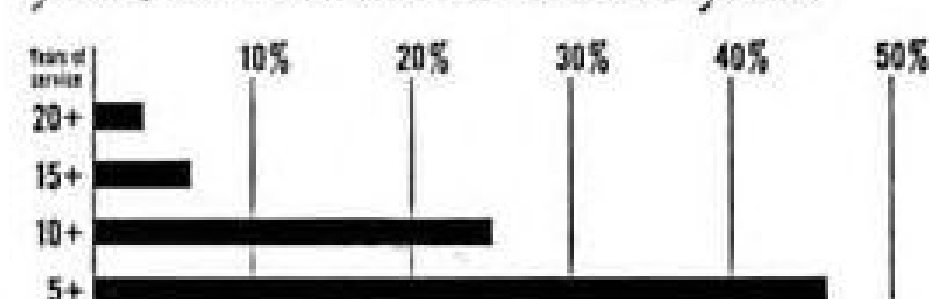
## Engineers—you can grow with Boeing

New career opportunities continue to open up at Boeing—as they have for the last 38 years. You can find direct application for your education and experience—in Research, Design or Production.

At Boeing you'd work with engineers who developed: The world's first all-metal, 3-mile-a-minute commercial transport. The first pressurized airliner. The first effective four-engine bomber (the B-17). Today's fastest operational bomber (the six-jet B-47). The even more advanced B-52 eight-jet global bomber, and the 707, America's first jet transport. Boeing engineers continue to design "years ahead," doing research on nuclear-powered aircraft and supersonic

flight. They are also developing a new Air Force defense weapons system, based on the Boeing F-99 Bomarc pilotless interceptor. These long-range programs project Boeing progress far into the future.

One measure of the satisfaction of Boeing careers is given in the chart below. It shows that 46% of Boeing engineers have been with the company for five or more years; 25% for 10 or more years; and 6% for 15 or more years.



Here are other advantages: Boeing promotes from within and holds regular merit reviews to assure individual recognition. Engineers are encouraged to take graduate studies while working and are reimbursed for all tuition expenses. Of technical graduates at Boeing, 28% hold Mechanical Engineering degrees, 24% Electrical, 19% Aeronautical, and 9% Civil. The remainder is comprised of other engineering graduates, physicists and mathematicians.

For full Boeing career information, send résumé of your educational and experience background to:

JOHN C. SANDERS, Staff Engineer — Personnel  
Boeing Airplane Company, Dept. C-9, Seattle 14, Wash.

**BOEING**  
SEATTLE, WASHINGTON WICHITA, KANSAS

## AERODYNAMICIST

Conduct analysis and studies in performance, stability, control and dynamics data on current and future Navy carrier based aircraft. Set-up and conduct subsonic and supersonic wind tunnel programs and correlate results for aerodynamic design and loads. Assist in developing analysis procedures and data for advanced designs. Conducts studies and advises design groups of related problems. AE or ME plus 5 years minimum aircraft experience.

## THERMODYNAMICIST

Conduct analysis of internal airflow systems, establish optimum design for power plant installations in advanced models. Calculate and reduce basic data and flight test results to establish engine performance and complete speed and altitude range. ME or AE plus 4 years minimum aircraft or related power plant experience.

## DYNAMICS ENGINEER

Apply analysis and experimental methods for solving aircraft flutter and vibration problems. Be familiar with aero-elastic theory as applied to aircraft structures, and capable of establishing procedures for handling dynamic problems and tests. Applicable University degree plus 5 years applied experience.

Write or apply  
Engineering Personnel Office Dept. A

**NORTH AMERICAN AVIATION**  
Columbus 16, Ohio

## MODEL DESIGN AND CONSTRUCTION SUPERVISOR

Design and construction experience in all types of aircraft test models for aerodynamic tunnel tests, aeroelastic and flutter tests, special free flight tests, etc. Knowledge or required instrumentation techniques and equipment, familiarization with model requirements for representative low and high speed wind tunnels, and specific knowledge of precision model construction machinery and techniques. Full responsibility for operation of expanding group. Minimum of engineering degree equivalent plus 6 years or direct experience.

Write or apply

Engineering Personnel Office Dept. A  
**NORTH AMERICAN AVIATION**  
Columbus 16, Ohio

## FILTER CENTER

►How Much Avionics in Missiles?—AVIATION WEEK has obtained a Defense Department answer to a question frequently raised by the avionics industry because budget figures do not show a breakdown of anticipated avionics procurement for guided missile use. Development cost of avionics guidance and control equipment will average 40-50% of the total cost of missile development. In production, avionics guidance and control averages 35% of total missile cost. Figures will naturally vary for individual missile types depending upon their guidance system.

►Digital Autopilot Under Test—Wright Air Development Center is evaluating a single-axis digital autopilot developed by the J. B. Rea Co., Santa Monica, Calif. (AVIATION WEEK May 17, 1954, p. 44). Company has contract to build a flyable three-axis model.

►New High-Scan-Rate Radar Antenna—Ingenious type of tracking radar antenna which scans the target at 300 "looks" per second by means of multiple lobing techniques, has been developed by Sanders Associates, Nashua, N. H. Novel feed mechanism provides dynamically balanced, low-inertia antenna dish, despite higher scan rates.

►Airline Avionics Grows—By 1958, airliners are expected to be equipped with \$80,000 worth of avionics equipment, weighing more than 750 lb., compared to figures of \$33,000 and 580 lb. for current airliners, according to the Air Transport Assn. Figures presumably are based on larger four-engine aircraft. New equipments which will be responsible for the increase include airborne storm-warning radar, ATC transponders (radar beacons), and possibly DME and Selcal (selective calling equipment).

►Gen. Kelsey to Talk to PGANE—Brig. Gen. Ben Kelsey, USAF Deputy Director of Research and Development, Office Deputy Chief of Staff, Development, will be the speaker at the New York luncheon of IRE's Professional Group on Aeronautical and Navigational Electronics. Luncheon will be held at the Waldorf-Astoria on Mar. 22, during national IRE convention.

►HAC Abandons Data Processing Plans—Reliable reports say that Hughes Aircraft has decided to abandon earlier plans to enter the industrial and commercial electronic computer and data processing fields because of present heavy military commitments. —PK

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of the  
Corporal  
Guided  
Missile.



## JET PROPULSION LABORATORY

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of electronics and physics  
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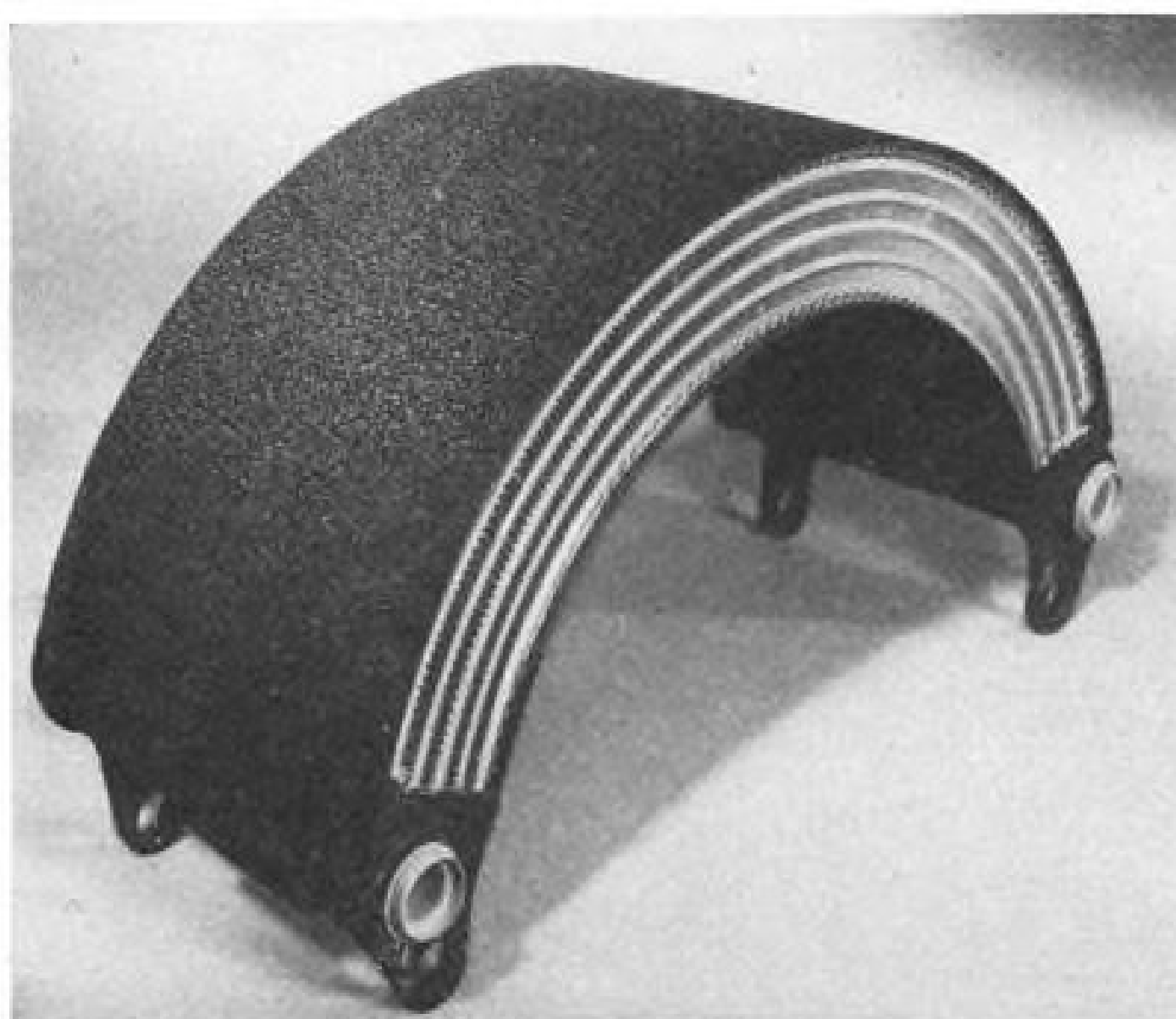
The nation's foremost guided-missile research and development facility, established in 1940, offers exceptional opportunity for engineers and research scientists in the fields of guidance and control, information theory, computers, electro-mechanical devices, instrumentation, and related aspects of electronic research. The Laboratory offers an ideal blend of academic and industrial environments and maintains a high level of technical competence. Attractive salaries are offered.

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opportunities and activities  
at the Laboratory will be  
sent upon request.

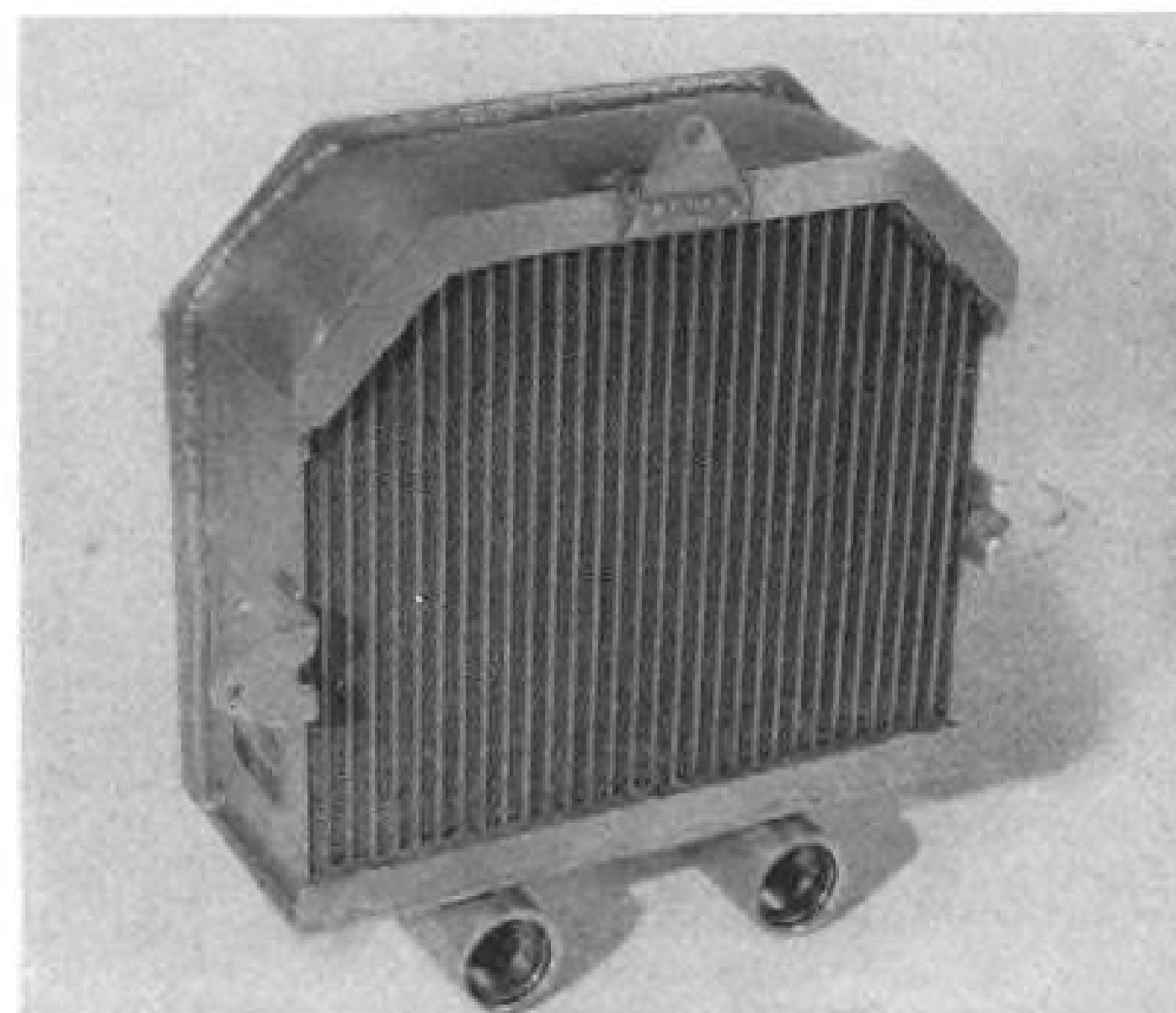
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## EQUIPMENT



**AIR-TO-OIL HEAT EXCHANGER** developed by UAP for cooling Sundstrand Drive lubricating oil on the B-47.



**TOPPING-OFF HEAT EXCHANGER** supplements engine oil cooler. It uses ram air as coolant. Weight is 8.6 lb.

## New Units Solve Tough Cooling Problems

By George L. Christian

Dayton—United Aircraft Products' developments are going into a growing list of new jet engines and military aircraft.

UAP-designed and -built Hi-D (high-density) coolers and other equipment, for instance, are used on Pratt & Whitney's J75, General Electric's J73 and J79, and Allison's J71. UAP units are going into such first-line production jets as the McDonnell F-101 Voodoo, the Grumman F9F-9 Tiger, the Boeing B-52 Stratofortress. In addition, installations are called for on the Convair B-58 Hustler, the Republic F-105, the Chance Vought F8U.

Because of the success of their light and small Hi-D units, UAP's technicians, under chief engineer Frank Carroll, are now busy designing applications for use in the missile field.

► **Expanding Applications**—Edward L. Ladd, the company's executive vice president, says the relatively small-size, lightweight Hi-D cooling equipment compresses the size and weight of a standard heat exchanger five or six times, with no sacrifice in efficiency.

Hi-D heat exchangers have now been married to the evaporative cooling principle to produce a still more efficient and compact heat exchange package, use of which is expanding into several new fields.

Among United's application of Hi-D-plus-evaporative-cooling are small, expendable fluid heat exchangers for avionic guidance systems for guided mis-

siles; "topping off" heat exchangers to supplement engine oil coolers; and auxiliary coolers for air-cycle refrigeration systems to boost the latter's output.

► **Evaporative Cooling**—Big point in favor of evaporative cooling is that water, cheap and available almost anywhere, is a very effective boil-off fluid. UAP officials say you can dissipate over 1,000 Btus./lb. of water boiled off.

On missiles, ordinary tap water can be used because short duration of flight cancels out effects of deposits in the evaporative cooling system. For sustained flights on piloted aircraft, where the system will see continuous use, distilled water could be used. The familiar problems of weight and space, plus necessity of keeping the water from freezing, will have to be faced, though.

United is looking into the desirability of other liquids, including ammonia, ammonia and water, alcohol, alcohol and water, and the various freons.

Water is good, but not all-purpose. Where low temperatures are required at low altitudes, other fluids are better. Where low temperatures are required in general, other fluids are required.

► **Into Systems**—Another new development here is UAP's entry into the field of complete temperature control systems; previously the company had produced only individual components to be incorporated with other units and controls into complete systems.

One recent UAP product is a system to control closely—control could be as tight as  $\pm 1^\circ\text{F}$ —temperature of avionic

equipment, components or other heat-producing airborne devices which need precise heat control.

Among aircraft incorporating UAP-developed systems are the Boeing B-52, Fairchild C-123B, Grumman SA-16 and the Piasecki H-21 helicopter.

► **Hi-D Definition**—United officials do not reveal details of the Hi-D principle. Here is what they do say:

"A more efficient geometry of heat exchange surfaces gives a higher coefficient of heat transfer in a Hi-D unit while a higher density core provides more heat exchange area for a given volume of unit."

Hi-D heat exchangers were initially developed as liquid-to-liquid oil coolers for jet engines (using fuel flowing to the combustion chambers to cool engine oil). Purpose was to fill a basic and urgent turbojet engine need—higher oil cooling capacities (as engine oil temperatures rose with increasing thrust) without going to unacceptably large envelopes and high weights.

► **Saves Weight & Space**—Hi-D coolers accomplish this job successfully. For example: On a typical jet engine installation, a Hi-D unit with a dry weight of 4 lb. and a wet weight of 6 lb. replaces a standard unit weighing 18.5 lb. dry and 27 lb. wet. A sixfold space saving of approximately 585 cu. in. is realized by replacing a 720-cu. in. envelope with a 135-cu. in. envelope. Both heat exchangers are of the same capacity.

Weight saving of the Hi-D units is so great that stainless steel units can re-

plant with a  
one-track mind...



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a practical approach  
to pressroom modernization

# Announcing

## TWO NEW PLANS

### to solve press obsolescence problems

The extensive capital expenditures required to meet competitive pressures have put many manufacturers in an unfortunate position. Modernization is necessary if the manufacturer is to price his product competitively and still make a fair profit. However, the fair profit is necessary before he can afford the modernization. Two new Verson plans make it possible to modernize now and pay for it out of the increased profits it provides. If you are one of the manufacturers faced with the dilemma of needing modernization for better profits, but needing better profits before you can afford modernization, one of these plans may be the answer to your problems.

### Customized INSTALLMENT PROGRAM

For the manufacturer who wishes to own his own presses but minimize his initial capital outlay, Verson offers a Customized Installment Program. It is called "Customized" because the payment plan is tailored to the buyer's own financial requirements rather than to a single fixed plan. Initial payments may be as low as 10 per cent of the purchase price with the balance payable over periods ranging from six months to five years. Further information on a plan to meet your needs will be furnished on request. Please outline your requirements.

### Customized LEASING PROGRAM

For the manufacturer who wants the advantages of modern, efficient presses without capital investment, Verson offers a Customized Leasing Program. Like the Installment Program, a choice of plans is available to best suit the buyer's requirements. In addition to the basic plans, options for continuation, termination and eventual purchase are also available. Special arrangements for special machines will be considered. Further information on a leasing plan to suit your needs will be furnished on request. Please outline your requirements.

A Verson Press for every job from 60 tons up.

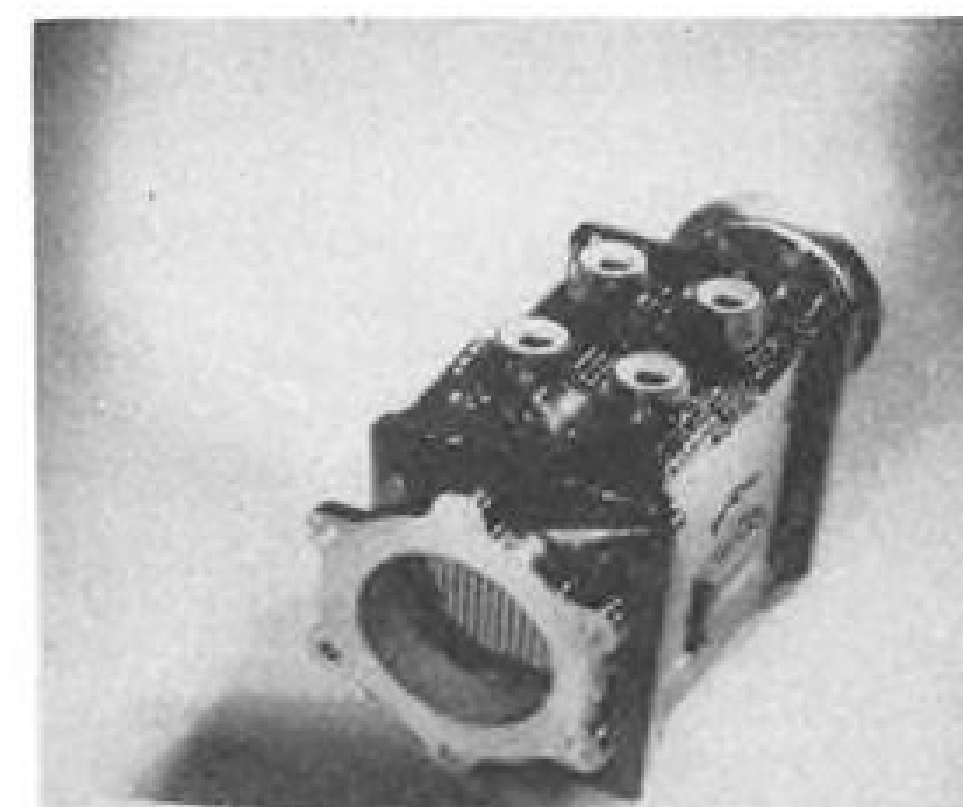


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**HYDRAULIC FLUID** unit on McDonnell F-101 Voodoo cools two individual hydraulic circuits. Engine fuel is used as the coolant.

place aluminum coolers and still be lighter.

► **Cooler Applications**—This list of engines and aircraft which mount Hi-D coolers shows the units' acceptance:

• **Engines.** J35 (Allison); J47 (GE, Packard, Studebaker); J57 (P&W, Ford); J65 (Wright, Buick); J67 (Wright); J71 (Allison); J73 (GE); J75 (P&W); J79 (GE).

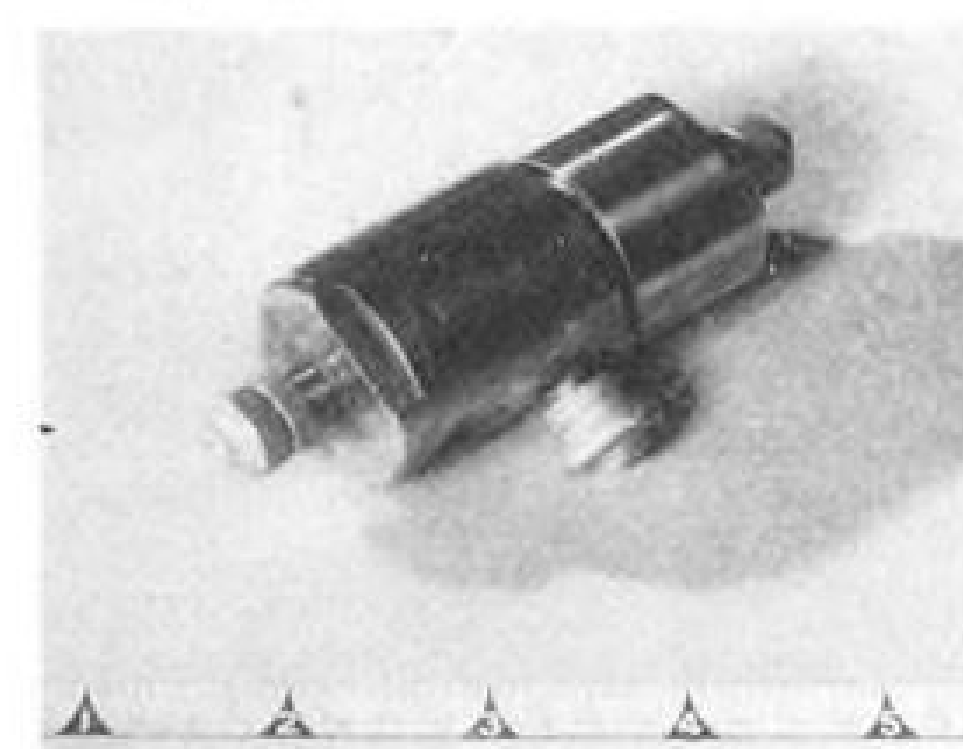
• **Aircraft.** Convair B-36 and B-58; Martin B-57; Boeing B-47; North American FJ-2 and -3; Chance Vought F8U; Lockheed F-104; McDonnell F-101; Republic F-105; Douglas A4D and B-66, Bell H-47 helicopter.

► **Missile Coolers**—United's missile heat exchangers are expendable Hi-D-plus-evaporative-cooling systems. They will be essentially free of environment effects (speed, altitude, temperature).

