

# AVIATION WEEK

A MCGRAW-HILL PUBLICATION

OCT. 10, 1955

50 CENTS

## To the Man in the Secret Drafting Room *who is designing tomorrow's planes*

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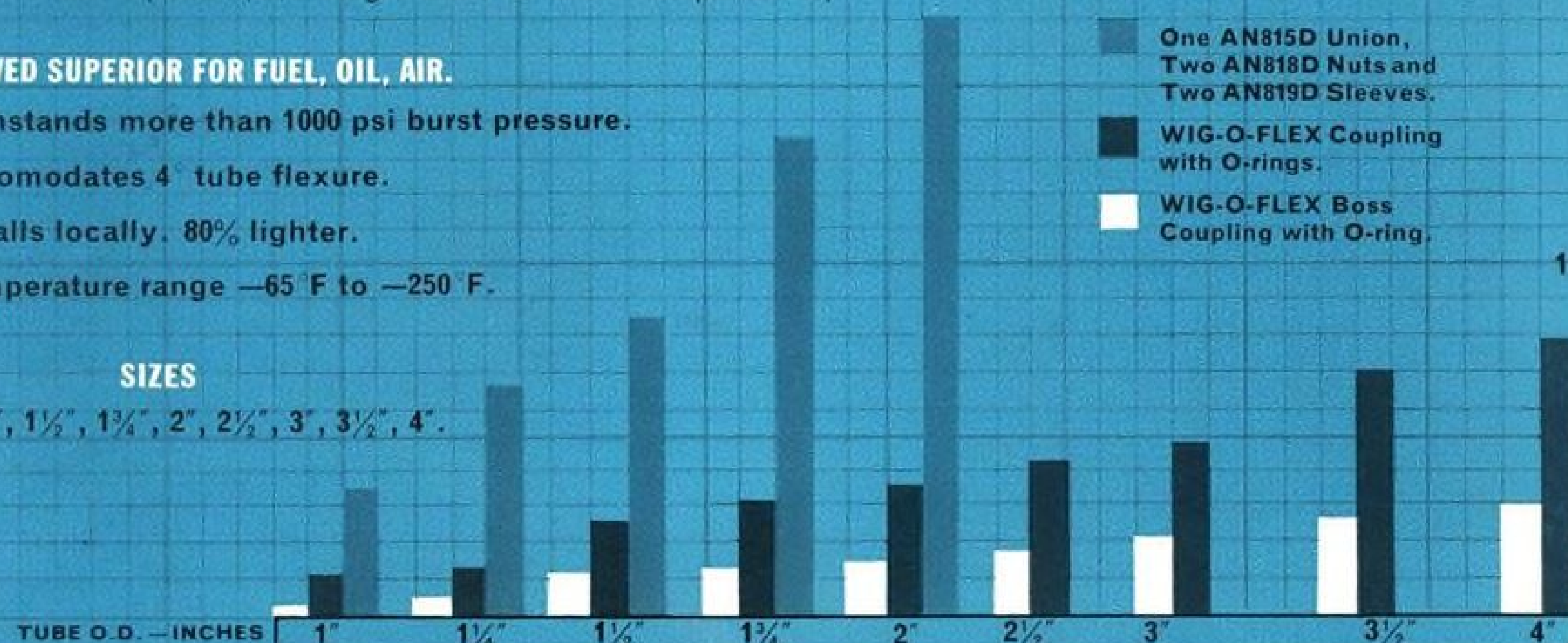
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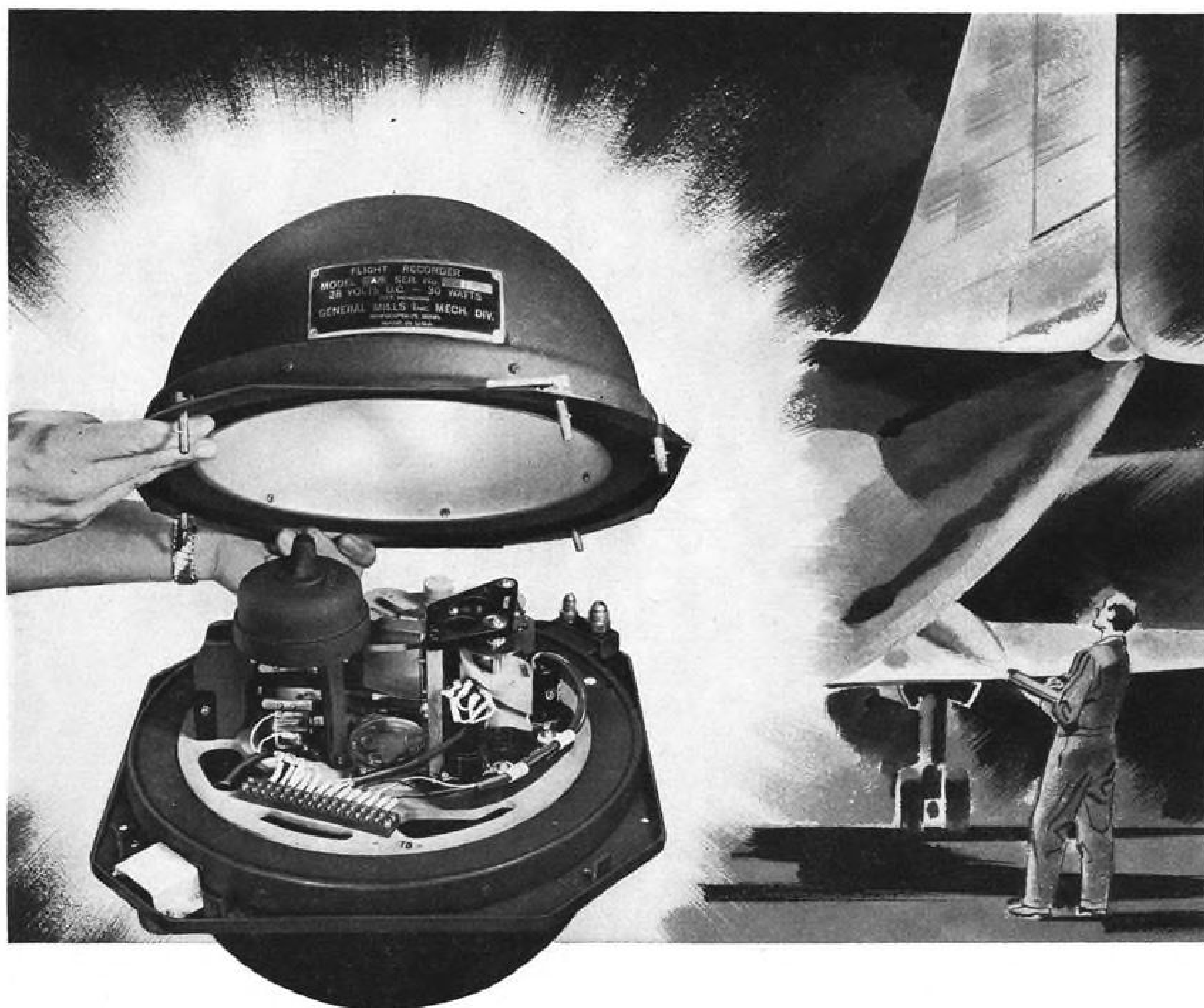
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AVIATION WEEK, October 10, 1955

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## NEWS DIGEST

### Martin, GE Receive Earth Satellite Awards

The Department of Defense announced last week that work has begun on the "Vanguard" earth satellite project, a joint Army, Navy, Air Force project under Navy management.

The Glenn L. Martin Co., builders of the Viking, has been awarded the prime contract for a major part of the project—the rocket launching vehicle.

General Electric Co. will supply the rocket motor which will be used in the first stage of the launching vehicle, and other important portions of the launching vehicle will come from different industrial sources.

The shape and size of the satellite have not been determined. It will be small, but it will be large enough to contain a number of instruments and to be tracked from the ground by optical and radio devices.

The "Vanguard" will be established in its orbit in this general manner: The first rocket will start the entire assembly vertically on the first part of its flight. When its fuel is exhausted, the first stage will be dropped off, and the second rocket deflected from the vertical will continue the satellite upward. The third rocket, carrying the satellite proper, will accelerate it to the top speed of about 18,000 mph., which will establish the satellite in its orbit where it will continue under its own momentum. This high velocity is required to balance the centrifugal force of the satellite against the gravitational pull of the earth.

Canadair Ltd., a division of the General Dynamics Corp., has entered the nuclear field with a contract to build components and parts for a "swing" type nuclear reactor for Atomic Energy of Canada Ltd. at Chalk River. The "swing" reactor will be used to determine the potential of irradiated nuclear fuel.

Lee R. Shannon, former budget director of Firestone Tire and Rubber Co., has been appointed Deputy Assistant Secretary of Defense (Comptroller). The new position carries responsibility for programming operations in the office of Wilfred J. McNeil, Assistant Secretary of Defense (Comptroller).

Dudley C. Sharp was sworn in as Assistant Secretary of the Air Force for Materiel last week. He replaces Roger Lewis, who was awarded the Medal of



### Russia's Jet "Freighter"

Russian jet "freighter," first announced by Radio Moscow as the Il-20, is revealed as a simple conversion of the Ilyushin 26 light bomber (AW May 23, p. 12). Plane is used to deliver high-priority cargoes, including newspaper matrices, on the run between Moscow and Novosibirsk, 1,800 miles distant in Siberia. Conversion seems to be nothing more than substitution of Aeroflot name and insignia for military markings. Note that gun ports have not even been faired over to improve the drag and that the open bomb-bay doors can be seen behind the crew.

Freedom for his work on the foreign aid program.

Air ordnance functions of Air Research & Development Command at Wright Air Development Center, Dayton, Ohio, have been transferred to USAF armament center, Eglin AFB, consolidating all air ordnance activities at one base. A technical support liaison office will remain at Wright-Patterson AFB, Dayton, to assist the Air Materiel Command in bringing ordnance materiel through research and development to procurement and production stages.

University of California's Field Engineering Field Station at Richmond, Calif., is operating a new wind tunnel in fundamental research on behavior of objects at speeds exceeding Mach 6 at 20-to-80-mi. altitudes. The three-foot diameter facility receives support from Office of Naval Research, NACA and USAF's Air Research & Development Command.

Six additional DC-6Bs have been ordered by Northwest Orient Airlines for delivery in the first quarter of 1958, bringing the airline's DC-6B total orders to 14. Latest order totaled approximately \$9 million.

Largest C-130A contract to date has been awarded Lockheed Aircraft Corp., Marietta, Ga. Total is undisclosed but exceeds a previous USAF order for \$100 million and will extend production schedules. The highest monthly plane delivery of the four-and-one-half-year

history of the Marietta plant was made to USAF in September. Deliveries included over 50 new B-47s, modified B-47s and C-130As. Lockheed says deliveries should remain at this level for several months.

The Douglas B-66 jet bomber has arrived at Kirtland AFB Special Weapons Center, N. M., for extensive tests.

First production J69 turbojet has been shipped by Continental Aviation & Engineering Corp., from its Toledo, Ohio, Air Force Plant 27.

Engineering and product interchange agreement has been signed between Stratos Division of Fairchild Engine & Airplane Co., Bay Shore, N. Y. and Sir George Godfrey & Partner, Ltd., Hanworth, England. Two firms produce a corollary line of aircraft accessories, systems and equipment, including air conditioning and pressurization systems, turbine drives and controls and valves.

### Financial

Coleman Engineering Co., Inc., reports \$916,557 sales for quarter ending July 1955 as compared with \$174,466 for the same period last year. Firm reports current backlog exceeds \$3 million. Coleman has completed construction and made initial trials of Project Smart (supersonic military air research track). It expects to receive an operating contract for the coming year from USAF to test various means of escape for personnel from highspeed aircraft.



## AVIATION CALENDAR

- Oct. 11-15—Society of Automotive Engineers, Golden Anniversary Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display, Hotel Statler, Los Angeles.
- Oct. 17-21—National Metal Exposition, Convention Hall, Philadelphia.
- Oct. 17-21—National Safety Council, 43rd National Congress and Exposition, La Salle and Conrad Hilton Hotels, Chicago.
- Oct. 17-21—International Air Transport Assn., 11th annual general meeting, Waldorf-Astoria Hotel, New York.
- Oct. 18—Massachusetts Second Aviation Conference, Fitchburg, Mass.
- Oct. 18-19—Seventh annual Aerial Diving and Spraying Conference, sponsored by the Washington State Aeronautical Commission and the State College of Washington, Wenatchee, Wash.
- Oct. 20-21—Sixth annual National Noise Abatement Symposium, Armour Research Foundation, Chicago.
- Oct. 24-25—Institute of Radio Engineers' Professional Group on Electronic Devices, first annual Technical Meeting, Shoreham Hotel, Washington, D. C.
- Oct. 25-27—Technical Conference on Aircraft Electrical Applications, American Institute of Electrical Engineers, Hollywood-Roosevelt Hotel, Los Angeles.
- Oct. 26-28—Southwestern Airport Managers' Assn., annual meeting, Greenville, S. C.
- Oct. 27-28—Aircraft Electrical Society, 12th annual display, Pan Pacific Auditorium, Los Angeles.
- Oct. 30—Second annual Topeka Aviation Day, Topeka, Kans.
- Oct. 31-Nov. 1—Institute of Radio Engineers, 1955 East Coast Conference on Aeronautical and Navigational Electronics, Lord Baltimore Hotel, Baltimore.
- Oct. 31-Nov. 2—Society of Automotive Engineers, Golden Anniversary Transportation Meeting, Chase Hotel, St. Louis, Mo.
- Nov. 2-4—Society of Automotive Engineers, Golden Diesel Engine Meeting, Chase Hotel, St. Louis, Mo.
- Nov. 3-4—Institute of the Aeronautical Sciences and Canadian Aeronautical Institute, second annual joint meeting, Chateau Laurier, Ottawa, Ont., Canada.
- Nov. 8-10—National Aviation Trades Assn., annual convention, Hotel Westward Ho, Phoenix, Ariz.
- Nov. 9-10—Society of Automotive Engineers, Golden Anniversary Fuels & Lubricants Meeting, Bellevue-Stratford Hotel, Philadelphia.
- Nov. 9-11—Industrial Management Society, 19th annual time, motion study, management clinics, Hotel Sherman, Chicago.
- Nov. 13-18—American Society of Mechanical Engineers & American Rocket Society, annual convention, Congress, Hilton and Blackstone Hotels, Chicago.
- Nov. 14-15—Aviation Distributors & Manufacturers Assn., 26th meeting, El Mirador Hotel, Palm Springs, Calif.
- Nov. 14-17—Second International Automation Exposition, Navy Pier, Chicago.

## PICTURE CREDITS

54—Wide World.



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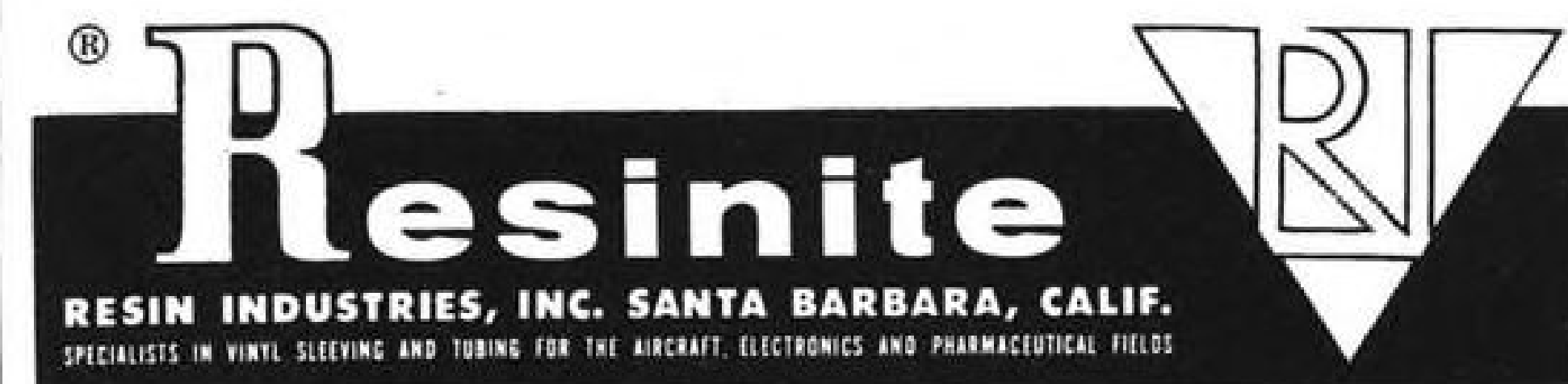
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AVIATION WEEK, October 10, 1955

## WHO'S WHERE

### In the Front Office

Charles A. Barnett, vice president-engineering and sales of Fletcher Aviation Corp.

Andrew C. Freimann, vice president-marketing of York Corp.

M. E. Paradise, vice president and board member of Hoffman Electronics Corp.

Armand J. Thieblot, board member of Thieblot Aircraft Co. Other members of the board: William P. Maloney, J. Robert Kirby, Eva P. Thieblot, J. Carlton Ward, Jr., Edward G. Littel and Dr. G. Russell Tatum.

Edward W. Carter, board member of Northrop Aircraft, Inc.

Harold D. Roebuck, comptroller of Topp Industries, Inc.

Seijiro Yanagita re-elected president of Japan Air Lines; Kambu Ishikawa, vice president. Other members of the executive board are: Yoshito Kojima, Shizuma Matsuo, Tetsuo Oba, Kikuye Urashima, Kinjiro Yuchi and Ryohei Itoh.

A. J. Fausek, chairman of the board of Modern Engineering Co.

### Honors and Elections

Jerome Lederer, director of Flight Safety Foundation, Inc., elected vice president of Air Mail Pioneers.

Richard E. Fisher, community affairs director for American Airlines, named chairman of Air Transport Assn.'s Public Affairs Committee.

Jack Moore, Jr., president of Reading Batteries, Inc., received President's Award from Aviation Distributors and Manufacturers Association.

Malcolm P. Ferguson, president of Bendix Aviation Corp., received an honorary Doctor of Science degree from Syracuse University.

### Changes

Vice Adm. Charles B. Momsen (USN-ret.), consultant, General Dynamics Corp.

Capt. David B. Young (USN-ret.), consultant-technical developments of General Electric's Special Defense Projects Dept. Howard D. Kurt, product planning specialist; Alton J. O'Neil, marketing research specialist for General Electric's Distribution Assemblies Dept. J. S. Gillespie, manager of diamond project section of Carboly Dept. of General Electric Co.

Dr. Samuel Zerfoss, chief of refractories section of National Bureau of Standards.

Dr. William R. Hawthorne appointed Jerome Clarke Hunsaker Professor of Aeronautical Engineering at Massachusetts Institute of Technology.

William J. Martin, manager of Convair's supersonic delta-wing F-102A production flight test facility at Palmdale, Calif. Rex Warden, chief pilot; W. H. Rumbaugh, chief of field operations.

Thomas R. Bartlett, sales manager of Bendix Aviation Corporation's York Div. Dan S. Tilden, commercial sales manager of the Eclipse-Pioneer Div.

John B. Gates, manager of Bell plant of Thompson Products, Inc.

## INDUSTRY OBSERVER

► Eastern Air Lines, long a hold-out on the use of automatic flight control equipment, reportedly is ordering a Sperry-integrated instrument system and A-12 autopilots for its new DC-7Bs.

► Belgian authorities are reported looking for customers for the Hawker Hunters built under license in that country. Belgium has built only a handful-of-the airplanes, is disturbed about the cost of the airframe, now almost \$350,000 each.

► Fiat is developing a new jet engine using a reverse-flow concept to reduce the engine length. Combustion chambers are built around the tailpipe, making total engine length only the combined lengths of compressor casing, single-stage turbine and combustion chambers. Engine diameter is about 24 in., length about 36 in. Design thrust is on the order of 2,000 lb., suitable for NATO light fighter designs.

► Gloster Javelin all-weather fighter development will be built around a pair of Bristol Olympus engines and a redesigned thinner wing. Thickness-chord ratio of the wing will be high at wing-nacelle intersection, change rapidly to a low value and then stay constant to the tip. Layout will be maintained, although internal change will be great. Engines will be left-and right-handed to power a single accessory section amidships.

► Russian bombers Bison and Badger are credited to designer Sergei Ilyushin by foreign observers. Farmer, code name for the latest Red supersonic fighter, is reported to be the Ykovlev 25.

► Bristol Aero Engines, Ltd., of Canada, is considering the possibility of manufacturing the Bristol Sycamore helicopter at its plant in Winnipeg. Market for the Sycamore in Canada is excellent, Bristol officials believe.

► Sncase S.E. 210 Caravelle, French twin-jet airliner, has completed more than 55 flights totaling about 100 flying hours. Latest tests have been made at full all-up weight. French industry sources report that one-engine takeoff tests indicate that maximum all-up weight performance exceeds the design figure of 83,600 lbs. Several flights were made at cruising speed of 435 mph. High speed tests include dive runs at Mach .86.

► The problem of accurately measuring barometric altitude above 25,000 ft. in order to provide safe altitude separation is already plaguing the military and will be aggravated when jet airliners enter the picture, according to USAF Lt. Col. B. H. Ferer. Problem stems both from lack of sensitivity in present instruments and the difficulty of obtaining a good static air source on high-speed planes. Solution appears to be the use of servo-driven altimeters and compensating computers.

► Widespread use of Selcal (selective calling) by domestic airlines may come rapidly in order to ease overcrowded voice channels and permit airline radio operators to reach pilots who are monitoring traffic control communications. System originally was developed for use by overseas carriers to save pilot from monitoring static-filled HF radio over long periods of time.

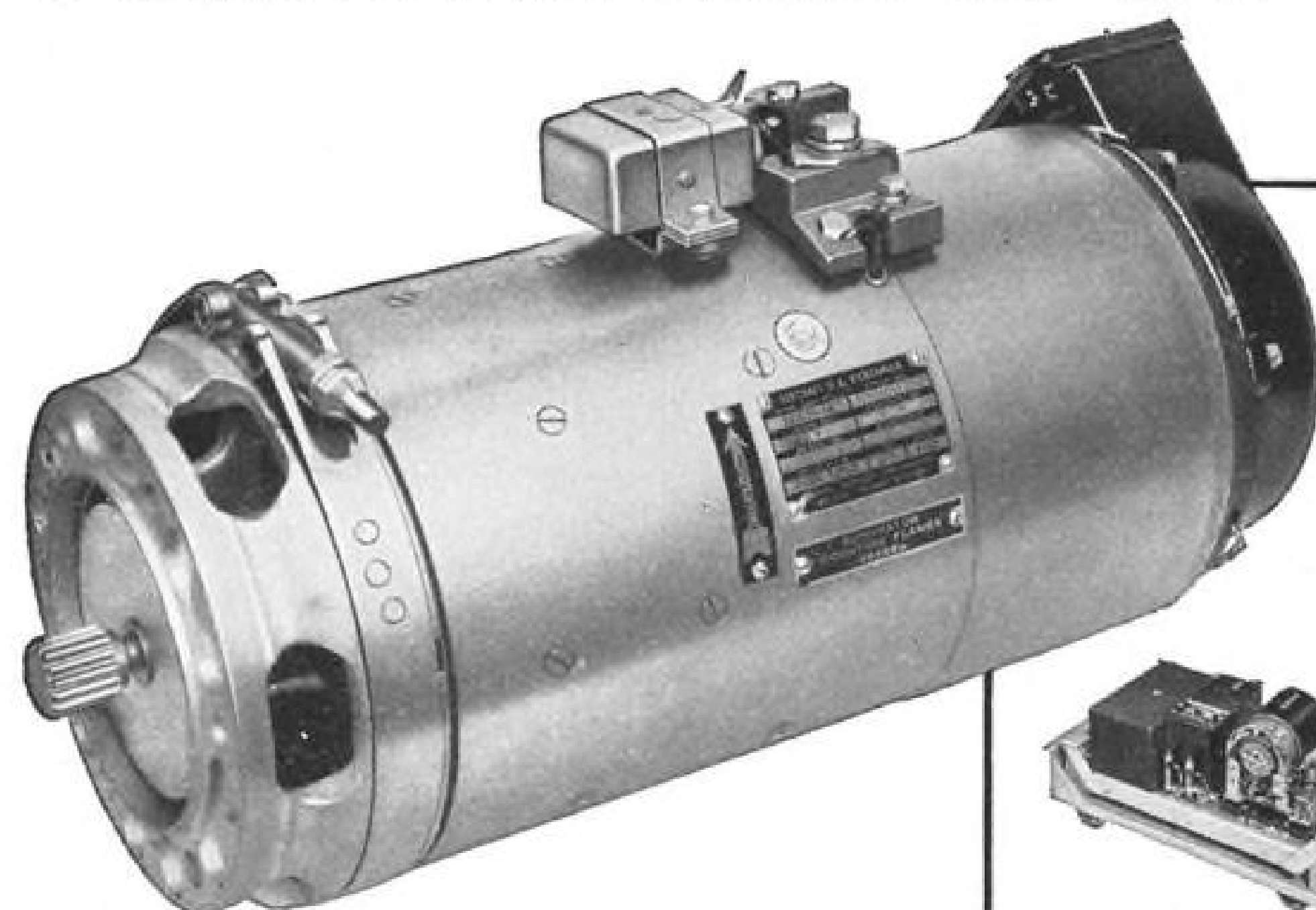
► Two Leduc 0.22 flying ducts are nearing completion at Argenteuil, France. Cockpit of the single seat, swept wing, Mach 2 fighter prototypes will be similar to that on the Leduc 0.21.

► An investigation into the possible employment of digital computers for designing basic electronic circuits is under way at a third major avionics firm, this one on the East Coast. Two West Coast firms are making similar investigations (AW Sept. 19, p. 9). In addition to speeding electronic circuit design, the use of a digital computer is expected to produce "design-centered" electronics circuits whose performance is less affected by variations in individual components.

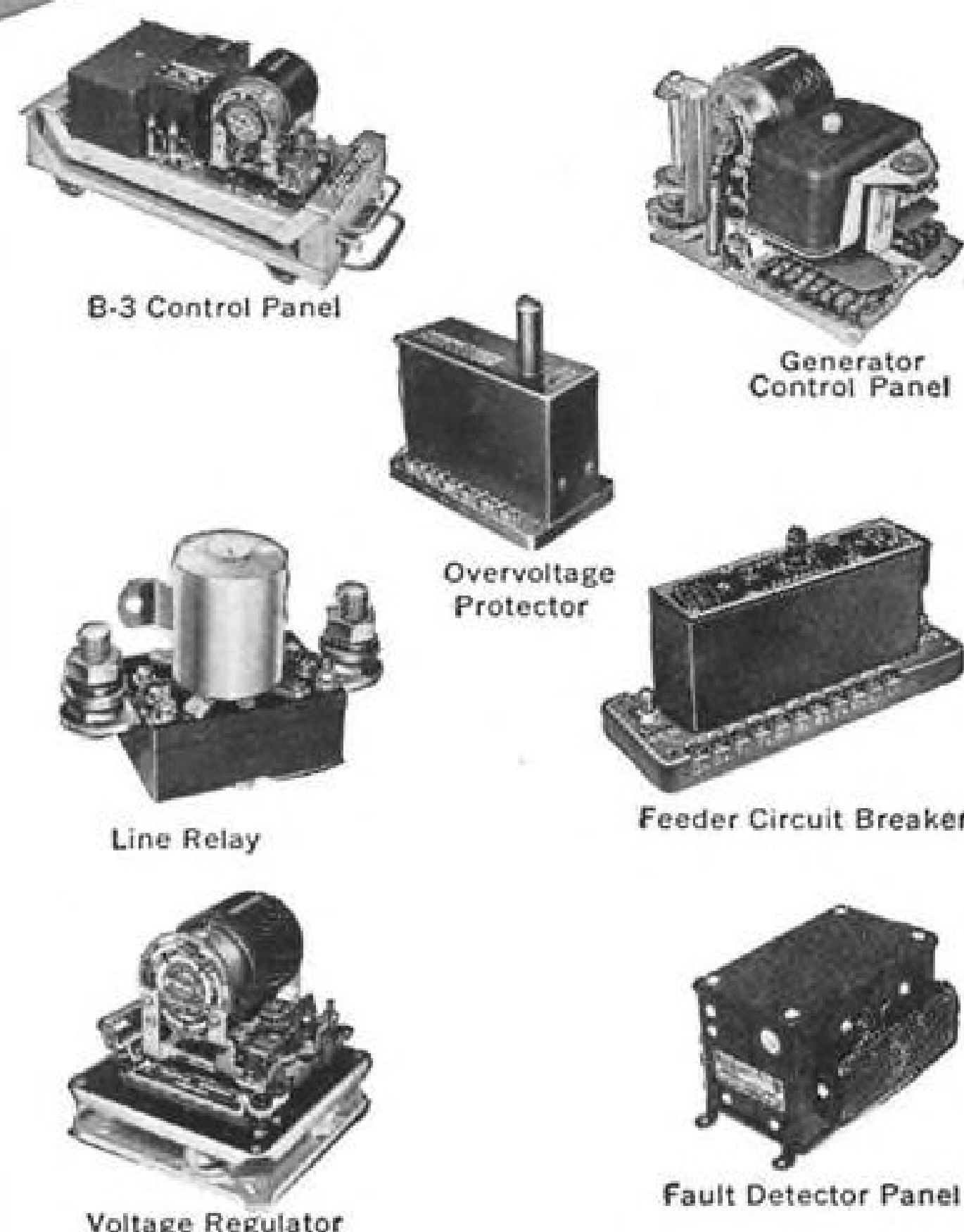
► Helicopter pilot training for high altitude flying will be started soon by U. S. Army at Fort Carson, Colo.