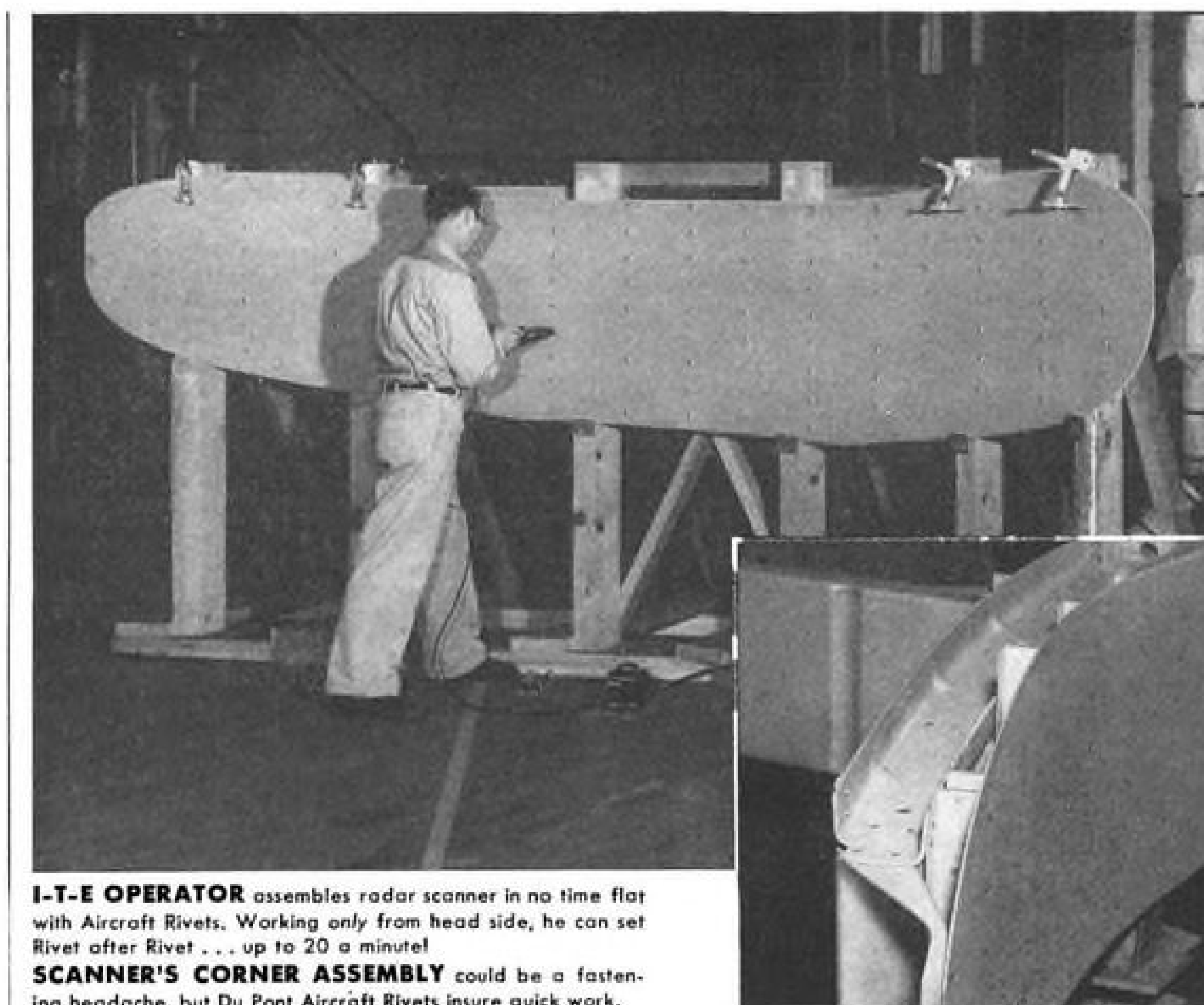
The packages are being designed with emphasis on simplicity, trouble-free service through use of few moving parts, and economical use of boil-off fluid. Yet they will give extremely accurate temperature control. United has missile systems in various stages, all the way from initial design and layout to prototype and pilot production.

These systems have more than just aircraft and missile applications—other uses are in trailers, shelters and ship-board installations.

► **Topping-Off Coolers**—Jet flight at extremely high altitudes has brought with



**DRAIN CHECK VALVE** stops water-alcohol leak through actuator at engine shutdown. It also acts as a pressure relief valve.



**I-T-E OPERATOR** assembles radar scanner in no time flat with Aircraft Rivets. Working only from head side, he can set Rivet after Rivet... up to 20 a minute! **SCANNER'S CORNER ASSEMBLY** could be a fastening headache, but Du Pont Aircraft Rivets insure quick work.

## Speeding blind fastening for electronic eyes

### ANOTHER ASSEMBLY PROBLEM SOLVED WITH DU PONT RIVETS

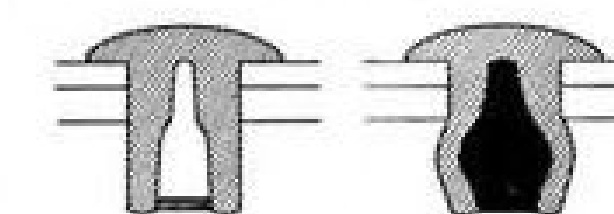
**FIRM:** The I-T-E Circuit Breaker Co. of Philadelphia, engaged in manufacturing radar scanners.

**PROBLEM:** Assembling the scanner, with its dozens of blind applications, hard-to-get-at and tight-squeeze spots. This could be a painstaking, long-drawn-out operation.

**SOLUTION:** I-T-E chose Du Pont Aircraft Rivets to do the job, and these split-second fasteners have cut assembly time to a minimum. Operators are setting as many as 20 a minute, with no after-finishing to slow the work. They simply insert them, expand them with heated iron—that's all it takes! A one-man, one-tool operation, 50% faster than conventional methods... the way to speed "problem" jobs!

Designed for both primary and secondary structural applications, Du Pont Aircraft Rivets can save you fastening time and money. Write for free 28-page booklet to: The Du Pont Company, Explosives Dept., Wilmington 98, Delaware.

#### HOW DU PONT AIRCRAFT RIVETS WORK



- 1. EXPLOSIVE RIVET** is inserted in drilled hole. Cross section shows cavity in shank containing minute explosive charge.
- 2. TIP** of electrically heated Du Pont Riveting Iron is applied to Rivet head, firing charge. Barrel-shaped head at shop end locks Rivets securely in place.

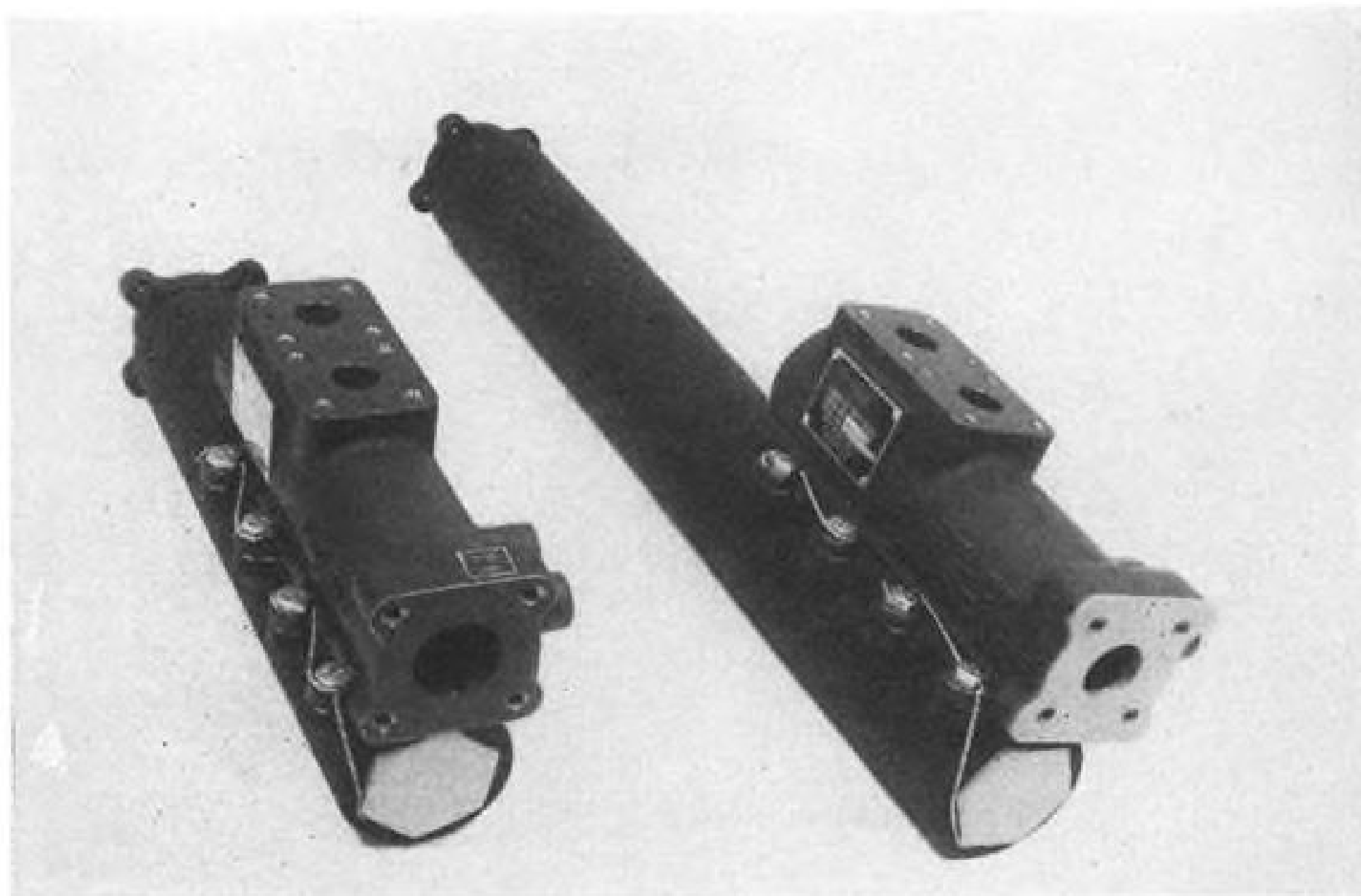
#### DU PONT AIRCRAFT RIVETS

A Product of Du Pont Research



BETTER THINGS FOR BETTER LIVING  
... THROUGH CHEMISTRY





**HI-D UNITS FOR GE'S J79**—Afterburner fuel-oil heat exchanger (l.) and main fuel-oil cooler (r.). Maximum heat dissipation is 850 and 2,200 Btu./min., respectively.

it cooling problems which no liquid-to-liquid coolers appear to be able to solve.

To supplement the performance of liquid-to-liquid heat exchangers at high altitudes (around 50,000 ft.), use is made of air-to-oil heat exchangers in series with liquid-to-liquid units.

The reason for the inability of the fuel-to-oil heat exchanger to cool the engine without aid under the new conditions is that fuel consumption decreases at altitude while heat rejection remains constant. Fuel is no longer available in sufficient quantities at altitude to use as a "heat sink."

The problem is further complicated when extremely high flight speed is coupled with high altitude, since this combination makes even air impractical as a heat sink (extremely low density coupled with rising temperature).

The solution of this problem seems to be use of an expendable heat sink carried in the plane. Water is extremely attractive for this application—it not only has a high latent heat of vaporization, but at altitude it will boil at a relatively low temperature.

UAP engineers believe that in at least two cooling applications (engine oil and crew quarters) their topping-off heat exchangers, using the Hi-D-plus-evaporative-cooling combination, will provide at least a temporary solution.

In UAP's engine oil system, the topping-off cooler is connected in series with the regular liquid-to-liquid cooler, boosting the latter's cooling capacity sufficiently to make the combined heat rejection of both coolers adequate to take care of current engine oil cooling requirements.

Air-to-oil topping-off coolers are now standard equipment on most late-model high-thrust turbojets, according to UAP. Addition of vapor-type heat exchangers should extend the engines' oil cooling system's maximum operating altitudes from about 50,000 ft. to somewhere above 70,000 ft. and permit an increase in Mach number, say UAP officials.

For crew quarter cooling, the topping-off heat exchanger is installed between the primary, air-to-air intercooler and the expansion turbine. This increases appreciably the cooling capacity of the aircraft's cooling system without undue weight or space penalty.

UAP builds two types of heat exchangers—tubular or plate-fin. Either may be used in liquid-to-liquid or air-to-liquid applications and either may serve as a cooler or a heater. The tubular type is supplied in either aluminum or stainless steel.

► **For Electronics Too**—Another new development among UAP's Hi-D cooling devices is a pair of electronic cooling packages designed specifically for such heat-producing electronic components as klystron tubes.

United claims its electronic cooling units "furnish the smallest possible means for dissipation of heat generated by modern electronic equipment."

• **U-514744-1** system consists of a compact package which is installed in a compartment where it depends on an air supply which must not exceed 135F at sea level or 68F at altitude.

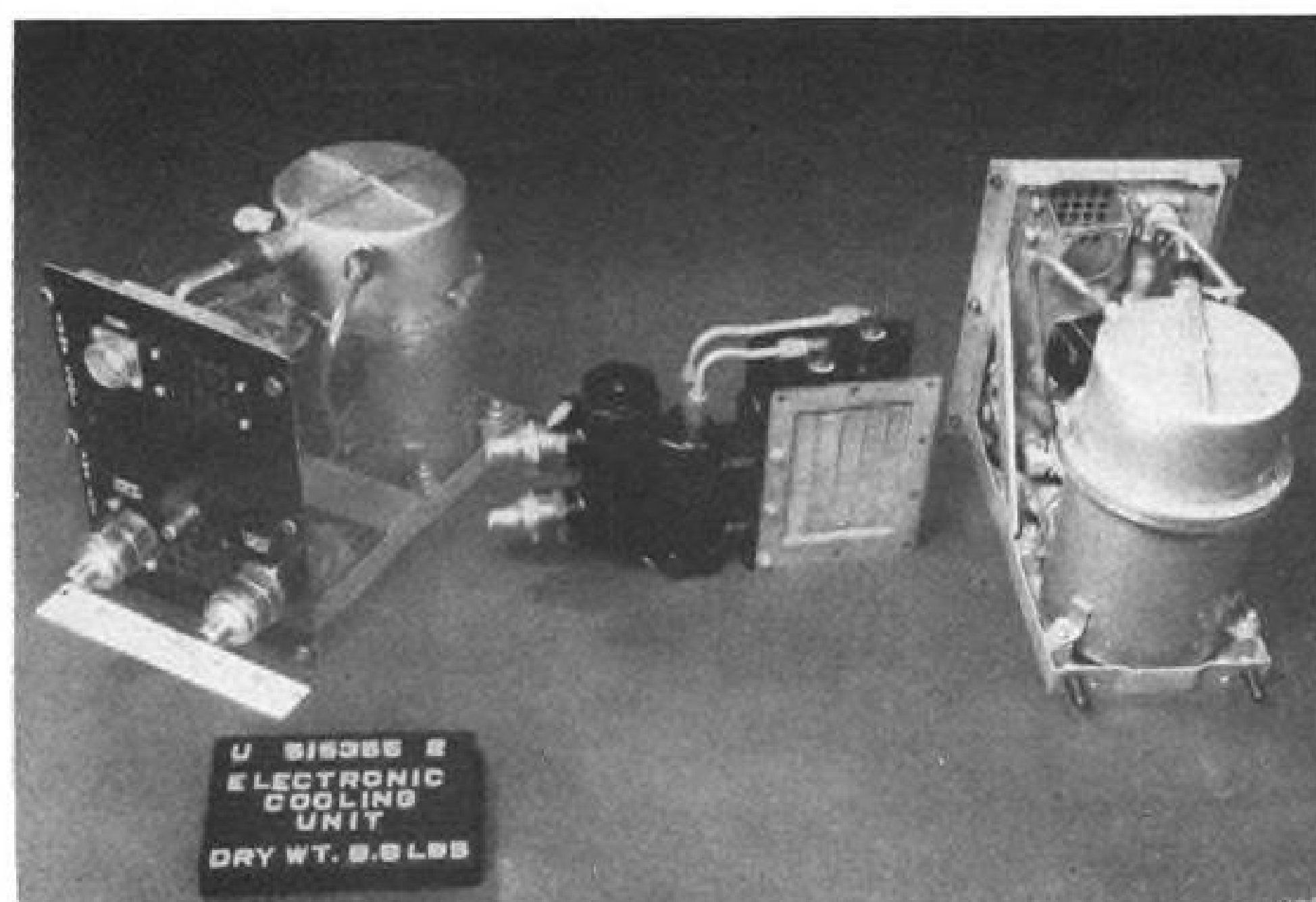
• **U-515355** system is basically the same, but has the added advantage of flexibility since the heat exchanger envelope is designed to be installed remotely from the packaged controls in such places as a ram air duct or a cooled air duct leading from refrigeration system (photo, below left).

These two units can withstand ambient temperatures from -80F to +200F in the inoperative state. And controls have been designed into the packages which prevent excessive pressures from rupturing any portion of the units which might damage the electronic equipment they are cooling.

To round out its electronic cooling packages, UAP has also developed units which incorporate both water boil-off and hydrous-ammonia evaporation systems.

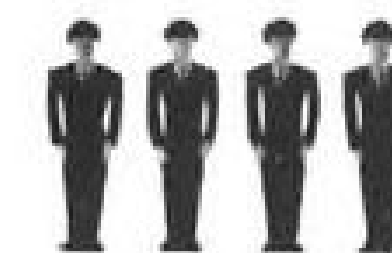
► **Other Products**—UAP produces many lines of aircraft equipment other than heat exchangers. Among them:

• **"Self-energized" metallic O-rings.** Designed for use in static installations, these O-rings are made of metal tubing with the ends butt-welded together. The self-energizing feature consists of drilling tiny holes in the ID of the ring. These act as ports, allowing sealed pressure to penetrate into the O-ring. This balancing pressure on the inner



**HI-D UNIT** (center) is installed remotely in this setup for cooling avionics equipment.

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—with the United States Air Force

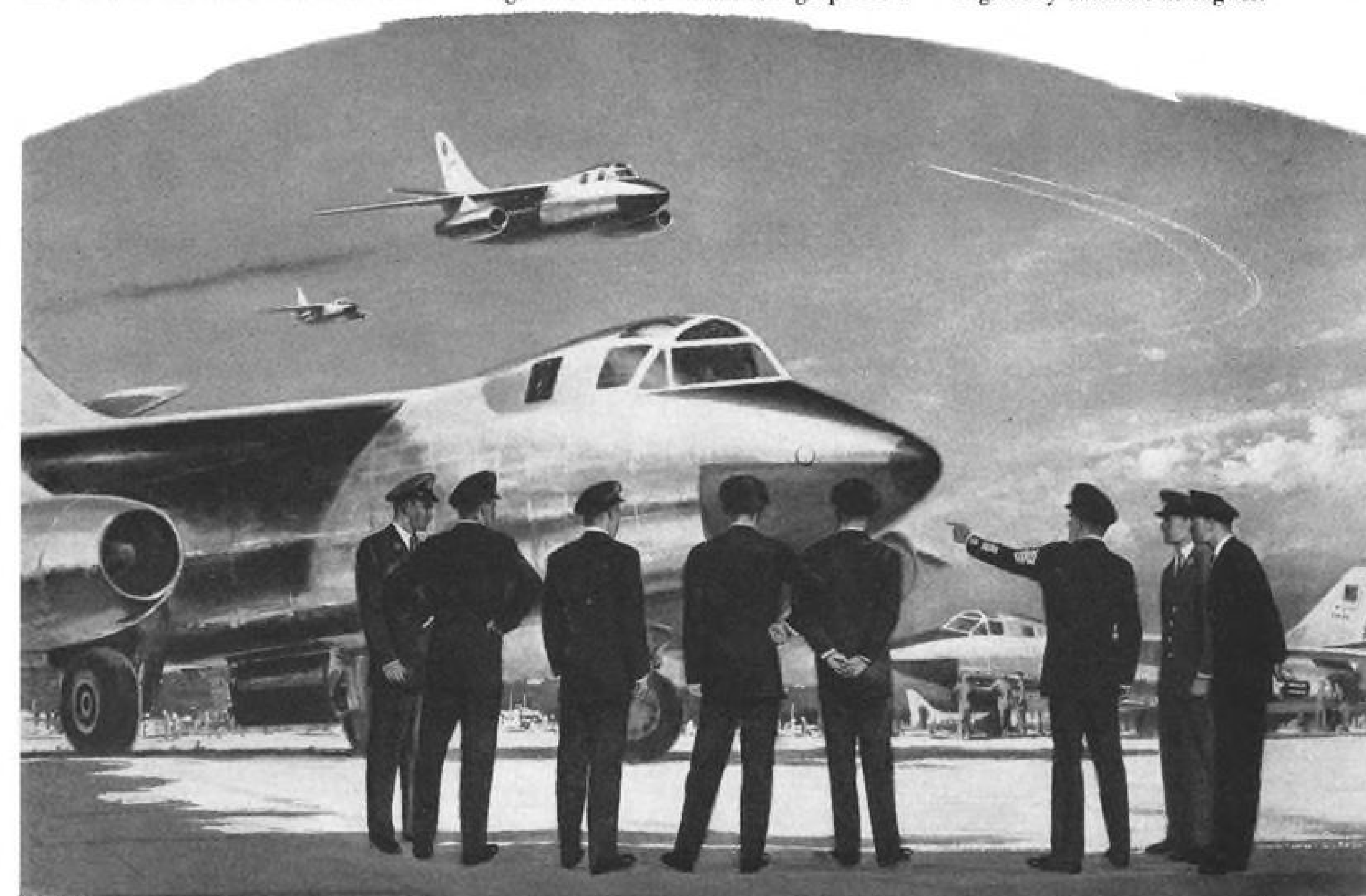
Deservedly the proudest young men of our day are those who have decided to enlist in the U.S. Air Force. They have a brilliant future in store.

Trained in the most efficient aircraft built—as pilots or in supporting roles—members of our Air Force enter an ex-

panding career. Realistically, their service offers opportunity to learn the specialized skills of the Age of Flight through on-the-job training and a chance to continue their educations through and beyond the college level. And, at an age when most civilians still grope for a

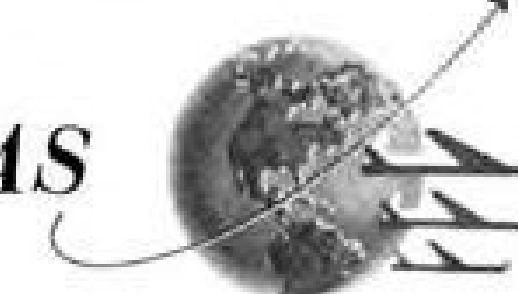
future, the man with the Air Force career is eligible to retire with a life income.

As a designer and builder of modern aircraft, Douglas is in a position to judge the skills developed by Air Force training. They couldn't be higher.



Student members of the U.S. Air Force study a Douglas RB-66

Depend on **DOUGLAS**



First in Aviation



# AWARD-WINNING POWER BEHIND



**NORTH AMERICAN'S F-100 (top) and DOUGLAS' F4D** share honors in the award of the Collier Trophy in 1954: Both are supersonic. The USAF F-100 Super Sabre holds the official world's speed record of 755.149 m.p.h., set in 1953, only a few weeks after the Navy F4D Skyray had hit 752.943 m.p.h. to bring the speed record back to the United States.



ONE OF THE DIVISIONS OF  
UNITED AIRCRAFT CORPORATION

# THE COLLIER TROPHY FIGHTERS

**Pratt & Whitney Aircraft's J-57 engine gives supersonic speed to the F-100 and the F4D**

With the 39th Collier Trophy award, America salutes two top jet fighters and the men most responsible for their design. The North American F-100 Super Sabre and the Douglas F4D Skyray are major achievements in aviation—and in U. S. Air Power.

Both Super Sabres and Skyrays are rolling from production lines to take their places in the nation's defense. And both are powered by America's highest-powered turbojet in quantity production—Pratt & Whitney Aircraft's J-57, winner of the previous Collier Trophy.

The Super Sabre and the Skyray are of a new generation of air power: a fighter generation designed from the beginning to utilize the tremendous thrust of today's high-powered engines. They are designed to fly and fight and climb supersonically . . . as their missions demand.

Pratt & Whitney Aircraft's J-57 is continuing to make its vital contributions to American air strength.



**THE MIGHTY J-57**—More than 10,000 pounds of thrust is provided by Pratt & Whitney Aircraft's J-57. After-burners increase this basic thrust tremendously for short periods of operation. The engine offers outstanding fuel economy and high acceleration, vital to fighter operations, in addition to the huge thrust needed for supersonic speed. A year ago Pratt & Whitney Aircraft's J-57 was the basis for the Collier Trophy award.

## Pratt & Whitney Aircraft

MAIN OFFICE AND PLANT: EAST HARTFORD, CONNECTICUT • BRANCH PLANTS: NORTH HAVEN, SOUTHLINGTON, MERIDEN  
In Canada: Canadian Pratt & Whitney Aircraft Co., Ltd.





Tail section of North American F-100

## vacuum-melted metals for "hotter" engines...

Vacuum-melted metals are breaking the "thermal-metal-barrier" of jet engine design. For they make possible higher engine operating temperatures, under conditions where conventional alloys fail rapidly.

Turbine blades of vacuum-melted superalloy, for example, were tested together with comparable blades of air-melted alloy. After 40 hours of operation the air-melted blades broke when bent less than 90° . . . the vacuum-melted blades took a full 180° bend without failure! For main shaft ball bearings, too, vacuum-melted metals far outperform conventional alloys.

Here's why . . . VACUUM MELTING LITERALLY SUCKS GASEOUS IMPURITIES FROM THE MOLTEN METAL...REMOVES INCLUSIONS AND GASSES THAT LIMIT

THE PERFORMANCE OF CONVENTIONAL AIR-MELTED ALLOYS. RESULT: PURER METALS WITH EXCEPTIONAL PROPERTIES . . . LONGITUDINAL AND TRANSVERSE UNIFORMITY . . . HIGHER CREEP AND STRESS RUPTURE STRENGTH...BETTER DUCTILITY AND FATIGUE STRENGTH.

Vacuum Metals Corporation, pioneer in the development and production of vacuum-melted and cast alloys, is producing these unique new metals designed for a wide variety of aircraft applications. If you have a metals problem that vacuum-melted alloys might solve, please describe it in as much detail as possible. Write *Vacuum Metals Corporation*, P. O. Box 977, Syracuse 1, New York.



# VACUUM METALS CORPORATION

Jointly owned by Crucible Steel Company of America and National Research Corporation

surface of the ring prevents it from collapsing.

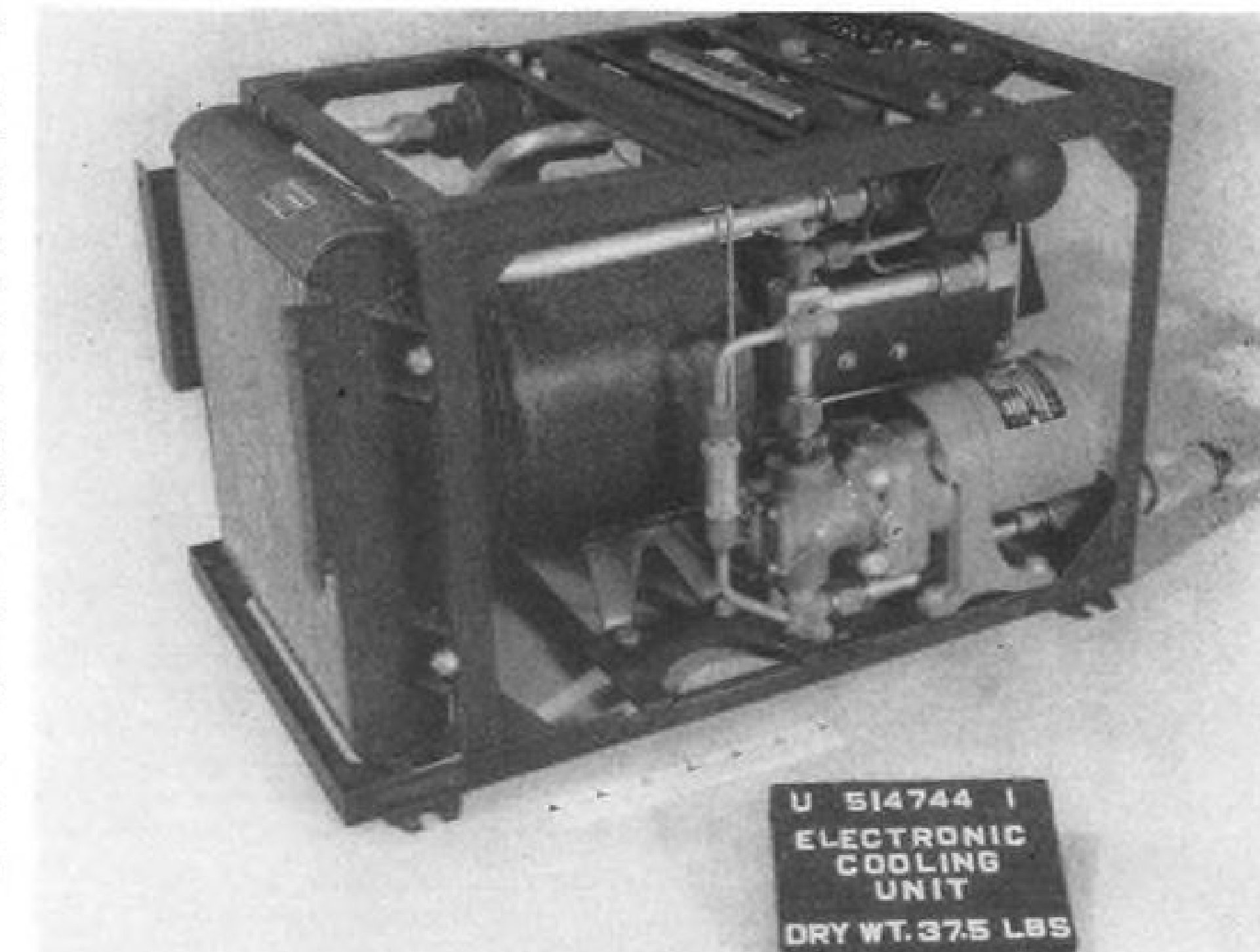
The metallic units can withstand very high temperatures, such as jet engine fuel at up to 1,200F, lubricating oil up to 600F, hydraulic fluid up to 550F, and combustion gases up to 1,800F. They are also good to -70F.

UAP says the rings are extremely resistant to corrosive liquids and gases such as are present in rockets and missiles. Furthermore, "the self-energizing metallic O-ring is capable of sealing fluid pressures equal to the ultimate compression stress of the metal itself, i.e., pressures of 50,000 to 100,000 psi. or more. . . . However, in a specific application, the pressure limitation is a result of excessive deflection of the sides of the O-ring grooves."

UAP has recently formed a wholly owned subsidiary, United Metallic O-Ring Corp., to handle all manufacturing, engineering and development of the rings.

• De-aerating cold weather oil system. With this system (AVIATION WEEK Sept. 24, 1953, p. 38) aircraft, left standing in temperatures as low as -65F, can be started in a matter of minutes instead of hours, with no pre-heat whatsoever. Companion piece is the Hot Fuel Prime System, which eliminates long fuel preheat periods.

United also makes a large line of

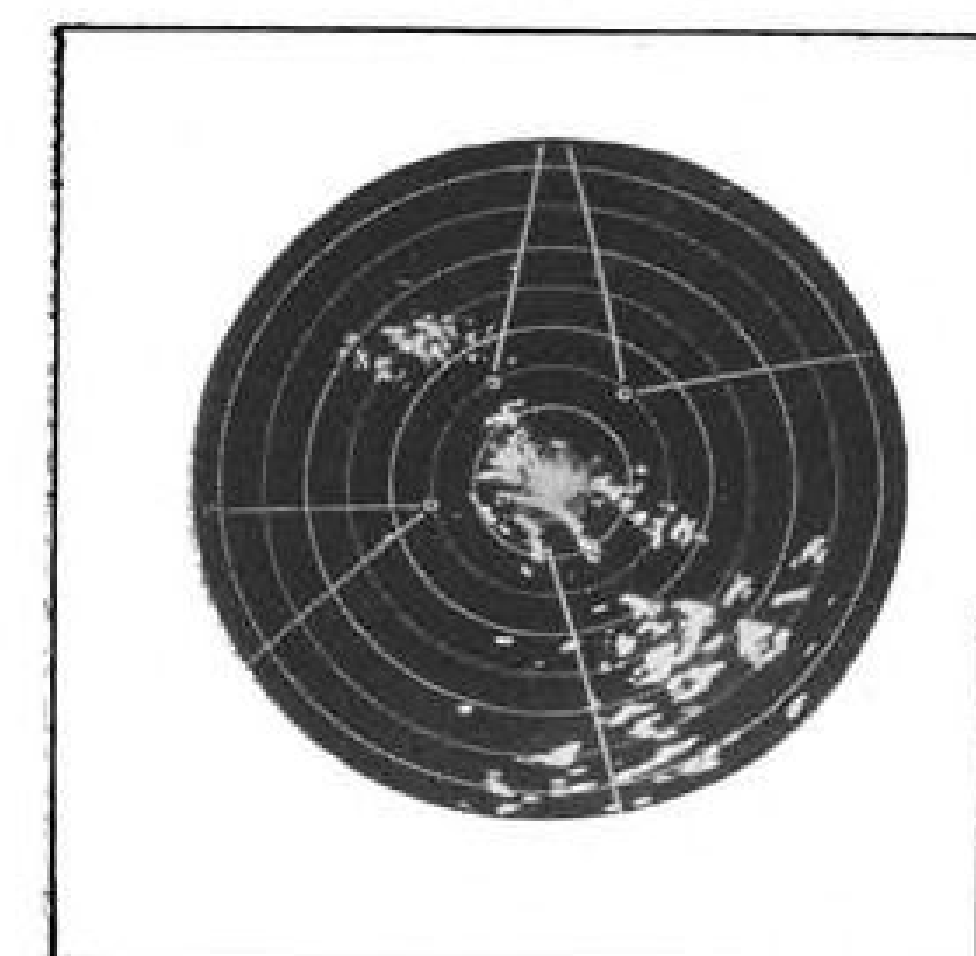


THIS COOLER for avionics equipment mounts the Hi-D unit (left) integrally.

thermostatic power elements (such as Vernatherm thermostats and thermostatic relief valves); lightweight fuel strainers that provide great flexibility of installation; oil sequence and temperature regulating valves; surge valves; water alcohol drain check valves; rate-

of-flow hydraulic fuses; hand-operated aircraft pumps; a large variety of aircraft oil tanks, including all-attitude tanks (which maintain a steady flow of oil to the engine regardless of flight attitude); and afterburner fuel-oil heat exchangers.

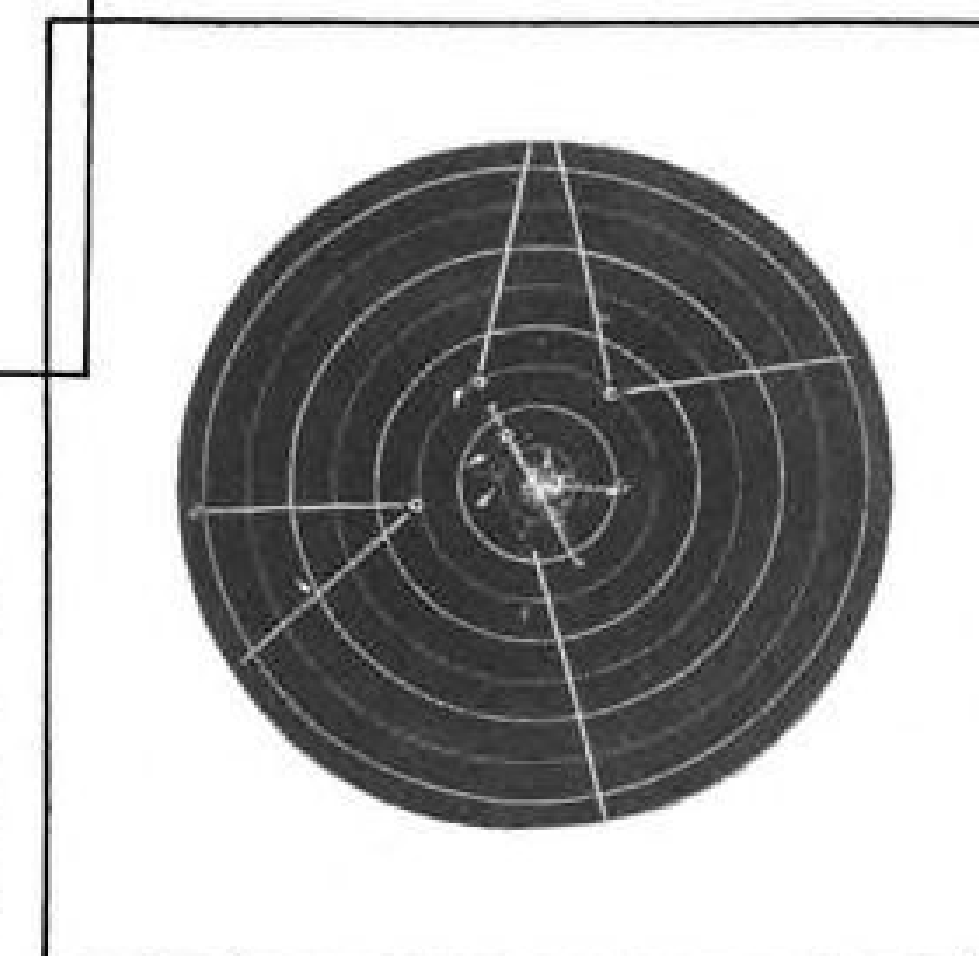
## COSSOR ENGINEERS MOVE THE ALPS



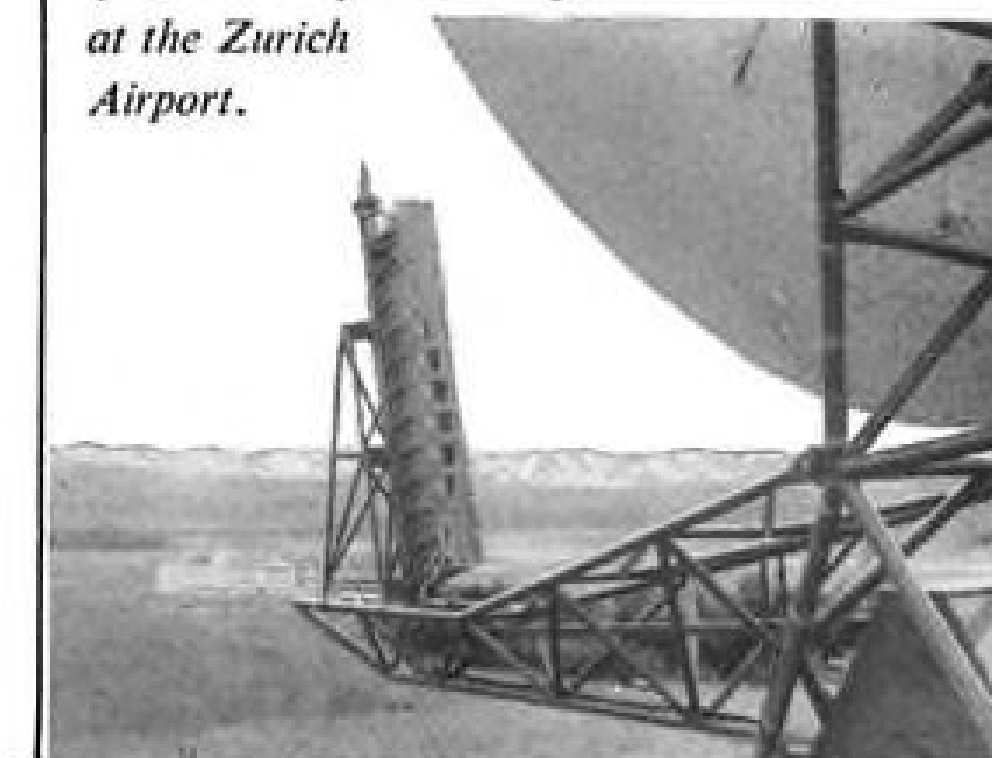
These two 40-mile range PPI photographs were taken on the Cossor Airfield Control Radar Mk. VI now installed at Zurich, Switzerland. That on the left is the normal radar display. The other PPI (right) shows clearly the effectiveness of the Cossor developed PERMANENT ECHO CANCELLATION circuits; the moving aircraft responses previously obscured are now revealed. Mountainous terrain such as is found in Switzerland, with saturation ground returns, has hitherto been a nightmare for radar operators. Cossor engineers specialize in advanced development of this kind and have produced THE FINEST CONTROL RADAR—ACR MK. VI BY COSSOR

# COSSOR

PERMANENT ECHO CANCELLATION  
C.R.D.F. SUPERIMPOSITION  
60 MILES RANGE  
VIDEO MAPPING



COSSOR AIRFIELD SURVEILLANCE RADAR (ACR Mk. VI) A view of the installation at the Zurich Airport.



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A. C. COSSOR LIMITED  
BEST PRODUCTS LTD.

STERLING CABLE CO. LTD.  
COSSOR (CANADA) LTD.

COSSOR RADAR LTD.  
BEAM INSTRUMENTS INC. (U.S.A.)





**now a Western source  
... for precision  
SHELL MOLDING and  
INVESTMENT CASTING**

Now from one western source — two methods of high fidelity production of small, complex parts for aircraft, machinery and tool manufacturers. Precision Castparts of Portland, leading suppliers to these industries can produce your parts — in stainless, alloy, high carbon steels and other metals — by either shell molding or investment casting, whichever best fits your parts requirements. Close tolerances, machined-like finishes, elimination of machining and tooling costs — these are your advantages when your parts are Precision Castparts.

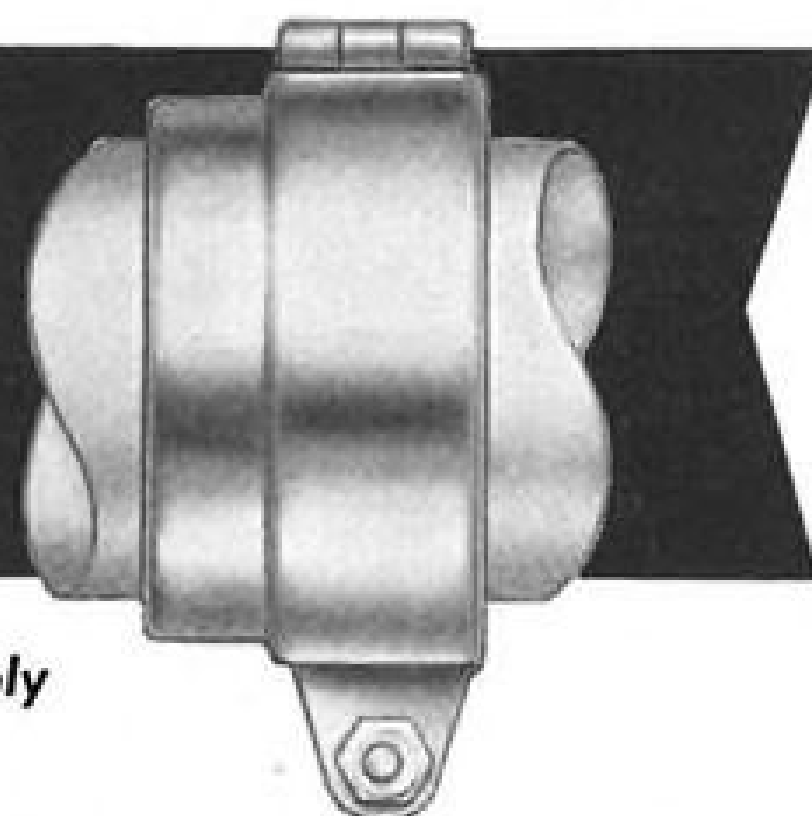
Phone, write or wire regarding your parts problems. Free literature describing both processes now available.

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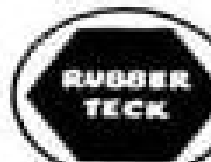
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assembly and misalignment with**

**RUBBER TECK'S  
FLEXIBLE  
HOT AIR DUCT  
CONNECTOR**



- ▶ Reduced weight
- ▶ Quick assembly and disassembly
- ▶ Wide Temperature Range
- ▶ Allows  $\pm 4^\circ$  misalignment.

Efficient, simple and flexible. Weight reduction up to 75% over other devices. Absorbs vibration and torque and provides misalignment up to  $\pm 4^\circ$ . Leak proof up to 400° F. and 125 PSI working pressure. Handles thermal expansion up to .150 inches. Available in either cadmium plated steel or anodized aluminum from 1/4" to 6" O.D. standard tube sizes.



OTHER RUBBER TECK PRODUCTS: Flexible Breakaway Connectors • Duo-Seals • Rigid Duct Connectors • Flexible Fluid Line Connectors. Write for data sheets on the complete line.

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ENGINEERING SERVICE  
554 Summit, Fort Worth, Texas  
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4378 Lindell, St. Louis, Missouri



COMPOSITE landing gear control panel.

**Panel Combines Gear  
Controls, Indicators**

A composite landing gear control panel that gathers controls and indicators into one package has been developed by Avionic Products Engineering Corp. The unit was designed to meet standardized cockpit requirements and is intended for instrument panel mounting.

Landing gear control handle is easy to identify because of its wheel-shaped knob. The panel contains a red warning light to indicate unsafe condition or that landing gear is not consistent with handle position.

The panel also includes a solenoid-operated lock to prevent inadvertent gear retraction while aircraft is on the ground; an override button for the solenoid lock, and a push button to test the warning light bulb.

Entire front of the panel is internally lighted in accordance with specification MIL-P-7788 and all electrical terminals at the back of the panel are standard AN connectors. The panel houses all switches and sequencing mechanisms.

Dimensions: width—3 1/4 in.; height—6 1/4 in.; depth—2 in. Nomenclature: Model A401.

Address: Dover, N. J.

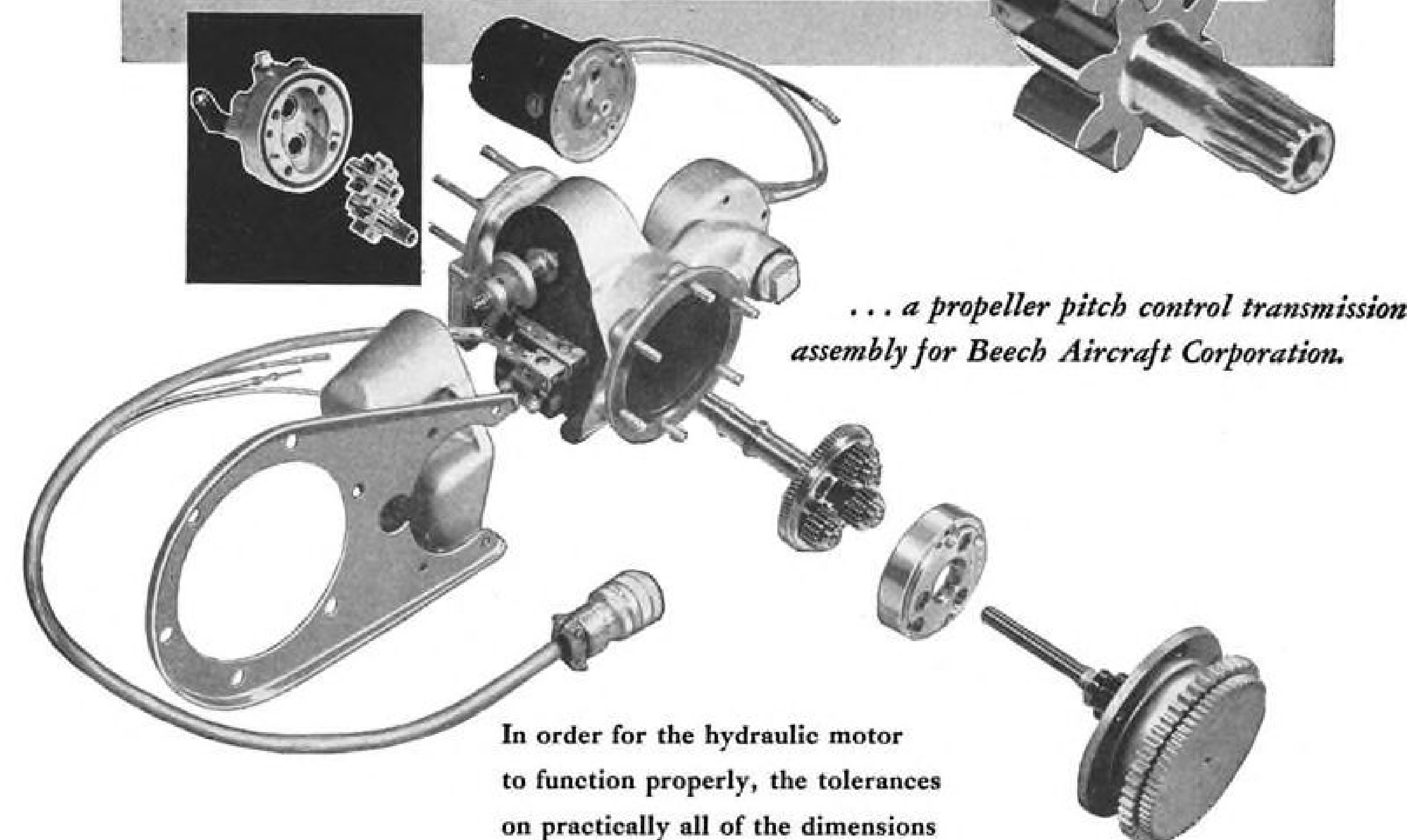
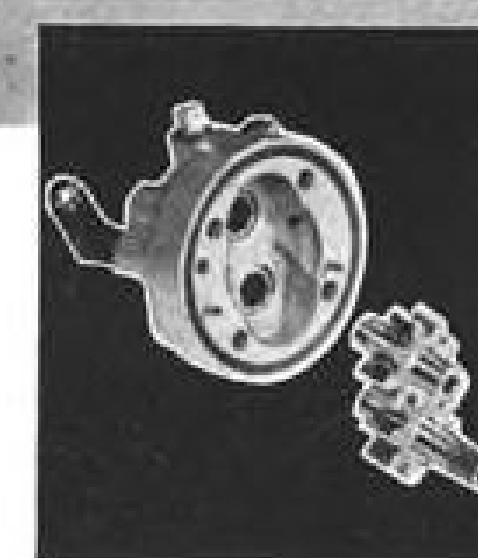
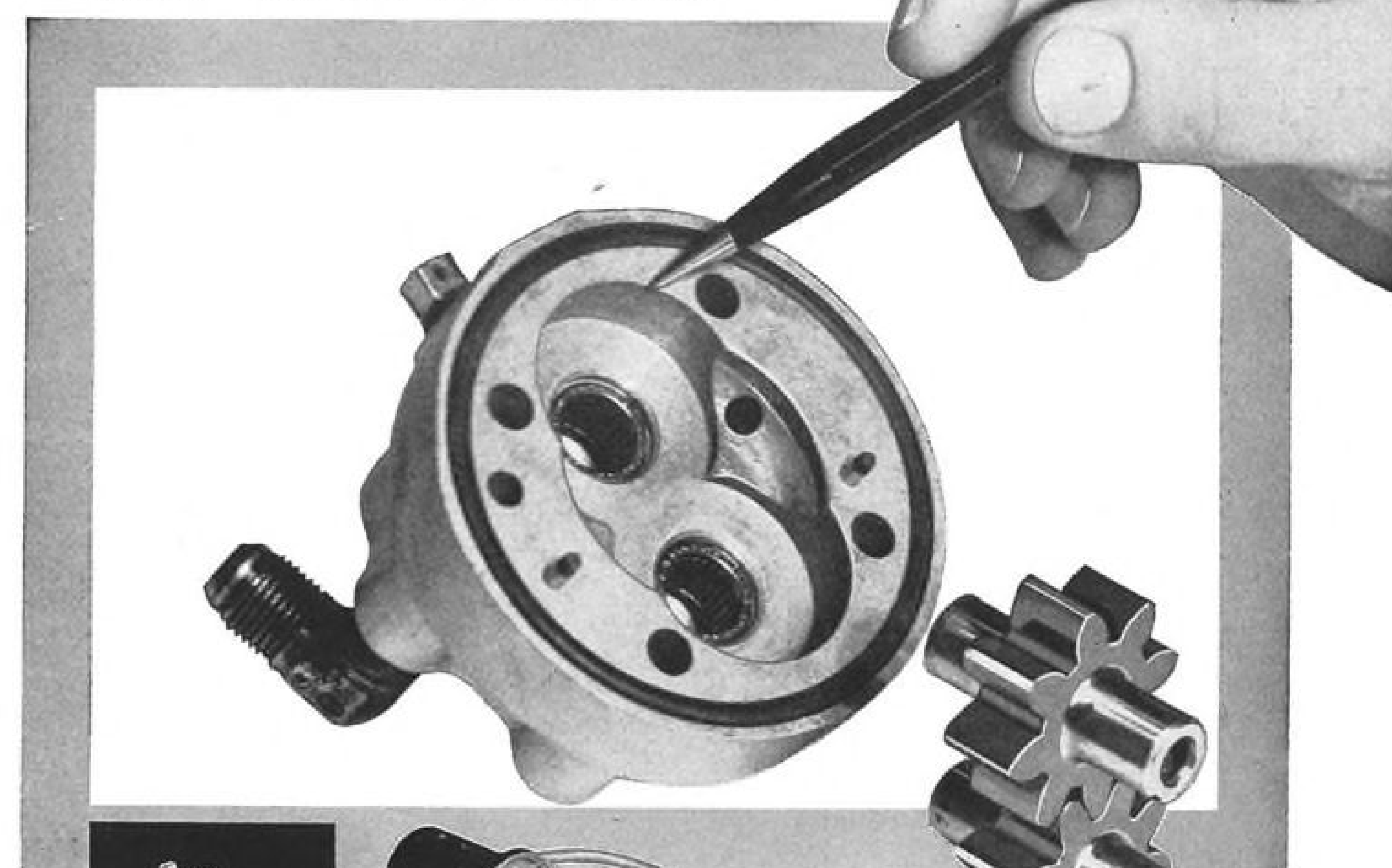
**Simulator to be Built  
For T-37A Trainer**

A prototype flight simulator for Cessna's new, twin-jet trainer the T-37A, is being built by Link Aviation, Inc., under contract to the USAF, the company announces.

The new simulator will incorporate cockpit motion which Link built into Navy F2H-2 and F2H-3 Banshee simulators where this feature enjoys considerable popularity.

An innovation in the T-37A simulator is that the instructor will ride in the cockpit with the pilot.