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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	52B6588
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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## Washington Roundup

### Aircraft Profits Hearings

House Armed Services Investigating Subcommittee, headed by Rep. Edward Hebert (D-La.), is expected to open public hearings on military aircraft contracts soon.

Subcommittee members and staff decline any comment.

The investigation originally planned was of six air-frame contracts—four by the Air Force and two by the Navy. But the project has been expanded into a comprehensive investigation of contracts, not only of all air-frame manufacturers, but also of engine manufacturers and major aircraft subcontractors. Helicopter manufacturers are being included in the investigation. Manufacturers have been requested to give detailed written answers to 35 questions. The first series of replies was due Oct. 1. Others are due Oct. 15 and Nov. 1, and the final series on Nov. 15.

Rep. Carl Vinson (D-Ga.), Chairman of the Armed Services Committee and an old hand at profits investigations, is actively participating in the direction of the investigation.

### New Aircraft Goal

The commercial aircraft expansion goal has been extended for rapid tax amortization by the Office of Defense Mobilization, but the airlines may have waited too long to get certificates for jet transports. The goal is extended by 300 aircraft, but ODM already has over 300 applications on file. To qualify under the extension, an airline must place a firm order by Dec. 31, 1955.

In the past, applications have been approved in the order in which they were filed. Unless ODM decides to set up a new procedure to establish priority for applications in the oversubscribed goal, applications for jet transport certificates will have to wait at the end of the line for fast tax writeoff benefits. If all the applications on file meet ODM standards (some may not, of course), this means no rapid tax amortization for jets unless the goal is extended again. Another extension isn't too likely right now.

Commercial aircraft is one of 11 goals reopened after ODM suspended 38 goals last August and initiated a review of the program (AW Aug. 29, p. 13). The goal is extended from the original mark of 600 aircraft, which was filled nearly a year ago, to 900 aircraft. The ODM order specifies that a firm order must be placed by Dec. 31 to qualify for a tax certificate. This requirement is included to make sure the aircraft will go into production.

### Canadian Bilaterals

Recent meeting between Canadian and U.S. civil aviation authorities, which was held at the insistence of the Canadians, ended without the U.S. granting any of the major concessions requested. Armed with a minimum program of five changes they desired in the route pattern established under the 1949 bilateral air agreement, the Canadian officials had expected to get just about what they wanted. There would have been no trading because nothing had been requested by American interests. If it hadn't been for the firm stand taken by CAB Vice Chairman Joseph P. Adams, heading the U.S. delegation, poor staff handling would have conceded all to the Canadians.

Other bilateral air negotiations which are in various

stages of progress are not going nearly as well for the U.S. interests.

CAB and State Department officials are still stewing over the meeting with India, while nothing has moved in months on the suspended renegotiations with the Dutch. At the same time, the Japanese discussions have yet to be concluded and those with Columbia are about to begin.

### Wilson Seeks Speed

Further evidence of Defense Secretary Charles E. Wilson's growing sensitivity to Congress and its powers is his current effort to speed the carrying out of orders when he gives them. Both Capitol Hill critics and the Hoover Commission have noted the lag between his demands and action by the military services. Wilson set up a committee, headed by assistant Carter L. Burgess, to study the problem. He told the committee he wanted a report by Oct. 1, did not have it by deadline. This happened despite Wilson's assertion to the committee that his directives are effective on the dates issued and are to be carried out "without alteration, amendment, paraphrase or change."

### Navy Carrier Defense

Declaring the USS Forrestal is the "object and direct result of a continual argument waged by the military minds of the nation over a six-year period," Navy spokesmen at the new carrier's commissioning used every opportunity to defend their \$198 million project. Navy Assistant Secretary for Air, James H. Smith, Jr. saw "the beginning of a new Navy, and with it a new concept of national defensive strength. . . ." Secretary Charles S. Thomas called the ship "a symbol of the Navy of tomorrow." Major disappointment of the ceremonies was the low ceiling that prevented scheduled flyover of F9F-8 and A3D aircraft flown from the West Coast. Planes landed at Oceana, Va., and Patuxent River, Md., unhealed and without establishing any records.

### New Handbook Program

New USAF program to have separate "systems" handbooks for flight line maintenance of weapons systems will come under scrutiny of Aircraft Industries Assn. this week at St. Louis. In the first panel session of Service Publications Representatives, problem areas will be defined. Later, industry delegates will meet with military representatives to discuss problems. Current USAF effort is to have each Air Materiel Area responsible for procuring handbooks of contractor-furnished equipment. Specifications are being revised to provide, among other things, for field maintenance instruction on engines and separate volumes on aircraft structures to cover repair, engineering and maintenance.

### USAF Saving

While Defense Department's program of aircraft procurement stands unchanged despite efforts to balance the budget (see p. 14), there is sound evidence that the Air Force is doing its bit to economize: USAF will save \$1 million a year by eliminating winter underwear as a mandatory item of issue.

—Washington staff



## Air Force to Give Industry Freer Rein

**Goal is shorter development cycle to meet Red threat; manufacturers who invest own funds will be favored.**

By Claude Witze

Washington—The U. S. Air Force is prepared to give the American aircraft industry wider latitude in the introduction of new weapons systems. This new policy is a direct result of the critical necessity of shortening the development cycle to meet the Russian challenge in new weapons.

Lt. Gen. Clarence S. Irvine, the new Deputy Chief of Staff for Materiel, told AVIATION WEEK that USAF hereafter will favor airframe and component manufacturers who help meet the Soviet threat by investing more money and engineering talent in development facilities.

No policy changes will be needed to carry out the program, but USAF plans steps to induce industry to speed development within present policy. In general terms, this means contractors will be encouraged to bend all their capabilities toward greater competition in the design and development of advanced weapons systems.

The new program will be co-ordinated with the doctrine that the most experienced, proven producers—who

have capacity, interest and are competitive—will be vested with weapons system responsibility as prime contractors.

### Performance Criteria

"We know the capabilities of certain companies," Gen. Irvine said, "and we know what they are doing. The record of past performance, plus willingness to explore new applications, must be prime considerations if we are to introduce new weapons at a pace competitive with our potential enemy."

The Air Staff's highest-ranking procurement officer emphasized that these policies apply to component makers as well as airframe manufacturers and will not alter USAF's firm stand against excursions by prime contractors into fields with which they are not familiar. In this, he reiterated the stand taken by his predecessor, Lt. Gen. Bryant L. Boatner, who said USAF can and will police the prime contractors using its control over government facilities to keep weapons system contractors in their own back yard (AW Jan. 17, p. 13).

Gen. Irvine told AVIATION WEEK he feels strongly that component specialists do the best possible job in design and development in their field. USAF policy will continue to protect them wherever possible.

Other major points made by Gen. Irvine included:

- Recent elimination of design studies, substituting Phase I contracts with a small number of carefully chosen primes, (AW Aug. 8, p. 12), is the first step toward fuller utilization of what Gen. Irvine calls "common-sense competition." The long range purpose is to "apply our engineering and production capabilities where we will get the most out of them." There is a possibility that this will, at least in some cases, result in award of contracts leading to a prototype weapons system instead of a mockup.

- USAF will continue to put its emphasis on placing contracts with contractors who can meet high performance standards. USAF has no desire to keep a company in business merely because it has a plant and a production line.

- A subcontracting level of 30 to 40% is considered essential to maintain a

properly broad base in the production of a weapons system. If this level is allowed to rise much past 50%, the prime contractor is prone to have trouble guaranteeing quality and a reliable delivery schedule.

- USAF would like to see each major prime contractor retain a capability to design, develop and produce more than one type of weapons system. Obvious examples are Boeing with bombers, tankers and missiles; Douglas and Lockheed with transports, fighters, missiles.

- USAF will adhere to its present approach on the industrial mobilization base—"hot plants" (those in production) will be the only ones of major value in event of war. The industrial mobilization base must be "in being," and capable of expansion.

### Change in Philosophy

Gen. Irvine's 37-year military career has given him both wide experience and strong convictions that have a bearing on his procurement philosophy. As Deputy Commander for Production of the Air Materiel Command, he probably had more individual responsibility for implementation of the weapons system concept than any other USAF or civilian officer.

AMC's determination to speed the development cycle, he says, goes back to the Korean war period, when he was commander of Strategic Air Command's 19th Air Division at Carswell AFB, Tex. The war diverted AMC from its goal and resulted in a broad aircraft production base with a huge mobilization potential.

A basic change in defense philosophy followed, based on the realization that America is living in what President Eisenhower had called the "age of peril." It meant that USAF must go to a "readiness policy," and it was from this that the weapons system evolved.

Gen. Irvine, his SAC experience fresh in mind and aware of SAC's assumption that the critical phase of another war might not last more than 30 days, was singularly equipped for his task of implementing the new concept.

### B-52 Experience

Under the weapons system, he says, USAF is paying the American aircraft industry for management skills and utilizing an engineering capability far beyond capacity.

While the Convair B-58 Hustler is



Lt. Gen. Clarence S. Irvine, 56, USAF Deputy Chief of Staff for Materiel, has spent 37 years in military aviation, much of it in procurement and production. At the same time, he has had wide experience in operations, ranging all the way from a job as gunnery instructor (1926) to command of a Strategic Air Command Division (1951). In World War II he was with the Assistant Chief of the Air Staff for Production, Chief of the Modification Division and supervisor of the very heavy bombardment program. He went to the Pacific Theater in December 1944 as Deputy Chief of Staff for Supply and Maintenance of the 21st Bomber Command and eventually became Deputy Chief of Staff for the Pacific Air Command. A command pilot, he was at the controls of the B-29 "Pacusan Dreamboat" on its non-stop flight from Honolulu to Cairo in 1946.

the first weapon born under the new concept, many of its principles were applied to the Boeing B-52.

It was possible here, Gen. Irvine points out, to pump back into the project "a lot of the lessons we learned on the B-47, and it paid off." When the first B-52 jet bombers arrived at Castle AFB, Calif., all of the components necessary for their operation were on hand.

There was no waiting for test or ground handling equipment.

Gen. Irvine gives credit for this in large part to the functioning of the Weapons System Phasing Group. This unit, set up at AMC for each project, includes representatives of maintenance and supply as well as production in AMC, Air Research & Development Command, the Air Training Command, USAF headquarters, the prime depots and the tactical commands. It is a platform where USAF can see the entire weapons system, uncover bugs and solve problems.

"Three years ago," Gen. Irvine said, "There were 783 problem items on the

B-52. They ran all through the aircraft, from starting the engines, power to run the auxiliary systems, towing, refueling and installation of major components such as the bombing system.

"When the first B-52 landed at Castle, it was a much bigger and more complex beast than the older B-47, but it did a better job right from the start. The phasing group made sure it was going to work."

### Engineer Utilization

Apart from Russia's demonstration in 1955 that it has made amazing gains in the field of weapons system development, major concern of Gen. Irvine in recent months has been the growing evidence that the United States must obtain better direction of its engineering talent. Efficient utilization of this skill is vital to a speedup in the technological race.

Elimination of the preliminary design competition, Gen. Irvine believes, is an important step in conserving this talent.

The preparation of a paper proposal, he said, involves a year's work and can cost anywhere from \$250,000 to \$1 million. If 15 manufacturers submit design proposals, total outlay for the paperwork can run as high as \$7 or \$8 million.

"After two or three companies with proven capability come across," Gen. Irvine says, "the rest of the engineering time is wasted."

Why was there so much bidding on design proposals?

"Because USAF was inviting everyone to bid," according to Gen. Irvine. He then cited the case of an aircraft manufacturer who spent \$300,000 on a design, not expecting or wanting to build the weapon. The proposal was submitted, he said, "Because they didn't want to say 'No' to Wright Field."

### Gains Time

After it was made clear that AMC did not want a manufacturer to waste money and talent in this way, the next competition brought letters from three aircraft companies declining the invitation.

All of them gave sound reasons for not taking part and asked for the opportunity to compete on the future projects.

Gen. Irvine cites this experience as proof that industry, as well as the military services, is eager to find better ways to use its engineers. He feels strongly that the new system of picking a minimum number of qualified firms for Phase I contract awards will insure competition among the best qualified people and gain at least a year's time in development.

### Subcontracting Policy

Washington—"If a company specializes in design and manufacture of a certain weapons system component, they usually will do the job better than someone else, because their bread and butter depends on it," says Lt. Gen. Clarence S. Irvine, USAF Deputy Chief of Staff for Materiel.

"This is true for small business just as it is for big business. USAF always will keep the opportunity there for the little guy."

This approach is written into the text of prime contracts for weapons systems.

The amount of subcontracting is agreed upon and a list of subcontractors is part of every proposal considered by the Air Force. Once the contract is signed, a source cannot be changed nor can a prime contractor undertake manufacture of a component without prior advance notice to the contracting officer.

At least one concrete result expected by AMC from this policy is a curtailment of the frantic bidding for engineers on the employment market. "There has been too much floating around," he says, "and it has been too difficult to build up the kind of engineering know-how that is important to both USAF and the industry."

### Great Strides Expected

Once this is curbed to some degree and the prime contractors do not feel forced to waste engineering talent in order to compete whether they want the job or not, Gen. Irvine feels the industry will have greater incentive to help fill USAF's pressing need for development facilities.

The preference will, where possible, go to contractors who put their own money into improved facilities. Gen. Irvine expects these companies to make the greatest strides when they look ahead for new ways to carry out the USAF mission.

He cites the cases of Boeing and the Pratt & Whitney Aircraft Division of United Aircraft Corp., each of which have investments of many millions in the type of facilities and equipment that makes them outstanding contributors of the new developments in the aviation field.

But, he adds: "We will never go down the route without examining the whole industry." To win USAF contracts, the competitor must:

- Be qualified and have a record to prove it.

- Want to do the job.

- Make contributions to the state of the art.

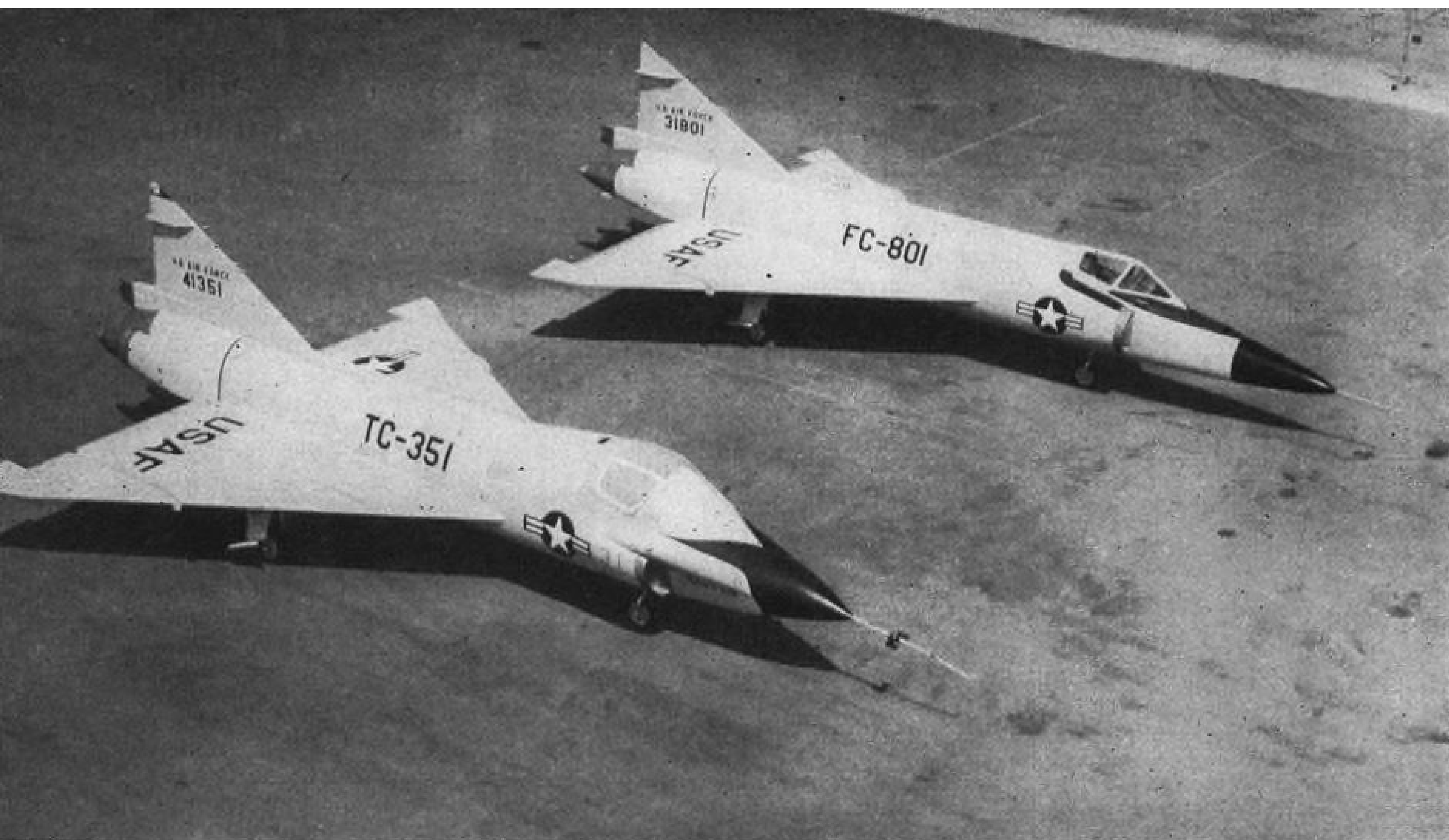
### Competition Insurance

Washington—USAF plans to give insurance to weapons system manufacturers who run a close second in future competitions.

"We will always buy the best weapons system," says Lt. Gen. Clarence S. Irvine, USAF Deputy Chief of Staff for Materiel, "but the number two competitor is not necessarily closed out. If his efforts look good and he is contributing to the state of the art, it is good economy for USAF to keep his engineering talent busy, even if it is on a different line."

Gen. Irvine did not mention any specific examples, but the policy clearly was carried out early this year when Boeing Airplane Company was given a contract to build the KC-135 tanker. Lockheed Aircraft Corp. was awarded a contract for design and development of an "advanced jet tanker."





CONVAIR'S FIRST TF-102A began pre-flight tests last week. The side-by-side combat proficiency trainer (left) is the first specifically developed for any century-series combat aircraft. Convair told Aviation Week that the area rule had been applied to the TF-102A, inferring that the bulging nose was sculptured according to Whitcomb's principle. Fuselage back of cockpit is identical to the F-102A.

## Wilson Rules Out Defense Cuts; '56 Estimate Raised \$500 Million

Washington—The Secretary of Defense, Charles E. Wilson, facing the most politically-potent decision of his administration in the Pentagon, has raised his estimate of Fiscal 1956 expenditures to \$34.5 billion. The figure is \$500 million more than estimated to Congress early this year.

His action came despite strong pressure from Treasury Secretary George M. Humphrey to have the Defense Department shoulder the main responsibility for expenditure reductions that would balance the federal budget. Wilson's stand, disclosed in a letter to Sen. Lyndon B. Johnson (D-Tex.), made it clear that no cuts are planned in the defense program.

### Faced Criticism

The decision followed strenuous exercises by the Air Force less than a month earlier, in which top officers and civilian chiefs studied alternate economy plans and showed how they would affect USAF operations (AW Sept. 5, p. 11). Wilson said the fiscal year target of 131 wings for the Air Force has not been changed.

Possibly the most important aspect of the Wilson stand is the way in which

it has upset the prognostications of many Washington political observers. The common viewpoint was that Humphrey was determined to balance the budget and that Wilson would not cross his Cabinet colleague.

This viewpoint did not take into consideration the fact that Wilson, fast picking up political know-how, was committed on Capitol Hill to a definite program. Failing to carry it out, he would have to face stern Democratic critics, well-informed on air power and skilled at investigative techniques. This apparently was a greater peril to Wilson than having the GOP face the electorate with an unbalanced budget.

Wilson denies basic disagreement with Humphrey and both of them said only last week that the Defense Department's spending goal for Fiscal 1956 remained at \$34 billion.

### Developments

Here are the pertinent facts: • **Wilson, in a letter to Sen. Johnson:** "In spite of our best efforts, it now looks as though it would be very difficult to get down to the \$34 billion estimate of expenditures made in the President's budget message last January. The

Defense Department's current estimate of expenditures for the many individual programs of the Department of Defense for Fiscal 1956 is now, after a very complete review, \$34.5 billion, although the \$34 billion figure which was the estimate in January is still the goal."

• **Humphrey, in a statement following Wilson's letter to Johnson:** "I am in full accord with the program outlined in Secretary Wilson's letter." However, he said, savings through economies and elimination of waste and extravagance still can be made.

• **Rowland B. Hughes, Director of the Bureau of the Budget, in a Chicago address:** "... Recent statements to the effect that the Administration has initiated a new round of drastic reductions in military expenditures are entirely without foundation. ... The goal today remains \$34 billion."

### Wilson Denies

During his vacation last month, top officers of the Army, Navy and Air Force made trips to Michigan to confer with Wilson on the budget problem. Wilson denied to newsmen there had been a "row" between him and his Treasury colleague but said, "We are still working on (the budget) and we have got about nine months yet to go, but I would just like to frankly say the trend is against us. ... We have quite a struggle to hold our own and still carry out the program."

## At RTCA Conference:

# USAF Condemns Traffic Control System

By Preble Staver

Washington—A double-barreled attack against the inadequacies of the air traffic control system operated by the Civil Aeronautics Administration and lack of action in solving them was made by two government aviation experts.

The attacks, touched off at the semi-annual meeting of the Radio Technical Commission for Aeronautics, came from:

• **Lt. Gen. Joseph Smith, commander of the Military Air Transport Service,** said the present system is "inadequate and obsolete . . . completely unacceptable to our economy, society and national defense."

• **Sam P. Saint, veteran airline pilot and consultant to the Air Navigation Development Board,** warned: "Unless something is done to clarify operational concepts so that technical development can operate from a proper springboard, these large numbers of improved airborne 'mousetraps' will still be controlled by a pencil, an interphone, a tired brain and bloodshot eyes scanning a radar."

CAA Administrator Fred B. Lee, speaking later before the National Business Aircraft Assn. meeting in Detroit, said: "The situation now calls for an attack on a grand scale, a patchwork approach won't do. We must take positive action to keep tomorrow's growth from being throttled by limitations of the airways system."

"If we are to prevent future Tacan-type squabbles on a much larger scale," Saint said, "The integration of a common system with purely military requirements must start with operational agreement and understanding." He also criticized the lack of a system concept.

Saint, who is a member of the Air Transport Assn.'s air navigation and traffic control group, said these questions must be resolved before a effective common system can be developed:

- **Airways or area type traffic control?**
- **Safe separation based on time, airspace reservation, or proximity warning,** such as can be provided by ground surveillance radar?
- **Is 24-hour traffic control required in some congested areas regardless of weather conditions (VFR or IFR)?**

Saint also proposed an air traffic control advisory team for these purposes:

- **Interpret operation requirements** established by the Air Coordination

Committee's navigation panel and give detailed guidance to the ANDB development program.

• **Refer back to the navigation panel** those matters which it believes need clarification or revision.

• **Assist the Civil Aeronautics Administration, ANDB and navigation panel** in evaluating new devices.

Gen. Smith's outspoken views publicly exposed a long-simmering behind-the-scenes struggle for action to solve the knotty air traffic control problems.

Air Transport Assn., Navv Department, Aircraft Owners and Pilots Assn., Air Line Pilots Assn., National Business Aircraft Assn., and other aviation interests which fear a breakdown in air traffic control, are involved in the fight.

### Cites Lack of Funds

The MATS commander said he understood one reason for the lack of progress has been the inability of the air traffic control agency to obtain necessary funds to fulfill the requirements.

He said the lack of funds is the greatest preventive to a natural growth of the system. The procurement of additional funds should be a common goal to all aviation interests, he said.

The Air Force is willing to do its part, he said, but "it is not our primary responsibility to provide for the needed services. We have offered and will continue to offer every assistance to those agencies responsible for providing ATC service in obtaining necessary funds from the Budget Bureau and Congress or other equitable measures necessary



LT. GEN. JOSEPH SMITH

to insure adequate ATC service."

The CAA administrator told the meeting:

"We will need more surveillance radars for our airport control centers in order to permit radar separation standards of a few miles instead of the ten-minute time separation now required for safety."

Lee predicted that "it will be necessary to more than double the present number of navigational aid installations" in order to provide coverage of the entire airspace between 18,000 and 75,000 ft. for jets, and of the CAA airways routes down to 700 ft. for pilots of smaller aircraft who fly under clear-weather rules. This was included in a 10-year program of improvements in air traffic control outlined by Lee.

But Gen. Smith was not satisfied with CAA progress to date. "We in the Air Force, with the arrival of the jet, came to a clear realization that if our requirements were to be met, we must take a more active part in the air traffic control and associated fields." He said Air Force efforts to assist in solving ATC problems were self-centered. "It should be appreciated," he said, "That any action taken to enhance air traffic control progress will, in turn, contribute to a healthy civil aviation potential which is essential to the national security."

### USAF Demands Action

Positive all-weather air traffic control was presented as the most pressing need today.

The Air Force has an urgent ATC need above 20,000 ft. but there is little control provided at these altitudes, Smith declared, and where it is provided, it is sadly deficient. He noted that more than a year ago the Air Force made known its definite requirements for high altitude control but no progress has been made.

Air movement delay figures of record alone reach staggering proportions when converted to dollars, Gen. Smith noted. The effect of special flow restrictions in the New York area are felt as far west as Chicago when critical traffic delays develop. The dollar impact of an inadequate air traffic control system on the national defense effort in the event of war cannot be estimated, he said.

Gen. Smith said the Air Force solution is to take action, and that enough planning has been done. He pointed to the continuous planning and replanning with the comment: "It's unjust



to say that we have had all planning and no implementation but it is most difficult to reach any conclusion other than that the situation is getting rapidly worse instead of better."

A program for action outlined by Gen. Smith embraced two things:

- **Additional funds.**
- **An appreciation by all aviation interests** that it will take a lot of money to improve ATC. He said: "We are not going to get progress by waiting for the ultimate system. Interim systems will cost dollars but will bring progress."

#### More 'Patches'

A by-product of the "lack of funds" noted by Gen. Smith is the extreme reticence of aviation to accept interim improvements, due to costs involved. This has meant, he said, a constant hoping and waiting for the so-called ultimate and ideal gear that is to solve all ills. He said that there is nothing wrong with the present ATC system of patches except that the patches aren't stacked high enough. "We must dispel the reticence of the user and the provider to accept improvisations in the system, and secure the necessary budget. The most effective results will be obtained only with the concerted effort of all aviation agencies," Smith said. He warned that the alternative could be the demand from the public for action generated by a major air catastrophe.

Lee thinks CAA can handle the air traffic control problem. "We in CAA don't claim to have all the answers, but we believe that our intensive study, backed up by the distilled practical experience of 30 years in the business of establishing and operating airways, has brought forth certain fundamental guidelines around which a successful program can be built."

Major ingredient in CAA's prescription for strengthening traffic control is radar. "We want radar, more radar, and then some more radar," Lee said. Among the types of radar involved are surveillance radars, long range radar,

and secondary radar. Lee indicated cost could be kept down by tying together military and civil radar wherever possible. But it must be accepted, he cautioned, that no matter how hard we strive to keep costs down, "If we are to meet the challenge of expanding aviation, we must be prepared to pay the bill."

CAA knows that it must stay ahead of aviation growth. Lee said, "Unless we are prepared for the load, we could be a stumbling block to industry progress." He doesn't want the so-called "crash" approach and will rely on draw-

ing up long range plans now, and shaping the annual programs in the years ahead so that those plans may be accomplished. The approaching jet era must be prepared for now.

However, so far as the Air Force is concerned "the jet age is not approaching; it has clearly arrived." Gen. Smith says jets have brought requirements far afield from present ATC concepts. He acknowledged that the jet aircraft are common only to the military today but the ATC must be ready for commercial jet aircraft that will come into operation in the very near future.

## Navy Blames F3H-1 Difficulties On Former Procurement Policy

**Washington**—Navy Secretary Charles Thomas places blame for the F3H-1 program—now under investigation by two congressional committees—at the doorstep of the Truman Administration, and adds that errors made will not occur again under new procurement procedures (AW Oct. 3, p. 12).

Navy is paying more than \$1.3 million each for 56 of the F3H-1 "Demon" fighters which will be used primarily for ground and other training activities.

Investigators of both the House Military Operations Subcommittee, headed by Rep. Chet Holifield (D-Calif.), and the Senate Preparedness Investigating Subcommittee, headed by Sen. Lyndon Johnson (D-Tex), have visited the McDonnell Aircraft Corp. plant at St. Louis, Mo., manufacturer of the airframe, and the Kansas City Division of the Westinghouse Electric Co., manufacturer of the J40 engine which failed as a powerplant for the aircraft. The J40 is rated at 7,200 lb. thrust. Committee staff members in Washington reviewed Navy files.

Holifield's subcommittee will begin public hearings October 24.

In other developments:

• **Secretary of Defense Charles Wilson** joined Thomas in blaming inadequate procurement procedures following the outbreak of the Korean war for failure of the program.

• **Question was raised** as to the propriety of an admiral, with responsibility over the F3H-1 program at one time as acting Chief of the Bureau of Aeronautics, subsequently taking a position as vice president of McDonnell.

A reporter asked Wilson: "Would it be sort of an unusual occurrence if the Acting Chief of the Bureau of Aeronautics at that particular time became an executive of the company that produced the plane?" No name was mentioned, but presumably the reference was to Rear Adm. Lloyd Harrison who

### New Voodoo Orders

A \$330 million Air Force contract with McDonnell Aircraft Corp. for production of three versions of the supersonic F-101 Voodoo was announced by J. S. McDonnell, president.

It boosted the company's backlog to an all-time high of over \$601 million.

The contract calls for an initial quantity order of the F-101B long range interceptor fighter for service with the Air Defense Command. It also increases the number of F-101A long range escort fighters to be produced for Strategic Air Command and the number of RF-101A photo-reconnaissance planes on order. The F-101 is powered by two Pratt & Whitney J57 turbojet engines, each developing 10,000 lb. thrust.

served as Deputy Chief of Bureau of Aeronautics from September, 1952, to July, 1955, and is now a vice president of McDonnell Aircraft Corp.

Wilson replied: "I never like to answer a hypothetical question because I can't tell what you have in mind."

### Thomas' Position

Of the 60 F3H-1s procured, four were prototypes and six crashed, killing two pilots. Navy has decided that 21 of the first models, costing over \$28 million, can be used only for ground training of mechanics or research into structural stress resulting from armament firings. The remaining 29 are to be converted for installation of the higher-powered Allison J71 engine, which is rated at 10,000 lb. thrust, at a cost of \$4.3 million, but their mission has not yet determined.

Thomas' statement:

"The difficulties with the F3H-1 McDonnell aircraft stemmed from aircraft under letters of intent let four years ago or in October, 1951, and converted

into a formal contract in August, 1952.

"These letters of intent and contract were let under procurement procedures now considered inadequate.

"From the time the deficiencies became apparent in this aircraft-engine combination, the Navy has made great effort to correct these deficiencies and also to utilize the aircraft which had already been produced to the best advantage possible.

"A subcommittee of the House Armed Services Committee was given detailed information relative to this contract . . . and further information will be made available to any additional congressional committees requesting it."

### Fails to Answer Question

This testimony dealt with the Navy's decision to cancel over \$1 billion in orders for approximately 1,000 planes, at a termination cost to the government of \$227 million (AW Feb. 21, p. 44). The public record shows only one mention of the F3H program. John Courtney, counsel of the House Armed Services Investigating Subcommittee, states that this includes all but 18 words of testimony given by the Navy. The two versions—the F3H-1 and its successor the F3H-2 powered with the Allison J71—were not identified. The first F3H-2 was delivered in June, and McDonnell officials report that it has passed tests successfully on the carrier Ticonderoga (see pictures on p. 23).

Only mention of the F3H was a report by Capt. H. T. Dietrich that the Navy plans to develop the plane. He anticipated that the Navy "may eventually get (its) money out" of the project. When Rep. Paul Cunningham (R-Ia.) pointed out that the objective of terminations is to "save money," Dietrich observed: "We are not going ahead to buy an airplane that doesn't perform the way we want it to perform."

Thomas' statement on the reason for the F3H-1 situation still does not answer one of the main questions in the minds of congressional investigators: Why did the Navy continue procurement of the plane from the time the first was delivered in December, 1953, through June, 1955?

Secretary Wilson explained the Navy's continued procurement of the plane for a year and a half:

"I suppose hope springs eternal in the human heart or breast or whatever you want to call it. They were trying to see if they couldn't salvage the thing and get the thing fixed up, and they did start to reduce their commitments and pull in their production so that they minimized the losses." Out of the total of 150 F3Hs originally ordered, 90 were eventually converted to the F3H-2 type.

## F-86 Sabrejets Win First Round In USAF Weapons-Rocket Meet

By William Coughlin

**Las Vegas**—North American Aviation's F-86F Sabre, first tried out in the latter days of the Korean war as a fighter-tactical bomber, took top honors in the Fighter Weapons Section of the 1955 U. S. Air Force Fighter Weapons and Rocketry Meet. An Air Training Command team, flying Sabres, took first place in the day fighter event while, in the "Special Weapons" phase, a U. S. Air Forces in Europe F-86F unit placed a close second to a Far East Air Force team flying Republic Aviation F-84G Thunderjets.

Republic's newer, sweptwing F-84F—making its debut in the day fighter competition—placed second. Flown by a Strategic Air Command team, it was first in the air-to-ground events but scored only 2,769.5 points to the ATC's winning 3,170, when air-to-air firings were added.

The F-84G nosed out the F-86F in the special weapons (atomic weapons) delivery contest, 27,154 points to 26,234.

The margin was less than the score for a single bomb of the 48 dropped.

### F-86 vs. F-84F

Col. R. C. Franklin, Jr., commander of the USAFE 21st Fighter Bomber Wing, whose unit took second place in special weapons, told AVIATION WEEK:

"I am of the opinion that the F-86F—for just plain delivery, not considering range or inflight-refueling—is the best airplane for the job. It is definitely better than the F-84F.

"We had an opportunity to win the meet and booted it. It was not the fault of the airplane."

Sabres modified to carry atomic bombs have been in operational use less

than a year. This was their first appearance in the special weapons phase of the gunnery meet. They were stock model F-86F-35s, modified only by the installation of an S-3 bomb rack and the instrument required for the bomb's delivery.

No modification to the airframe is required to give the Sabre its A-bomb capability.

### Practical Capability

"We have found nothing in the aircraft that gives any difficulty in delivery," Colonel Franklin said. "The difficulty is in presentation of information to the pilot." He would not discuss this further for security reasons, but he obviously was referring to inadequacy of the low altitude bombing system instrument.

Col. Franklin said results in the special weapons competition indicate that USAF has a "tremendous capability" for delivery of tactical atomic weapons.

"The figures on accuracy have been extremely acceptable for several years," he noted. "Where the improvement is coming is that where before we had ten pilots capable of this accuracy, we now have thousands." (Only six pilots appearing in the 1954 meet were entered in this year's competition.)

Success of the overseas commands—FEAF and USAFE—in the special weapons competition indicates, Col. Franklin said, that tactical units in the field have developed their atomic-bomb delivery skills to the highest point.

The colonel also praised the F-86F for its in-commission rate.

Noting that his team had used the same six Sabres for three meets and two practice sessions, in addition to flying them across the Atlantic, Franklin said there had been no mechanical aborts during the competition and only one

### ATA Endorsement

Milton W. Arnold, vice president of the Air Transport Assn. for operations and engineering, emphatically endorsed the Air Force demand for substantial improvements in the air traffic control system. Arnold said Lt. Gen. Joseph Smith's speech was "most encouraging."

"The recognition of an expanded positive system of control of all traffic with proper provision for flexibility is essential to all users of the air space. It is gratifying to hear and read such an exposition of our requirements by one of the major users of the air space," Arnold said.

## Douglas Expands Missile Facility

**Santa Monica, Calif.**—Douglas Aircraft Co. announced last week that it will separate its missiles' engineering functions from those of aircraft engineering because of the increased emphasis it is placing on guided missiles.

Elmer P. Wheaton will head the new department as chief missiles engineer. R. L. Johnson has been named assistant chief missiles engineer. Other key men include: M. W. Hunter, design engineer; A. J. Carah, assistant for component design; C. S. Perry, administrative engineer; R. W. Creal, chief draftsman; E. C. Kaliher, engineering personnel manager; T. A. Kivass, chief of preliminary design, and William Baker, chief of reliability and production design.

Douglas is currently working on eight major missile projects under contracts from the Air Force, Army and Navy. The Honest John, Nike and Sparrow 1 are among the missiles now in production.

The company expects to complete the move of the new department into a missiles building here by next spring.





### Forrester Goes to Sea

USS Forrester, world's largest naval vessel, moves out for sea trials after commissioning. Longer catapaults (foreground) are for attack planes; shorter two in background for fighters.

armament malfunction — encountered when a relay failed—in 48 special weapons deliveries.

"I have never seen an airplane stay in commission as well as this F-86F-35," added Marine Maj. George H. Dodenhoff, an exchange pilot on duty with the USAF unit and a member of the team. "It is a well-proved, well-designed combat airplane."

Pilots and ground crews of the Republic F-84Fs which competed for the first time praised the performance of the aircraft but said it is still plagued with engine difficulties.

#### Engine Trouble

The fighter, flown by SAC, also placed third in the special weapons event.

The sweptwing fighters were equipped for this competition with the Curtiss-Wright J65-W7 engine, which provides about 600 lbs. more thrust than the W3 but is—according to the pilots—extremely sensitive to temperature and moisture.

To overcome this difficulty, the engine now is being modified by cutting

the turbine blades. Tests indicate it will solve the problem of weather sensitivity but reduce thrust by about 400 lbs. Thus, the W7 engine will have a net gain of only 200 lbs. over the W3.

During practice for the competition, M/Sgt. Joseph Hutchison, ground crew chief of SAC's 508th Strategic Fighter Wing, said the Thunderstreaks were plagued with engine troubles such as hot starts and false starts. One engine "blew up" as the pilot was on final approach at Luke AFB, Ariz., during his flight to Las Vegas, but a quick engine change enabled the aircraft to reach Nellis AFB in time for the meet.

The engines, however, performed without difficulty during the competition. "We watch them closely at the start for hot starts but otherwise are running the hell out of them," a pilot reported.

Pilots praised the performance and G-tolerances of the Thunderstreak and described it as being "as rugged as they come," as well as faster than the Sabre Jet. They noted that it was more difficult to fly in the competition since it is not as stable a gun platform as the

F-86F. This was attributed to the over sensitive hydraulic control system.

The F-84F also was handicapped in the 30,000-ft. altitude air-to-air firing by the fact that it weighs more than the Sabre Jet and is less maneuverable, team members reported. For air-to-air firing, pylon bomb racks were removed from the F-84Fs.

One pilot said he would prefer to see a more satisfactory emergency control system on the Thunderstreak. "If you lose your hydraulic system, you are out of business," he commented.

Sgt. Hutchison reported that redesign of the F-84F hydraulic system is under way to make the three hydraulic systems independent of one another. "Now, if one system goes out, there's a good chance they all will go," he said.

#### Maintenance Problem

One of the greatest maintenance troubles with the new fighter is that of hydraulic leaks, according to Hutchison.

There have been some actuator leaks in the spoiler system on the new F-models, he said, as well as difficulties with leaks in the stabilizer actuator. "One squadron encountered ten in two weeks," he reported.

When the wing first received the F-84F nine months ago, Hutchison said, it was troubled with gun malfunctions due to faulty design of the link chute. This was corrected and there were few malfunctions during the meet.

Pointing out that almost every aircraft is plagued with maintenance "bugs" early in its life, Hutchison concluded, "There has been a lot of talk about trouble with these F's that is untrue. They are rugged just like the old G was—built to stand the gaff."

His comment was echoed by a pilot who summed up the team's opinion of the F-84F as "all in all, a good, fast, dependable airplane."

### Godfrey Pays Penalty

Arthur Godfrey radio and television performer, has settled out of court his latest difficulty with the Civil Aeronautics Administration by paying a \$500 civil penalty.

Godfrey denied the payment was an admission of guilt in the incident with an Ozark Air Lines DC-3 at Chicago's Midway Airport (AW Sept. 19, p. 139). He was accused of flying dangerously close to the airplane when he overtook and passed it after takeoff with his own DC-3.

The civil penalty compromise is a common method of settlement for CAA violations, tax disputes and other government cases.

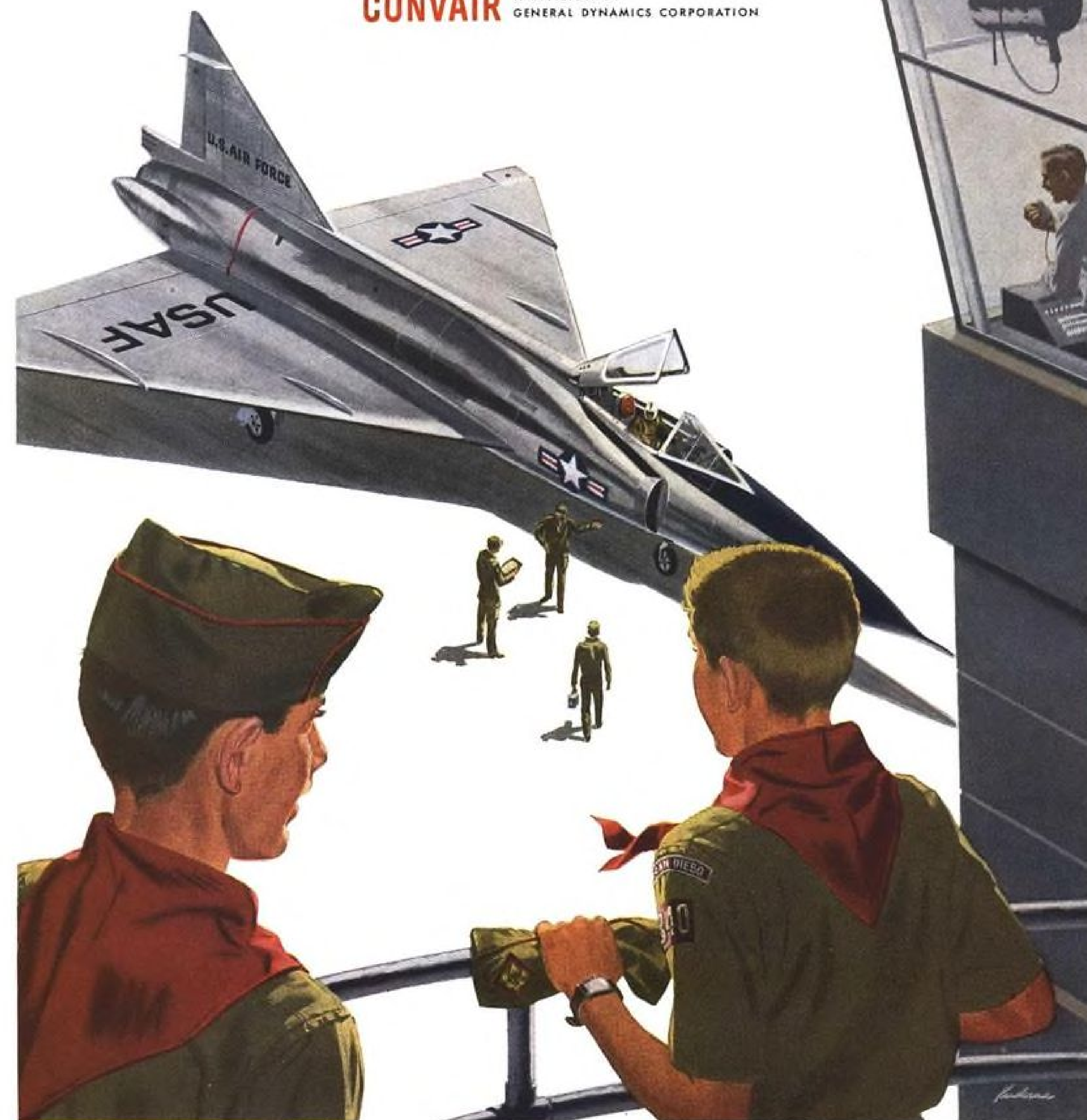
Earlier, Godfrey's pilot license was suspended for six months when he was found guilty of flying too close to the tower at Teterboro Airport, N. J.

*The New American Tradition...*

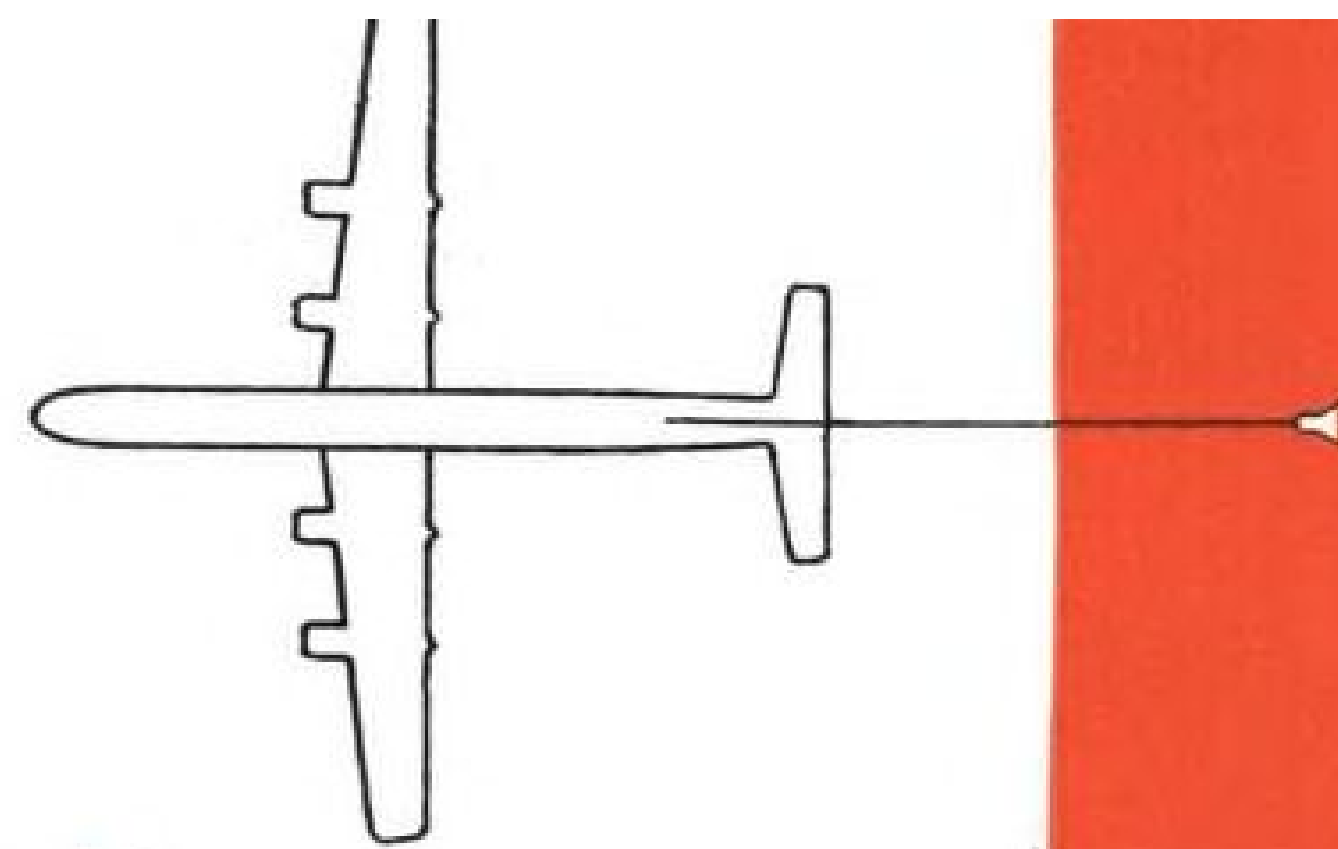
## Be Prepared

Convair is now producing in quantity the supersonic, delta-wing F-102A. With this day-or-night, all-weather Interceptor the U.S.A.F. Air Defense Command will be prepared to better fulfill its mission — the discouraging of attack through the effective protection of America! Through engineering to the Nth power Convair continues to be prepared to help assure peace and freedom by producing aircraft with the capabilities of the F-102A.

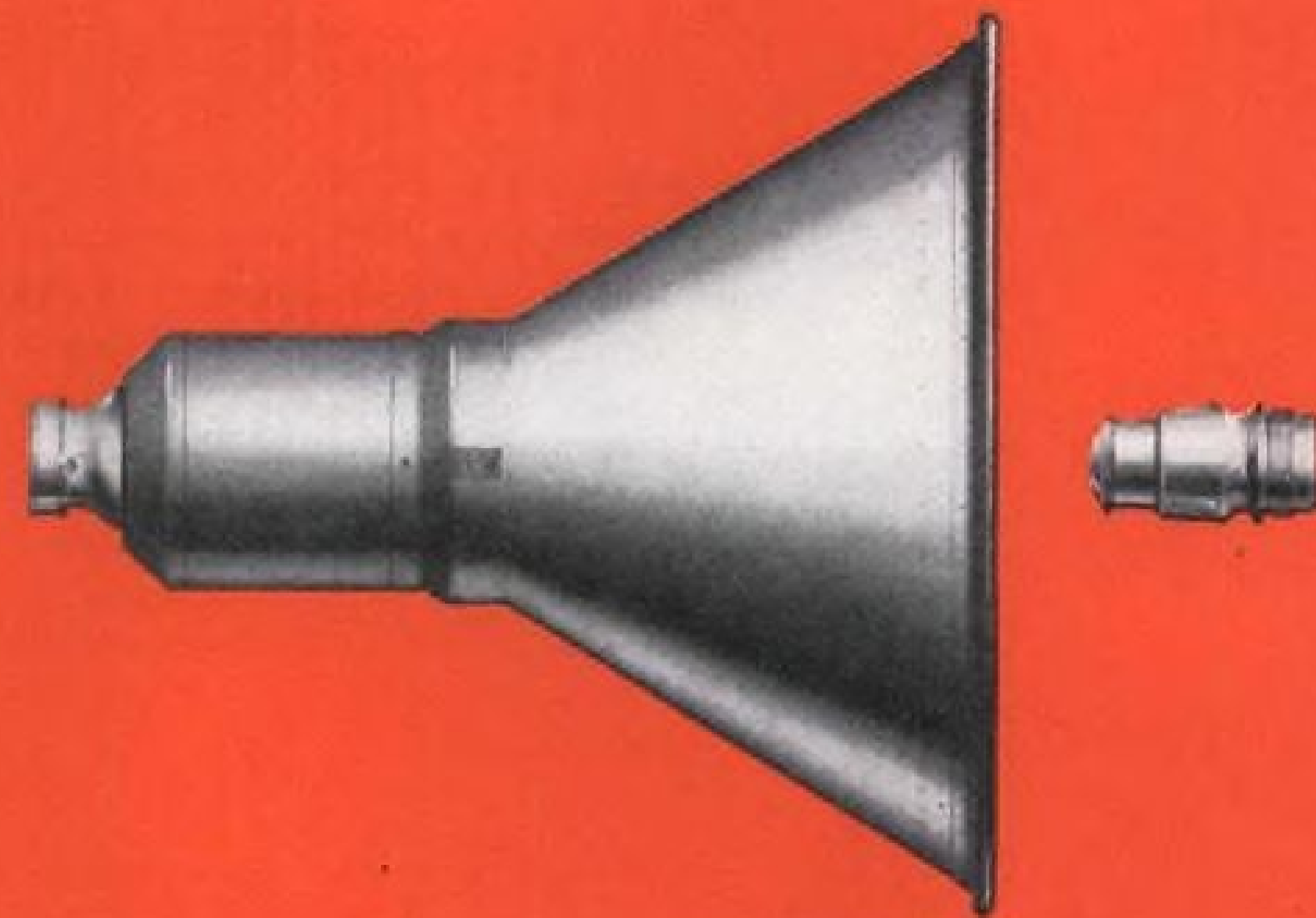
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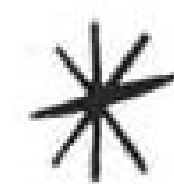
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We are proud that McGraw-Hill publications were among the founders and charter members of the Audit Bureau of Circulations.

Today the Bureau numbers 3,670 members. These include advertisers, agencies, and publishers of newspapers, farm papers, general magazines and business journals such as this one. These publisher members hold their memberships and their right to display the ABC symbol in their publications only so long as they live up to the circulation standards that are established through the Bureau.

It is one thing to set up high standards; it is another to see that those standards are maintained. This latter and all-important function is performed by a staff of auditors maintained by ABC to check periodically on the circulation practices of the publisher members. When a business magazine, such as this one, joins the Bureau it agrees that the ABC auditors shall have "the right of access to all books and records." Their inspection may dig into the files of original subscription orders, payments from subscribers, paper purchases, postal receipts, arrears of payments, editorial expenses and many other significant items. Sometimes the auditors go behind the records and seek verification of purchase and payment from subscribers themselves.

The information thus obtained and certified by the Bureau then becomes available to the public

and constitutes an authoritative report on the publication's circulation practices.

The advertisers and agencies benefit directly from the ABC because it provides a generally recognized factual yardstick by which the circulations of member publications can be measured and appraised. Every paragraph in an ABC report on a business publication gives the advertisers data that help them make intelligent use of the publication as an advertising medium.

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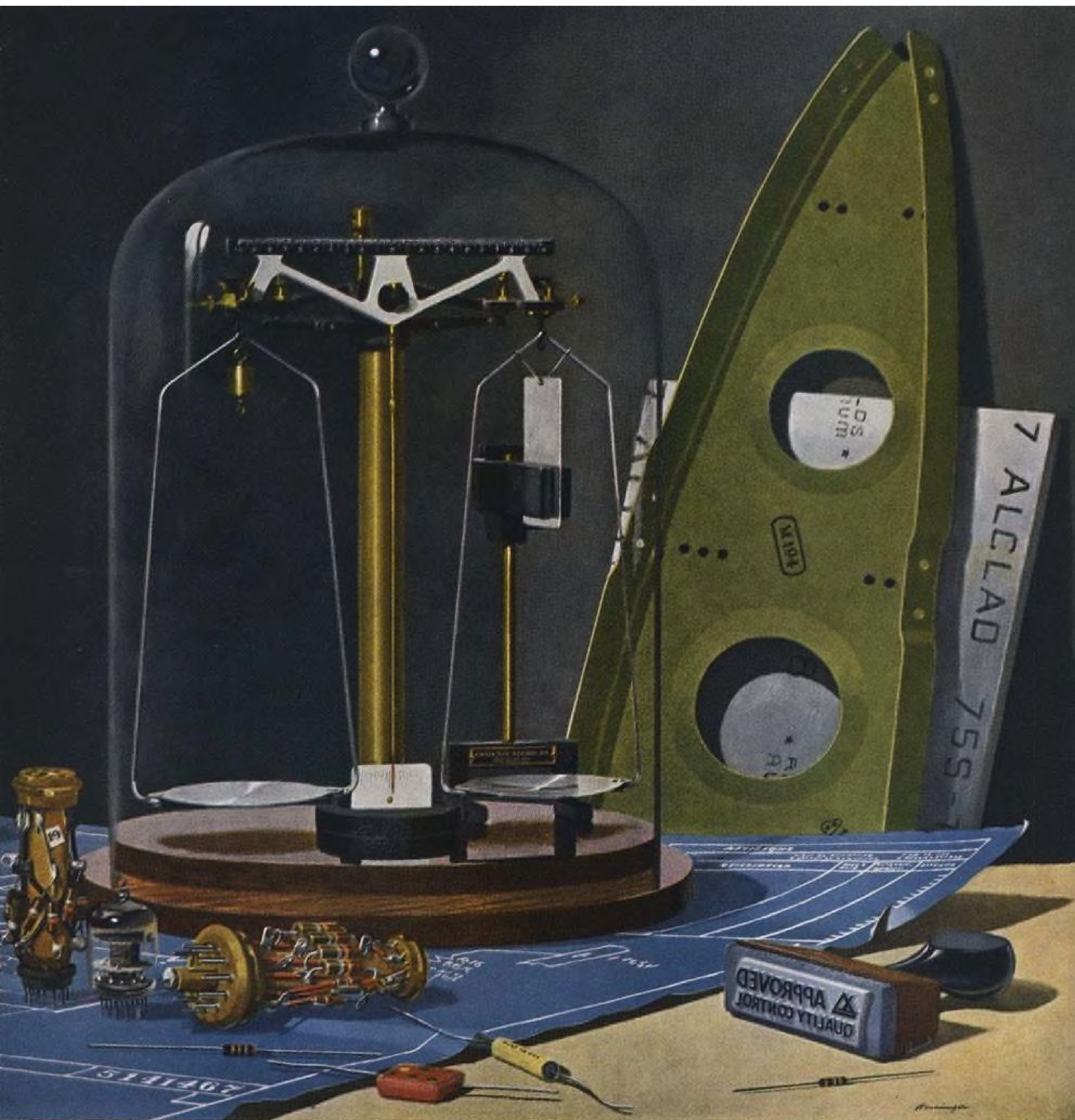
So the editors of ABC publications must constantly keep their editorial services up to the mark if they are to survive a competition in which the reader's right to buy or not to buy is paramount. Each paid magazine or newspaper will prosper or fail as it wins or loses the voluntary patronage of thousands or millions of readers. And—the ABC is scorekeeper in this vital contest.