**and then we built**



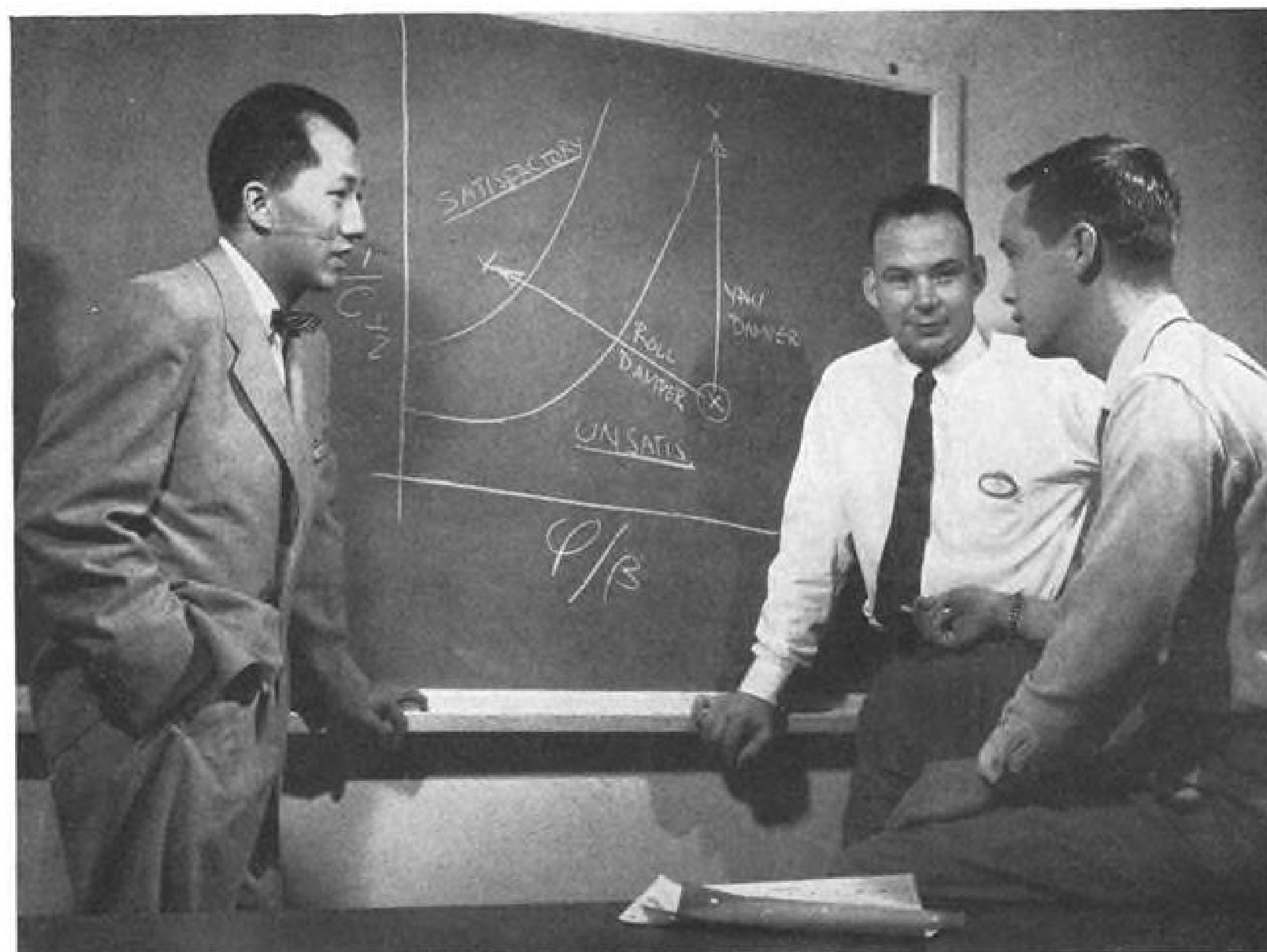
... a propeller pitch control transmission assembly for Beech Aircraft Corporation.

In order for the hydraulic motor to function properly, the tolerances on practically all of the dimensions had to be held to within .0001" or .0002" for squareness, parallelism and concentricity.

**INDIANA GEAR**

INDIANA GEAR WORKS, INC. • INDIANAPOLIS, INDIANA





Jim Hong, Aerodynamics Division head (left), discusses effects of auxiliary damping devices on roll-to-yaw ratio requirements for desirable flying characteristics of a supersonic fighter with Richard Heppel, Aerodynamics Department head (center), and Aerodynamicist Bob Scott (right).

## AVIATION CALENDAR

- Feb. 11—Air Transport Command, 10th reunion dinner of World War II officers, Waldorf-Astoria Hotel, New York.
- Feb. 20-22—Fourth annual Texas Agricultural Aviation Conference, A&M College of Texas, College Station, Tex.
- Feb. 20-22—Institute of Surplus Dealers, trade show and convention, 212th AA Armory, New York.
- Feb. 21-22—National Model Plane Show, Higbee Co., auditorium, Cleveland.
- Feb. 22-25—International Air Transport Assn., four-day conference of airline public relations directors, Kurhaus Hotel, The Hague.
- Feb. 23-25—Fourth annual Ohio-Indiana Agricultural Aviation Conference, Purdue University, Lafayette, Ind.
- Feb. 26-27—Associated Glider Clubs of Southern California, ninth annual Pacific Coast Mid-Winter Soaring Championships, Torrey Pines Glider Port, San Diego.
- Mar. 11—Institute of the Aeronautical Sciences, National Flight Propulsion Meeting (restricted), Hotel Carter, Cleveland.
- Mar. 14-16—Society of Automotive Engineers, production meeting and forum, Netherland Plaza, Cincinnati.
- Mar. 14-18—American Society of Tool Engineers, first Western Industrial Exposition, Shrine Auditorium and Convention Hall, Los Angeles.
- Mar. 20-23—Aero Medical Assn., 26th annual meeting, Hotel Statler, Washington, D. C.
- Mar. 21-24—Institute of Radio Engineers, national conference, Waldorf-Astoria Hotel, Kingsbridge Armory, New York.
- Mar. 28-Apr. 1—American Society for Metals, ninth Western Metal Exposition and Congress, Pan Pacific Auditorium and Ambassador Hotel, Los Angeles.
- Mar. 31-Apr. 1—Symposium on Boundary Layer Effects in Aerodynamics, Britain's National Physical Laboratory, Teddington, England.
- Apr. 5-7—Radio Technical Commission for Aeronautics, spring assembly and joint meeting with the Institute of Radio Engineers, Los Angeles.
- Apr. 6-10—World Plastics Fair & Trade Exposition, National Guard Armory, Los Angeles.
- Apr. 14-15—American Ordnance Assn., symposium of Proving Ground Instrumentation Committee, Patrick AFB, Fla.
- Apr. 16-20—American Association of Airport Executives, 1955 annual convention and business meeting, El Conquistador Hotel, Tucson, Ariz.
- Apr. 18-21—Society of Automotive Engineers, Golden Anniversary Aeronautic Meeting, Aeronautic Production Forum and Aircraft Engineering Display, Hotel Statler and McAlpin Hotel, New York.
- Apr. 18-21—American Society of Mechanical Engineers, Diamond Jubilee spring meeting, including four aviation sessions, Lord Baltimore Hotel, Baltimore.
- Apr. 20-22—American Rocket Society, spring meeting, Baltimore.
- Apr. 27-29—Society for Experimental Stress Analysis, spring meeting, Hotel Statler, Los Angeles.

## Six Prototypes Show Trend of Lockheed Aerodynamics Progress

Aerodynamics engineers work in a realm of classified activity. Their accomplishments become known only when a plane first flies or is declassified—long after the Aerodynamics work is done.

That is why Lockheed's six prototypes are so significant to career-minded Aerodynamics Engineers.

Ranging from hovering to supersonic flight, the prototypes individually are aerodynamics achievements. Collectively they demonstrate the versatility and scope of Lockheed's Aerodynamics Staff.

They emphasize the creative atmosphere at Lockheed. For with Lockheed activities covering virtually every phase of aeronautical endeavor, fresh thinking, new ideas are welcomed and rewarded.

Moreover, the variety of the prototypes point out the path of Lockheed's Aerodynamics future: significant advances in *all phases* of aircraft, commercial and military.

**AERODYNAMICS CAREER OPPORTUNITIES**—This diversified expansion program has created new positions for Aerodynamicists at all levels to: create supersonic inlet designs for flight at extremely high altitude; match human pilots with rapid oscillations of supersonic aircraft at low altitude; develop boundary layer control systems for safe take-off and landing of fighters and transports; remove aileron reversal and tail flutter problems incurred in high-speed flight through analysis and design; participate in determining configurations of turbo-prop and jet transports and advanced fighters, interceptors and bombers.

Aerodynamics men interested in those problems are invited to write E. W. Des Lauriers, Dept. AWA-2, for an application blank and brochure describing life and work at Lockheed.

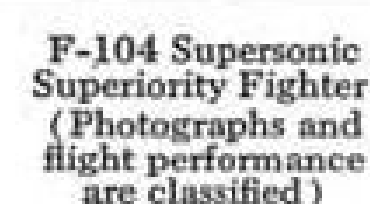
XFV-1 Vertical-Rising Plane  
In development: advanced versions of vertical-rising aircraft.



Jet Trainer  
In development: Jet trainers which will simulate flight characteristics of any plane.



In development: Jet fighters with speeds far exceeding those of present-day aircraft.



P2V-7 Neptune Patrol Bomber  
In development: (Projects in the bomber field are classified).



R7V-2 Turbo-Prop Transport  
(world's fastest propeller-driven plane)  
In development: Advanced versions of the Super Constellation.



C-130 Turbo-Prop Transport  
In development: Jet transports, other types of cargo planes.

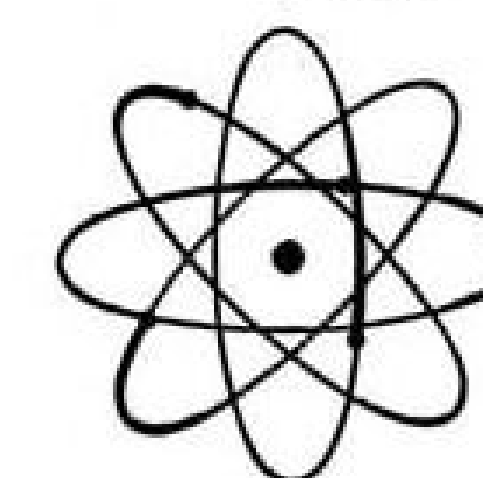


**Lockheed**  
AIRCRAFT CORPORATION  
BURBANK **California**

## Engineers! Scientists!

### UNLIMITED OPPORTUNITIES IN

## Atomic Power AT Westinghouse



In a new plant on the outskirts of Pittsburgh, Pa., atomic energy will be explored as a source of power for transportation and industry.

Opportunities in this new field are unlimited for:

### MECHANICAL ENGINEERS

Fluid flow, heat balance, valves, mechanical and hydraulic devices and mechanisms, design and application of high pressure piping and systems, heat transfer, rotating machinery, general steam apparatus and steam power systems.

### ELECTRICAL AND CONTROL ENGINEERS

Development, design and application of control systems and apparatus for nuclear plants. This includes servo analysis, application of analog computers, functional and operational analysis of mechanical and electrical power systems and the application of temperature, pressure, flow instruments, nuclear instruments, motor controllers, regulators, control panels and special electrical controls.

### PHYSICISTS

Basic reactor physics, reactor design and analysis, control systems, and experimental testing.

### METALLURGISTS

To conduct basic research in physical metallurgy, corrosion and radiation effects on metals; applied research and development on materials and processes for reactor components in the field of vacuum induction melting, ceramics, powder metallurgy, welding, metal working and non-destructive inspection.

Openings also exist for Chemical Engineers, Chemists and Radio Chemists.

### SALARIES

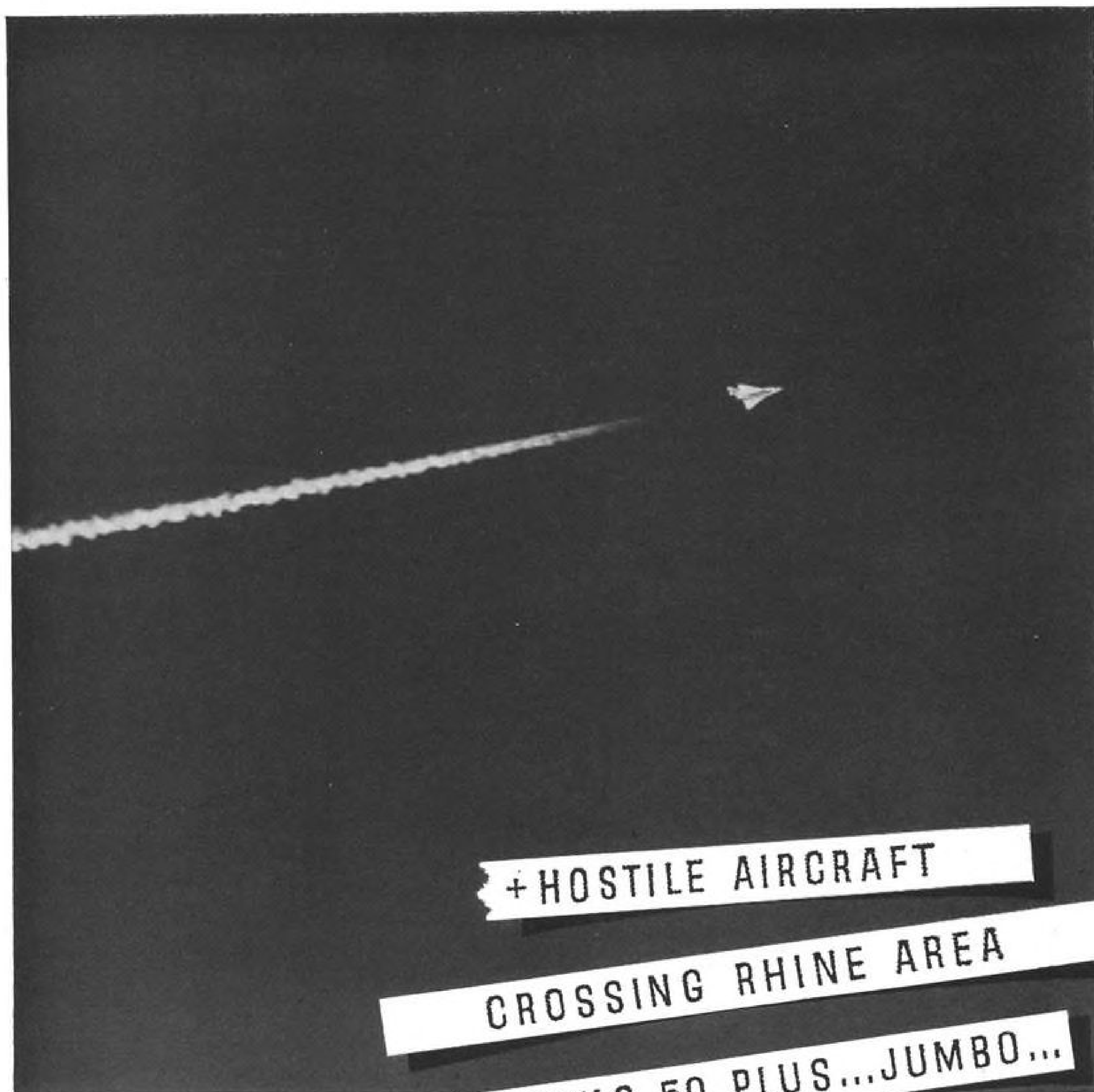
Open. Ample housing available. Benefits include a hospitalization-insurance program, and graduate study under the Westinghouse program at company expense.

### HOW TO APPLY

United States Citizenship is required!  
Send resume concerning your experience and education to:

Mr. C. F. Stewart, Atomic Power Division,  
Westinghouse Electric Corporation  
P.O. Box 1468, Pittsburgh 30, Pa.





If—and when—that message is clicked out on the teletypes of Western Europe's radar network, New Yorkers, and indeed all America, had better batten down their hatches. It may well be that that pregnant message will signalise the outbreak of World War III. For those who are not airmen, Angels 50 Plus is R.A.F. lingo for altitude over 50,000 ft. Jumbo could mean carrying the Big Bomb, Atomic or Hydrogen. It is a Jaconic message, but then the R.A.F. is given to understatement.

At that precise moment Javelins will be in the air, fair weather or foul, able to fly and fight higher, faster and more destructively than any other fighting aircraft has ever done in history. The Javelin is not a Sunday flier. No other aircraft in the world equals it in fire power and in that all-important radar. It carries two

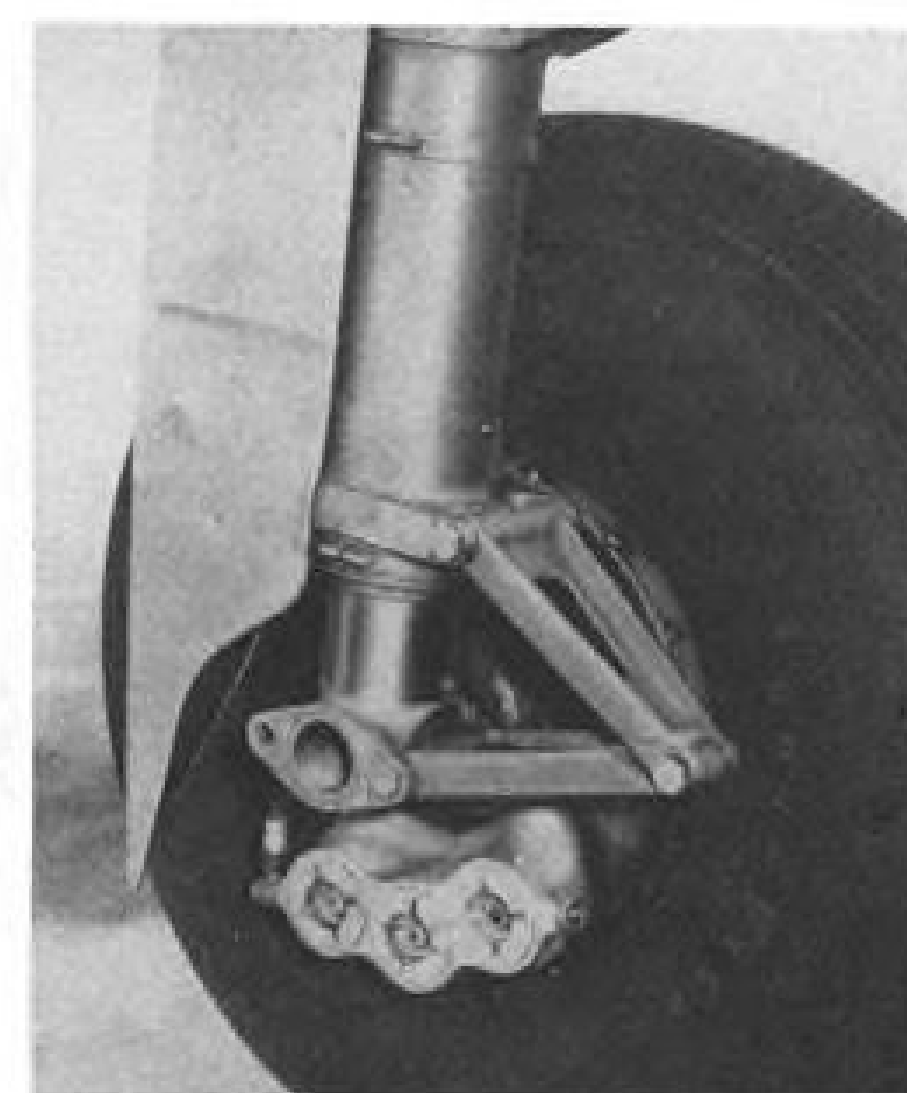
men—one to fly the machine and the other to work the infinitely complicated radar gear. No one man can do both jobs. All that can be said within the bounds of Security is that when the time comes, there will be Javelins in the air ready for operational duty within minutes of that ominous tickertape alarm. Take a look at your map. It is not very far from the Rhine to London, hence the importance of the all-weather Javelin.

DAY AND NIGHT ALL WEATHER FIGHTER  
**Gloster Javelin**



GLOSTER AIRCRAFT CO. LTD., GLOUCESTER, ENGLAND. Member of the Hawker Siddeley Group | Pioneer... and World Leader in Aviation

## NEW AVIATION PRODUCTS



CONVERSION KIT sells for \$3,000.

### Wheel-Brake Kit Updates Lodestar Landing Gear

Modification kit to convert Goodyear wheels and single-disk three-spot brakes, used on Convair 340, for installation on all Lockheed Lodestars has been approved by Civil Aeronautics Administration.

Special parts modify the wheels to take standard 15.00 x 16 tires and to permit attachment of brake assemblies to Lodestar torque plates. The new installation is said to be capable of more than doubling the available energy capacity of old-type Lodestar brakes.

Complete conversion kit includes new wheels, brakes, special parts, all necessary AN hardware and installation drawings, but not tires and tubes. Cost: \$3,000.

Aircraft Engineering Division, Lear Inc., Santa Monica, Calif.

### Missile Heating Element Is Sprayed on Like Paint

Guided missiles and aircraft can be given protective heating elements by spraying on an inorganic film whose watt density can be engineered to 40 w./sq.in. for voltages from 6 v. to 220 v.

The element's temperature resistance coefficient is such that it provides accelerated heat rise, yet needs no thermostat in many applications.

This is how it is applied:

- An inorganic insulation of .003 to .010 in. is applied to the metal surface, depending upon dielectric requirements.
- An inorganic ceramic-type material is sprayed onto the base insulation. Element thickness can be varied from .010



from initial design . .

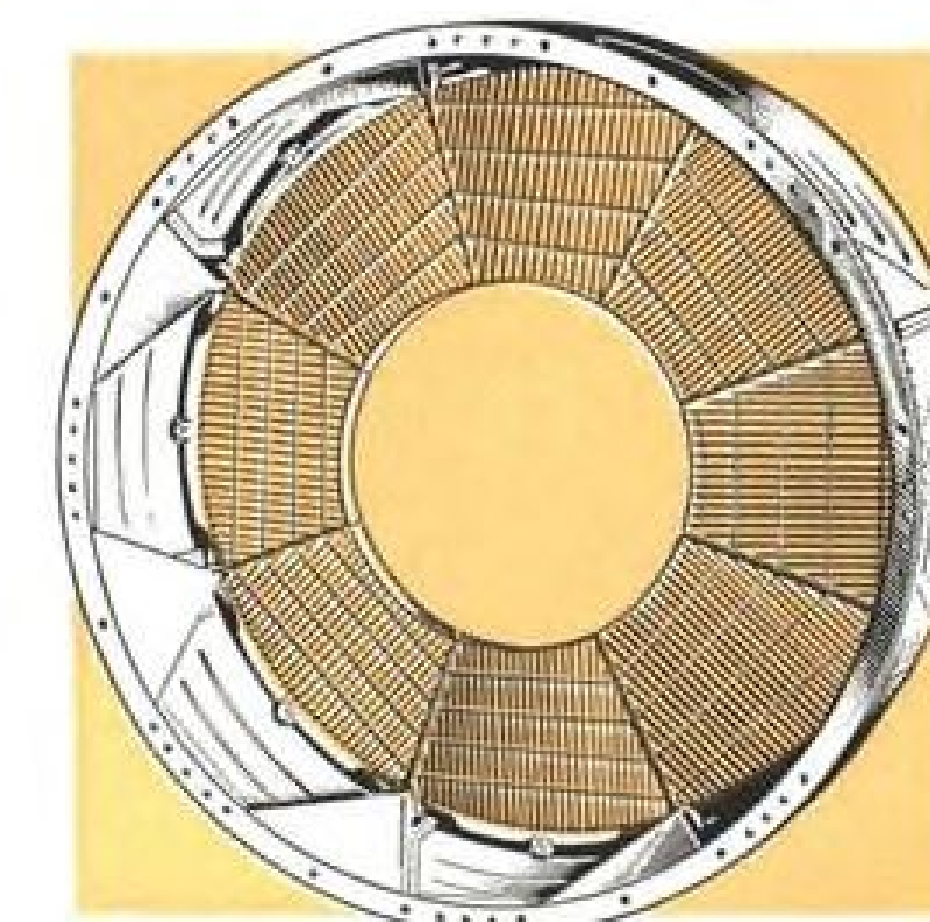


through production line . . .

**SMITH-MORRIS** all the way

### Retractable AIR INTAKE SCREEN

Specifically designed and manufactured for axial flow compressor gas turbines . . . Hydraulic actuation system contained within the screen housing . . . Strict adherence to AN standards and aircraft quality throughout.



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PRECISION AIRCRAFT COMPONENTS  
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# AIRPOWER

# in the AGE OF PERIL

**22<sup>nd</sup> Annual Aviation Week**

**MARCH 14, 1955**

**"Inventory of Airpower" Edition**

**will cover vital aviation subjects on global scale**

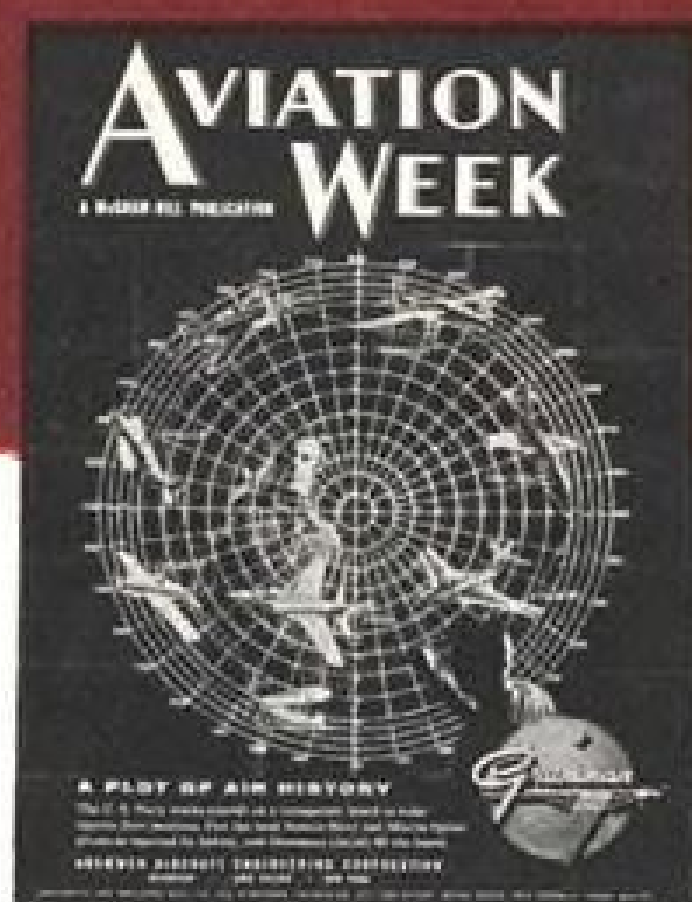
**AVIATION WEEK'S 22<sup>nd</sup> ANNUAL "INVENTORY OF AIRPOWER" EDITION**—"Airpower in the Age of Peril"—covering every phase of U.S. civil and military aviation, and providing the latest information on foreign airpower, will be published March 14, 1955. Featuring the complete story of the transition from the Korean crisis buildup to the solid industrial and airpower base necessary to meet the requirements of U.S. Policy over the long pull, this important issue will hold significant and lasting interest throughout the aviation world.

Aviation management men, engineers, military and government officials will read, refer to and depend upon "Airpower in the Age of Peril." Only in this edition will be found full information on fiscal 1956 federal aviation budgets, new procurement and financing regulations . . . ground rules that will guide Air Force and Navy policy in doing business with the aviation industry over the next two years, as well as latest reports from AVIATION WEEK correspondents in every part of the world on significant developments abroad.