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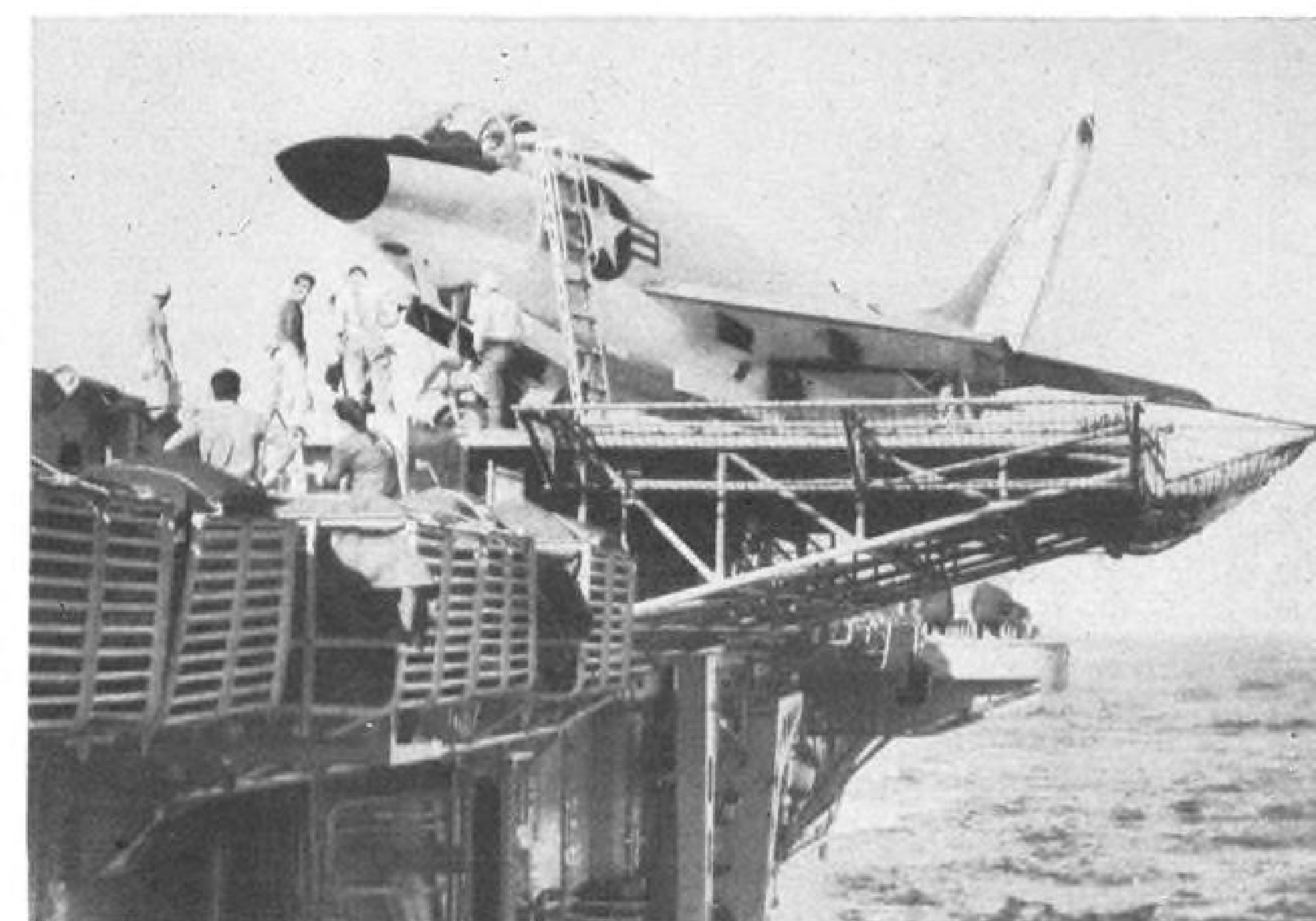
*Pioneers in All Weather and Pilotless Flight*



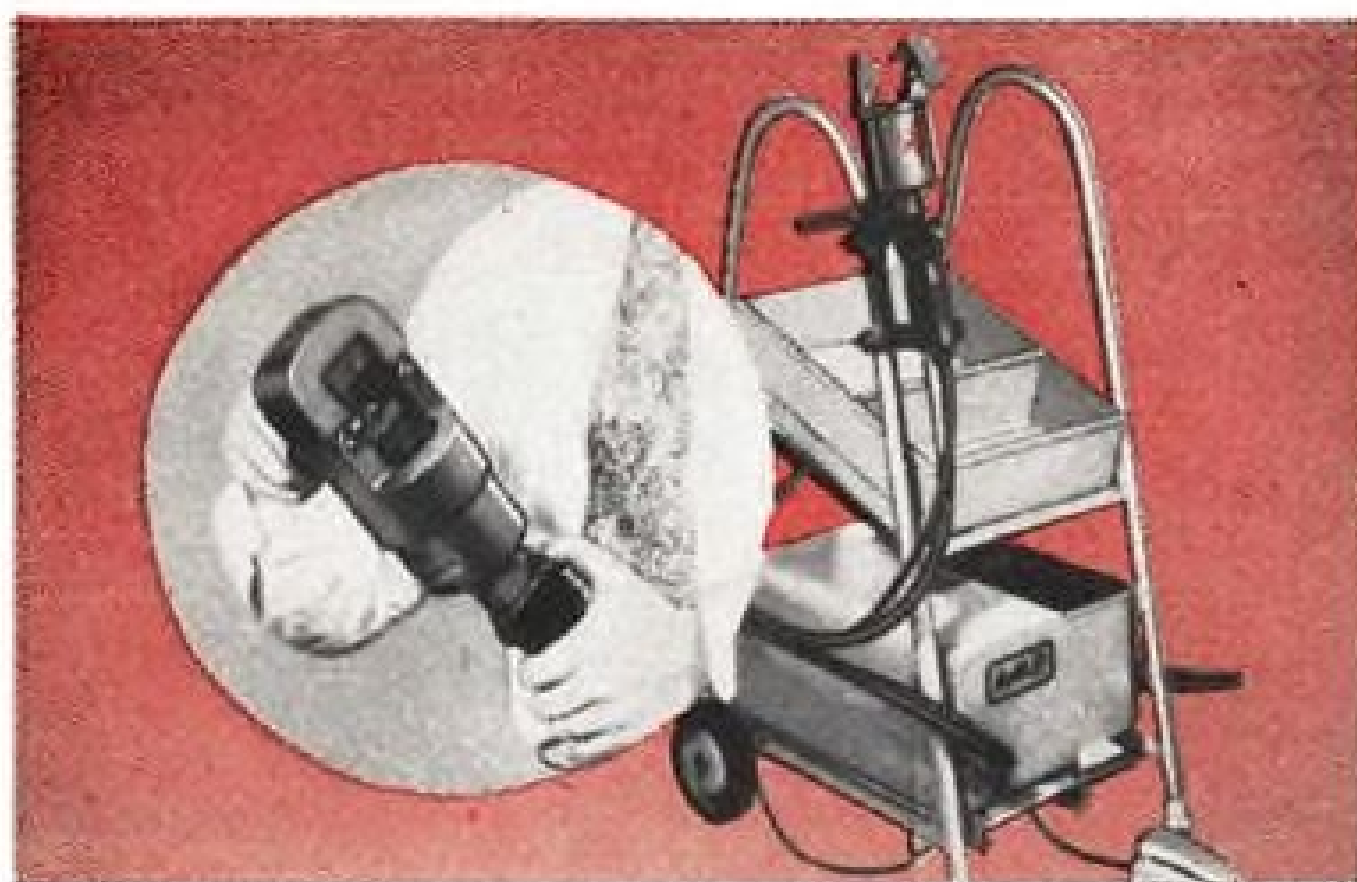
## The Demon Goes To Sea

While Congress threatened to investigate the Navy's purchase of its underpowered predecessor (the F3H-1N), the McDonnell F3H-2N moved out to sea for carrier trials aboard the Ticonderoga. Flown by pilots of the Naval Air Test Center, Patuxent River, Md., the all-weather fighter executed a total of 25 steam catapult launchings, 24 arrested landings and 25 touch-and-go landings—all without incident.

The F3H-2N is powered by a 10,000-lb.-thrust (with afterburner) Allison J71 engine, as opposed to the F3H-1's 7,200-lb. Westinghouse J40. Its wing area also has been increased. Top photo of Demon being positioned above steam catapult shows sharp, aerodynamically-designed low drag radar nose apparently the first to be installed on a U. S. plane; carrier approach-light system mounted on the nose wheel rather than on the conventional wing-tips; bomb-rocket racks, and two fuel pylons beneath fuselage. Side picture shows three weapons pylons below wing.

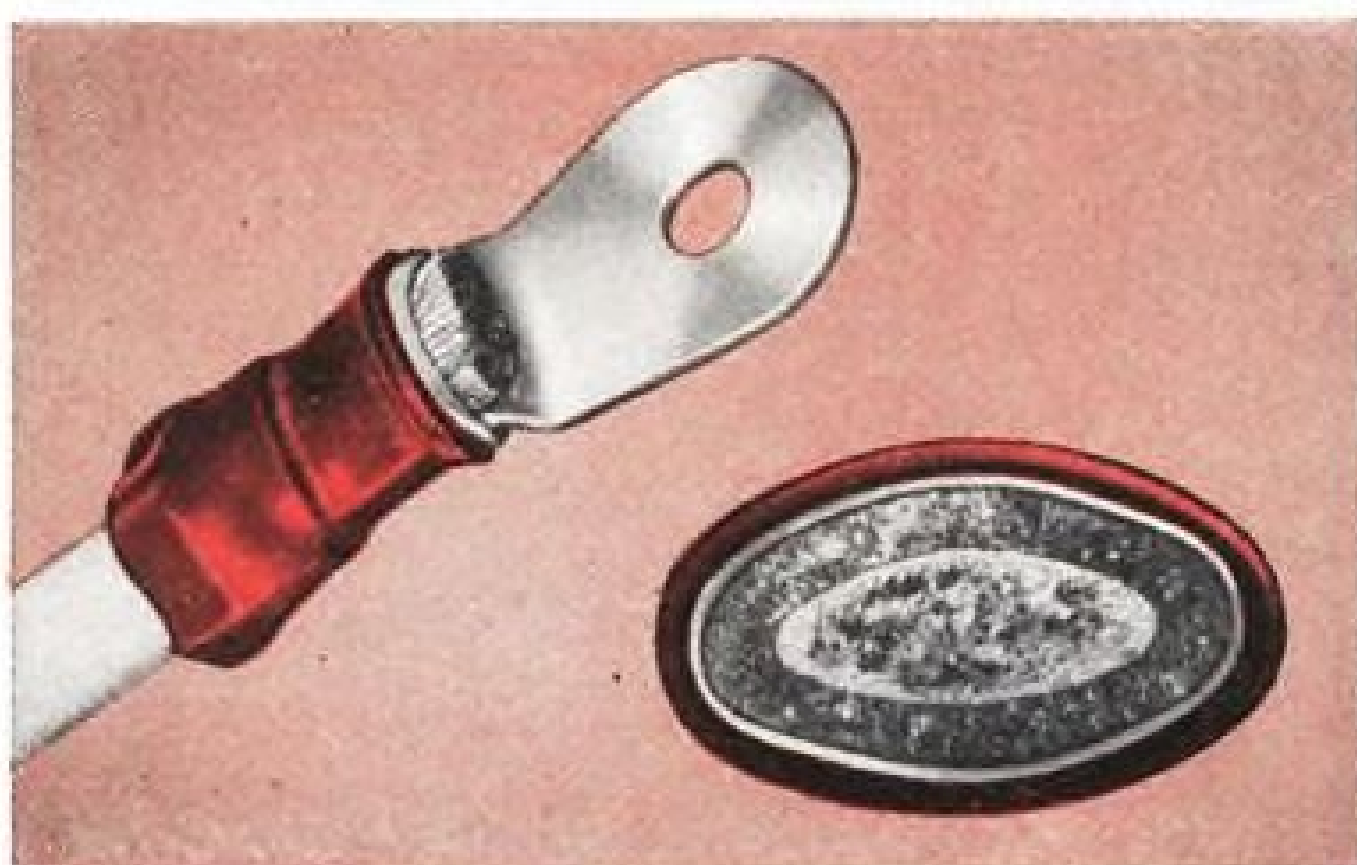






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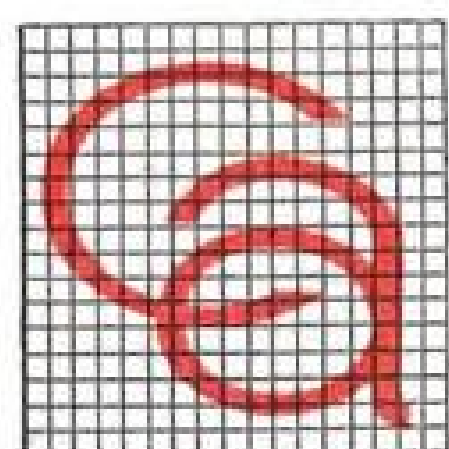


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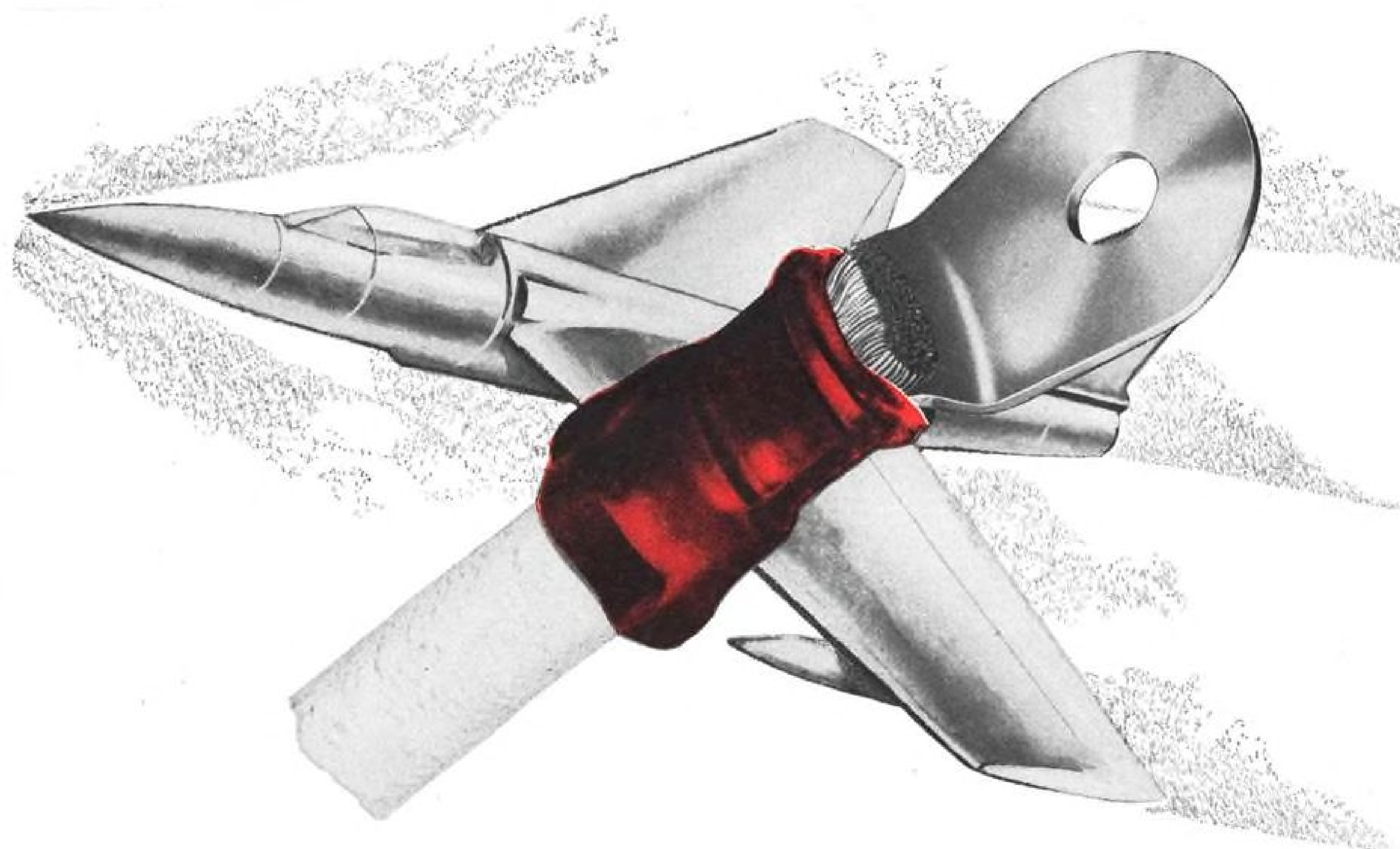
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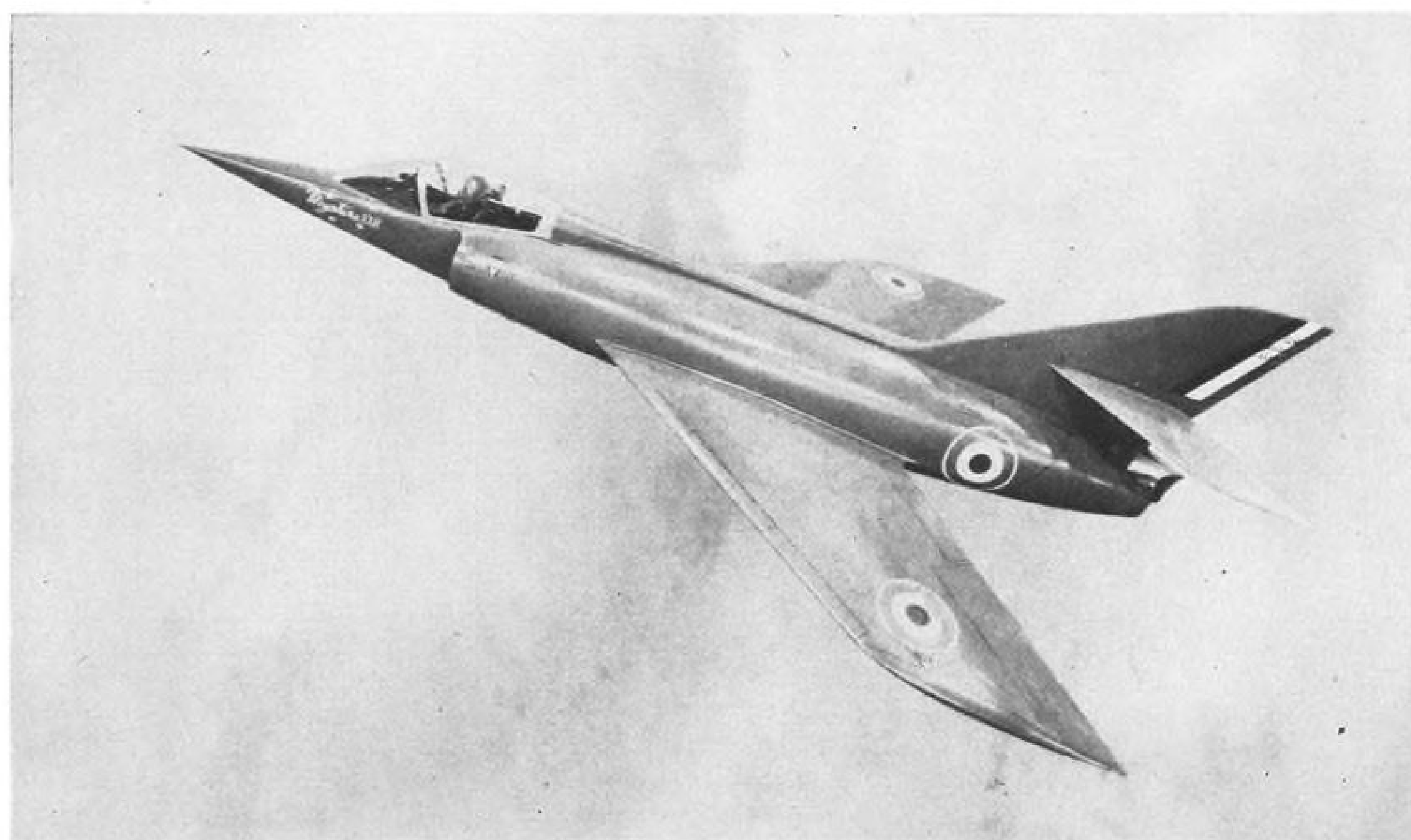
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# AERONAUTICAL ENGINEERING



Mystere 22

## Dassault Designs NATO Light Fighter

By David A. Anderton

**St. Cloud, France**—The first prototype of the Dassault Mystere 22 light tactical aircraft design for the French Air Force is nearing completion in the company's experimental shop here.

Although aerodynamically similar to the Dassault Super Mystere supersonic fighter now entering production, the 22 is much smaller—the gross weight is under 12,000 lbs.—in keeping with its light-fighter concept.

Two other basic prototypes will follow:

- **The Dassault 24**, a flying study of the possibilities of the Snecma Atar G turbojet.

- **The Dassault 26**, ordered for NATO's light tactical aircraft program. Designs for both aircraft have almost been completed, and construction of the prototypes has begun.

The basic mission of the series will be low-altitude combat at transonic speeds. NATO requirements call for a 105 nautical-mile flight to enemy forward positions at 3,000 ft. altitude and 350 knots, carrying full internal loads plus wing rockets.

Over the line, the plane has to make a run-in to a target 50 nmi. behind the

enemy positions, loiter for eight minutes at the target and then return the 50 nmi., all at full throttle. The return cruise is at 105 nmi., the same as the outgoing.

Armament of the light planes will be a pair of the French-built 30-mm. revolver cannon, internally carried air-to-air or air-to-ground rockets and 1,000 lb. of external stores (most typically a pair of 500-lb bombs). For ferry missions, external fuel will give up to 1,200 nmi. range.

Dassault engineers say that the refueling operation should take about five minutes. Re-arming the plane should take about eight. In all cases, ground operations and maintenance have been among the governing factors in design of components.

### Design Features

The family resemblance of Dassault airplanes has been kept in the new light series. Wing and tail geometry—both in outline and in respective location—are the same as those of the Super Mystere 4B2.

This probably is one of the few times in aircraft design history that fuselage design has been controlled by the size of the tires. Rough field operation is