Reference tables especially designed for "Airpower in the Age of Peril" will give new, revised specifications on U.S. and foreign aircraft, missiles, and engines. Special reports will cover the expansion of the guided missiles industry, the conversion of do-

mestic and international airlines from piston to gas turbine powered equipment (including full statistical coverage of all U.S. and foreign airline operations), the expanding role of equipment and component manufacturers in the weapons system development and production cycle, and avionics in military and civil aviation. This storehouse of vitally needed aviation information will be used constantly wherever aviation business is transacted.

This extremely great usefulness to the aviation industry gives "Airpower in the Age of Peril" prime importance as an advertising medium. Aviation companies and their suppliers will find the long-lasting selling power of this significant AVIATION WEEK issue unmatched in aviation publishing today.



# AVIATION

# WEEK

A MCGRAW-HILL PUBLICATION



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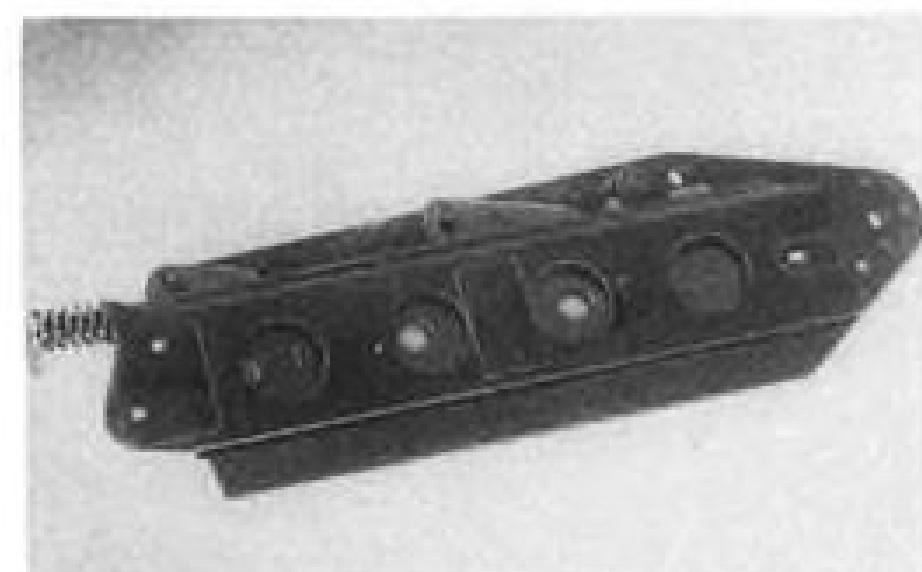
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to .025 in., depending upon specified resistance.

- Top insulation is applied.

Therm-O-Lab Corp., 6940 Farmdale Ave., North Hollywood, Calif.



A-40208-2 will carry 75-150-lb. load.

### Telescoping Slides Aid Equipment Accessibility

Two sizes of heavy-duty telescoping steel slides, useful for storage of equipment in aircraft where material must be moved from "in-use" to "storage" positions, are made of close-tolerance stampings designed to replace extruded types.

- Universal A-40346-2 is the larger unit, 24 in. long with an 18-in. telescoping travel, and capable of supporting 150-250-lb. load when extended.
- Universal A-40208-2 operates from a spring-action trigger and can carry a 75-150-lb. load extended.



A-40346-2 can support 150-250 lb. load.

Universal Metal Products, Inc., Alhambra, Calif.

### Large Magnesium Plates Ready for Plane Tooling

Low-cost rolled magnesium plate is now available from one-quarter to three-inch thicknesses and sizes up to 6 ft. wide by 24 ft. long for aircraft tooling and product manufacture. Prices are said to be below those of other commonly used tooling materials.

Some of the uses suggested for the magnesium plate: checking fixtures, bases and gages; assembly and locating jigs, fixtures and bases; adhesive bonding fixtures and vibration test fixtures. Other applications include contour boards, stretch form blocks, alkaline-resistant bases for master plasters, molds

for fibrous glass and plastic parts and bases for plastic stretch blocks.

The manufacturer's new rolling and extrusion process facilities at Madison, Ill., having a total metal casting capacity of almost 7 million tons monthly, have made it possible to bring down prices, the company reports.

Dow Chemical Co., Magnesium Dept., Midland, Mich.

### Small Blower Will Cool Aircraft Electronic Gear

A new blower weighing 20 oz. is available for cooling airborne electronic equipment. The unit has a 3-in. tunnel and is rated at 70 cfm. at 1 in. of water static pressure.

Designed to meet all applicable military environment specs, the unit operates directly from a 115-v. 400-cycle line in conjunction with a phasing capacitor. Measurements: 3½-in. side, 3½-in. high and 3-12/32-in. long.

Servomechanisms, Inc., Components Division, 625 Main St., Westbury, N. Y.

### C-W Offers Ultrasonic Tools to Labs, Industry

A new line of ultrasonic devices useful in quality control, manufacturing and industrial and scientific research has



### HERE Is Your CHANCE

... to establish a future in a young and fast-growing industry with a live wire progressive company. Send complete resume to:

### EMPLOYMENT MANAGER

#### ★ EQUIPMENT DESIGN STAFF ENGINEER

Responsible for all Helicopter Equipment Engineering

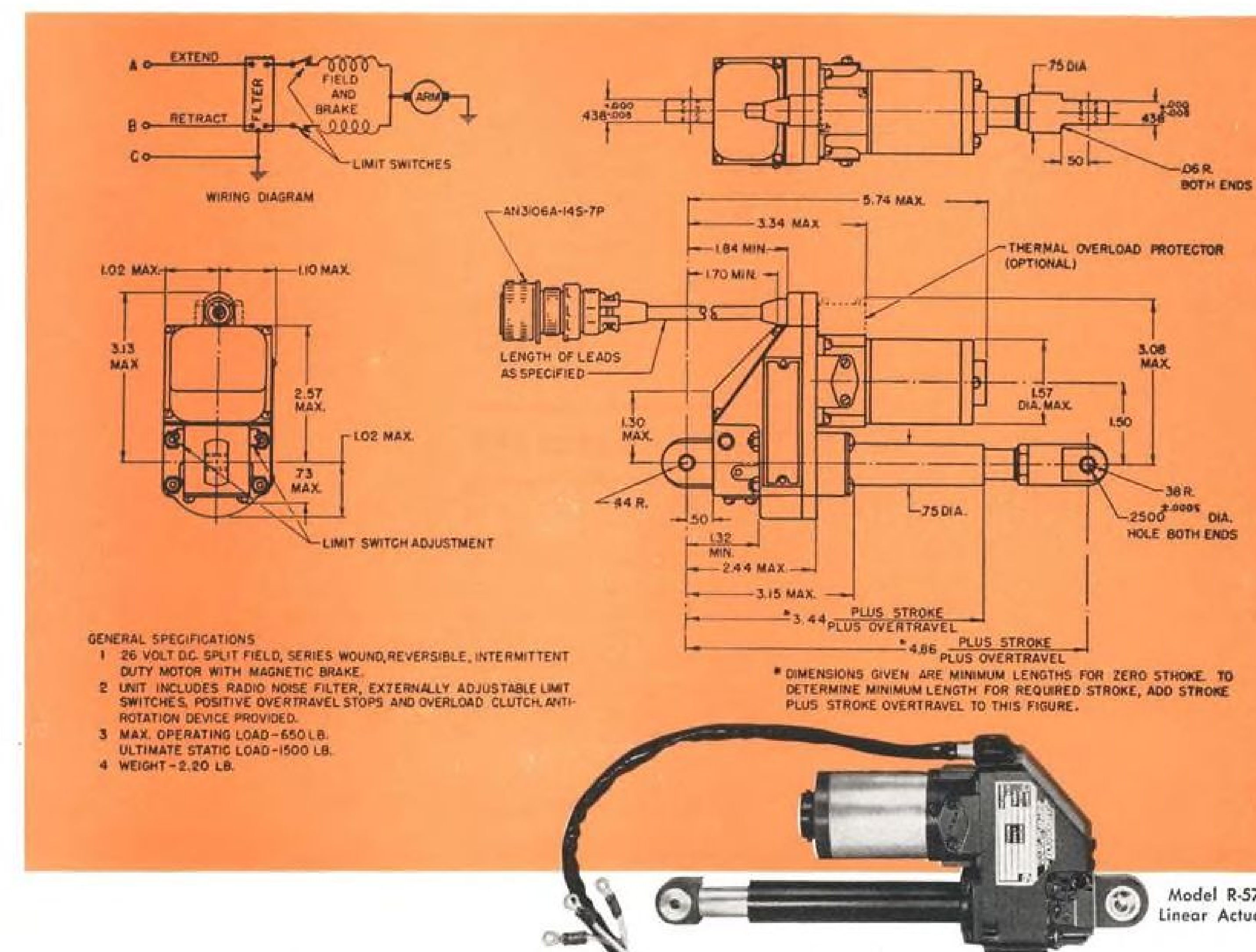
#### ★ CHIEF OF TEST FLIGHT

Responsible for development, operation and administration of all company Flight Testing activities

#### ★ ENGINEERS, Experienced In . . .

- DYNAMIC ANALYSIS
- AERODYNAMICS
- TEST (Flight & Structural)
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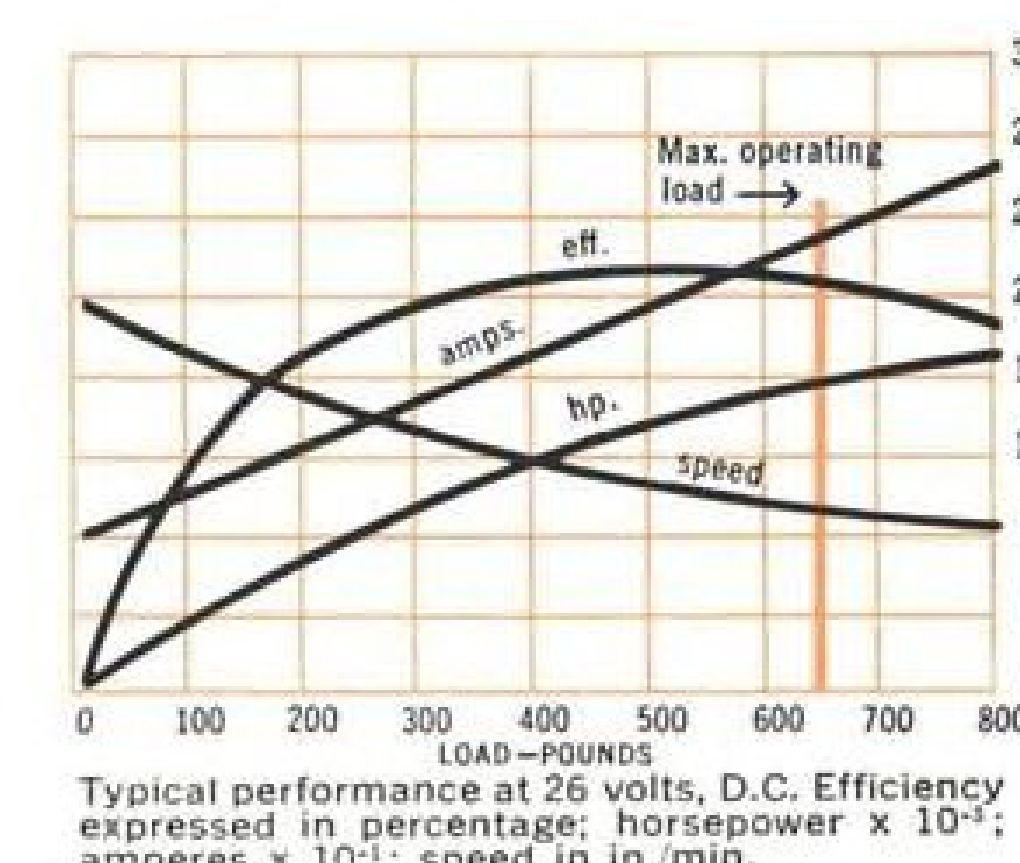


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large variety of materials. Ultrasonic impulses are reflected by the hidden flaws and transmitted to a visual cathode-ray tube indicating the position and depth of the defect.

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Curtiss-Wright Corp., Wood-Ridge, N. J.

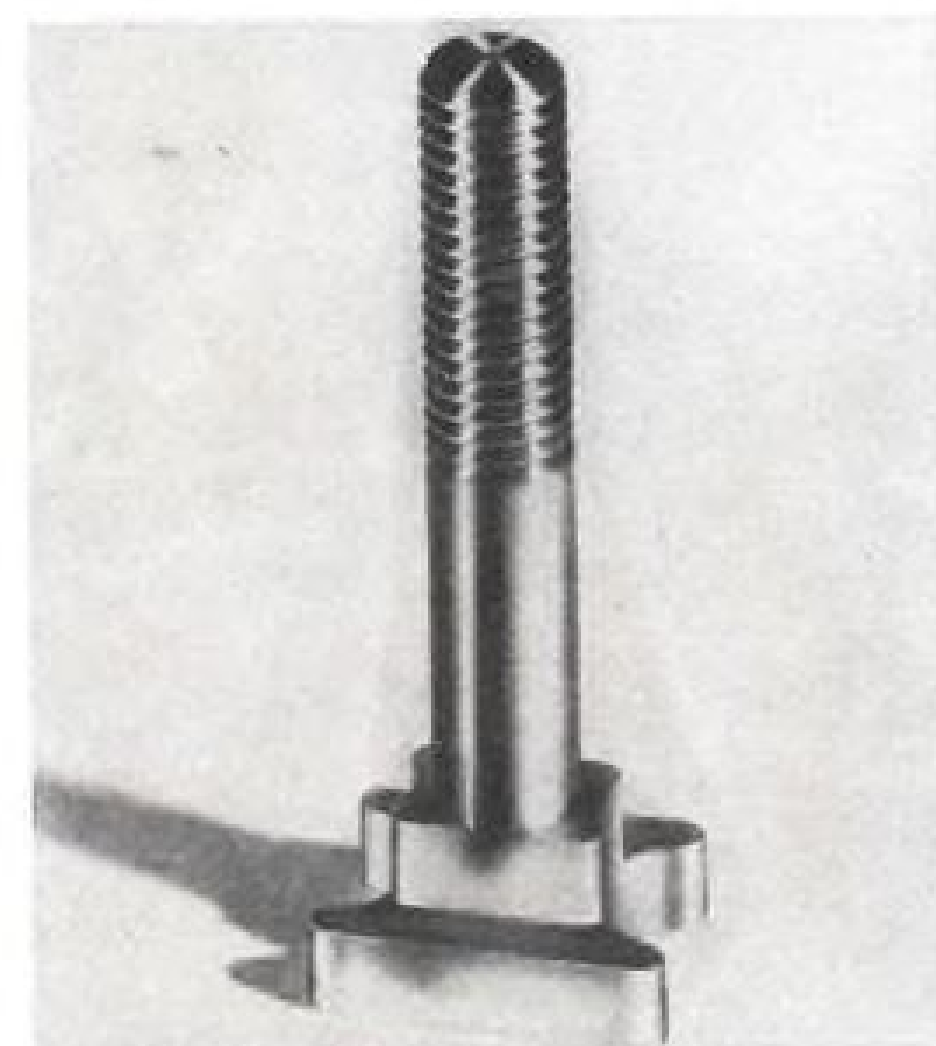
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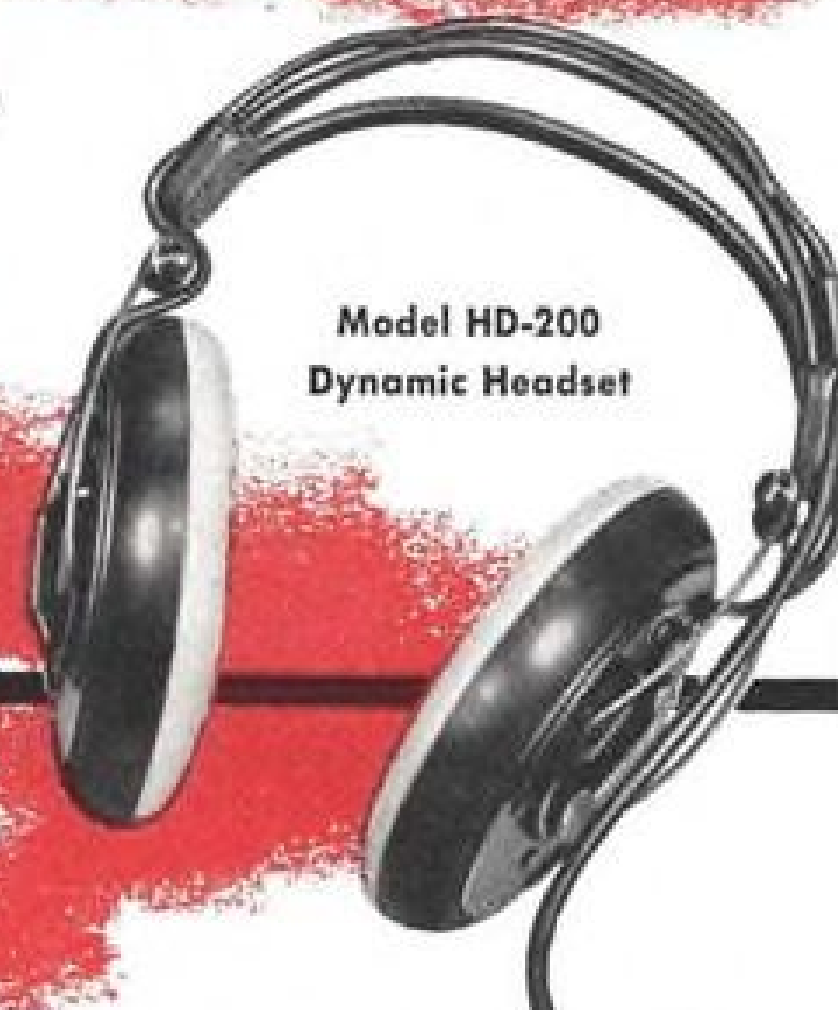
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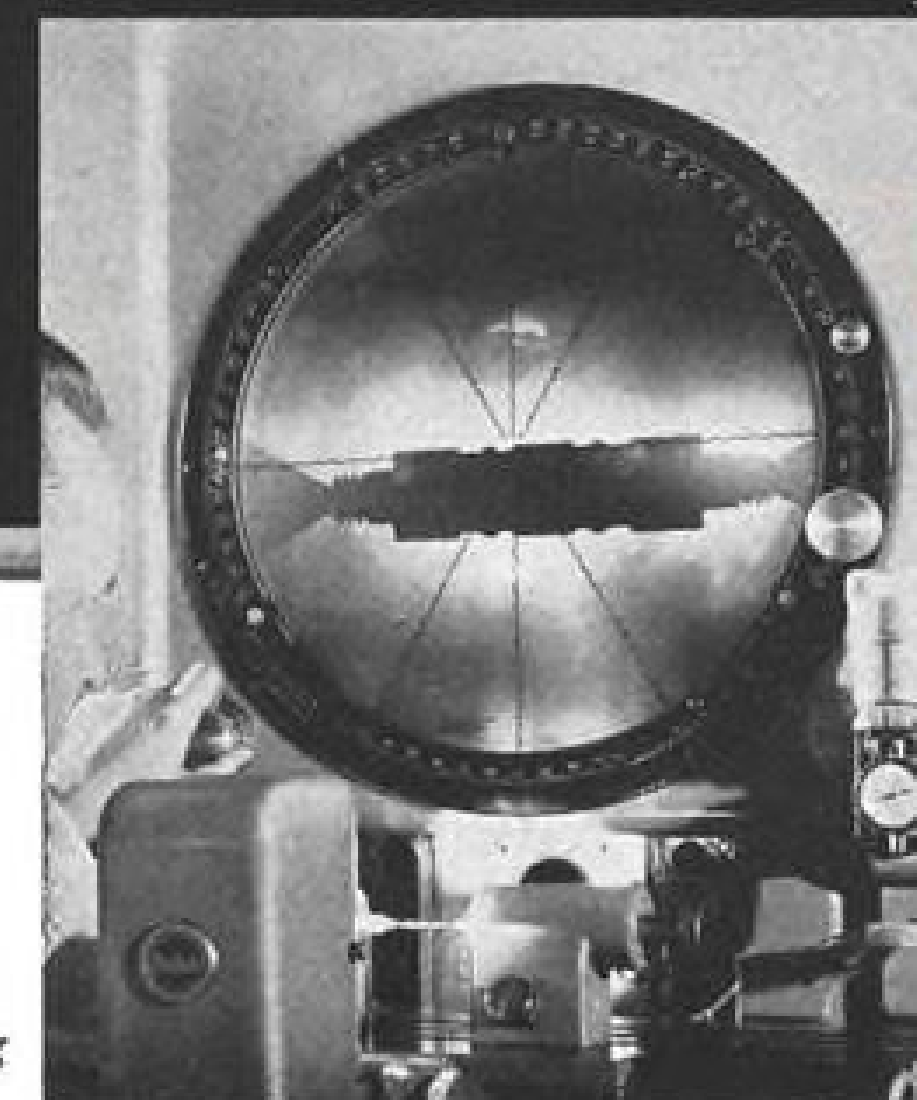
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PRECISION MECHANICS and CERAMICS	■ ■ ■	■	■ ■ ■	■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■	■ ■ ■	■ ■	■ ■ ■
ELECTRICAL EQUIPMENT and COMPONENTS	■ ■	■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■	■ ■ ■	■ ■	■ ■ ■
ELECTRONICS	■ ■		■ ■ ■	■ ■ ■	■ ■ ■	■	■ ■ ■	■ ■	■ ■ ■	■ ■	■ ■ ■
HYDRAULICS and LIQUIDS HANDLING	■ ■ ■		■ ■ ■	■ ■	■ ■ ■	■ ■	■ ■ ■	■ ■	■ ■ ■	■ ■ ■	■ ■ ■
PROFESSIONAL and INDUSTRIAL TELEVISION EQUIPMENT	■ ■		■ ■ ■	■	■ ■		■ ■		■ ■ ■		
INSTRUMENTATION	■ ■		■ ■ ■		■ ■ ■	■	■ ■ ■	■ ■	■ ■ ■	■ ■	■ ■ ■
SERVOS and CONTROLS		■	■ ■ ■	■ ■	■ ■ ■	■	■ ■ ■	■ ■	■ ■ ■	■ ■	■ ■ ■
AUTOMATIC COMPUTERS and COMPONENTS		■	■ ■ ■		■ ■ ■	■	■ ■ ■		■ ■ ■	■	■ ■ ■
ULTRASONICS	■ ■		■ ■ ■		■ ■		■ ■	■ ■	■ ■ ■	■ ■ ■	■ ■
RADAR and MICROWAVE	■ ■		■ ■ ■		■ ■ ■	■ ■ ■	■ ■	■ ■ ■	■ ■ ■		
MOTION PICTURE and SOUND EQUIPMENT	■ ■ ■	■ ■ ■	■ ■ ■	■ ■		■ ■ ■	■ ■ ■	■ ■ ■			■ ■ ■
OPTICAL DEVICES	■ ■	■ ■	■ ■ ■		■ ■ ■	■ ■	■ ■ ■	■ ■ ■			

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- ■ Manufacturing and product development
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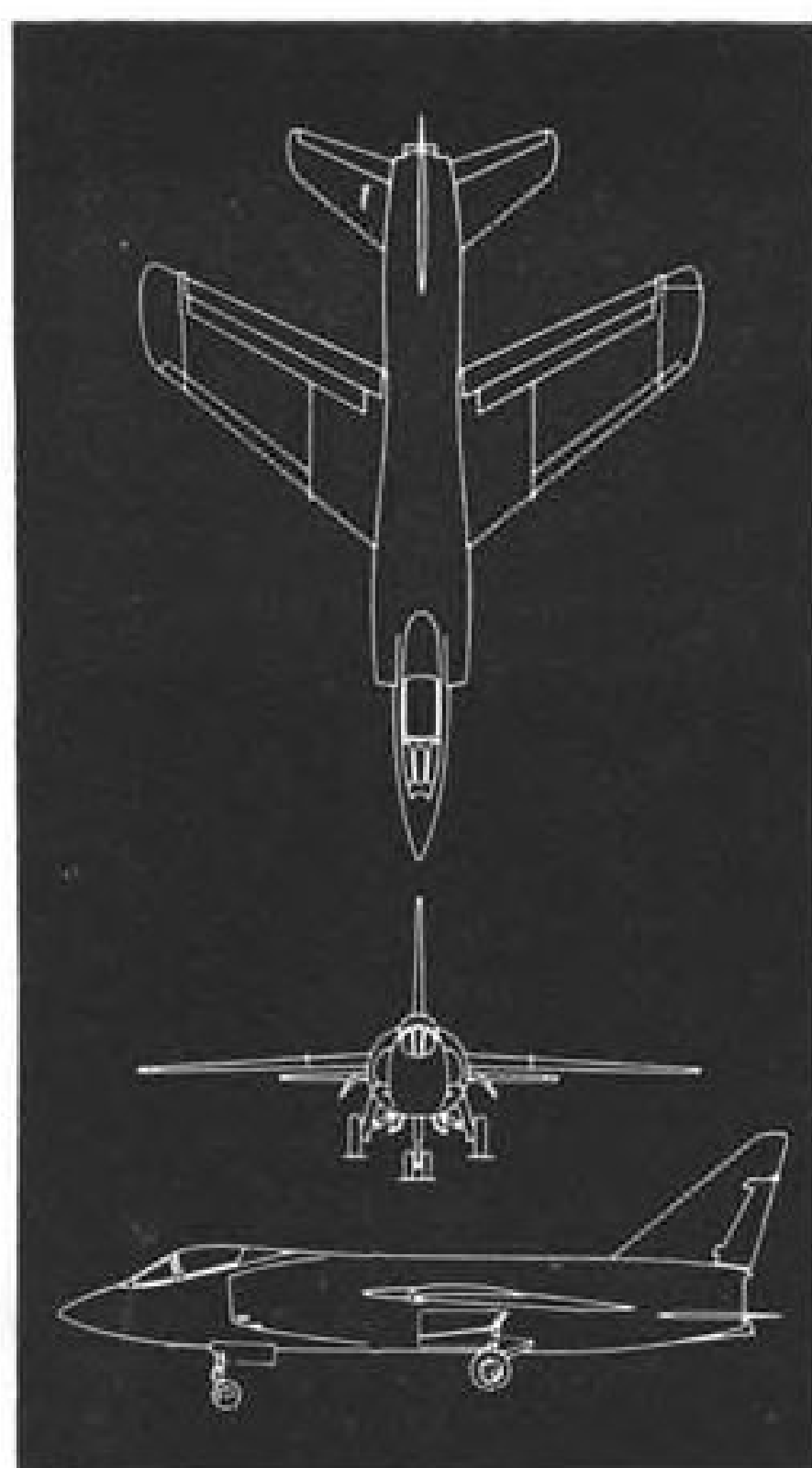


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# AVIATION SAFETY

CAB Report on Crash That Killed 13

## Storm Area Trap for Braniff DC-3

### THE ACCIDENT

A Braniff Airways DC-3, N 61451, crashed in a farm field approximately 16 miles south of the airport at Mason City, Iowa, at 1703, Aug. 22, 1954. Ten of the 16 passengers aboard were killed and six received serious injuries. Of the crew of three, the captain and first officer were killed, and the stewardess was seriously injured. The aircraft was demolished by ground impact.

### HISTORY OF THE FLIGHT

Braniff Airways Flight 152 of Aug. 22, 1954, was a daily scheduled flight between Memphis, Tenn., and Minneapolis, Minn., with intermediate stops at Little Rock and Fort Smith, Ark.; Muskogee and Tulsa, Okla.; Kansas City, Mo.; Des Moines, Waterloo and Mason City, Iowa; Austin and Rochester, Minn.

Flight 152 departed Memphis, Tenn., at approximately 0835 and the flight to Kansas City, Mo., including all scheduled stops, was routine. The flight departed Kansas City at approximately 1422 after a flight crew change, consisting of Capt. Wm. Pickering, First Officer Wm. Wilde, and Hostess B. A. Truly.

The two segments to Des Moines and Waterloo, Iowa, were routine in all respects. Flight 152 canceled its IFR clearance before each departure, proceeding VFR to the next scheduled stop.

Flight 152 was off the ground at Waterloo, Iowa, at 1641 with a gross load of 24,745 lb., 601 lb. less than the maximum weight allowable. The Waterloo IFR clearance was also changed to VFR before the takeoff.

Shortly before 1700, Flight 152 was observed on its usual northwest course, but at a lower altitude, about 17 miles south-southeast of the Mason City Airport. This ground witness observed the Braniff DC-3 make a left turn over his farm and proceed almost directly west toward a light spot in a thunderstorm. As Flight 152 headed west at an altitude estimated by several eyewitnesses as 400 to 500 feet above the ground, it was observed to enter and disappear in the thunderstorm approximately 1 mile east of where the wreckage was later found. The crash occurred approximately 8 miles west of where the left turn over the farm was made.

Eleven occupants were killed, a twelfth died several days later in a hospital and the seven survivors received serious injuries. Fire did not occur after impact.

### INVESTIGATION

The location of the crash is 16 miles south of the Mason City, Iowa, Airport, the destination of Flight 152. The heading

<sup>1</sup>All times mentioned herein are central standard time and are based on the 24-hour clock.

of the aircraft at the time of impact was 290° True. The time of the crash was established at 1703 by an impact-stopped aircraft clock on the instrument panel. Ground marks at the initial impact point indicated a level lateral and longitudinal attitude, gear and flaps retracted, with considerable downward or sink velocity. A low forward speed was indicated by the short distance (448 feet) that the aircraft skipped forward after the initial impact.

The extremely disintegrated condition of the bottom of the cabin and center section substantiated the level aircraft attitude and high sinking velocity. Both wings, outboard of the attach angle, were relatively undamaged. The de-icer boots on the leading edge of both wings were undamaged and both navigation lights at the wing tips were intact and in place. The left wing tip was distorted downward at an angle of approximately 10 deg. and there were compression wrinkles on the underside of both wing tips adjacent to the tip-to-wing panel attachment. The support legs of the cabin seats incurred compression bends, further substantiating the high sinking velocity at initial impact.

No evidence was found to indicate power or structural failure, or malfunctioning of any aircraft control or component prior to impact. Settings and condition of the propeller blades indicated approximate cruise power at impact. All aircraft radio equipment was bench tested and found to function normally. The channel setting of the VOR<sup>2</sup> receiver was 114.9 megacycles which is the Mason City VOR frequency. Examination determined the course selector of the VOR to be 355 deg. which is the VOR approach heading for Mason City Airport.

Investigation disclosed that the flight crew was thoroughly familiar with the route. The captain had flown for Braniff, and a predecessor company, regularly over the pertinent route for more than 10 years in the same type of aircraft involved in this accident. The first officer, previous to his employment by Braniff, had flown commercially in the Mason City area.

Investigation disclosed that company dispatching procedures were complied with and the operation of Flight 152 from a dispatching standpoint was entirely normal.

The course from Waterloo, Iowa, to Mason City, Iowa, is on a northwest heading and the air distance is 63 miles. Ground witnesses testified to visual flight rule weather conditions to and several miles west of where Flight 152 altered course and proceeded westward towards a lighter spot in the thunderstorm.

Seven minutes after Flight 152 departed Waterloo, Iowa, at 1641 a heavy thunderstorm was over the Mason City Airport and extending southwest. The Mason City Braniff radio operator at this time was un-

<sup>2</sup>Very high frequency omnirange.

able to contact Flight 152 and requested Braniff Flight 145 (southbound from Minneapolis) and the Waterloo company radio to relay Mason City weather to the flight. Flight 145 complied with this request and received acknowledgment of the message. At 1658 direct radio contact between Mason City company radio and the flight was established and at that time the flight advised it would hold southeast of Mason City due to thunderstorms to the west and northwest.

Approximately 20 persons along the east-west line between the left turn and crash point (8 miles) were questioned as to their observation of the aircraft and weather conditions. The consensus of these witnesses was that a vigorous storm was in the area as the aircraft, at an estimated altitude above the ground of 400 to 800 feet, flew westward over them and disappeared into the lighter spot in the center of the storm. The nearest witness, 1 mile east of the crash, was in heavy rain immediately after the aircraft passed overhead.

Damage from the storm in the vicinity of the crash varied considerably. There were trees 12 inches in diameter broken off 18 feet above the ground a mile east of the crash. There was evidence of strong winds from all directions. A mile west of the crash a wooden silo was blown down toward the west and chicken coops twisted on their foundations. A mile west-northwest and a half mile east of the crash, corn stalks had been forced to the ground in 100-foot swirling counterclockwise circles. East of this point corn was blown down generally toward the east but with an occasional northeast or southeast direction. A mile and a half east of the crash five 60-foot-high H-shaped power line supports were blown down toward the east. The power company owning this line stated the poles were constructed to withstand a steady wind of 85 to 90 mph.

A pilot of a Beech Bonanza, on a flight from the Omaha, Neb., area to Mason City, encountered the west edge of the thunderstorm at about the same time that Flight 152 entered from the east. By holding southwest of Mason City for a short period this aircraft remained VFR and landed



### Airborne Invader

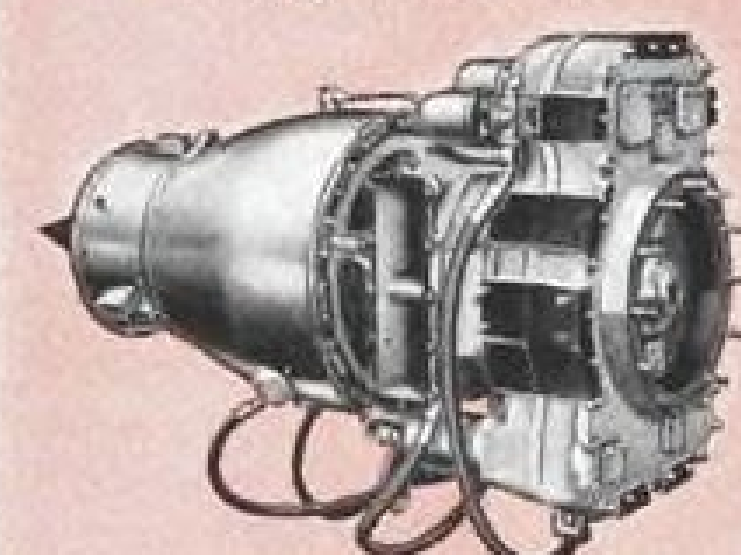
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### SAFETY . . .

without incident at Mason City at 1715.

There was testimony at the hearing to the effect that Capt. Pickering, after checking the weather and preparing the flight plan at Kansas City, remarked that "it looked like it was building up to a rough trip north of Des Moines."

The advisory service of the Waverly, Iowa, Air Force radar station (approximately 40 miles southeast of the crash) was available to Flight 152 at any time after the departure from Waterloo, Iowa; however, no contact with the station was made. Procedures to use Air Force radar advisory service had been set up by Braniff's operations department some months before and were used frequently by Braniff flights. Some two hours later, at 1932, Braniff Flight 163 westbound contacted Air Force Waverly radar and upon being advised of thunderstorms in the Ft. Dodge area (approximately 60 miles southwest of Mason City) reversed its course and returned to Waterloo, Iowa.

The synoptic weather maps for the morning of Aug. 22, 1954, showed a low pressure center in Canada, a pressure trough southward through the Dakotas, Nebraska, and New Mexico. There was an occluded front in this trough from Canada southward to Nebraska with a cold front across northwestern Kansas and southeastern Colorado. A stationary front extended southeastward into Missouri and Kentucky with the west portion becoming a warm front with northward movement. At the time of the accident the trough line and cold front were more than 200 miles west of Mason City. The stationary front had been moving northward as a warm front and by 1700 was in the immediate vicinity of Mason City, Iowa.

A heavy thunderstorm area built up southwest of Mason City that passed the Mason City Airport about 1648 with heavy rains and gusty winds up to 48 mph. A southern extension of this line of thunderstorm development existed south of Mason City. It was this storm area that Braniff Flight 152 entered.

The Weather Bureau forecast for en route weather issued at Kansas City for the period of 1300 of the 22d to 0100 of the 23d indicated conditions between Kansas City and Mason City as follows:

South portion—scattered clouds at 6,000 feet, high broken clouds becoming occasionally broken at 4,000 feet, visibility 5 miles with light thundershowers. North portion—broken clouds 3,000 to 4,000 feet, and broken clouds at 10,000 feet, occasional light rainshowers and widely scattered afternoon and evening thundershowers in the warm sector. Local turbulence was forecast in the vicinity of thunderstorms. The terminal forecast applying to Mason City for the period 1450 to 1830 was scattered clouds at 600 feet, ceiling 4,000 overcast, winds south-southeast 12, occasional light rain showers or thundershowers, visibility briefly 1 mile. The company forecast for Iowa covering the period 1200 to 2000 was for broken to overcast 1,000 to 1,500 feet, broken to overcast 6,000, occasional moderate rainshowers, visibility 1 mile plus light to moderate turbulence. No amendments were issued to either the Weather Bureau's or the company's Iowa forecast.

The Air Force issued severe weather ad-

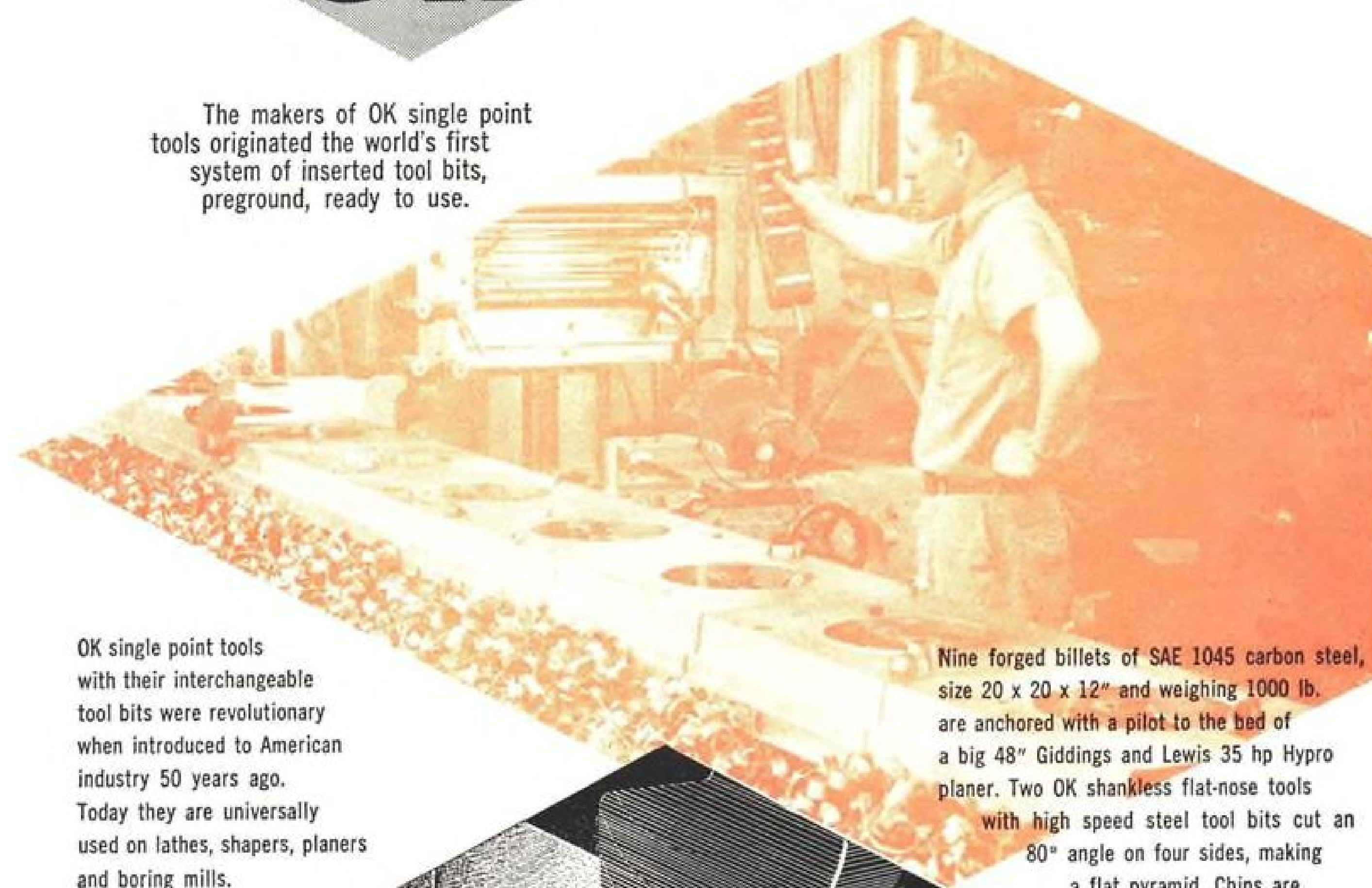
How Bullard  
with two

Man-au-trol turret heads are gang-planed

OK

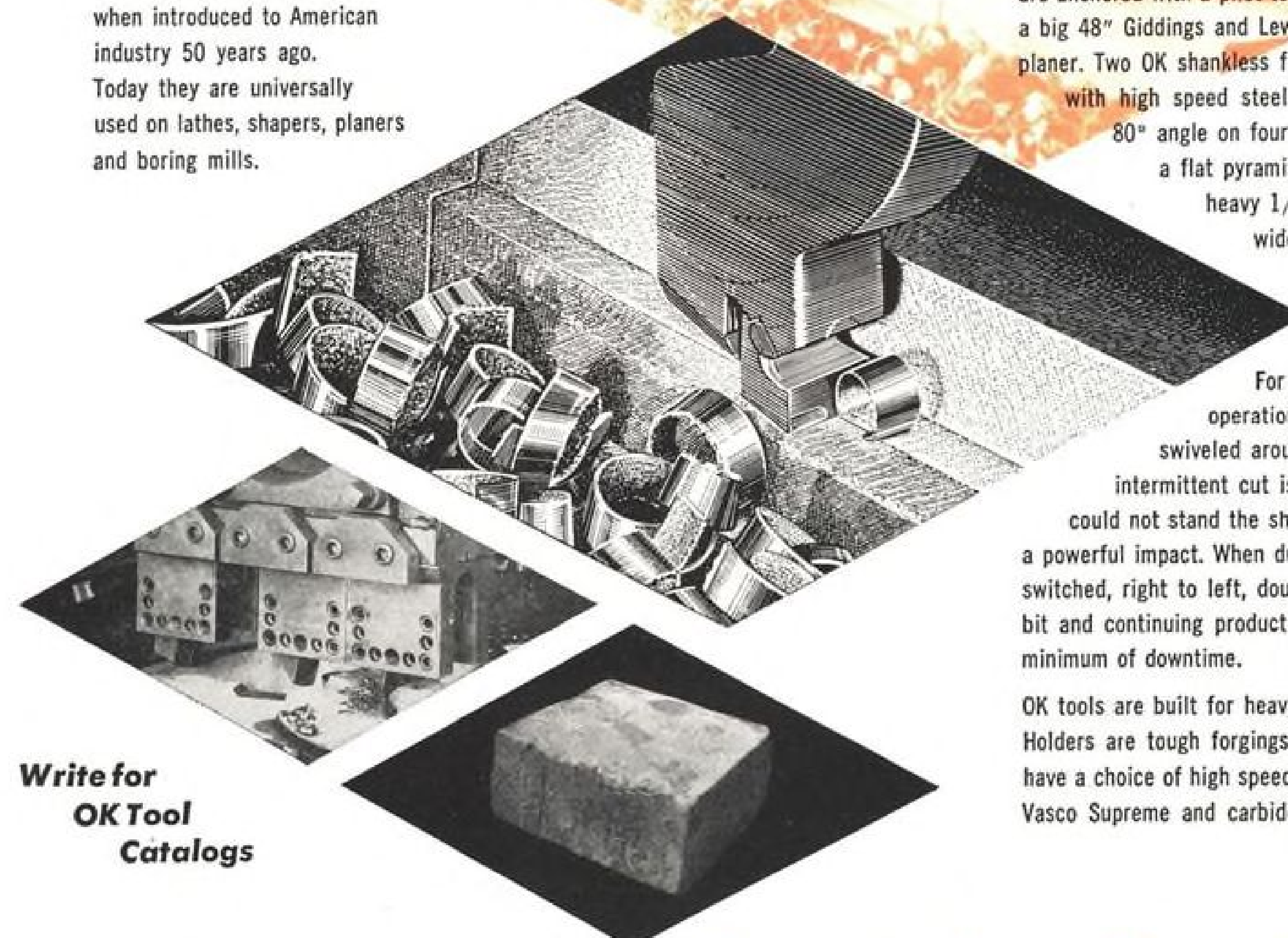
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## SAFETY . . .

visories from Tinker AFB, Okla. These advisories are transmitted on an Air Force teletype circuit and the Weather Bureau forecast centers at Fort Worth, Chicago, and Kansas City have a drop on the circuit. On Aug. 22, 1954, the Air Force issued two severe weather advisories, pertinent to the South Dakota, Nebraska, Minnesota, and Iowa area, one at 0930 and one at 1614, forecasting heavy thunderstorms, gusts to 50 knots, isolated hail at various altitudes and severe turbulence in thunderstorms. This last advisory forecast a line of thunderstorms that would have been 60 miles west of Mason City by 1700.

Radar storm detection information is

<sup>3</sup>The AF's use of severe turbulence corresponds approximately with the Weather Bureau's definition for heavy turbulence.

normally available from the Weather Bureau at Des Moines but the equipment was inoperative for 24 hours before the accident, consequently advisories from that source were not available for use by Flight 152.

### ANALYSIS

The flight's estimated time en route Waterloo-Mason City was 23 minutes for the 63 mile flight, a ground speed of 164 mph. At the point where the left turn to the west was made, 46 miles, or 17 minutes of the segment had been flown and the approximate time of the turn would be 1658. This is the time that the flight advised that it would hold southeast of Mason City. It is 8 miles, or 3 minutes, from where the turn was made to the crash point, making an arrival time of 1701 at the crash

point. The small time discrepancy between 1701 and 1703 can be explained by the probable reduced airspeed, due to the known turbulence experienced by Flight 152 in the last 5 minutes of flight.

From the above it is evident that Flight 152 did not hold southeast of Mason City any appreciable time. Although the aircraft's exact altitude at the time could not be accurately determined, several witnesses estimated its height as 400 to 800 feet above the ground. The reason why the flight proceeded into the thunderstorm area at this low altitude rather than hold clear of the storm can only be conjectured. Undoubtedly the captain had encountered many similar appearing storms during his years of operation over the route and it is quite possible that he entered the lighter area between the darker clouds on either side in order to get on the back side of the storm and subsequently land at Mason City.

At about the time the flight left Waterloo the previously reported towering cumulus had developed into thunderstorms scattered over the state but not forming into a true squall line. One of these thunderstorm areas formed to the southwest of Mason City and moved northeast to the Mason City Airport at 1648. Further thunderstorm building progressed rapidly at the southwest end of this development with one or more thunderstorm cells reaching the mature heavy rain stage at about the time Flight 152 arrived in the area of the accident.

The light area that ground eyewitnesses stated Flight 152 flew into can be accounted for by the lighter color of the rain curtain in contrast to the darker clouds above and on either side. By the time the flight went into the light spot the rain was very heavy and a downdraft had been established.

It is clear that a very strong downdraft developed in this rain area. Substantiation for the strong, gusty winds is shown by the damage done by these winds in the area of the accident and some of the gusts may have exceeded 80 mph.

In the initial stage of a downdraft of this nature the strong downward component continues to the surface and it appears probable that Flight 152 penetrated the



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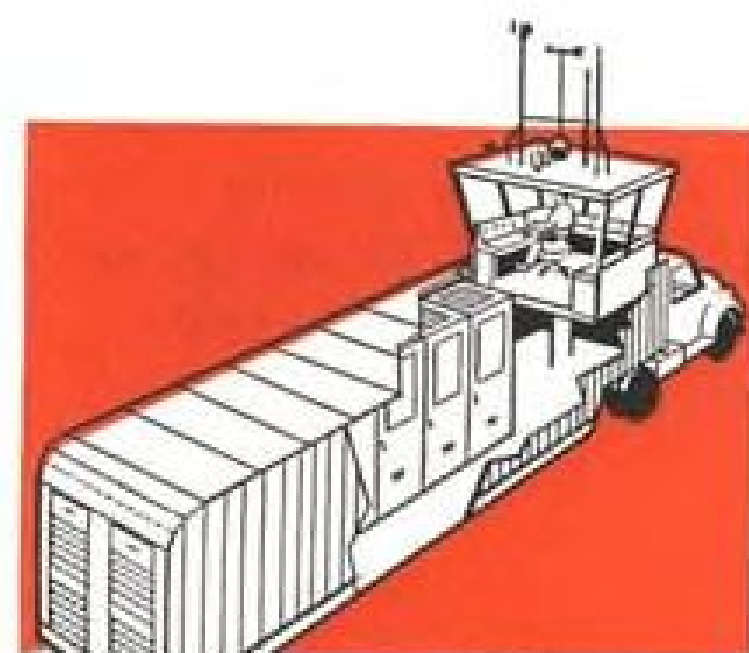
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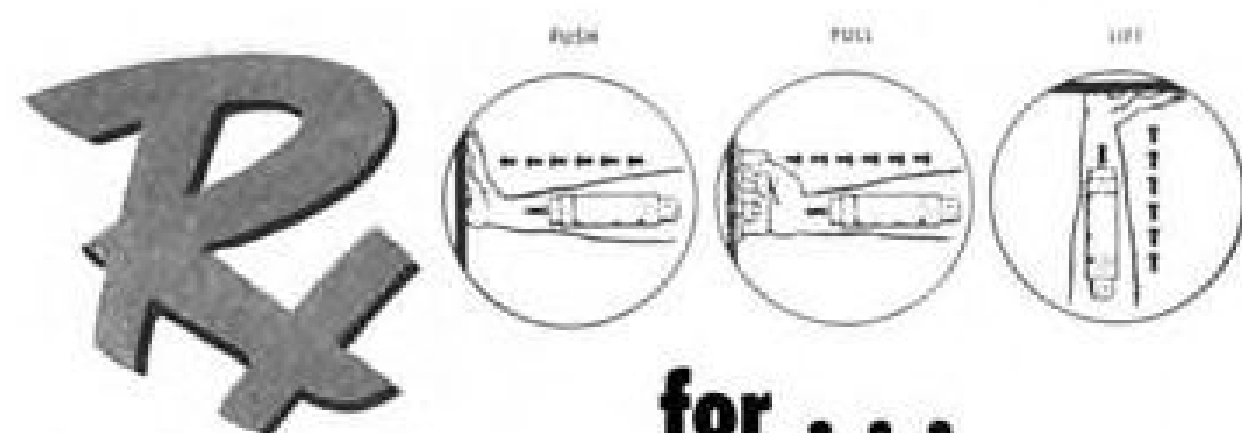
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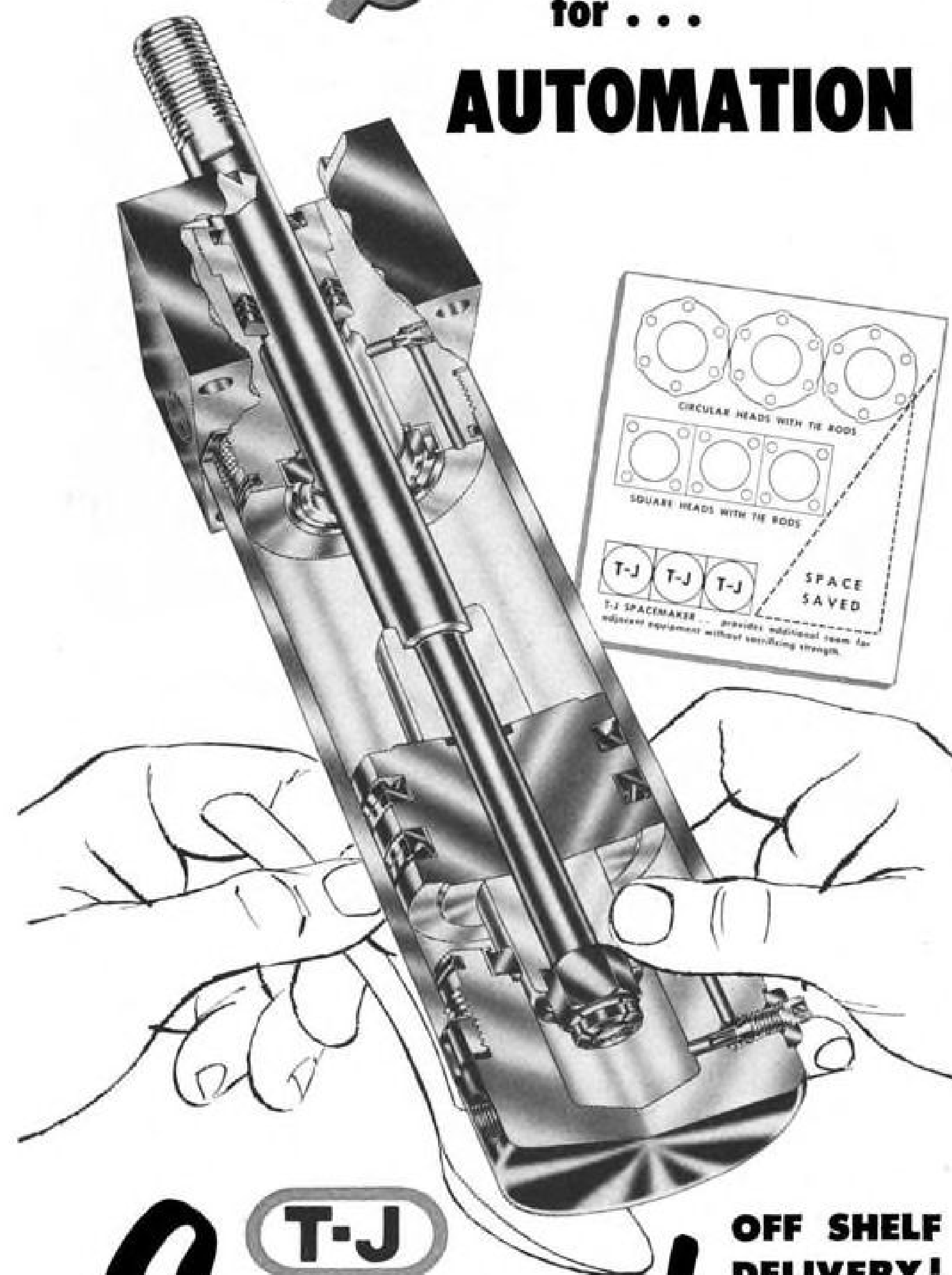
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storm in the initial stage of this downdraft. Further contributing to the loss of altitude is the possibility of a sudden airspeed loss as the aircraft proceeded into the divergent winds from the storm center.