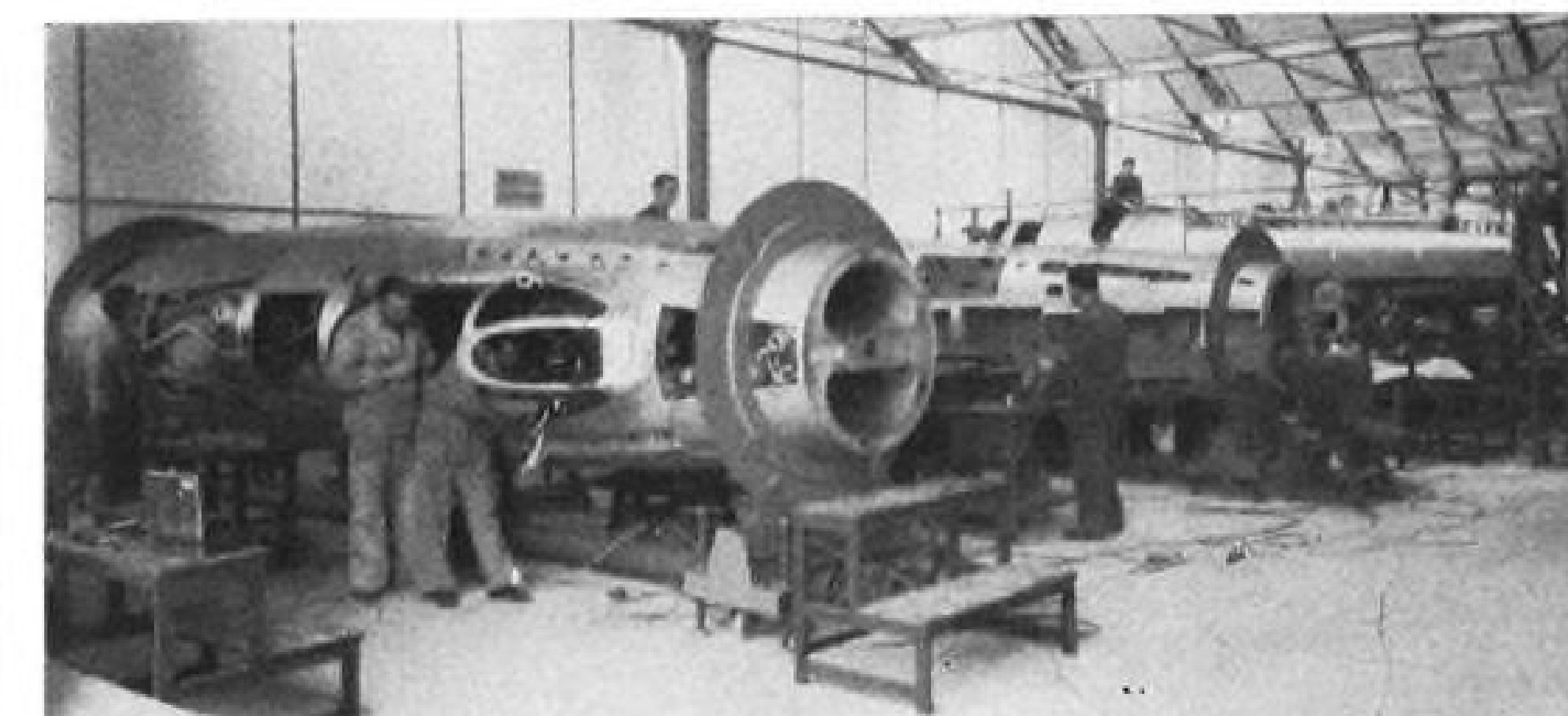
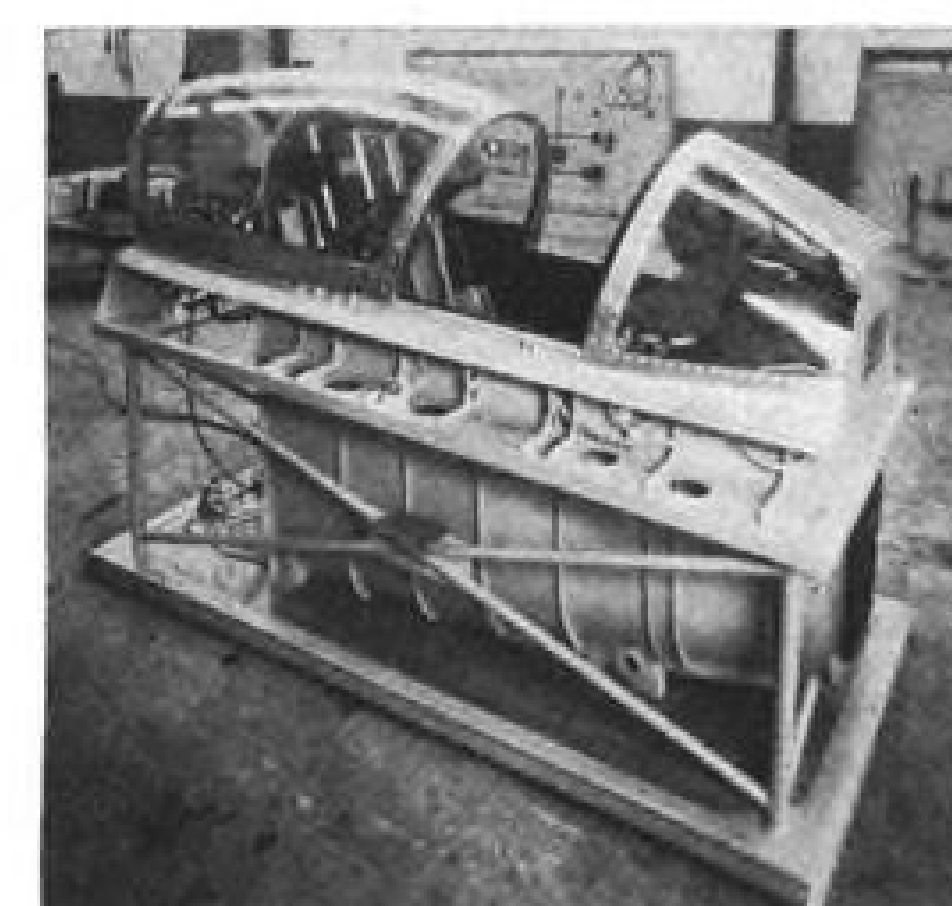
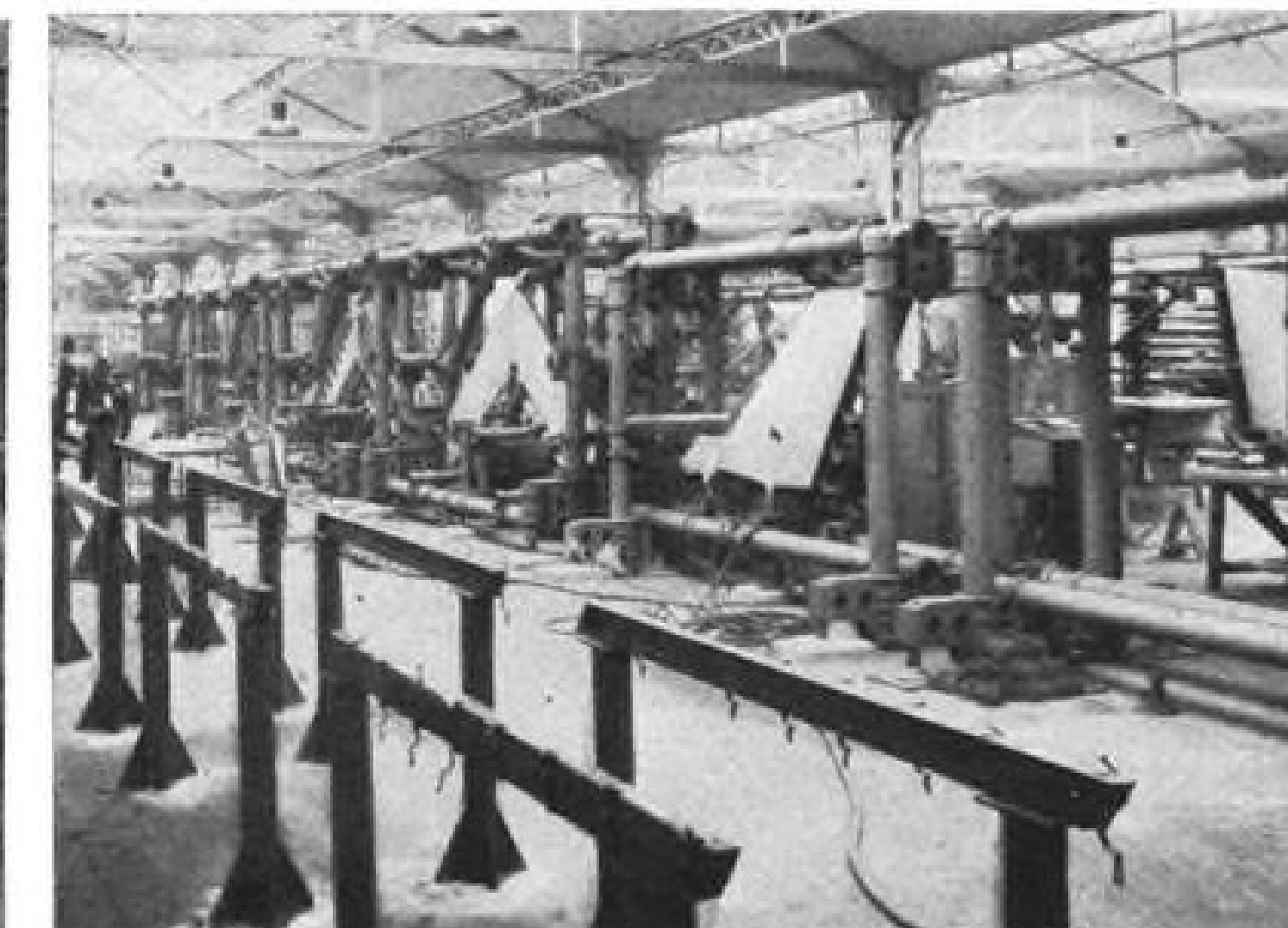
a must for the new generations of French and NATO fighters, and rough fields mean big tires; wheel pressure is less than 50 psi.

But big tires won't retract into the thin wings needed for transonic operations, so the only solution is fuselage storage. Two large-sized wheels, retracted to lie flat and almost touching in the fuselage belly, govern the width of the body. The pilot, powerplants and ducting are all subordinate to the wheels' dimensions.

Structure of the first prototype is conventional. The components are built up of sheet aluminum alloys, mostly of 24ST, although some 75ST is used in forgings. The second prototype will be more of a structural experiment in integrally stiffened milled components. Dassault is converting some of the Super Mystere components to that kind of design after fabricating earlier planes from bits and pieces and will save more than 100 lb. on the center section alone.

The design ultimate load factor for the structure was 12; even so, local buckling and rigidity requirements often dictated the choice of metal thickness.

The fuselage is built as a box struc-



**DASSAULT PRODUCTION LINES** for Mystere series (top row and above right) shows fuselage and tail assemblies for the Mystere 4A. Cockpit trainer for the fighters is shown above left.

ture, with two vertical shear webs running from the side walls of the cockpit to near the wing trailing edge—and with the distance between them decreasing as they run aft. A single shear web continues aft from the bulkhead that terminates the paired webs; engines are mounted on either side of the single web, and the two main tail beams straddle it.

Nose, ducting and tail cone structure are treated like fairings riveted on to the box structure.

Separate structural bays behind the cockpit hold radio, the armament and fuel, in that order.

Wing design is conventional, with the center section formed from rolled plate stiffened by spanwise hat sections. Center-section to outer-panel connection is made with a multiple-bolt fitting, probably to be face-milled for alignment after assembly, as in the Super Mystere series.

### Aerodynamic Layout

The Dassault 22 wing has 45-degree sweepback. Thickness-chord ratio is 6%. Ailerons are conventional; all controls are powered.

For high-lift characteristics, the now-familiar formula of slats and flaps is used. The nose slat is in three segments, closed by air loads. Double-

slotted flaps are fitted inboard of the ailerons.

Although all Super Mysteres will have the slab tail after the 150th airplane (earlier ones had the all-flying tail), the 22 may revert to a combination of the two.

In one Dassault proposal, the elevator and stabilizer are locked into a single tail—effectively a slab tail—for the normal flight range. With landing gear down and locked, the elevator and stabilizer can function separately in the normal manner of the all-flying tail.

Wind tunnel tests have been made at low speeds on the 22, and have confirmed calculations made for the design and based on similar tests of the similar Super Mystere. For these reasons, the Dassault engineers foresee no high-speed troubles for the layout.

### Armament

The pair of 30-mm. French-built revolver cannon, similar to the British Aden gun, is combined with the ammunition in a gun pack that can be winched in and out of the fuselage for quick rearmament. Designation of the revolver cannon is AME 3CGF. Although all the 30-mm. cannon now being fitted to aircraft of the NATO nations differ in detail, they all fire a standardized shell. The 22 carries 120

rounds of ammunition for each gun.

Air-to-air or air-to-ground rockets will be carried in an internal tray which projects for firing. Dassault engineers have developed an expendable tray, which is destroyed one row at a time as each bank of rockets is fired. This makes it unnecessary to retract the tray after firing a salvo, as must be done with other systems. The new tray has been standardized by Dassault on the Super Mystere and will probably be used on the 22.

Standard gunsight and range radar are installed, but no search or acquisition gear is employed.

### Powerplants

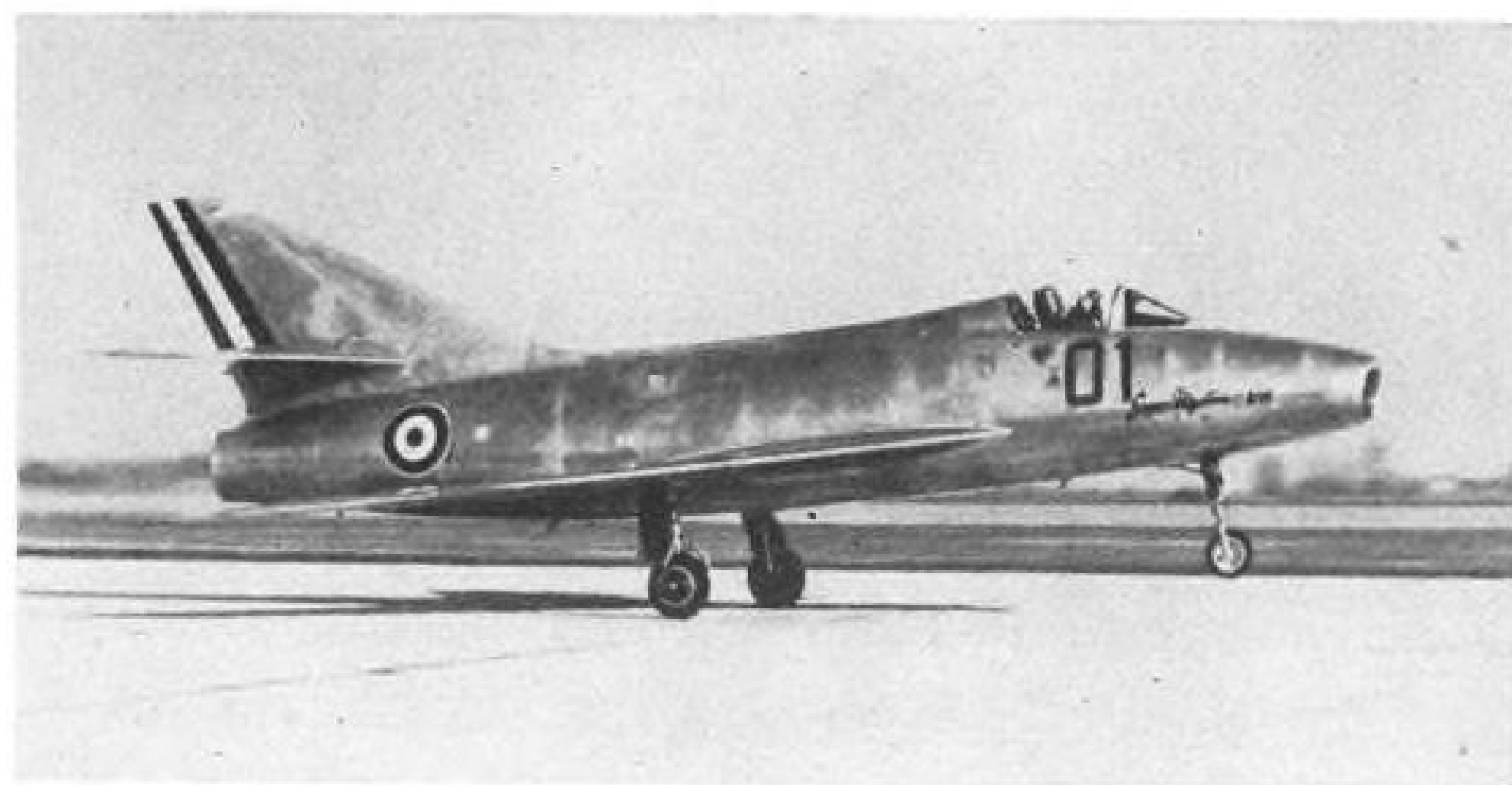
The only differences between the designs of the 22, 24 and 26 are in the powerplants. The first prototype—the 22-01—is being designed around a pair of Turbomeca Gabizos jets rated at about 2,200 lb. thrust each. If the engines are not ready when the airplane is, then the prototype will be flown with Dassault-built Armstrong Siddeley Vipers at less thrust.

Other possible powerplants studied for installation are the Snecma R105 and the Hispano Suiza R800, rated between 2,860 and 3,300 lb.

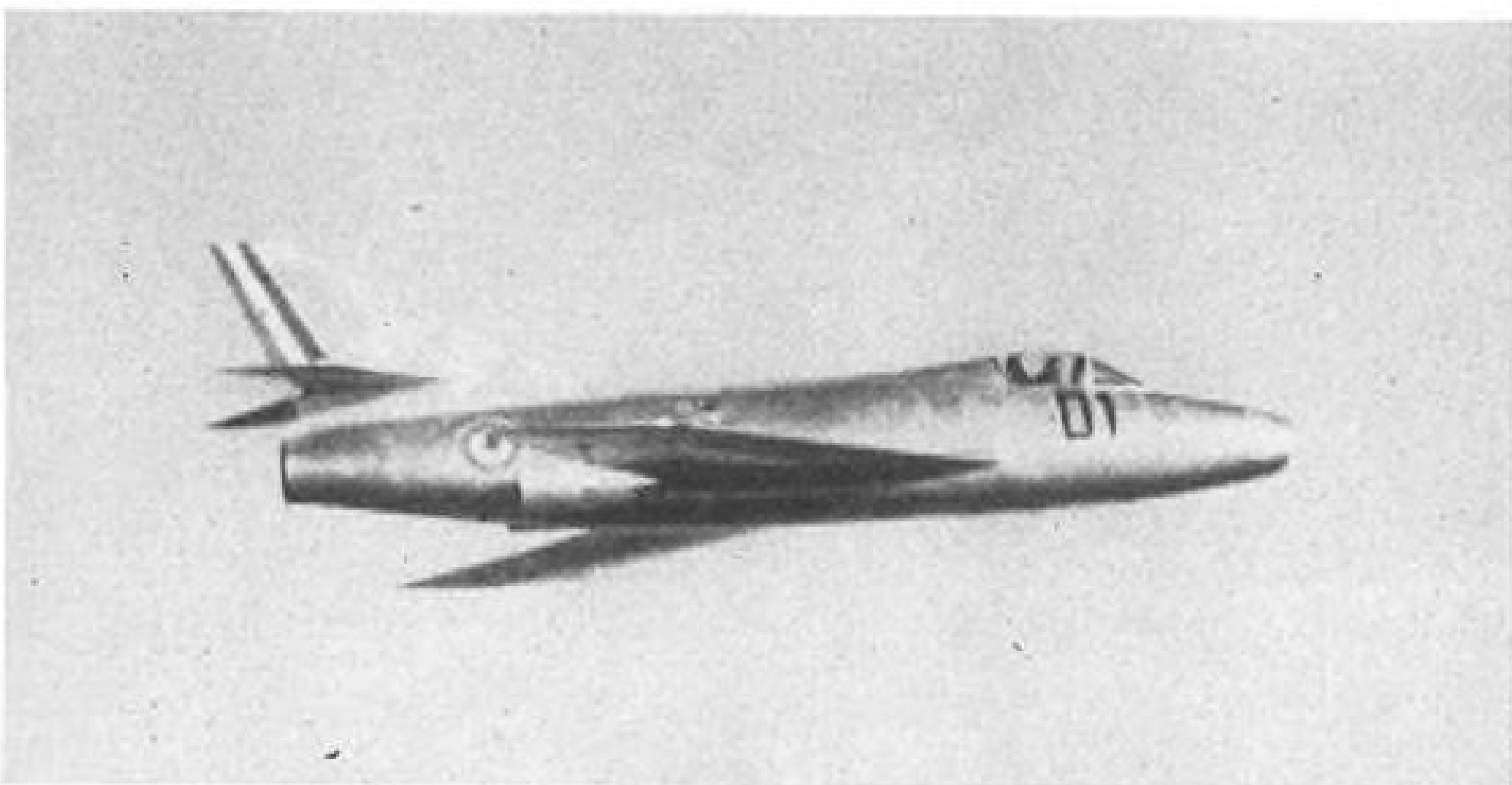
The second model—the 24—is to be powered with a single Snecma Atar G



## Super Mystere



PILOT LIFTS NOSE of Super Mystere off runway as he leaves on test flight . . .



ALOFT, he puts ship through paces (above) and then drops back in for landing (below).



DASSAULT SUPER MYSTERE built around alternate powerplants—Rolls-Royce Avon or Snecma Atar turbojet with afterburner—will soon be delivered to the French Air Force. First component assemblies of the Super Mystere are now being built, replacing the Mystere 4A units in production. Design and fabrication of the first Super Mystere prototype (shown above) began two years ago; first flight was in March. Plane reached supersonic speeds in level flight many times since then. Wing sweepback angle is 45 degrees; thickness-chord ratio is six percent. First 150 Super Mysteres will have all-flying tail; subsequent planes will be equipped with a slab tail in France's first production use of that control surface. Rockets and cannon are standard armament on Super Mystere.

turbojet, now rated at 7,700 lb. thrust. Two Bristol Orpheus engines—picked by NATO as the standardized powerplant for its three light-fighter proposals—will power the 26, of which three are being built with some U. S. aid. Bristol expects to be able to guarantee a thrust rating of 4,850 lb. for the Orpheus by the end of this year; with nearly 10,000 lb. of thrust available, the 26 should be capable of astonishing short-field takeoffs.

### Super Mystere

Latest of the Dassault fighter line to enter production is the Super Mystere 4B2. The French Air Force order for 150 of the supersonic fighters arrived at Dassault on Sept. 15, but production tooling and some preliminary construction had been under way before then.

Dassault's plants are now shifting over from Mystere 4A production to the 4B2. Engineers say that in two months the Super Mystere will be at full-rate production levels in the component shops.

Indicative of the plane's performance is the level flight speed of Mach 1.3 reached by Maj. Gen. Albert C. Boyd on his first flight in the Super Mystere.

Armament of the Super Mystere is a pair of 30-mm. revolver cannon, a tray of 35 Matra rockets and two external loads, which may be a cluster of 19 rockets per side, or four or six heavy rockets.

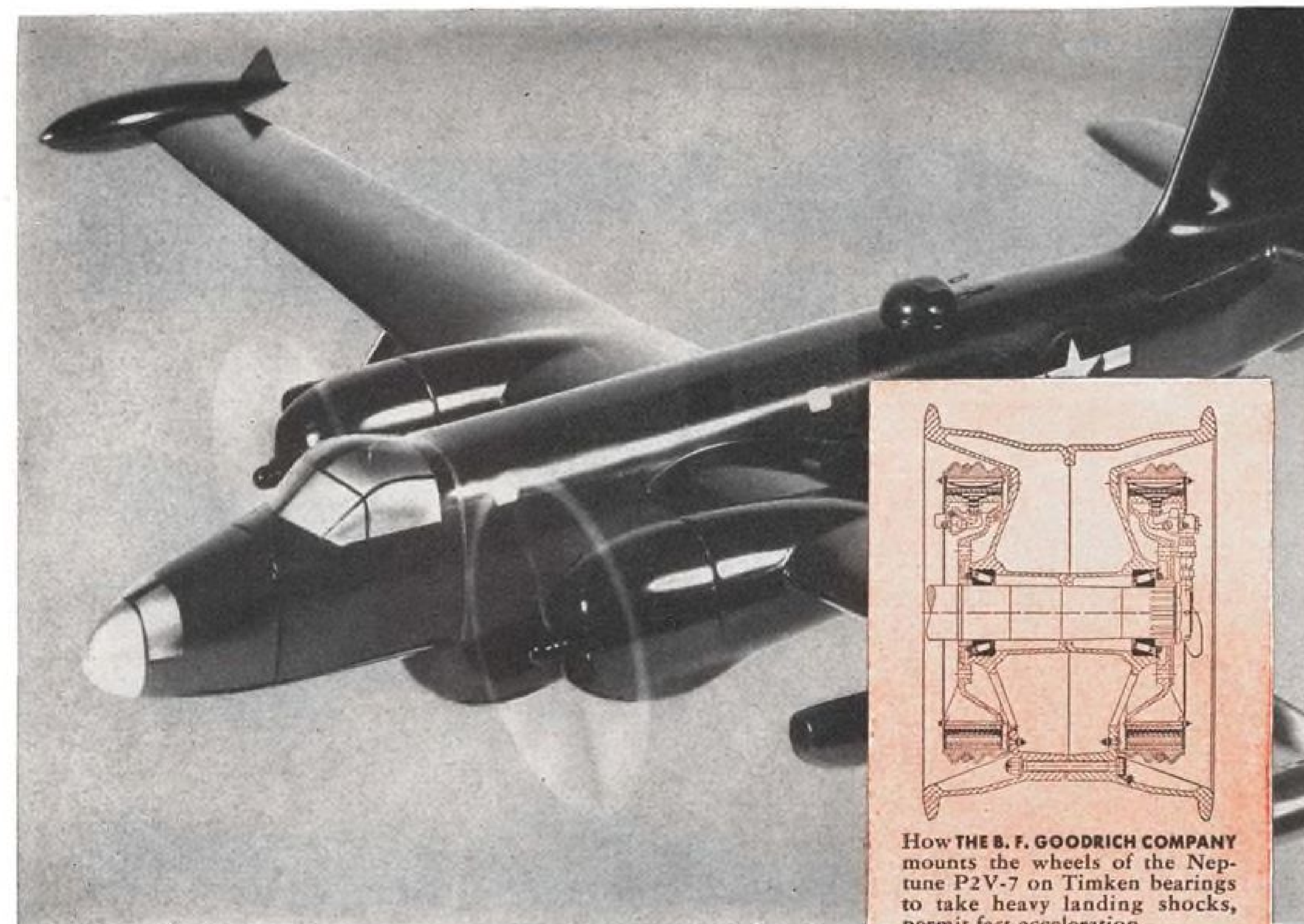
### Production Transition

The first forward fuselages for the Super are going together in their light green jigs, now springing up all over the factory floor to replace the dark-green jigs of the 4A. These fuselages are made by the "half-shell" technique, married in an assembly fixture and then shipped—after inspection—to the firm's main production plant at Merignac near Bordeaux.

Among the heavy equipment on the floor of Dassault's Argenteuil plant is the only Anderson "forming-by-drawing" machine in Europe, and the only one in the world—says Dassault—of a new design. Tool engineers say the process is faster and makes less scrap than processing on a Hafford.

The machine grips a sheet of metal in one set of universal jaws and pulls it through another set of variable-contour jaws whose shape is altered by the motion of cam followers. Dassault's operator says he can produce 300 pieces without a change in adjustment of the machine; its capacity is a sheet with maximum dimensions of 144-in. length, 50-in. width, and 0.250-in. thickness.

Also at Argenteuil is a single Giddings & Lewis skin miller, now being used to process experimental parts and to train operators. The machine will be



How THE B. F. GOODRICH COMPANY mounts the wheels of the Neptune P2V-7 on Timken bearings to take heavy landing shocks, permit fast acceleration.

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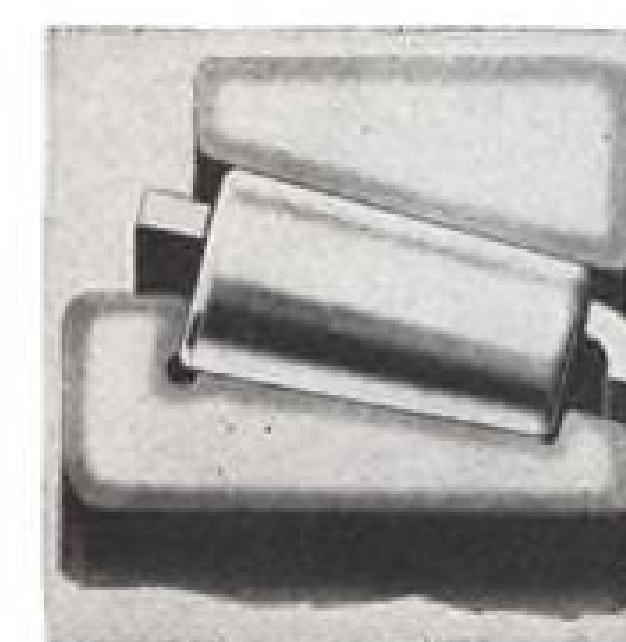
landing of the Neptune's wheels. Timken bearings are designed to roll true, by geometrical law. And they are precision manufactured to live up to their design.

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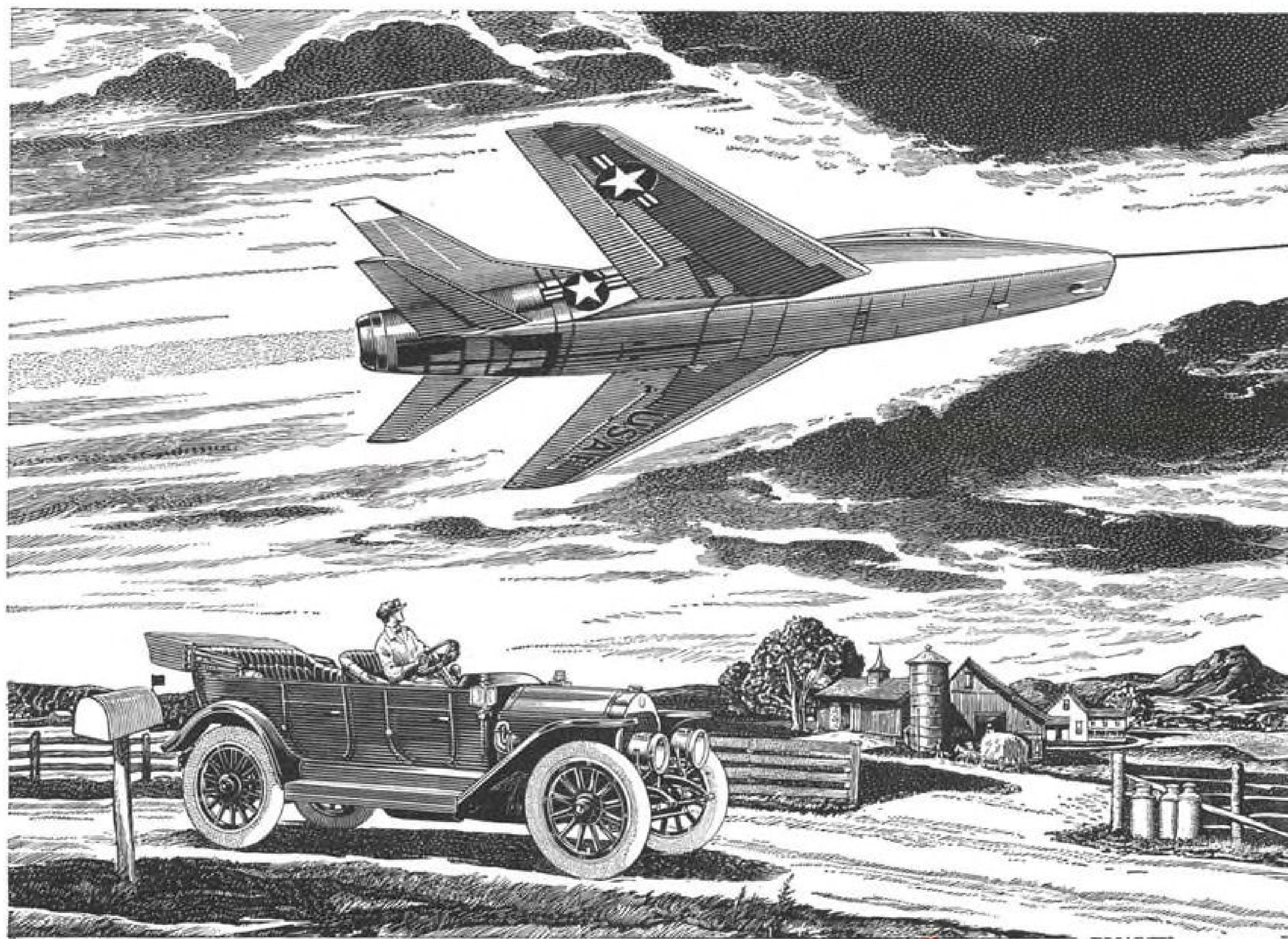
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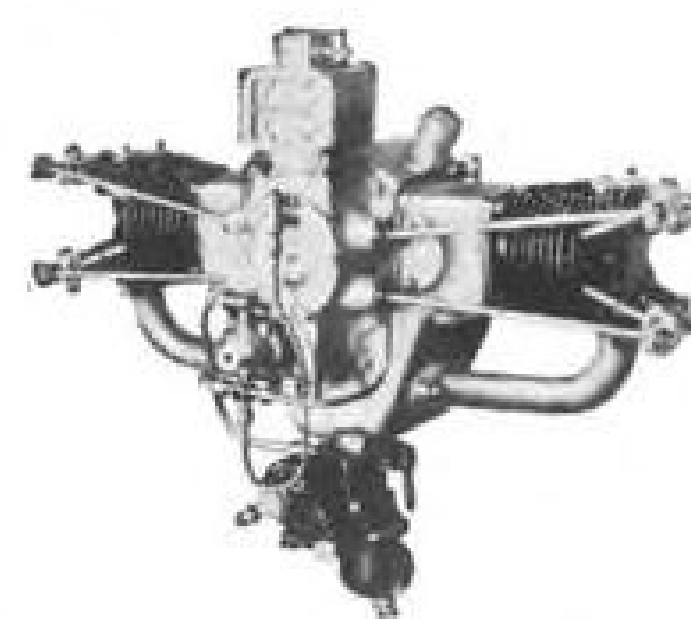
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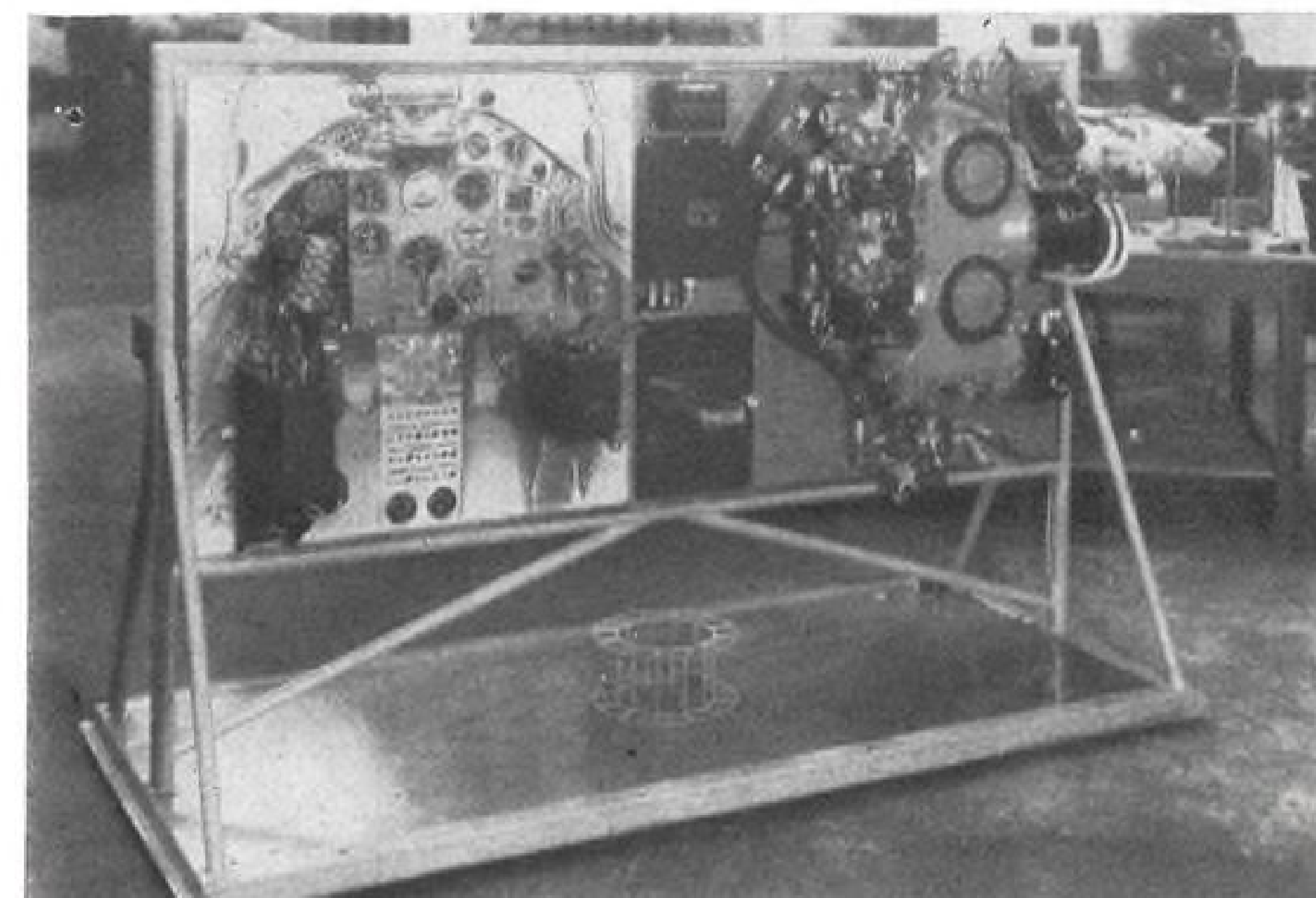
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DASSAULT ENGINE-STARTING training unit to be used by pilots and mechanics.

used to produce production models of the Super Mystere.

Wing attachment fittings are assembled on the fuselage sides in the jigs; after completion of the entire fuselage in its assembly fixture, the fittings are machined in place. This is done to guarantee accuracy of alignment and parallelism of the fitting faces. Two Cazeneuve horizontal millers are used for the process, mounted one on each side of a special jig which positions the fuselage.

### Avionics Research

A new kind of communications antenna is one development of Dassault's energetic avionics department, formed less than a year ago. Since then the group has concentrated on two phases of development: communications and target-illuminating radar for the Dassault aircraft designs.

Out of this program has come a new kind of communications antenna, now standardized for the French Air Force. It features an omni-directional radiation diagram and can utilize VHF-UHF channels from 100 to 400 megacycles without adaptation or changes.

The antenna is a simple pressing of aluminum alloy, held near one end with a pin which is the electrical connection and at the other by slipping over a dielectric post. The entire assembly is contained within the tip of the vertical fin.

Dassault believes that the range of a radar like the APG/30—something on the order of two miles—is not enough for their light fighter. They want an illumination radar with a 20- to 30-degree beam width and a range of about 20 km. (12 mi.). Thus the ground radar need not be so accurate; acceptable values would spot a target

within 5 to 10 km., and within a 5- or 10-degree beam.

To match these requirements, Dassault engineers have developed a new radar that can acquire a fighter aircraft the size of the Dassault Ouragan or the Republic F-84 at a distance of 8-12 km. An aircraft as big as a Lockheed Constellation transport can be picked up at 18-20 km. This radar, in conjunction with target-seeking radar used in missiles such as the Hughes Falcon, will give the French aircraft the kind of target acquisition performance they now require.

Design of the unit is conventional, with no transistors and no mag-amps. It operates at a peak power of 300 kw, on a wavelength of 3.25 cm. Combined with the other electronic equipment on board, the radar plus the rest of the package weighs about 90 lb., takes up about two cubic feet of space.

Pilot presentation is in the form of two indicators and a single lamp. No scope is used. The lamp lights to indicate that the target has been acquired; one of the indicators gives the range and the other gives the bearing of the target.

### Trainers

Dassault has designed and built a large number of mobile training units for its fighters, particularly the Ouragan series which was sold to the Indian Air Force. The Ouragan required a group of 13 of these trainers; later aircraft will need a comparable number.

One idea not previously seen on such trainers was the use of large photographs of the item in question, with only the necessary gadgets or controls being modeled or made as operational units.

The engine starting trainer uses such

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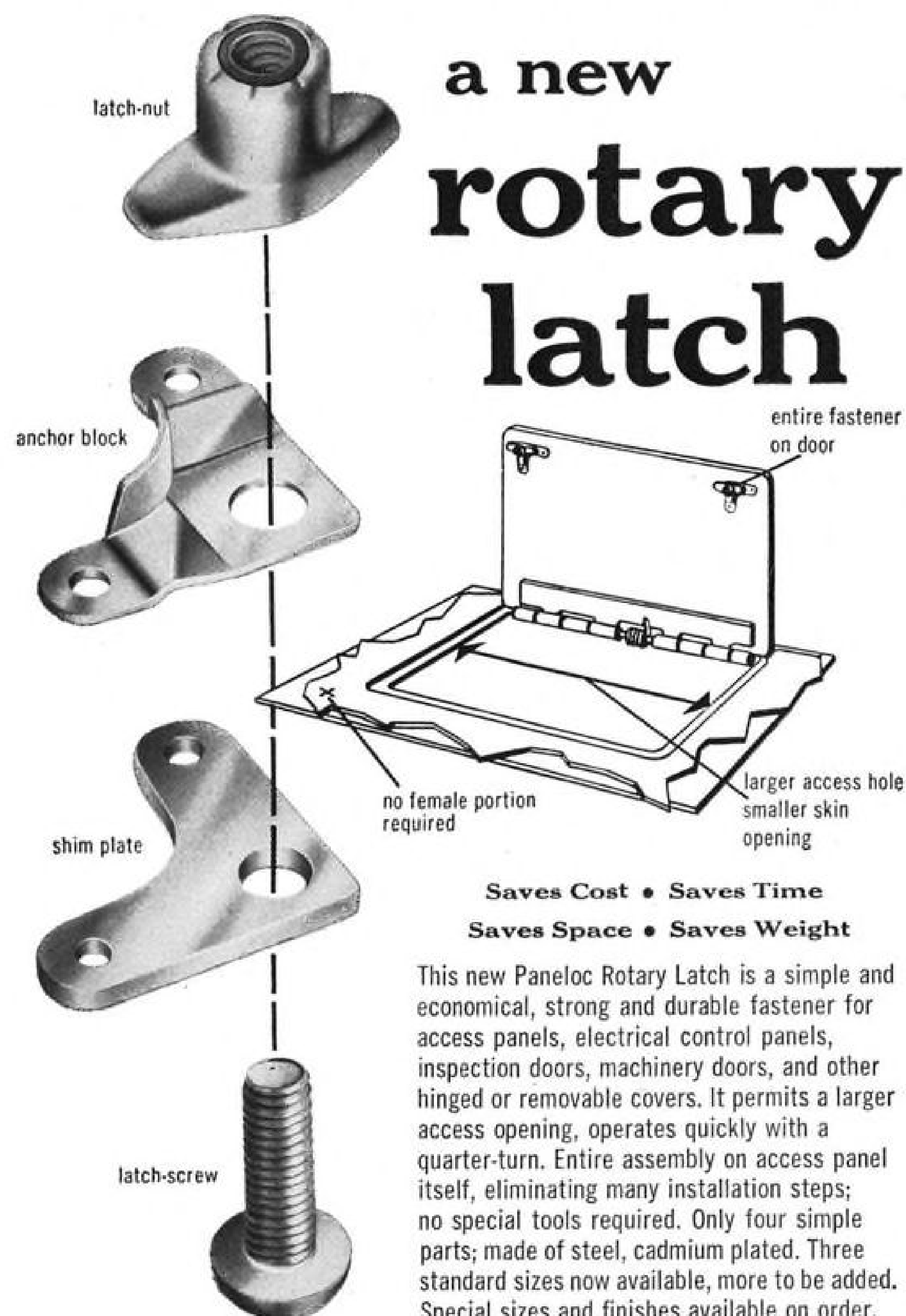
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a photograph of the accessory end of the turbojet. It caused a mild sensation at the Paris Salon de l'Aeronautique because it also simulates the noise of a starting engine. Inside the exhibition hall it was startling.

The company also assembles ground and auxiliary power units needed to service its aircraft. Components are purchased and built by Dassault.

### Intertechnique

One of the Dassault associated companies is Intertechnique, a firm which holds license rights to many non-French production items, among them Hi-Shear rivets, Wiggins couplings, Avien fuel gages, Aro oxygen regulators and Lear autopilot and communications equipment.

Many of these items are being made in large quantity after having been standardized by the French Air Force for use on all of its aircraft. The subsidiary is the baby of the Dassault family, but, in a few short months, it has shown a lusty growth.

### Army Fuels Plan

Washington—The Army is considering a proposal which would reduce the number of fuels used in Army aircraft to three, according to D. D. Weidhuner of the Department of the Army.

The three fuels, Weidhuner said, are Grade 80 aviation gasoline to be used in low output reciprocating engines, Grade 115/145 aviation gasoline which could be used in all higher output reciprocating engines, and JP-4 to be used in turbine engines.

"This would provide a near optimum fuel policy has not yet been adopted said, "since 115/145 should impose no penalty on engines qualified on 91/96 and 100/130."

A further possibility is that all Army aircraft engines would be qualified on Grade 115/145 as an alternate fuel without undue penalty.

The Army official emphasized that this fuel policy has not yet been adopted and is only a proposal.

A similar proposal is being considered for lubricants, Weidhuner said, using the same lubricants for both engines and transmissions.

"In the case of turbine engines, we expect that this oil would be MIL-L-7808, due to its good low temperature capability minimizing pre-heat requirements, and satisfactory lubrication and load carrying ability in the engine and transmission," he said.

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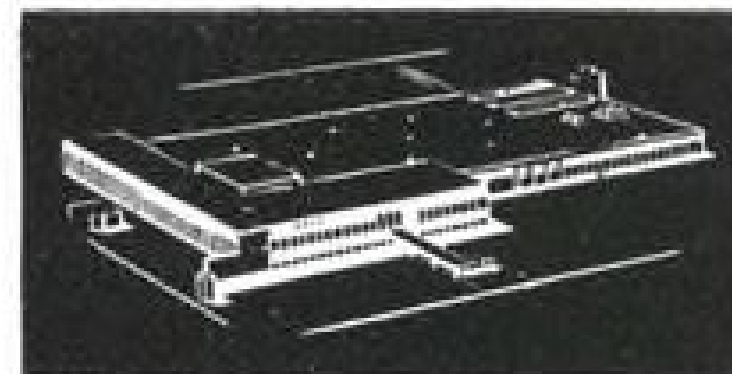
Stratos has acquired the Rhodes-Lewis Co., a subsidiary of McCulloch Motors. Rhodes-Lewis engineering, manufacturing and sales now are being incorporated into the Stratos organization.

Rhodes-Lewis products are being integrated into Stratos' line of pneumatic systems and equipment for aircraft. During the transition period close cooperation between Rhodes-Lewis and Stratos assures continuous production and uninterrupted delivery of Rhodes-Lewis equipment.

Concurrent with the acquisition of Rhodes-Lewis, Stratos is establishing a western factory. This will make Stratos' manufacturing facilities convenient to major aeronautical centers on both coasts.



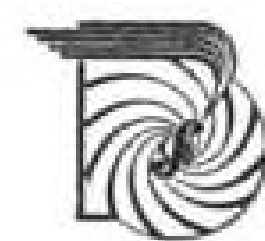
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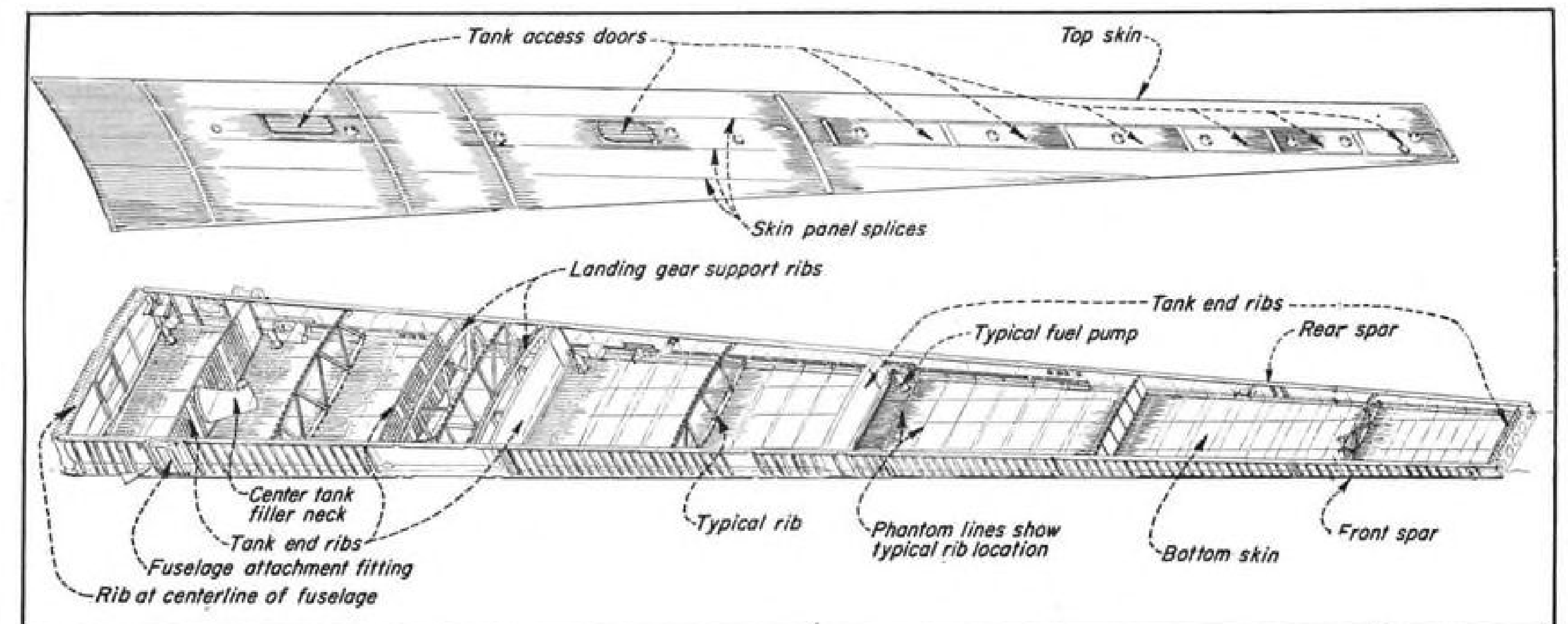
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WING BOX BEAM structure for Lockheed's new 1649A piston-powered transport makes extensive use of integral stiffening.

## New Wing Design Secret Behind 1649A's Greater Range and Speed

By Irving Stone

Burbank, Calif.—Lockheed's 1649A Super Constellation will gain up to 2,000 mi. range and 70 mph. over its earlier sister ships, company officials reported last week, because of a new, thinner wing design incorporating a greater fuel-carrying capacity and boasting a "minimum-drag" profile.

Scheduled for delivery to the airlines in early 1957, the 1649A was designed to provide major improvements over existing transoceanic nonstop service (Aviation Week, June 6, p. 18).

The new transport will fly 1,000 mi. further than its predecessor (the 1049G) at maximum cruise power and 2,000 mi. further at maximum range power.

At ranges over 4,000 mi.—enough to compensate for heavy headwinds on a Paris-New York flight—the 1649A will be about 70 mph. faster than the 1049G and any other piston-powered transport now flying, according to a Lockheed spokesman. On such flights, other planes would have to throttle back to maximum range power instead of using maximum cruise power.

To accomplish this capability with the basic Super Constellation configuration, the obvious design feature to change was the wing. The new 1649A airfoil incorporates:

- Changes in profile to give low minimum drag.
- Changes in camber to afford minimum drag at lift coefficients normally flown—at maximum cruise or long range cruise.
- Reduced thickness to improve Mach

number characteristics. Thickness of the new wing is 15% at the root and 11% at the tip, as compared with 18% and 12%, respectively, for the 1049G.

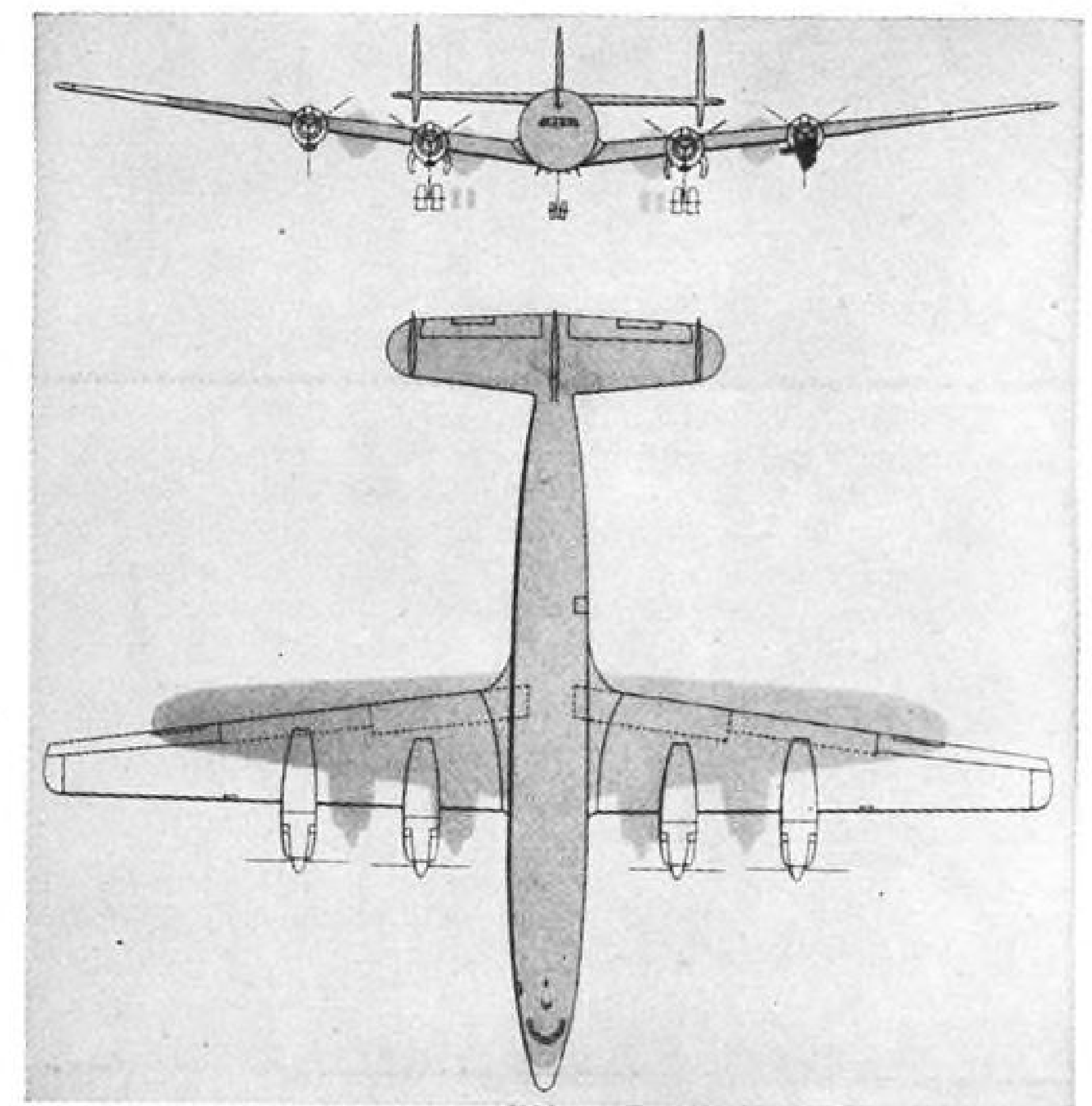
- Increased aspect ratio (a value of 12, as compared with 9.17 on the 1049G) to reduce induced drag. This allows cruising at higher altitudes earlier in

the flight pattern, usually eliminating steep climbs.

- Increased fuel tankage. Capacity is 9,600 gal., as compared with 6,500 on most Super Constellations and 7,750 gal. on tiptank-carrying models.

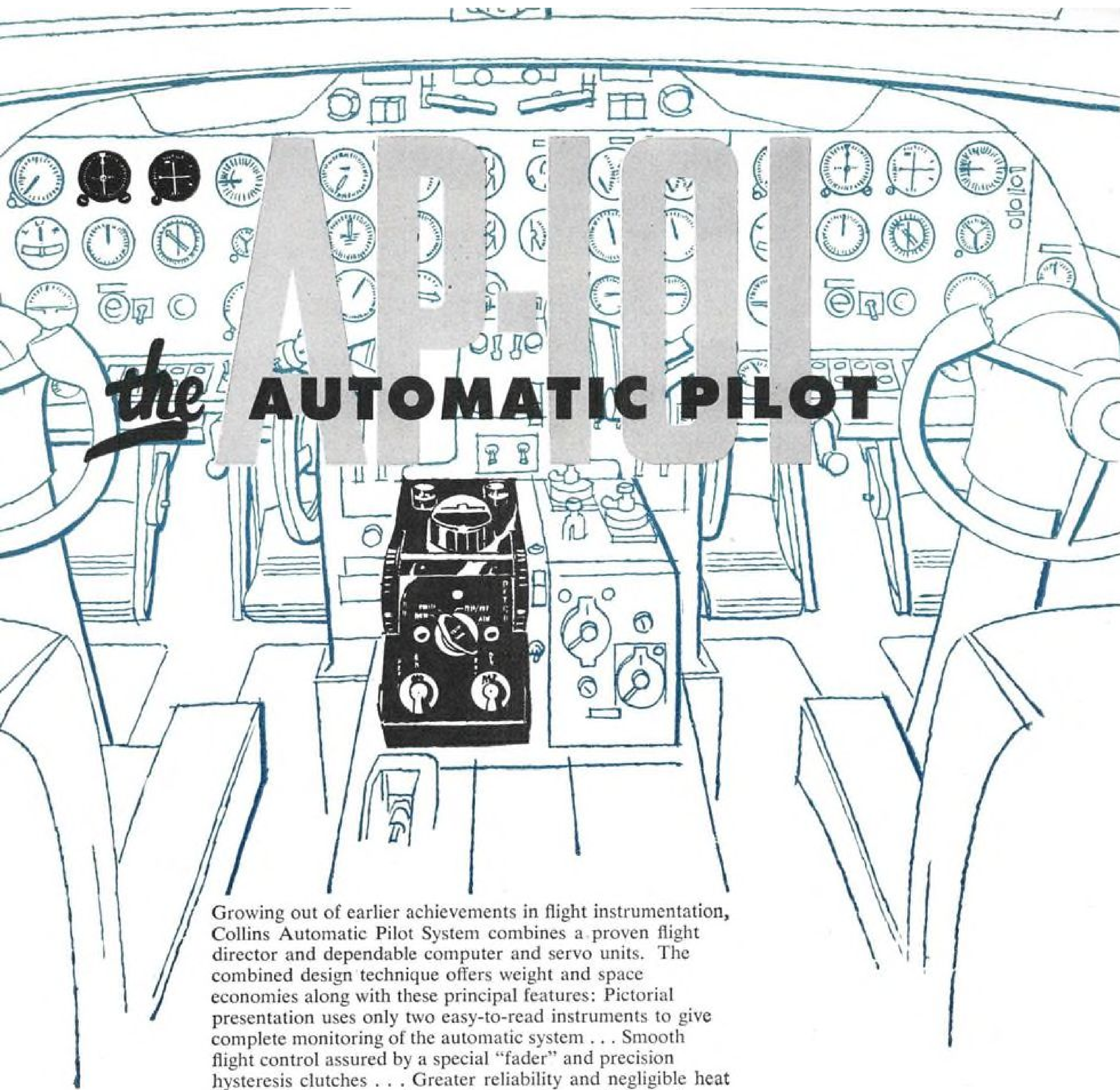
In addition to normal strength requirements, the wing is designed to embody two characteristics:

- Unlimited fatigue life. Allowable stresses have been chosen sufficiently low to remove danger of fatigue cracking. Detail design provides a minimum of stress concentration.
- Fail-safe properties. To accomplish



SKETCH shows 150-ft. wingspan of 1649A superimposed on that of 1049G.