Extensive investigation was conducted with regard to possible tornadoes, but it can be definitely stated that a fully developed tornado reaching to the ground did not occur. There is insufficient evidence to state whether a vortex aloft occurred. With regard to this storm, had the radar set at Des Moines been in operation it would not have been capable of determining the intensity of the storm due to the distance being beyond its effective range. Radar storm detection information could have been provided by the Air Force station at Waverly (approximately 40 miles from the scene of the accident) had the pilot of Flight 152 requested such service.

The Weather Bureau's forecast for Mason City, Iowa, did not contain information that would properly warn the pilot of conditions that would be encountered, and this is also true of the company forecast. If the storm that developed near Mason City had been anticipated by the forecaster, a severe weather forecast would have been required.

## FINDINGS

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

1. The flight crew, aircraft, and air carrier were currently certificated for the subject flight operation.
2. According to company records the aircraft's load was properly distributed so that the center of gravity of the aircraft was within approved limits.
3. There was no evidence of structural or power failure or malfunction of controls or communications prior to impact.
4. The dispatching of the flight was normal and in accordance with company procedures.
5. The flight advised that it would hold southeast of Mason City.
6. The flight was observed to enter and disappear in a thunderstorm.
7. The aircraft crashed in an area where severe storm ground damage occurred.
8. The U. S. Weather Bureau at Kansas City received the U. S. Air Force severe weather advisories but considered their forecast in effect at the time to be adequate.
9. The weather forecast issued by the Weather Bureau and Braniff did not indicate the severity of the storm that was encountered.

## PROBABLE CAUSE

The Board determines that the probable cause of this accident was that the flight while endeavoring to traverse a thunderstorm area encountered very heavy rain, divergent winds, and strong downdrafts that forced the aircraft to the ground.

By the Civil Aeronautics Board:  
Chan Gurney  
Harmar D. Denny  
Oswald Ryan  
Josh Lee  
Joseph P. Adams

# NEW FJ-4 FURY FEATURES "pump that couldn't be built"



Intended for combat at near sonic speeds, North American Aviation's FJ-4 Fury jet fighter is characterized by thin wings. The carrier-based craft, first flown on October 28, 1954, relies on a new-type Pesco fuel transfer pump and three Pesco submerged fuel pumps.

The U.S. Navy's newest jet fighter, the North American Aviation FJ-4 Fury, uses a revolutionary new Pesco pump in a line-mounted fuel transfer application. This—the pump that couldn't be built—is the first centrifugal impeller type pump ever perfected for such use.

The extremely thin wings of the FJ-4 prevented use of submerged fuel pumps in the wing tanks, so Pesco engineered the so-called "impossible" pump. A radically new Pesco-designed impeller permits the pump to overcome long inlet line losses and deliver a full flow of JP-4 fuel up to 45,000 feet altitude. The pump is instantly self-priming should it become unprimed during maneuvers.

Designed for a 1200 hour overhaul cycle, this motor-driven pump is powered by a Pesco-built DC Electric Motor. Precise and powerful, it weighs only 7.4 pounds and its 11" x 5" x 5" envelope fits into a close-tolerance fuselage location.

Three submerged fuel pumps in the fuselage tank are other Pesco components of the fuel system which supplies the Wright J-65-W4 power plant.

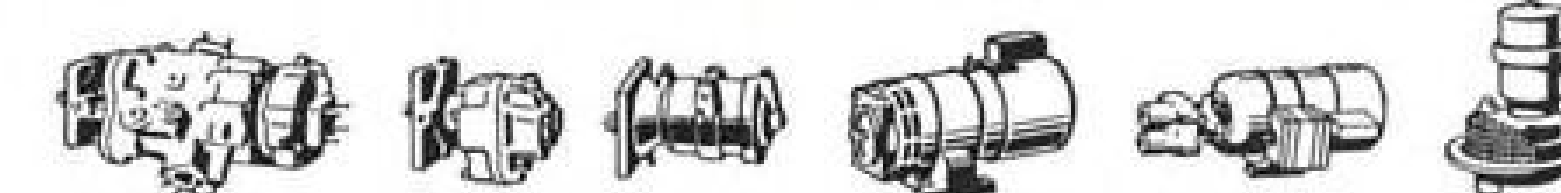
The "pump that couldn't be built" typifies Pesco's continued success in solving difficult aircraft pumping problems. If you have such a problem, take advantage of the development facilities, engineering experience and greatly increased manufacturing capacity of Pesco. Call or write: PESCO, 24700 North Miles Road, Bedford, Ohio.



Model 122913-010 Fuel Transfer Pump was specially developed by Pesco for FJ-4. Able to pump boiling fuel, run "dry" for 15 hours and reprime itself, this pump performs a function previously considered impossible for a line-mounted aircraft fuel pump.

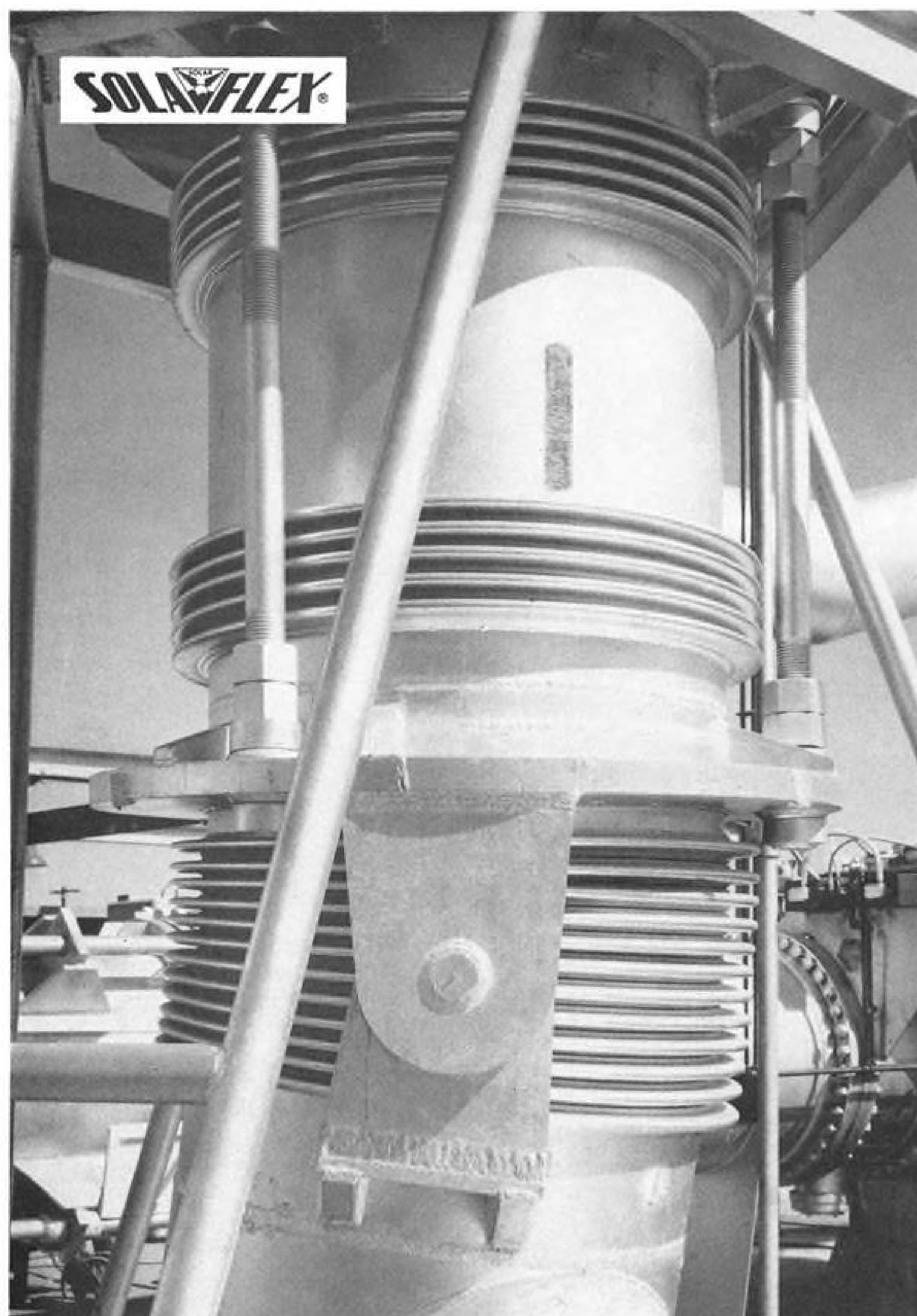


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## A "hinge" for hot air

**THE SOLA-FLEX BELLOWS** shown above give flexibility to a 36 inch hot air line in a facility for testing ramjet engines at Marquardt Aircraft Company.

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Many Sola-Flex bellows of all sizes are today in use in wind tunnels and

similar installations. The world's largest expansion joint—28 feet in diameter—was built by Solar for a supersonic wind tunnel at NACA's Lewis Laboratory in Cleveland. Sola-Flex bellows are another example of Solar's increasingly diversified services for the aircraft industry.



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## AIR TRANSPORT

# CAB's 2-1 Vote Dims Nonsked's Hopes

- Split Board says compliance ruling should precede decision on North American N. Y.-Chicago route plea.
- Josh Lee's dissent hits at long delays in processing route case, but does not support carrier's application.

By Craig Lewis

Attempts by North American Airlines to get a decision in the New York-Chicago case ahead of action in its own compliance case are an admission that the nonscheduled carrier is operating illegally, Civil Aeronautics Board finds.

In denying a North American motion, the Board said that the company's efforts must be "founded on the assumption that it has been operating illegally and can be legally required to terminate its operations."

► **Court Action**—North American has countered with petitions to the Court of Appeals to stay the Board's action and review the case.

The situation centers on the issue of which of two cases—the New York-Chicago service case or the Twentieth Century Air Lines compliance proceeding—should get priority in the issuance of examiner's reports. Both cases are being handled by examiner William F. Cusick. North American wants the New York-Chicago case decided before the compliance proceeding. The Board has decided to go ahead with the compliance case.

CAB members Joseph P. Adams and Josh Lee hold the opinion that the New York-Chicago case has been held up long enough.

The New York-Chicago case is a general route case in which North American is an applicant for certification as a regular air carrier between the two points. The compliance proceeding deals with alleged violations of its operating authority by North American and could result in the irregular carrier being put out of business.

► **Lee Dissents**—The Board decision came as a denial of a North American petition for reconsideration. Since November, the nonsked has been petitioning examiner Cusick and the Board to have a report issued on New York-Chicago before the compliance report. On Jan. 7, the four-member CAB split evenly and the petition failed for lack of a majority.

North American filed for reconsideration, and the Board has turned the carrier down by a 2-1 vote, with Lee filing a dissent.

It is understood that CAB member Adams withdrew from participation in the matter, with the result that there was a clearcut majority decision. The dissenting views were aired in Lee's minority dissent.

► **No Irreparable Damage**—The North American family has asked the United States Court of Appeals to review the matter and has also asked for a temporary restraining order to stay the effectiveness of the Board's order. CAB has agreed to take no action until the hearing on the temporary injunction, scheduled to be held this week.

In denying the motion for reconsideration, the Board found that since decisions issued by examiners are not final, North American isn't going to be irreparably damaged if the compliance report is issued first.

The majority also found that the examiner should give priority to the compliance case because:

- The examiner has said that the compliance report is in an advanced stage of preparation and "the expeditious handling and proper dispatch of the Board's business and the ends of justice will best be served" by having the examiner complete the compliance report before finishing the certificate case.
- The record in the compliance case will be used in considering North American's "fitness" in the certificate case.
- While the Board wants to complete the certificate case promptly, it is also important to expedite enforcement proceedings in order to maintain the effectiveness of enforcement action and the Civil Aeronautics Act.

► **North American Views**—The individuals and corporations which make up the North American group want the court to set aside the CAB order, issue instructions that the New York-Chicago report is to come out first and restrain the Board and the examiner from taking any action until the court reaches a decision.

In support of these requests, the nonsked holds that:

- CAB erred in assigning both cases to the same examiner.
- CAB was wrong in allowing a situation where an examiner "was free to 'sit on' one case submitted to him for

months, i.e. the New York-Chicago service case," while the compliance case was developed.

• CAB should have taken direct action to instruct the examiner which case to consider first.

North American holds that the Board's order is erroneous and unlawful in purporting to approve these actions as lawful. It also says that the CAB action was "arbitrary, capricious, unlawful and in abuse of respondent's administrative discretion" in failing to consider its duty or the rights of the petitioners to have the cases disposed of in a specified order.

The brief to the court says that the Board made the improper supposition that North American had a duty to submit the question of priority and that it has failed in its duty to expedite certificate proceedings.

The Board order is claimed by North American to be "predicated and founded on a completely erroneous analysis of petitioner's contentions," and to be unlawful and void because it was adopted "with only three members participating although no reason is given why the fourth member failed to participate."

► **Lee's Views**—CAB member Josh Lee opposes the majority action in his dissent, but he steers clear of North American. His view is that any delay in the processing of the New York-Chicago case is contrary to the public interest.

"I, too, believe it is in the public interest," said Lee, "to process in an orderly fashion enforcement proceedings where it is necessary to promote and further the objectives of the Civil Aeronautics Act. But I also believe it is my duty to see that new route proceedings involving vital questions of public interest are processed in an orderly manner as required by the statute. Such has not been true with respect to the New York-Chicago case."

Lee observed that the Board has been criticized for slowness both in getting cases started and in getting them handled once they are under way. He pointed out that the United Air Lines' restriction case, dealing with UAL's nonstop service between Chicago and the Northwest, was deferred more than two years ago pending action on the New York-Chicago case and is still hanging fire while that case is unfinished.

► **Delay Concern**—Lee reviewed the proceedings in the New York-Chicago case, finding that two years have gone by since the prehearing conference and 13 months since hearings closed, and esti-



mates that a decision can't be expected before late summer or fall.

"This question of delay gives me concern," he said, "and I propose to take advantage of every reasonable opportunity to correct it. It is in the light of these circumstances that I have come to the conclusion that any further delay in the New York-Chicago case, no matter how slight, is contrary to the public interest. . . ."

## AA's Smith Predicts Higher Airline Fares

Higher airline fares are predicted by American Airlines president C. R. Smith to offset continuing increases in airline costs. He also sees turbojet airliners replacing current types in the early 1960s.

Smith told the Buffalo, N. Y., chamber of commerce that the airline industry has "held the line" on fares for 20 years, while the average cost of services and materials doubled. Economics stemming from more efficient aircraft and large-scale production were viewed by Smith as the principal factors in keeping fares down and maintaining air transportation as a bargain.

► **Growth Leveling Off**—But economics will be more difficult to gain, according to Smith, with the rate of growth of the industry leveling off. Also, some economy gains will go into improving service.

"Looking at the next five years," said Smith, "it seems obvious that there must be some upward adjustment in fares and charges, some increased revenue from that source to offset the continuing increase in the cost of providing the service.

"But even with these increases, air transportation will continue to be one of the best bargains in the market place, and air transportation will continue to be within the economic reach of those with modest incomes."

► **AA's Jet Requirements**—In reviewing the turbojet and turboprop airliner situation, Smith said he thinks it is doubtful that the turbine-powered airplane will have much impact in the field of domestic air transportation in 1956 or 1957.

Smith said American's future requirements fall into three general categories:

- A short and medium-range four-engine turboprop airplane carrying 50-60 passengers and cruising at 350-400 mph.
- A longrange, four-engine turbojet carrying 80-100 passengers and cruising at 550-600 mph.
- An intermediate-size airplane with turboprop engines and a cruising speed of 450 mph.

"As of now," Smith said, "it seems sensible to predict that the small turboprop should be available for service in 1958, and the large turbojet within a year or two thereafter."

## EAL Wins New Round In Fight for Colonial

A finding that Eastern Air Lines no longer controls Colonial Airlines and that the case should be dismissed is recommended in a brief filed by the Civil Aeronautics Board Office of Compliance. National Airlines disagrees and wants Eastern found guilty.

The Compliance Office says: "The record does not contain any evidence that Eastern has had within its control any person who owned stock in Colonial as of Aug. 31, 1954, or since that date."

National replies: "Eastern still illegally controls Colonial. The record proves it. Only the names have been changed to confuse the issues in this case."

Just before the briefs were filed, Colonial announced it had accepted Eastern's offer for its assets, subject to approval of Colonial's stockholders, CAB and the President. Eastern has offered one share of stock for two shares of Colonial stock.

► **Compliance Findings**—The Board instituted the investigation, and the Office of Compliance participated in the case as an investigative body. Its purpose was to determine whether Eastern had control of Colonial on Aug. 31, 1954, or at any time after that up to the end of hearings and, if so, to what extent. The question of what action should be taken against Eastern also was raised.

The Compliance Office found that of the original 110,524 shares pinned within the orbit of Eastern influence during the EAL-Colonial acquisition of assets case, only 27,755 of these shares remained Aug. 31, 1954, and 5,055 Dec. 23, 1954.

The compliance attorney concludes that the examiner should find that:

- Eastern did not have control over Colonial stockholders or management on Aug. 31, 1954, or between then and the end of the hearing in December.
- Holdings of persons found to be under EAL's sphere of influence by the examiner in the acquisition case were reduced to 27,755 Aug. 31 and 5,055 by Dec. 23.
- No Colonial stockholders hold their stock as a result of Eastern's influence or are controlled by the larger airline.
- EAL did not control Sigmund Janas' Colonial stock on Aug. 31 or between then and the end of the hearing.
- Eastern did not control Colonial on Aug. 31, 1954, or between then and the end of the hearing.
- The proceeding should be dismissed.

National takes a different view and asks a finding that Eastern illegally controls Colonial right now.

► **National's Arguments**—"The evidence in this case is bulky and difficult to review due to the number of names involved and the interlocking relationships existing among said names," says NAL. "Despite the problems encountered and Eastern's failure to assume its burden of proof, the record clearly re-establishes Eastern's guilty. . . ."

"To cleanse Colonial of Eastern's influence and control is next to impossible. The disapproval by the President of the United States of the Eastern-Colonial merger was meaningful.

"It was decided that a carrier should not and cannot, consistently with a sound program of law enforcement, be permitted to keep the fruits of an illegal act. But the apparent position of Eastern all along has been that such illegal acts can be condoned by approval if Eastern cleansed itself of such control. This it has not done."



## Venezuela Gets New Super Connies

Here is one of two 59-passenger Lockheed Super Constellations delivered to Linea Aeropostal Venezolana and now serving on the airline's routes to New York and to Rome. LAV was one of 12 airlines receiving

Super Connies last year—with delivery to a different carrier each month. Lockheed plans to maintain the same delivery pace this year, with planes so far scheduled for 11 air transport operators.

## CAB Okays Nonsked Miami-Panama Trips

An agreement between Trans Caribbean Airways and Aerovias Interamericanas De Panama, S.A. (Avispa) under which Trans Caribbean would perform flight operations for the Panamanian carrier has been approved by Civil Aeronautics Board.

Under terms of the pact, Trans Caribbean, a large irregular airline, will operate 4 to 20 roundtrips a month between Miami and Panama and any other flights agreed upon by the two companies. Flights are to be operated with Trans Caribbean's DC-4s and DC-6s, with the American carrier furnishing all flight crews and paying all aircraft operating and maintenance expenses.

► **Stock Offer**—Avispa will be responsible for loading, traffic and sales, ticketing, filing of tariffs, preparation of manifests, and immigration and customs clearance.

For its services, Trans Caribbean is to get \$2.50 a mile flown for DC-6s and \$1.65 a mile for DC-4s.

In addition, Avispa offered to sell Trans Caribbean 40% of its authorized capital stock for \$1,000. The Board decided that under its policy of working toward elimination of substantial ownership and effective control of foreign air carriers by American carriers, it must restrict stock provisions of the agreement. During the life of the agreement, Trans Caribbean and its officers, directors and principal stockholders must get CAB permission to acquire any interest in Avispa.

► **Two-Year Approval**—Avispa has held a foreign air carrier permit since last March, but it has never operated under it. The Board has found that the agreement provides Avispa an opportunity to get into operation immediately, and to offer service until it can gain sufficient experience and acquire enough equipment to run its own operation. In view of this, the agreement has been approved for two years.

Trans Caribbean requires additional authority to perform the projected operations in foreign air transportation. But the Board has issued an exemption in view of the purpose, the short term of the agreement and the expense and delay involved in getting a certificate.

All aircraft operated in Avispa service must bear only Avispa markings.

## North Central Gains

North Central Airlines reports revenue passengers increased 30% in 1954, airmail 12% and air express 20%. Revenue passenger-miles went up 26% to 47,456,757 and load factor climbed from 41.9 to 43.4.

## What's Wrong With Airfreight?

FTL's Burwell says air cargo lines need express and surface mail contracts plus protection from nonskeds.

Six mistakes in airfreight policy and a variety of cures for air cargo ills have been outlined by L. C. Burwell, Jr., vice president of Flying Tiger Line.

Burwell said airfreight should be subsidized but that "prior to such outright subsidy, certain disorders should be corrected and we think that a great part, if not all of the subsidy, could be managed with no expense to the taxpayer." He spoke before the American University Transportation Institute.

► **Policy Errors**—A need for help from policy makers was seen by the Tiger's official. Reviewing the 10-year development cycle of airfreight, he listed six errors in current policy:

- Failure to realize that the World War II airlift was operated with a cost factor of lives rather than of dollars as a governing force.
- Failure to adequately account for the competition of surface transportation.
- Basing operational policy on the personnel and aircraft surpluses of 1945 and not taking into account the cost of training and replacement 10 years later.
- Failure to allow for wage increases over the 10-year period.
- Trying to develop freight as a sideline to passengers and regarding the problems and techniques of both to be the same.
- Forecasting the success of airfreight to the point of applying all the statutory prohibitions and responsibilities of the passenger carrier without all its prerequisites and privileges.

Burwell called for a joint effort of operators and rule makers to correct the flaws that now are apparent.

► **Corrective Measures**—In the speech, a number of corrective measures were recommended to give greater federal support to airfreight without indulging in direct subsidy.

Burwell asked for expansion of the authority of all-cargo airlines to include all forms of property, including express and surface mail plus present freight loads.

Civil Aeronautics Board should permit a low rate category for deferred freight that would help correct directional imbalances in traffic, said Burwell. The all-cargo carriers should have the same protection afforded passenger airlines against irregulars that misuse their authority by operating scheduled service under the guise of charter.

► **Military Help**—Three recommendations were made by the FTL official for aid from the military in developing airfreight as a necessary defense resource:

oriented to air rather than to surface transportation.

- Shipment of military traffic on a common carriage basis rather than by contract.
- Military guarantee of leases to encourage investors—insurance companies—to buy modern, all-purpose cargo planes and lease them to the cargo operators.

Burwell estimated that if airlines could reduce direct operating cost through use of such all-cargo aircraft, a fleet of 50 could cut the airfreight rate structure by as much as 40%. He viewed this plan as a solution to the problem of obtaining the much-needed cargo plane freight operators cannot afford because of the limited market and subsequent high purchase price of new equipment.

► **Industry Self-Help**—Burwell came up with a radical plan for combining industry-wide freight operations to cut costs and raise efficiency.

Under current systems, all airlines maintain separate facilities for processing freight and consequently waste a lot of money through inefficient use when traffic is low. By consolidating operations into one joint facility, carriers would pool their freight and ship it through one sub-contractor who could handle the total traffic more efficiently. Lower costs and lower rates could lead to more business.

Burwell also asked CAB to set up a staff section whose sole responsibility would be airfreight, because "until some such agency exists, any airfreight matter is doomed to appraisal in a minor perspective."

## New Legislation Asks Ban on High Antennas

Radio and television antenna towers more than 1,000 ft. high would be banned as hazards to air navigation under legislation introduced by Rep. Oren Harris and Rep. Carl Hinshaw, both members of the House Interstate and Foreign Commerce Committee.

Federal Communications Commission could license a tower over this height only if "due to being shielded by existing obstructions or, for other reasons, it is not a hazard to air navigation."

The measure points out that with the rapid growth of military and civil aviation and the broadcasting industry, "the navigable air space . . . has become a vanishing national resource."



## Airwork Leases Slick Planes for U.S. Route

With less than a month to go before it is scheduled to start trans-Atlantic air cargo service, Airwork Ltd. last week found some airplanes. The British company signed an agreement with Slick Airways for an undisclosed number of DC-6A and C-54 transports.

► **Slick Craft, Crews**—Slick has filed an agreement with Civil Aeronautics Board that says the U.S. carrier will provide aircraft and crews, with an option allowing Airwork to supply its own crews on 30 days' notice to Slick. Airwork hopes to use its own crews as soon as possible in order to check them out before the carrier takes delivery on its own DC-6As from Douglas Aircraft Co.

Under the law, aircraft of U.S. registry cannot be operated by pilots who do not have U.S. airman certificates. Airwork petitioned for and has been granted a waiver of certain sections of the Civil Air Regulations relating to requirements for pilots, navigators and flight engineers for certificates.

► **Training Burden**—CAB is granting U.S. certificates, provided the British airman has a certificate issued in the United Kingdom. Such certificates will be valid only in operation of U.S.-registered aircraft employed in the service authorized by Airwork's foreign carrier permit.

Such certificates will become effective, however, only after the Slick-Airwork agreement has been approved by CAB or the Board issues a statement to the effect that approval is not necessary.

CAB approved the pilot certification before deciding on the agreement itself in order to release Airwork from the burden and expense of training its crews to pass U.S. examinations. The Board emphasized that it is not prejudging its decision on the actual agreement.

## CAB Examiner Backs Rival Lines in Hawaii

Competitive air transportation will continue in the Hawaiian Islands if recommendations by Civil Aeronautics Board examiner Merritt Ruhlen are adopted.