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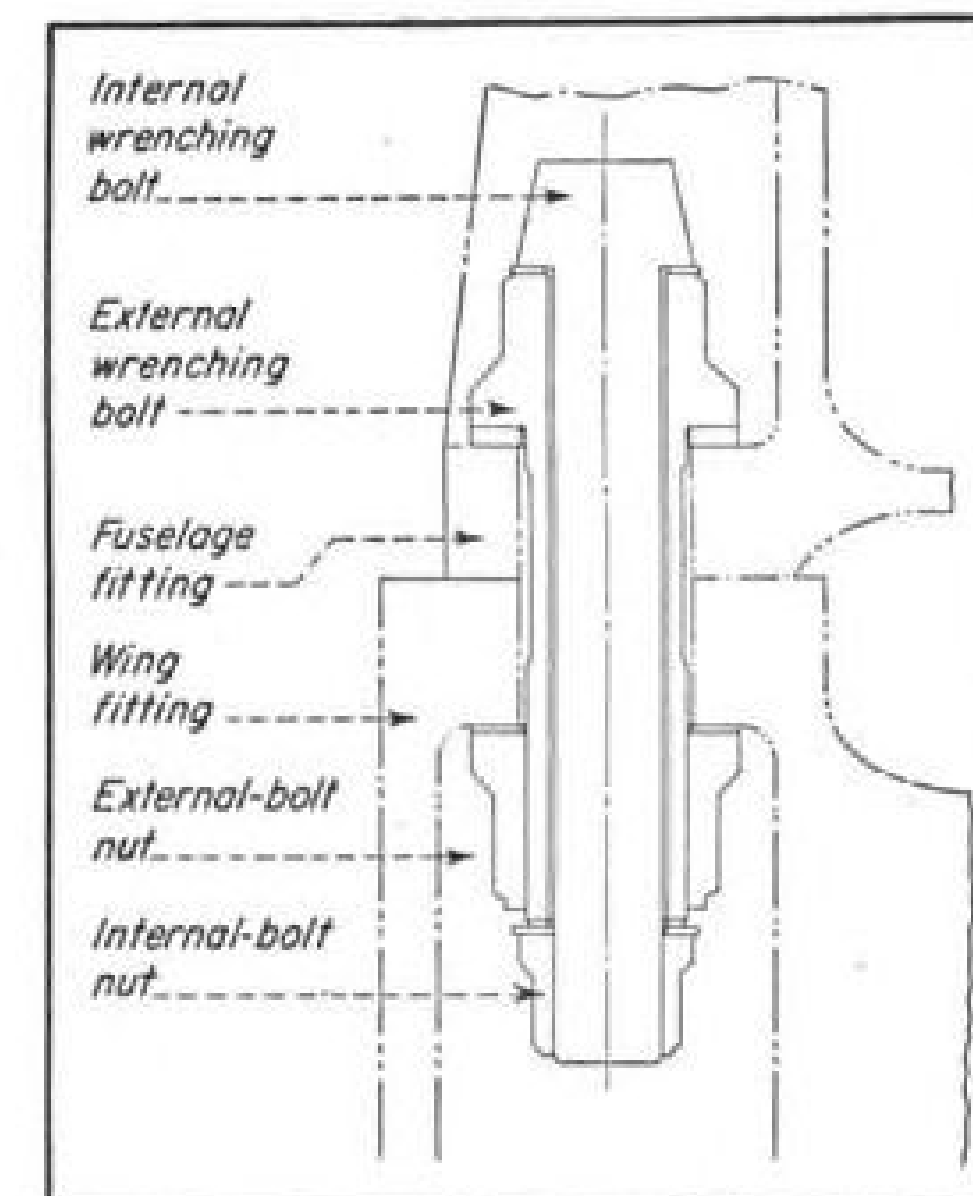
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**CROSS-SECTION** of typical wing-to-fuselage attachment for Lockheed 1649A showing the use of two concentric bolts for additional "failsafe" characteristics.

this, multiple load-path structure is being used. Dependence is not placed on any single element of the structure to carry safe loads. The design includes special attention to "failure stoppers" to preclude any reasonable failure from becoming catastrophic.

The wing uses more integral stiffening than any other commercial plane. The 1049G uses integral stiffening on the lower wing skin only; whereas the 1649A incorporates it in both the upper and lower skins and in all wing tank bulkhead webs. The only comparable integrally-stiffened structure is that used in Lockheed's C-130 Hercules military transport.

### Structural Arrangement

The wing, essentially, is of conventional structural arrangement, but detail makeup takes advantage of latest fabrication methods and materials.

The airfoil is a single structure between tip attachment points, without root or mid-span joints. This scheme was adopted to save weight and may pare as much as 500 lb. from conventional makeup.

Another feature of the design is that the landing gear is completely outside of the structural wing box and folds into the bottom of the inboard engine nacelle.

This allows additional weight saving in the elimination of heavy structure required to bridge around the wing lower surface cutout normally required.

Wing skins are made up of spanwise planks about 22 in. wide and approximately 40 ft. long, joined chordwise at the centerline of the plane and at about the center of the semi-span.

The planks incorporate integral spanwise stiffeners about 1½ in. high at

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## Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,  
Senior Member, Aviation Writers Assn.



Of all the planes you've seen and flown in, which do you remember best? Some will seem like old friends recalled from an almost forgotten past. Some will bring back chuckles or pleasures to be relived. Others will paint thrills or frights on the canvas of memory.

The "first ride" airplane can never be forgotten. Mine was a Travelair biplane on a 20-minute hop (\$2.50) about 1927, and I shall always remember the scare that chilled me when the leather-helmeted pilot in the rear cockpit stacked the ship up in a sudden tight bank that left me gazing straight down between the wings into the Los Angeles Coliseum 2500 feet below.

Digging back into the years I can see the Douglas World Cruisers over Southern California, Lindbergh's Spirit of St. Louis on tour in Los Angeles, the first Ford tri-motor that made its appearance on the coast, a monster that looked too heavy to fly; Sir Kingsford Smith's Fokker tri-motor, the Southern Cross, patched and dirty on a bleak field before the big flight.

I can remember watching enthralled as open cockpit biplanes flew off with the mail from an unlighted field at midnight, their red-yellow exhausts climbing into the darkness, and I can picture the Air Corps DH-4s, the Jennies flown by reservists and barnstormers alike, a rickety Standard home-converted into a cabin job; even a Thomas-Morse Scout or two.

My first transport ride was in a Boeing 247, first of the modern-type airliners, and the first crash I ever covered for a newspaper was also a 247 that crashed into a mountain just at Christmas time, scattering tinsel decorations over the macabre scene.

There was a host of sports planes, Waco, Travelair, Thunderbird, Swallow, Alexander Eaglerock, Monocoupe, in which I rode for the fun of riding—and another host, the romantic military planes that caught my eye in the days of open cockpits and fixed gear, the Hawks and the Falcons and the Corsairs, the P-12s and the F4Bs that roared at air shows along with the famed stunt teams, the Three Musketeers and the Three Sea Hawks.

There was the Fokker Question Mark droning through the first endurance flight, the San Jacinto landing of the wide-spanned Russian monoplane out of Moscow, the Gee Bee racer with its milk bottle fuselage, the sleek Wedell-Williams speedster, the beautiful lines of the Vega and the Orion by Lockheed, even a miraculous autogyro that seemed suspended on a celestial string.

Later came many another thrill, covering test flights of the Douglas DC-4, then triple tailed, and the mammoth B-19 which I followed

through to a final story that told of a pile of aluminum ingots in a junk yard. There were the test flights of Lockheed's Constellation and Constellation, the bright yellow primary trainer in which I had my first aerobatic wringout; later the first fighter hop, "piggyback" in a P-38 with Jimmie Mattern.

The combat planes of the World War II era are known to everyone who follows aviation, but those that cling clearest in my memory are the P-38, the Mustang, the SBD Dauntless and a dive bombing run over the desert; the twin-engine Mitchell, the Black-widow night fighter, the B-17 Flying Fort that I rode on first production test hop, the AT-6, the A-20 and the A-26, the Twin Mustang, the P-40 and the P-47, the B-29 Superfort which we newsmen were allowed to ride before the first raids on Japan with stories "hold for release."

In the same era came first a whisper of Northrop's Flying Wing, then the unfolding of a saga on that unique tailless airplane that eventually ended in the same junkyard with the B-19. Shortly thereafter a hop in an early B-36, like flying in an apartment house with a horizontal elevator.

One of the planes I remember best is the P-59, America's first jet, and a flight sans propellers out of Edwards AFB in a tiny open cockpit cut into the nose section. Another is the X-1 which first wrote the word "supersonic" into the world's headlines. I got a first-hand view of the orange bullet in action, riding in the mother ship while Chuck Yeager made one of his last drops in the rocket job before she went to the Smithsonian.

These are a few of my airplane memories, catch as catch can, and I can but envy the guys who have more intimate knowledge of even a single plane, their ability to take it aloft and explore the cloud canyons solo if they wish. I'm a bystander and occasionally lucky enough to be a passenger. But let's put it this way—I'm enthusiastic!





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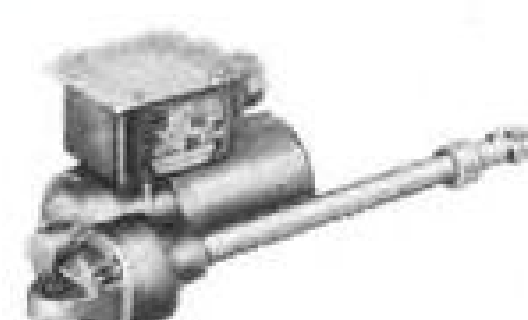
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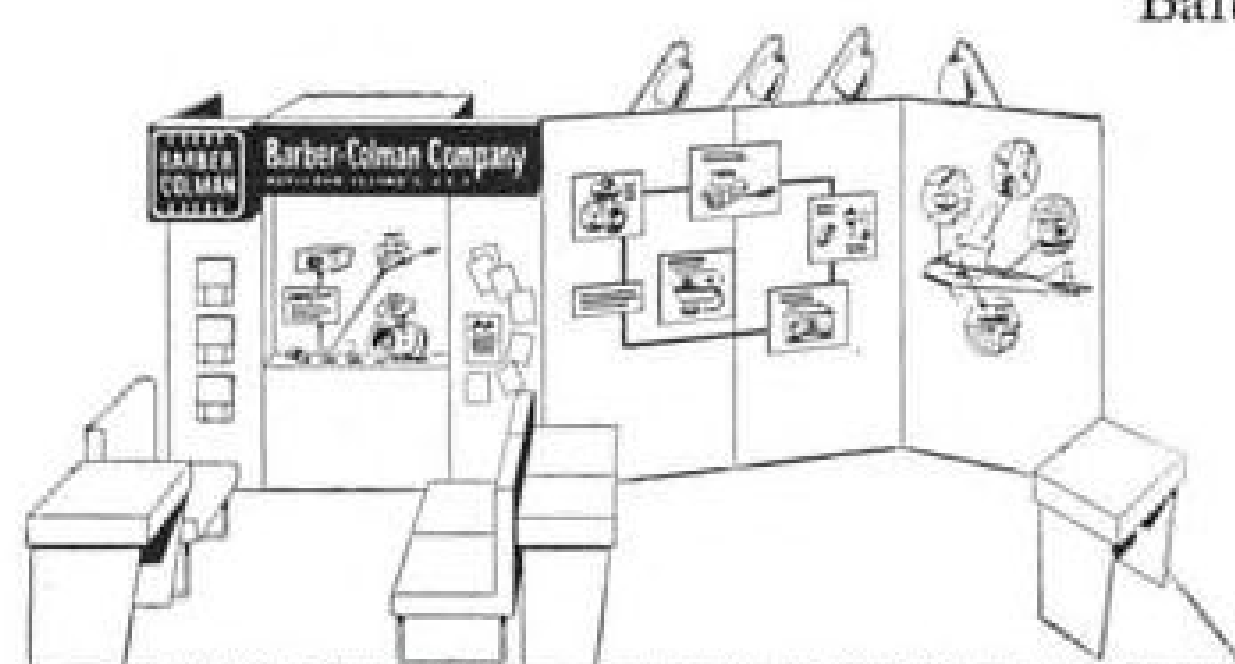
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## Lockheed 1649A Super Constellation Wing & Control Surfaces

### WING

Airfoil section, NACA  
designation . . . Root 0015 modified  
Tip 0011 modified  
Area . . . . . 1,850 sq. ft.  
Span . . . . . 150 ft.  
Root chord . . . . . 217 in.  
Tip chord . . . . . 82 in.  
Taper ratio . . . . . 2.65  
Aspect ratio . . . . . 12  
Mean aerodynamic chord . . . 159.6 in.  
Flap area . . . . . 335 sq. ft.

### CONTROL SURFACES

Aileron area . . . . . 105 sq. ft.  
Angular deflection . . . Up 25 deg.  
Down 15 deg.  
Total horizontal stabilizer  
Area . . . . . 463.6 sq. ft.  
Span . . . . . 50 ft.  
Maximum chord . . . . . 134.5 in.  
Elevator area . . . . . 106.8 sq. ft.  
Angular deflection . . . Up 40 deg.  
Down 20 deg.  
Total vertical tail area . . . 302 sq. ft.  
Rudder area . . . . . 91.2 sq. ft.  
Angular deflection . . Right 30 deg.  
Left 30 deg.

the root area, tapering to about 1 1/4 in. at the tip.

### Plank Design

The planks have been designed so that if one fails completely, the wing is still capable of sustaining limit design load.

Material of the planks on the in-board sections is 7178-T6 (78ST) aluminum alloy; on the outboard sections, 7075-T6 (75ST).

The spar web in front and rear spars is made in two sections, spliced at about one-third the height from the bottom cap. This cap is integral with the lower portion of the web as a single extrusion, whereas the upper cap is riveted to the machined upper webplate. The fail-safe feature here is that if the lower cap and its integral web portion fail, the remainder of the spar can—Lockheed says—carry the limit loads without failure.

Conventional-type extruded members are used to stiffen the spar web.

Spar material is 7075-T6.

Essentially, three types of wing ribs are used. Tank ribs consist of integrally stiffened extruded webs and extruded upper and lower caps. At the riveted connection of the rib caps to the skin



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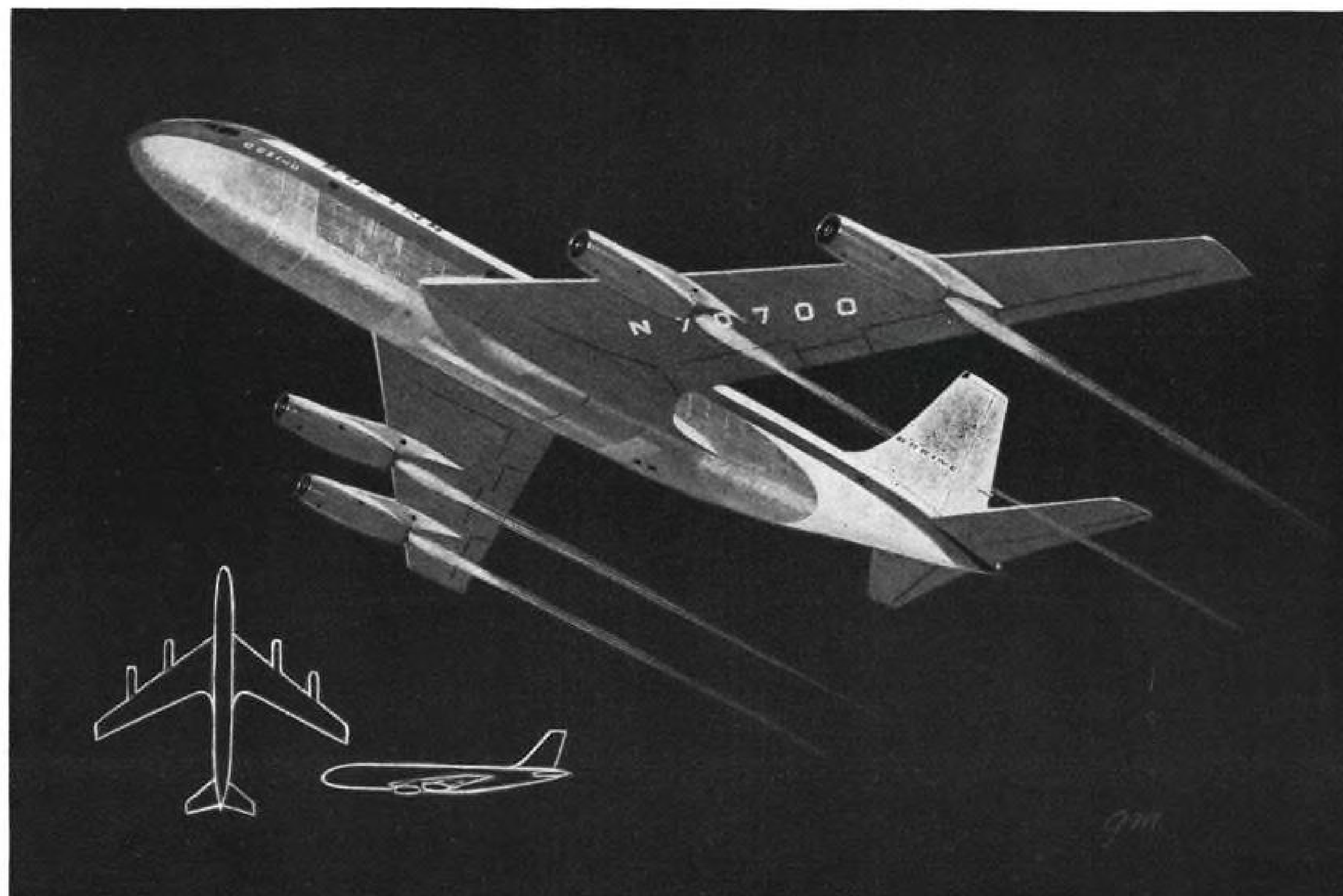
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internal surface, the latter is machined flat to facilitate wing tank scaling.

### Landing Gear

Landing gear support ribs are one-piece forgings about 7½ ft. long and approximately 2 ft. deep. These will be produced on Wyman-Gordon's 35,000-ton press and Aluminum Co. of America's 50,000-ton press.

Other ribs are conventional truss-types made up of extruded caps and extruded truss members.

The entire wing structural box serves as a fuel tank, with the exception of a dry bay over the landing gear as an additional safety feature.

The leading edge is hinged from the outboard nacelle to the fuselage to permit ready access to controls and plumbing.

Goodrich de-icer boots have chord-wise expanding elements. The leading edge is recessed to provide a completely flush boot installation. This arrangement is an important drag reducer.

The trailing edge structure uses a beaded inner skin bonded to the outer skin. The adhesive is Minnesota Mining & Mfg. Co.'s Scotchweld. This makeup is used to obtain a smoother skin surface and greater fatigue life than is possible with conventional structure, Lockheed engineers say.

Flaps are long-span units of conventional construction, with two flap sections installed on each wing panel.

The wing-to-fuselage attachment bolts are specially designed to carry out the fail-safe policy, Lockheed structures engineers report. Each bolt is made up of two concentric units, either one of which can carry the design limit load normally carried by the concentric pair.

### Hydraulic System

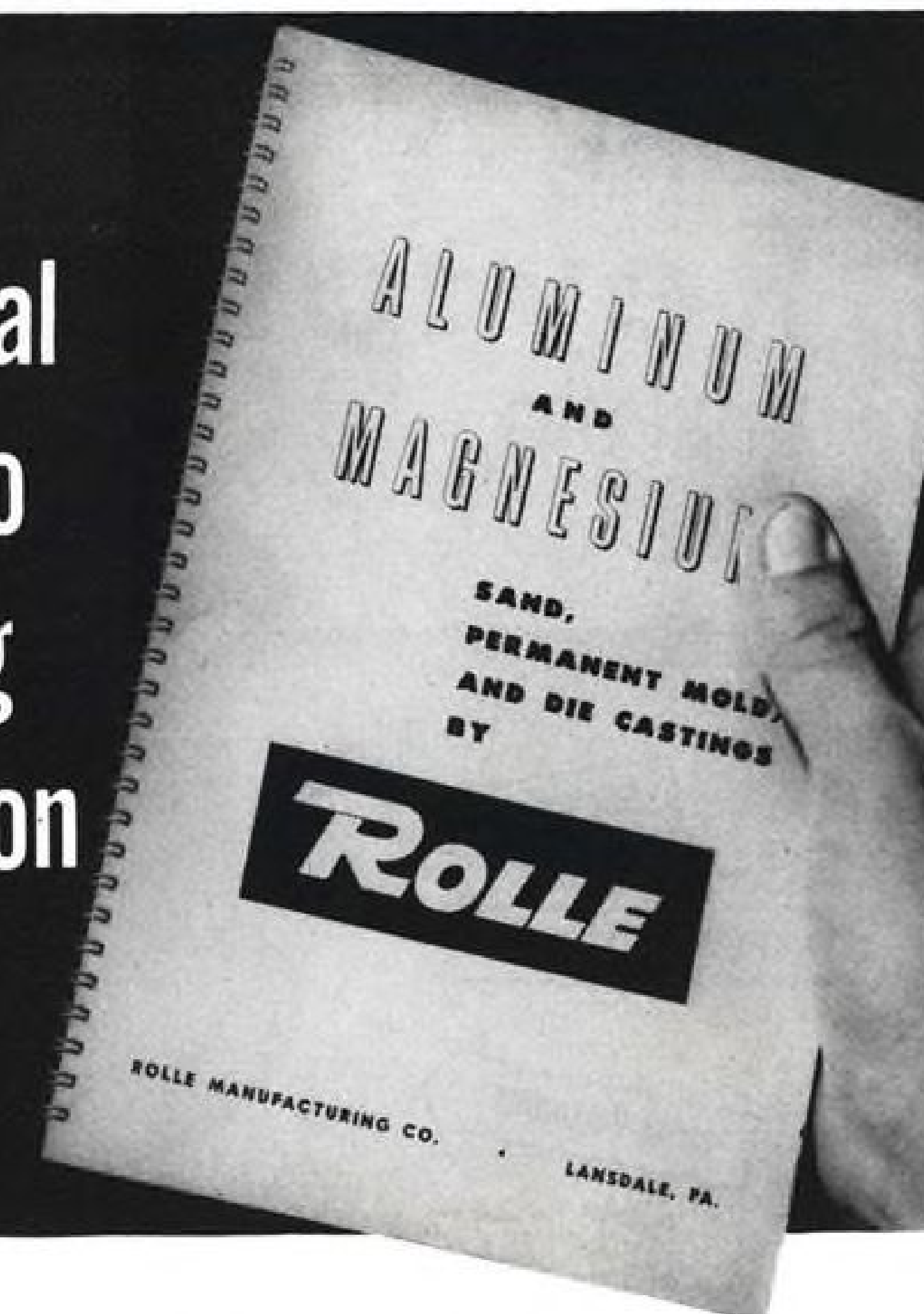
Lockheed went to a 3,000-psi. hydraulic system to save weight (about 150 lb.) and reduce space requirements for components such as landing gear retraction cylinders, booster cylinders and engine-driven pumps. (System pressure in the 1049G is 1,700 psi.)

Flareless fittings (Weatherhead Ermeto) are used throughout the high-pressure system.

Improvements have been included in the new hydraulic boost system for ailerons, rudder and elevator. The system will provide easier control for a given maneuver; better centering characteristics, which, in turn, provide greater stability for hands-off flight; and improved maintenance and servicing characteristics.

A quieter cabin will result from moving the engines farther outboard on the longer-span wing. The clearance between propeller tip and fuselage is approximately 62 in.—about 4½ times

## New practical guide to casting selection



Whether you're interested in the sand, permanent mold, or die casting of aluminum or magnesium alloys, you'll find this handy pocket manual a constant source of valuable on-the-job information. *If you design castings or specify materials* you'll be particularly interested in the 28 pages of graphs and tables on the casting characteristics of aluminum, conventional magnesium, and "premium" rare-earth-magnesium alloys. *If you purchase castings*, you'll appreciate the wealth of material on choosing among the various casting processes—the advantages and disadvantages of each. But the supply of these sturdy, ring-bound manuals is limited. *Write for your copy NOW!*

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## TYPICAL SPECIFICATIONS — 22-Gauge Revcothene Wire

Spark Test Voltage	7500
Insulation Resistance	1000 megohms/1000'
Operating Temperatures:	
Flexing Application	-40° C. to 135° C.
Non-Flexing Application	-65° C. to 150° C.
Flammability	Does not support combustion
Operating Voltage	1000 volts
Water Absorption	0.00
Effect of Acids & Alkalis	Generally unaffected
Cold Flow (Compressive Strength)	32,000 PSI
Abrasion Resistance (MIL-T-5438)	Passes 36"-400 grit aluminum oxide with 0.3 pound weight

\* Revere's tradename for monochlorotrifluoroethylene



**Revere CORPORATION OF AMERICA**

WALLINGFORD, CONNECTICUT A subsidiary of Neptune Meter Company

the clearance on the 1049G. Propeller tip speed is reduced 5%, which also cuts noise.

Gross weight of the 1649A is 156,000 lb., as opposed to 137,500 for the 1049G. Takeoff power for each engine on the 1649A-Wright Turbo Compound R3350-EA-2-is 3,400 bhp. as compared with 3,250 bhp. on the 1049G Super Connie.

## USAF Contracts

Following is a list of unclassified contracts for \$25,000 and over as released by Air Force Contracting Offices:

WRIGHT-PATTERSON AIR FORCE BASE, OHIO.

Douglas Aircraft Co., Inc., Long Beach, Calif., RE-66C electronic reconnaissance mobile training units, 3. (PR 205184-PH), \$183,857.

Lockheed Aircraft Corp., Burbank, Calif., repair of GFAE, (PR 226855), \$27,732.

Bell Aircraft Corp., P. O. Box 482, Fort Worth, Texas, special tools and GHE (items 6 and 13), \$10,691, spare parts, (item 12), \$15,555, (PR No. PA 207397) \$26,246.

General Electric Co., X-Ray Dept., 4855 Electric Ave., Milwaukee, Wis., camera body for KA-2 camera, Type D-4, 800 ea., lens cone for KA-2 camera, Type C-3, 800 ea., engineering data, (PR 286905), \$243,163.

Abrams Instrument Corp., 600-620 East Shilwaukee St., Lansing, Mich., intervalometers, Type B-8A, spare parts and data, 56 ea., (PR MO-570986 and MO-570986-1), \$47,041.

Bendix Aviation Corp., Eclipse-Pioneer Div., Teterboro, N. J., transmitter, rate of flow, Type MA-2, Aero 61-2458, 290 ea., (PR 235815), \$86,815.

Air Products Inc., Emmaus, Pa., facilities for the production of liquid oxygen, (PR 148870), \$5,480,000.

ROBINS AIR FORCE BASE, GA.

Aeroproducts Div., GMC, Dayton, Ohio, kit assemblies for modification of propellers, 290 ea., (Cont. 23659), \$25,960.

Clements Mfg. Co., 6650 S. Narragansett St., Chicago 38, Ill., vacuum cleaners, hand type, exposed separator, Type MVU, Spec. MIL-C-632B, 2587 ea., (IFB-348), \$109,307.

Glenn L. Martin Co., Baltimore, Md., modification kits for aircraft (Cont. 25532), \$40,887.

ARDC, BALTIMORE 3, MD.

The Regents of the University of Minnesota, Minneapolis, Minn., research: study of mass transfer cooling (AF 18(600)-1226), job, \$83,000.

The Ohio State University Research Foundation, research: study of oxidation of hydrocarbons (AF 18(600)-787), job, \$161,802.

The Ohio State University Research Foundation, Columbus 10, Ohio, research-Barkhausen-Kurtz oscillator (AF 18(600)-982), job, \$26,586.

GRIFFISS AIR FORCE BASE, ROME, N. Y.

The Haloid Co., 2-20 Haloid St., Rochester 3, N. Y., paper, 20 1/2"x500', (RFP-30-635-56-4391), 1500 roll, \$112,500.

The Haloid Co., 2-20 Haloid St., Rochester 3, N. Y., paper, 9 3/4"x100', Type IVE, high speed, (RFP-30-635-56-4390), 1236 roll, \$81,971.

GENTILE AIR FORCE STATION, DAYTON, OHIO.

Tung-Sol Electric Inc., 95 Eighth Ave., Newark 4, N. J., lamp P/N AN 3124-307, (PR-GE-659337), 455800 ea., \$105,371.