His report recommends that:

- Trans Pacific Airlines' temporary certificate be renewed for five years, to terminate Dec. 31, 1955.
- Hawaiian Airlines' certificate be amended to include service to Hana, Maui and Kamuela.
- Cockett Airlines and Andrew Flying Service be permitted to operate air taxi service under the same provisions as are applied in the continental United States.

Chief issue in the case is whether

Trans Pacific should continue to operate as an inter-island airline in competition with Hawaiian. TPA started operations in 1949 and, by 1952, was flying 32.33% of the revenue passenger-miles in island traffic. When Hawaiian, which started operations in 1929, added Convair 340s to its DC-3 fleet in 1953, TPA's share slipped. But it has recovered.

In view of the relatively short distances involved, Convairs do not substantially increase service on island routes as far as safety, comfort and speed are concerned, according to the report.

Ruhlen estimates that current total mail pay needs for the two airlines will be \$500,000 more than for a single carrier, but he says feeder lines in the United States get considerably more mail pay for similar service.

His report says Hawaii presents an unusual problem: There is no other type of transportation available to compete with air service. "In Hawaii you use the airline or you don't travel." Under these circumstances, the examiner believes that "some subsidy is justified to prevent a complete monopoly of all transportation facilities between the Hawaiian Islands."



**Fast Factfinder**

American Airlines' ticket agents now can give its patrons flight information only moments after a query is asked. A hitherto unused portion of AA's electronic Reservisor computer and calculator, hooked up to this agent's set, does the job. The airline feeds flight data into the Reservisor's magnetic "memory" drum. An agent has only to key her set to the flight in question, then press twin buttons. The Reservisor flashes the answer back to the set. The airline has 127 of the counter sets in its reservations and ticket offices throughout the New York metropolitan area. As the carrier extends use of the Reservisor automatic reservations controller around the country, it will tie the new flight information device into it.

## Charter Market

- IMATA survey shows need for air exchange.

- Association says traffic would increase 100%.

There is a large potential market for air charter services in the U. S., according to a nationwide survey of typical charter users by the Independent Military Air Transport Assn.

IMATA says its survey shows that establishment of an air exchange, or commercial clearing house of some sort, would help to increase commercial air charter traffic by as much as 100% among present users.

It also would provide an opportunity for exploiting potential traffic.

► **Basic Need**—In its survey, IMATA sent detailed questionnaires to three varying groups—colleges and universities, national and regional associations and industrial organizations. Response was received from 36% of 1,801 organizations polled.

Of colleges replying, 41.2% had used charter services at least once over the past two years; industrial concerns, 17.7%; associations, 8.6%.

IMATA says the basic need for an air exchange service, similar to the one presently operated by IMATA for the military, was revealed in answers to questions relating to the difficulty of obtaining aircraft for charter. Nearly half the colleges and universities using charter service in the past have at one time or another been unable to locate an available plane of the right type when wanted. Of industrial concerns, 13% had similar trouble.

► **High Prices**—According to IMATA, these were the reasons most often given for failure to use charter service:

- No aircraft of any sort available.
- Price too high, especially because of ferrying or deadhead charges.
- Available aircraft not suitable.

"These are factors," says Ramsay D. Potts, Jr., IMATA president, "which can be largely eliminated through the coordinating service of an air exchange. It is apparent from our study that the charter market demands a wide variety of equipment, from single-engine to the largest and most modern four-engine planes.

"Moreover, there are fluctuating seasonal demands and a geographic scatter of requirements. It would be difficult, if not out of the question, for even the largest single carriers to meet the needs of this market or to develop it to its maximum potential."

► **Supply, Demand**—Potts says that by bringing together information on avail-

ability of aircraft and aircraft requirements in one coordinating group, demand and supply can be matched. This, he says, would result in improved service, elimination of much ferry mileage and waiting time and substantially lower costs to the user.

It also is likely that reductions in ferry mileage and attendant costs for military charter would occur if one single group could be established to serve both military and commercial charter needs.

► **New Business**—One of the most significant facts uncovered in the survey, the IMATA chief says, is that "charter business is very largely new business for aviation. For example, if colleges had to find a substitute for air charter, 78% would choose surface transportation . . . only 21% would use scheduled air transport. . . .

"Industrials and associations would use scheduled air transportation to a higher degree. However, 11% of the industrials would cancel their trip, and 36% would use surface transportation. Air charter fills a specialized need, and its potential users exceed the number of those who already know its advantages."

## Los Angeles Asks Mexico City Service

United States-Mexico air service took another turn when Sen. Thomas H. Kuchel asked the State Department to press for service between Los Angeles and Mexico City by an American carrier.

In a letter to Thruston B. Morton, Assistant Secretary of State, Kuchel asked that Los Angeles-Mexico City service get priority in negotiations between the two governments, reported about to reopen.

► **Inconvenience**—Kuchel said the U. S. should make every effort to obtain equality of treatment and definite adherence to the principle of reciprocity. "Mexico's refusal to allow an American-owned line to operate between Los Angeles and Mexico City is not to the best interests of our own country. . . . Steps should now be taken respectfully to indicate this to our neighbor."

Civil Aeronautics Board gave Western Air Lines a permit in 1946, but the route never was operated because no agreement was reached with Mexico, either on an individual basis or as a bilateral.

"The inequity restricting hundreds of thousands of air travelers in the western half of the United States deserves to be corrected," said Kuchel, "before any speedier or additional service is arranged for those portions of this country now already enjoying more direct and less time-consuming connec-

tions with Mexico." Proceedings are under way in CAB to certificate a U. S. carrier for nonstop New York-Mexico City service.

► **Mexican Applicant**—In the nonstop New York-Mexico City route fight, another factor came into focus when Aerovias Guest, S. A., renewed its efforts to get a permit for the service. Earlier, it was reported that Compania Mexicana do Aviacion, S. A., had the inside track to represent Mexico in the service (AVIATION WEEK Jan. 10, p. 91).

Guest holds a permit to operate between Miami and Mexico. In 1947, the airline applied for a permit for New York-Mexico City nonstop service after obtaining rights for the service from the Mexican government.

► **Bilateral Lack**—Guest has made attempts to expedite its application, but the Board has followed a general policy of not considering route applications for U. S.-Mexico service because of the absence of a bilateral. Guest says the Board is now actively processing the applications of Eastern Air Lines, American Airlines and Pan American World Airways for the nonstop service.

Guest concludes that CAB is ready to consider a Mexican airline and points out that the Mexican government probably will want a Mexican carrier certificated in exchange for any rights granted a U. S. line. Thus the airline suggests that expeditious hearing on its application would be in the interest of early initiation of nonstop service, since it allegedly is the Mexican carrier with government approval.

Guest says it has "no concern with the issue in the New York-Mexico City nonstop case as to which, if any, of the three U. S. carrier participants should be granted the right to operate the route. Applicant believes, however, that the same factors which warranted the consideration of the granting of the route to any United States carrier likewise compel the consideration of the granting of the route to the applicant, the Mexican carrier which, since 1947, has held the Mexican authority to operate the route."

## Board Approves New EAL, Piedmont Routes

Civil Aeronautics Board has decided to supplement service through Ohio by certificating Eastern Air Lines from Charlotte, N. C., to Detroit and Piedmont Aviation from Charleston, W. Va., to Columbus.

Eastern's route is segment of Route 6, amended to authorize service between Charlotte and Detroit via intermediate points Columbus and Toledo, Ohio.

Piedmont will operate new service between Charleston and Columbus via

intermediate point Parkersburg, W. Va.-Marietta, Ohio.

Lake Central Airlines asked for Detroit-Charleston service via Columbus, Lima and Toledo, but the Board decided its application offered insufficient evidence to warrant certification of that route.

Eastern wanted its new segment to terminate at Charleston, rather than Charlotte. The Board said that its decision to amend Piedmont and Eastern's certificates "is based on our view that such action will realize the bulk of the public benefits of the services proposed by both of these carriers, and at the same time will operate to minimize Piedmont's subsidy requirements."

## CAB ORDERS

(Jan. 20-26)

### GRANTED:

The Postmaster General leave to intervene in the case involving Western Air Lines service to Richfield and St. George, Utah, and Chadron, Neb.

### APPROVED:

Transfer of certificate of Munz Airways to Howard J. Mays.

Intercompany agreements involving Delta-C&S Air Lines, Braniff Airways and various other carriers.

### ORDERED:

Investigation and suspension of certain charter rates for DC-3 and C-47 type aircraft filed by General Airways.

Investigation and suspension of certain reduced fares filed by Great Lakes Airlines.

### DENIED:

California Central Airlines' petition for reconsideration of an earlier CAB decision denying an exemption and deferring action on requested service to Tijuana, Mexico.

### DISMISSED:

Nassau Aviation Co.'s application for a foreign air carrier permit between the Bahama Islands and Florida, since the application has been withdrawn.

## SHORTLINES

► **American Airlines** will start a second daily nonstop, roundtrip flight between Los Angeles and Washington Mar. 1. It is scheduled for 8 hr. 20 min. westbound, 6 hr. 50 min. eastbound.

► **United Air Lines** has bought \$1 million in airborne radio equipment for its aircraft. The purchase includes 224 very high frequency receivers and the same number of VHF transmitters . . . United figures it will serve 5.3-million meals and snacks in 1955.



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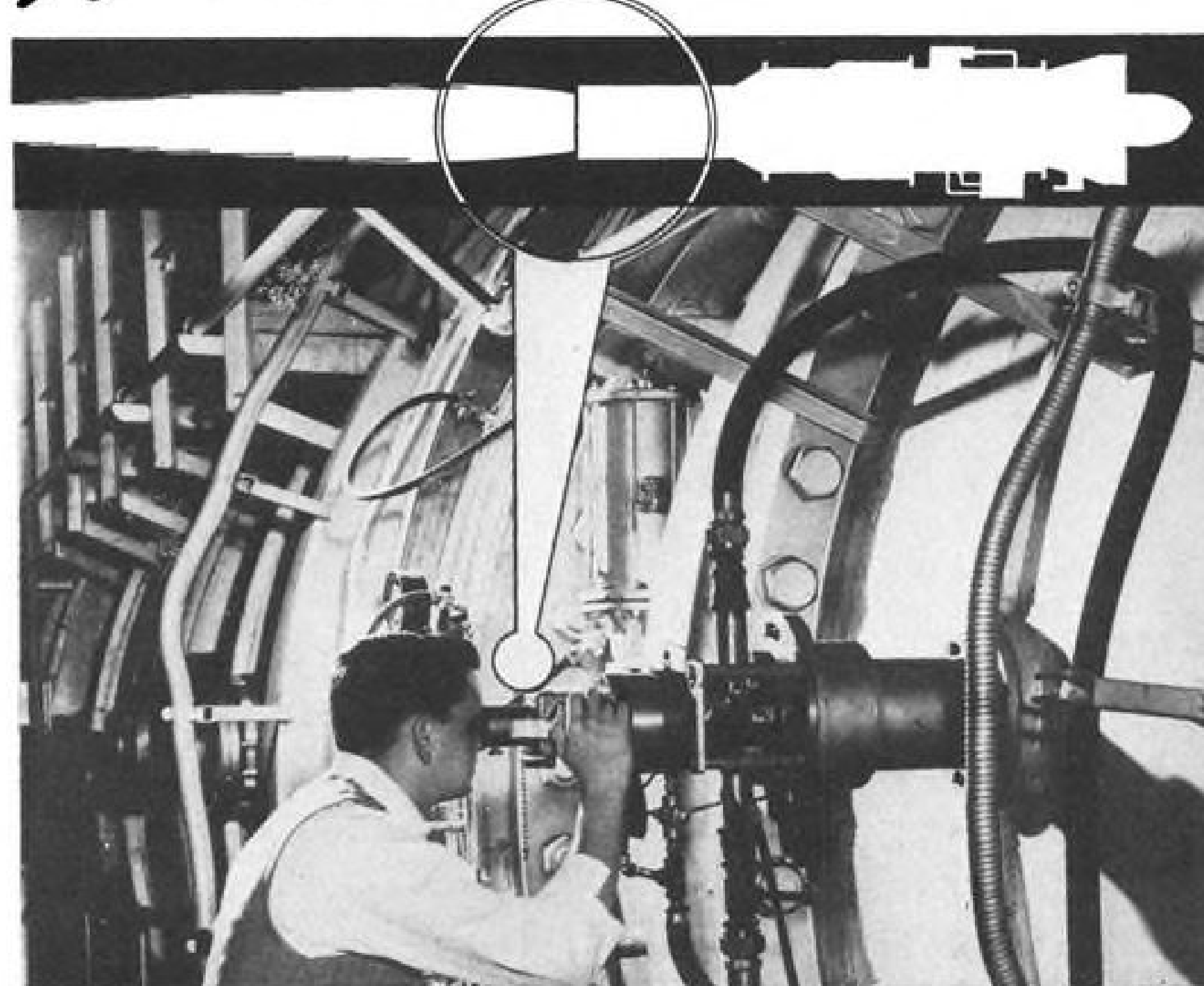
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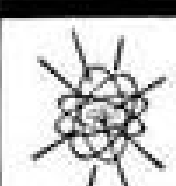
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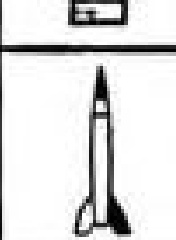
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RW-5197, Aviation Week  
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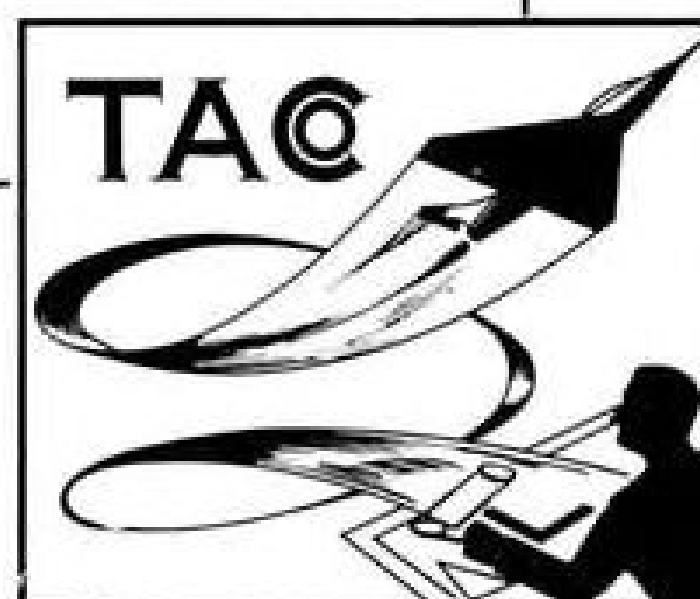
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P-5174, Aviation Week  
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P-5400, Aviation Week  
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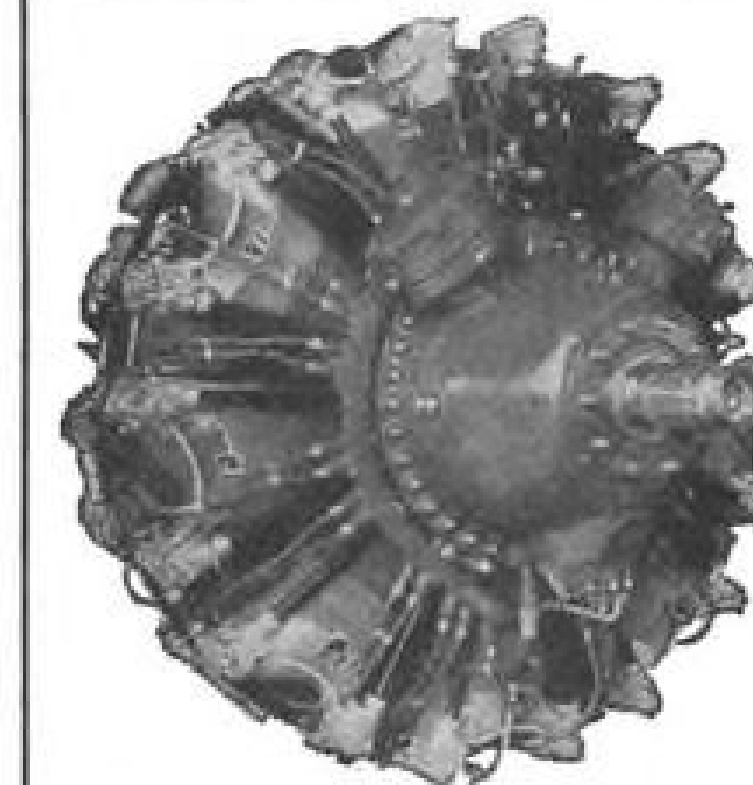
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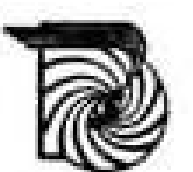
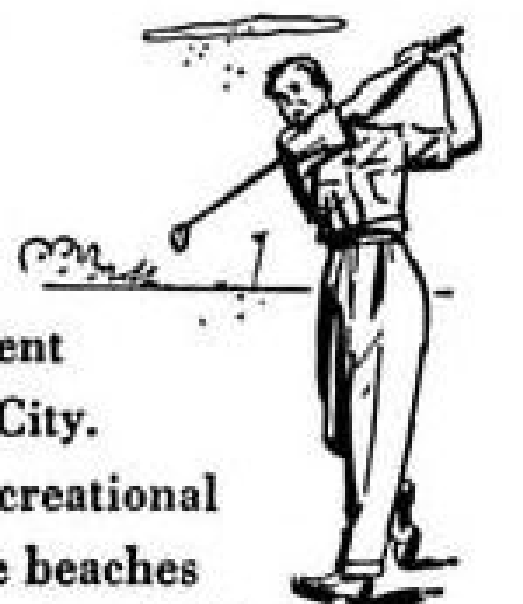
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## EDITORIAL

### Losing the Technical Race To Russian Manpower

The voice of Dr. Hugh L. Dryden, director of the National Advisory Committee for Aeronautics, is the latest in a long list of eminent scientists to be raised in protest over the lack of technically trained workers being educated annually in this country. Dr. Dryden cites statistics showing U.S. technical schools will graduate between 20,000 and 25,000 persons during 1955 while Russia will provide similar technical training for nearly 100,000.

"Obviously if year in and year out Russia is to give technical training to four times as many young men as we do, we cannot hope to maintain for long our present lead in aeronautics," says Dr. Dryden. "That is the most serious of the problems of highspeed flight which confront us in America today."

How many other voices will have to join this chorus before industry, government and educators will combine forces for an effective solution to this problem?

### Required Reading On Air Strategy

The technological revolution in aircraft and nuclear weapons has moved so rapidly that military strategy, tactics and organization are still far behind. In the months ahead we forecast a long and bitter debate in the Pentagon, on Capitol Hill and from public rostrums on new strategy, tactics and organization designed to fit and fully exploit the current and future capabilities of atomic airpower. This debate will affect profoundly the life of the American people, from their chances for survival to the load of the tax burden they must carry. It is already apparent that the revolutionary technology of atomic airpower is eroding the foundations of traditional military organizations such as the Army and Navy and that even a relative newcomer such as the Air Force will not be immune from the ideas it is generating.

As a primer for the study of this debate and the problems it will try to settle, we recommend reading two articles published in recent weeks by young, former USAF officers now in civilian pursuits. They are:

- "Counter-Force Strategy" by T. F. Walkowicz in the February issue of *Air Force* magazine. "Teddy" Walkowicz is a former USAF lieutenant colonel now a consultant to Laurance Rockefeller and is well known to the aircraft industry for his USAF activities in research and development.

- "No Need to Bomb Cities to Win War" by Richard S. Leghorn in U.S. News and World Report's issue of Jan. 28. Leghorn is a colonel in USAF Reserve, was a World War II pilot and Pentagon planner until 1953 and now works for Eastman Kodak Co.

Both of these articles assail the moral, political and military bankruptcy of the "massive retaliation" policy as it is now interpreted and echo the growing military opinion that any effective employment of atomic airpower must be against military targets rather than against masses of population in open cities. This concept was first voiced in 1953 by Gen. Nathan F. Twining, USAF Chief of Staff, and James Harold Doolittle, USAF Reserve lieutenant general and military planner and operator extraordinary.

This debate on the future strategy, tactics and organization of atomic airpower should be followed closely by every American citizen, including those in the aircraft industry, because it will determine what type of equipment must be built and to whom it will be sold.

### USAF's New Plane Book Offers Useful Data

The latest edition of "Releaseable Information on U.S. Air Force Aircraft" should prove useful to aircraft industry executives. It is compiled by the USAF contingent in the Security and Review Branch of the Public Information Office of the Secretary of Defense. This group, headed by Lt. Col. George Schenkein, does a creditable job of serving both industry and press within the limitations imposed by whimsical policies from higher Pentagon authority.

Their releaseable aircraft data is presented between hard covers that aid survival in well-used files; offers good three-view drawings of many aircraft, and makes a genuine attempt to include all generalized performance data and detailed dimensions possible. There also is a handy blank space under each aircraft where additional data can be recorded as it becomes available. There are some style oddities and omissions that will occasion comment. For example, the Northrop Snark is designated B-62 while the Bell Rascal is labeled XB-63, despite the fact the Rascal is much more advanced in development and closer to operational use than the Snark.

What security restriction prevents the Rascal powerplant from being identified as the same three-barrel rocket motor released publicly in Bell's annual report for 1953 baffles us. Since missile designations were being included, the omission of the North American B-64 Navaho also is puzzling, since it has been part of other USAF public lists.

If readers wonder why the range and gross weight of the Douglas RB-66 and B-66 twin-jet bombers are omitted from this data book, they may ponder the fact that the USAF versions of this design weigh considerably more and have much less range than the A3D version built by Douglas for the Navy.

All in all, the USAF aircraft publication is a step in the right direction and will be helpful to all who use it.

—Robert Hotz

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for the passenger-flying public. This is a classic example of the benefits to the nation and the public which result from close cooperation between the Armed Forces and American industry.

Turbo-Prop power means a gas turbine engine similar to a jet, but with its tremendous power harnessed to turn a propeller.

The big advantage of the Turbo-Prop engine is that it uses less fuel than a jet, yet it enables aircraft to travel faster with *greater payload* than any other propeller-type engine.

The Allison Model 501 is the most efficient Turbo-Prop engine for its size and weight ever built in this country or abroad. It delivers more power than piston engines of twice its weight.

It incorporates all the knowledge that Allison has gained in building gas turbine engines that have *flown* more than five million hours — more flight experience than has been accumulated by any other turbine engine

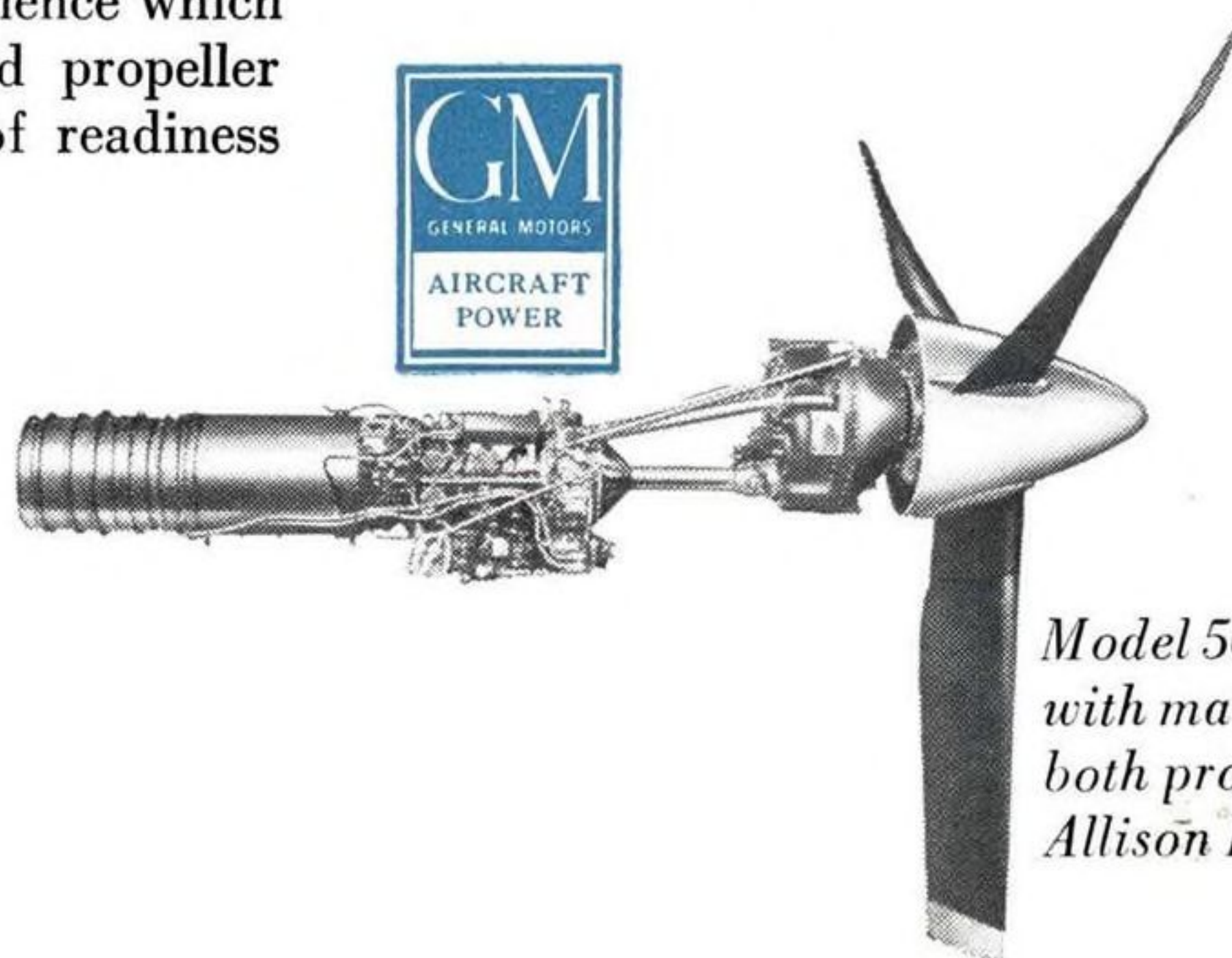
manufacturer — experience in the air where it counts most.

The military versions of the Allison Turbo-Prop already power eight different types of Navy and Air Force aircraft, including the new Vertical Take-Off Interceptors.

Now being readied for commercial use, the Allison Turbo-Prop will enable America's airlines to carry heavier payloads, maintain faster schedules, use shorter runways, and to offer passengers a far smoother, quieter, more comfortable ride.

While this Allison Model 501 engine can be installed in today's airplanes, the aircraft industry is busy designing new airframes to take fullest advantage of its performance.

General Motors is proud that its wide experience in engine design is paying off in this important contribution to the progress of American-built-and-powered aircraft for both military and commercial service.



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HARLOW H. CURTICE  
President,  
GENERAL MOTORS CORPORATION

Model 501 Turbo-Prop Engine  
with matched Aero-products Propeller,  
both produced by  
Allison Division of General Motors.