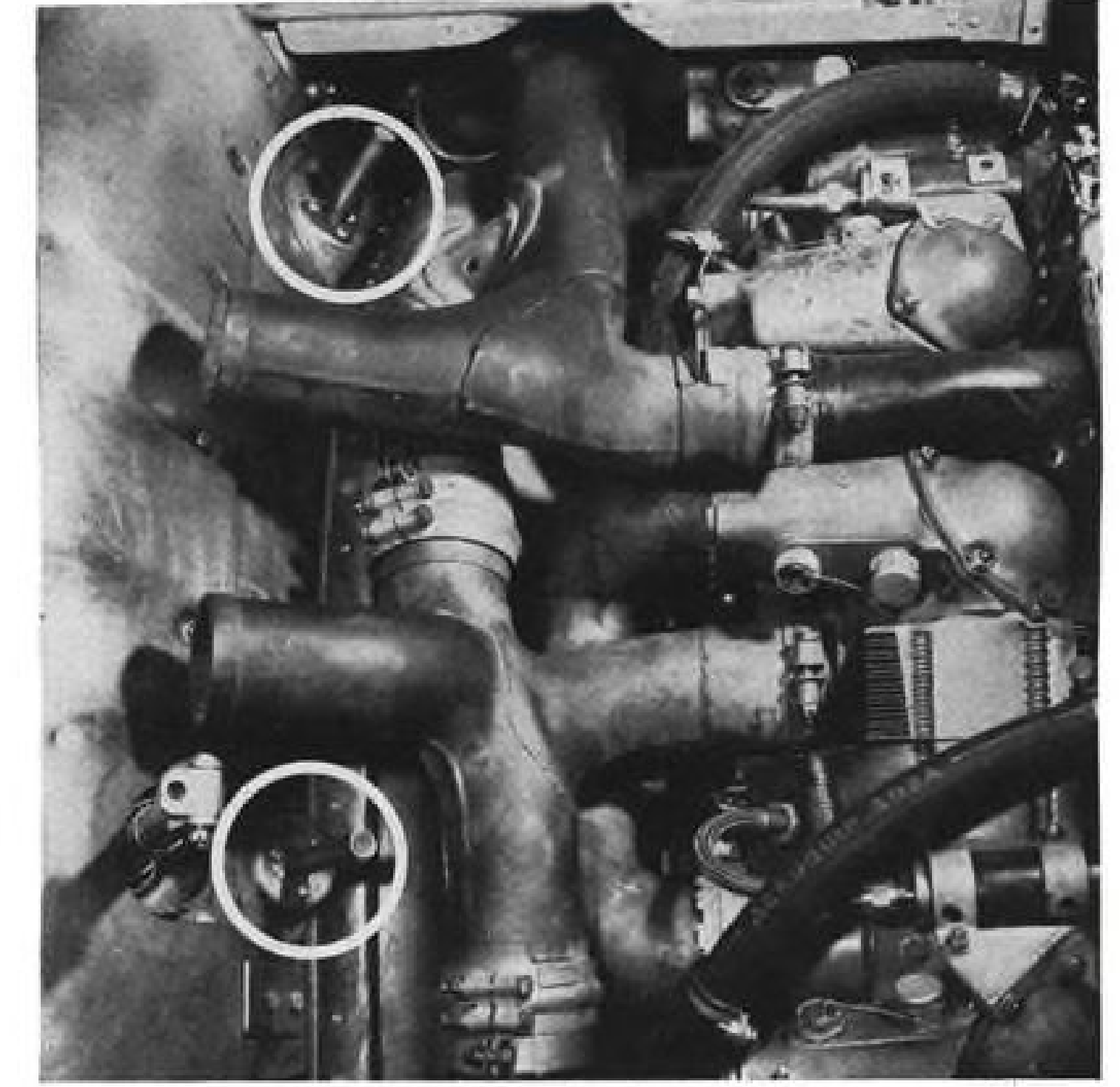
Radio Corp. of America, 19th and Federal Sts., Camden, N. J., power supply electronic type AN/APS-42 RT-156/APS-42, (RFP 33-604-55-3885), 117 ea., 054058.

Goslin Electric & Mfg. Co., 2921 W. Olive St., Burbank, Calif., transformer power Goslin PT-725-A, (RFP 33-604-55-3860), 1500 ea., \$126,795.

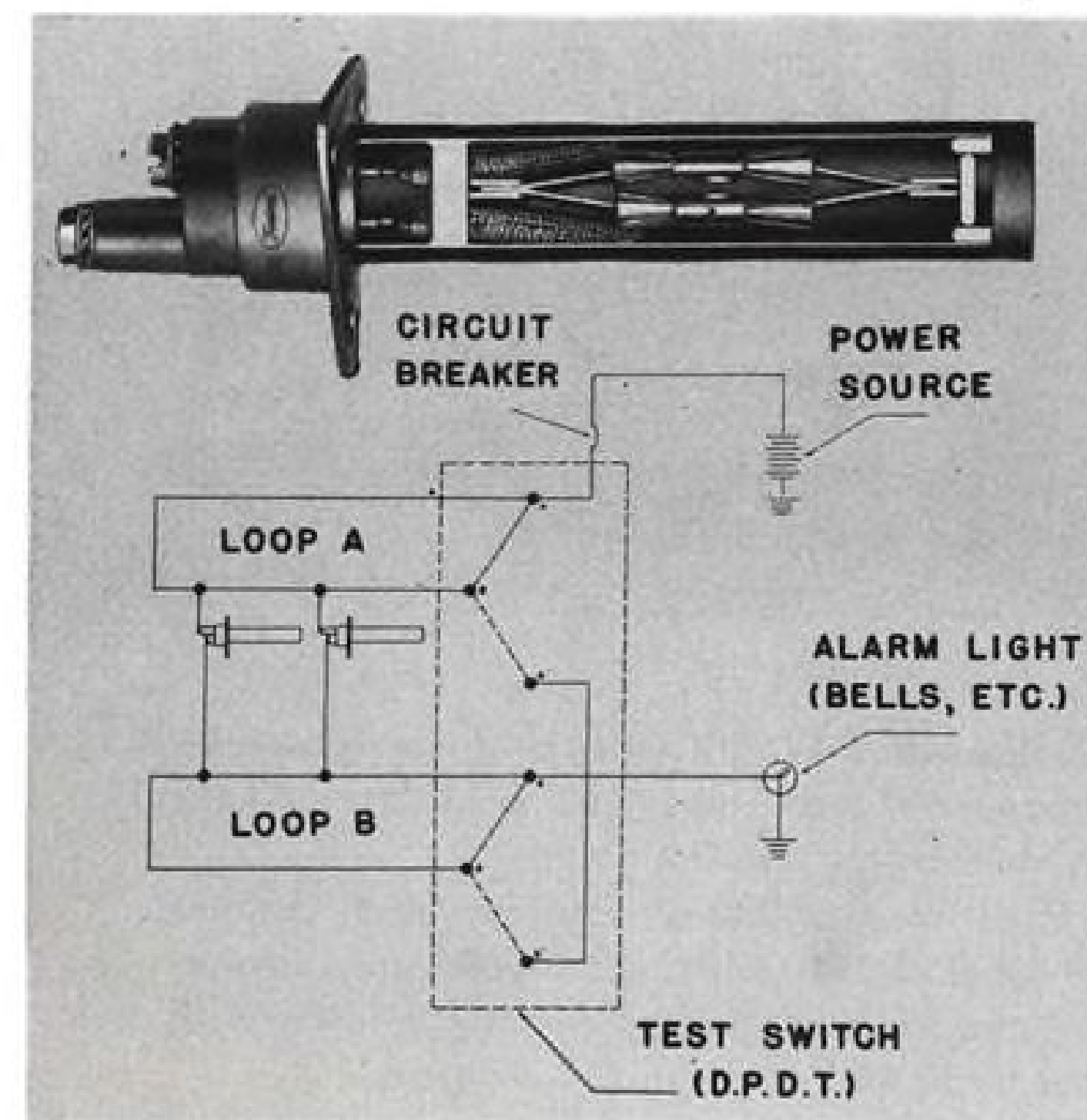
## Why intercontinental and transcontinental aircraft depend on Fenwal unit detectors



**1. PROVED DEPENDABILITY** for America's first intercontinental bomber. Boeing's B-52 jet engine Stratofortress uses Fenwal Fire and Over-Heat Detectors for fire detection dependability and extra safety. Fenwal units accurately reset following actuation. These long service Fenwal detector units are tamper-proof and dust-proof, compact and easy to install.



**2. EASY INSTALLATION.** Shown in Lockheed's transcontinental Super Constellation, these Fenwal unit Fire and Over-Heat Detectors are precision-set at the factory. Fenwal unit detectors eliminate the need for external relays, costly field adjustment and periodic maintenance. Fenwal units are in to stay — and stay right.



**3. COMPLETE FLEXIBILITY** for all types of aircraft. Fenwal units anticipate danger and give warning before emergencies occur. A single unit reacting will sound an alarm. Double loop circuitry guards against system failures, and gives dual push button operational check. Fenwal unit detectors meet exacting government and military specifications.

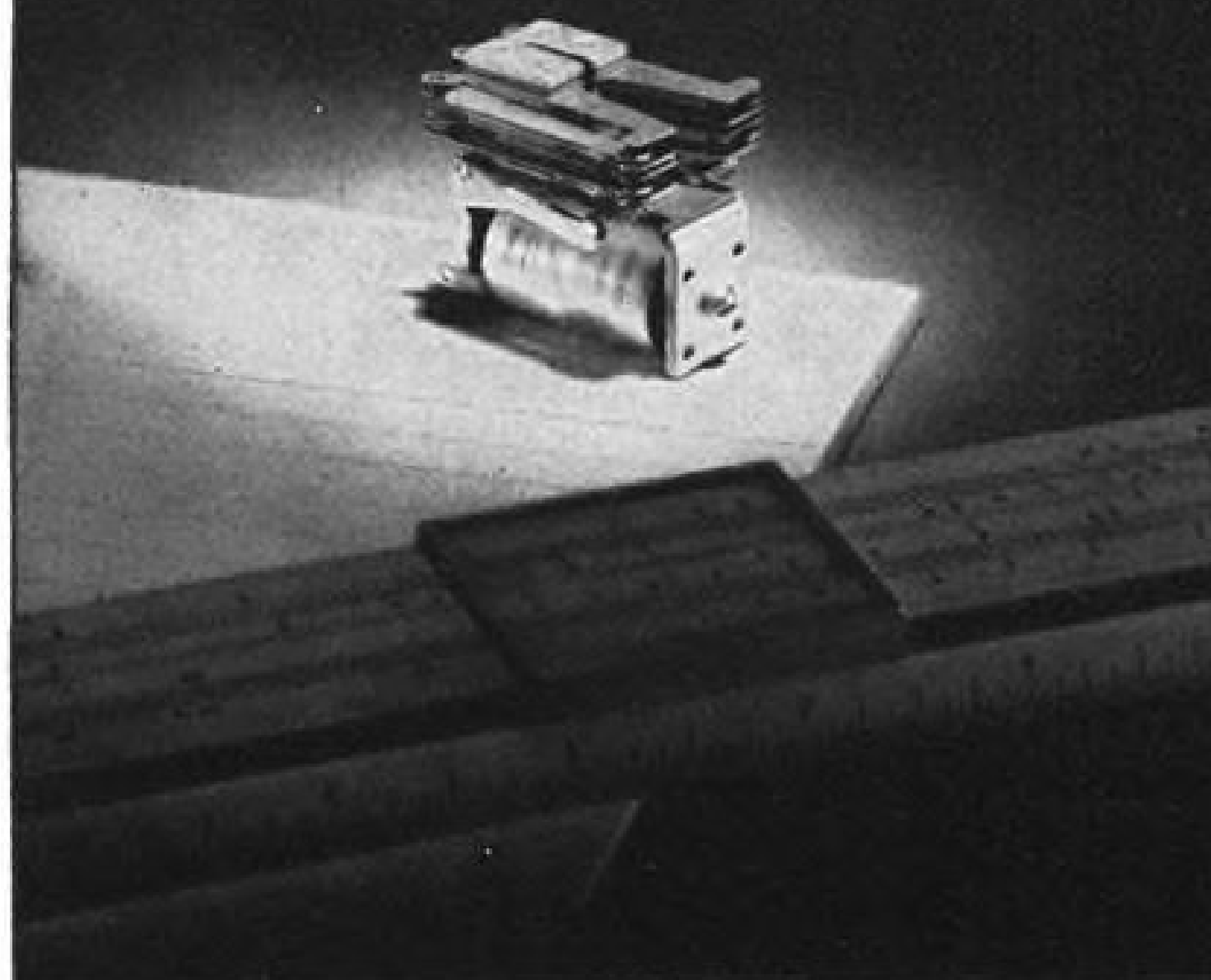


**4. GET FULL DATA** on Fenwal's positive Fire and Over-Heat Detectors, Heater Controls, Aircraft Gas Turbine Thermocouples and Accessory Controls. Fenwal manufactures precision devices for the entire aviation industry. Fenwal engineers can help solve your detection and control problem. Write to Fenwal Incorporated, Aviation Products Division, 1210 Pleasant Street, Ashland, Mass.

**Fenwal Controls Temperature . . . Precisely**

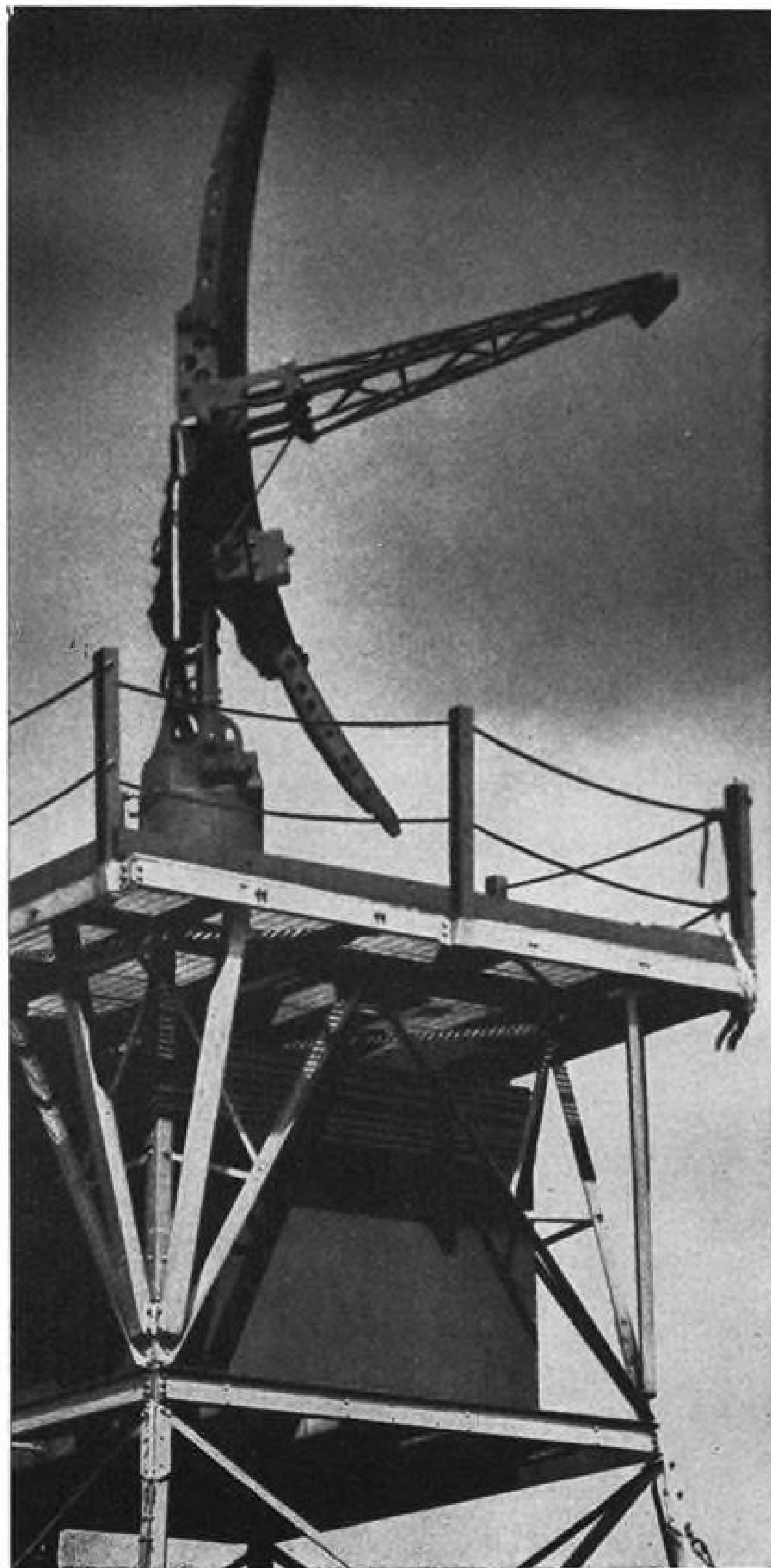


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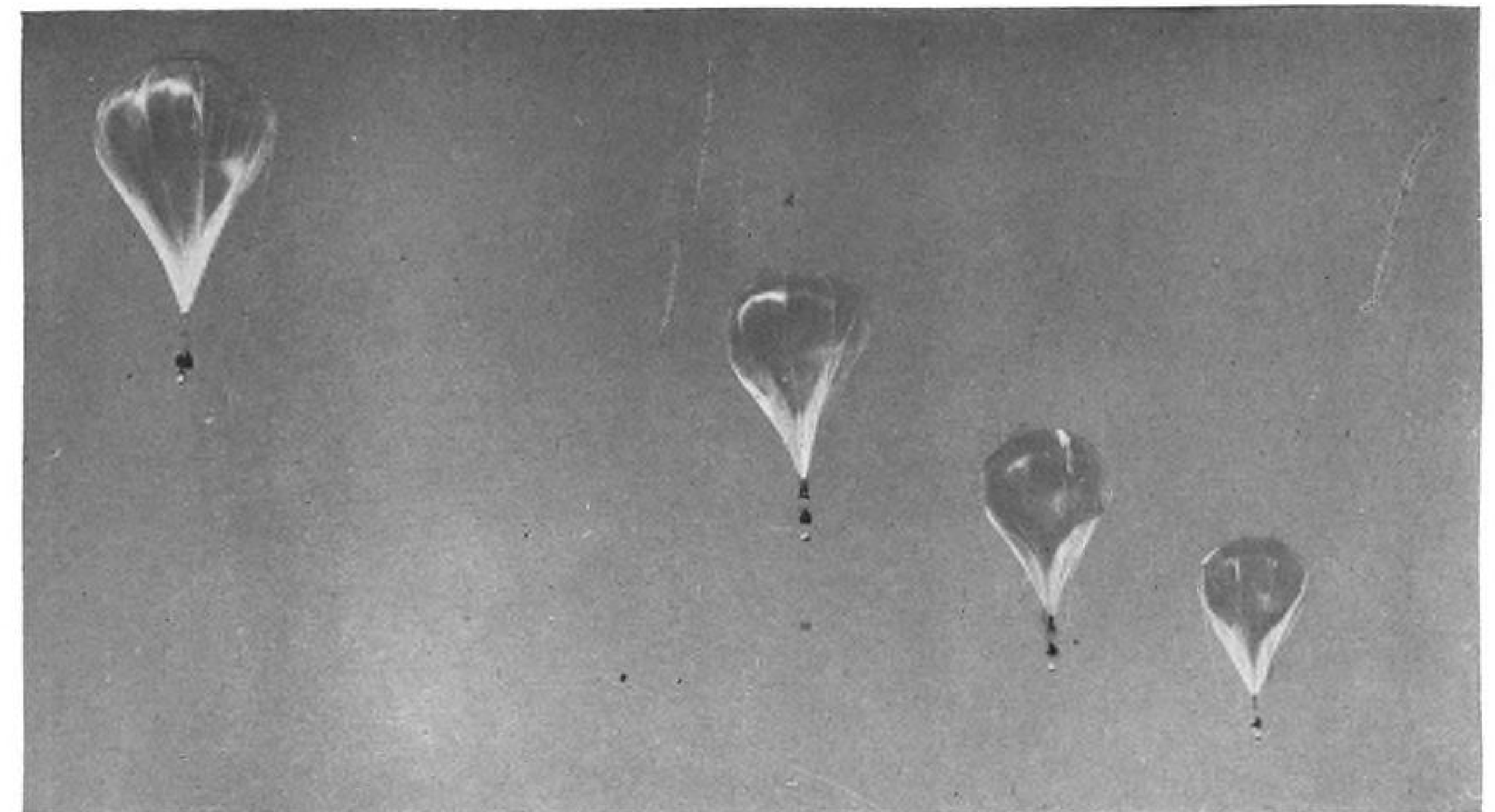
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## Satellite Research



SIMULTANEOUS launching of four 30-ft. Skyhook balloons on upper-air mission from General Mills research site.

# Skyhooks May Become Space Platforms

By George L. Christian

Minneapolis—Skyhook balloons, originally developed as vehicles for very-high-altitude measuring and calibrating systems, have evolved into potential weapons carriers.

They already have been used as high-altitude platforms for launching rockets and, their adherents hope, may eventually solve the problem of how to carry the recently-proposed space satellite through the first stage of its journey.

Dr. Cleo Brunetti, director-engineering of the research and development department of General Mills, Inc.'s mechanical division—a leading manufacturer of the balloons—believes the paper-thin, 200-ft.-high plastic bags could become another set of "eyes and ears" for the military, ferrying airborne radar half-way around the world.

## Atlantic Sounding Program

The 2-to-3-million cu./ft. translucent polyethylene envelopes soar to altitudes well over 100,000 ft., stay aloft five to six days and sometimes travel a quarter of the way around the world.

Most recent project undertaken by General Mills is its Trans Ocean Sounding Program. This involves launching balloons across the Atlantic on flights lasting for several days. The ticklish

part of the flights, which originate near Minneapolis and are carried eastward by prevailing winds, is to bring the balloons down before they cross longitude 20 deg. W., just off the West African coast—a line drawn by the State Department in a move designed to keep Skyhooks and their instruments this side of the Iron Curtain.

On a recent TOSP launching involving 10 balloons, five hit their mark, one bounced out of the ocean after losing part of its payload, two went astray (landing in the southeastern U.S. and the Western Atlantic respectively), one suffered instrument failure and one was lost at launching.

General Mills' officials anticipate that the TOSP program will soon be extended to flights over the Pacific Ocean.

H. E. Froehlich, chief engineer of General Mills' Balloon & Meteorological Systems Group, told AVIATION WEEK that the objectives of the balloon projects include investigation of the physical and chemical properties and the motion of the upper atmosphere, infrared and cosmic ray radiation, composition of ozone, visibility and numerous other aspects of very-high-atmosphere physics.

General Mills also supplies Free Europe Committee with technical assistance and the bulk of the small, "pillow"

balloons used to carry propaganda from Western Europe through the Iron Curtain.

Among other possible applications of Skyhooks would be their use to calibrate high-flying jet plane instruments by having pilots fly by the balloons; or equipped with reflectors, they could be used as radar targets.

## Balloons vs. Rockets

While balloons have not attained the extremely high altitudes of rockets, they have many advantages over rockets at heights which are within their range.

They can carry an appreciably higher payload than all but the largest, very costly rockets. They can stay at extreme altitudes for long periods of time, and they can be made to hold a fairly constant altitude for hours at a time.

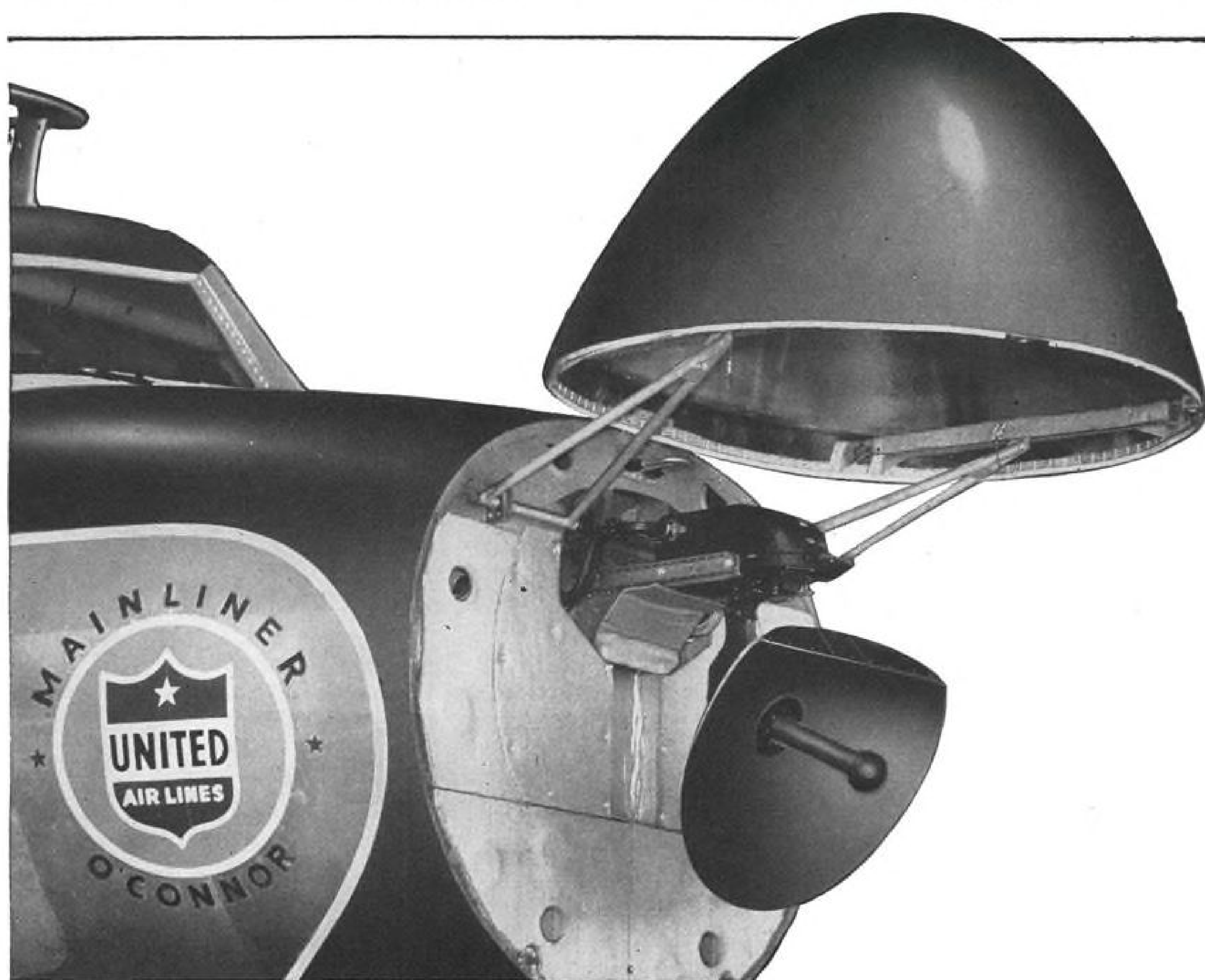
Balloons are fairly reliable, Froehlich says, and are much less expensive and safer to operate than rockets. Since they do not disturb the atmosphere in which they float, their instruments give true readings.

Dr. Brunetti says General Mills has complete facilities to handle every facet of Skyhook operation, initial design, manufacture, launching, tracking, control recovery of instruments and data reduction.

A staff of company meteorologists



**KOCH**...World's largest fabricator of moulded Fiberglas products



## How Convair 340's Solve a Housing Problem for United Air Lines' All-Weather Radar



**The nose knows** when and where bad flight weather threatens! Radar weather-spotting equipment in the nose of United's Convair 340 now sees through a Koch Fiberglas Radome.

When Convair received United's order for radar-equipped 340's, they naturally turned to Koch, world's largest fabricator of moulded Fiberglas, for domes to house the radar.

The life expectancy of the Koch Radome is many, many times that of any other Radome. This Radome is made possible only by Koch's own exclusive method of moulding.

W. J. Flanagan, Convair Purchasing Agent, wrote Koch upon completion, "You have made

substantial contributions to this industry by proposing and successfully applying new departures and moulding technique."

If you are a plane manufacturer, or if you install airborne radar, investigate Koch's Moulded Fiberglas Radome. If you manufacture any equipment that needs special protection, ask the people who know the most about Fiberglas fabrication. We will be glad to confer with you about your project. Address Dept. AMD.



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Pioneer in industrial products of moulded Fiberglas  
CORTE MADERA, CALIFORNIA

forecasts weather conditions so that launchings may be made under the best possible conditions.

### Skyhook Development

General Mills' scientists put an analog computer to work to determine the "correct natural shape" a bubble of gas will assume when enclosed by a non-restrictive envelope. It turned out to be roughly the outline of an inverted pear—almost flat on top and sloping conically to a point at the bottom.

This shape for the bag proved an advantage, as the plastic envelope is inherently stronger in the meridional than in the circumferential direction. Thus the correct natural shape utilizes all available stress in the plastic to the fullest.

A formal research program determined the exact character of the material from which the envelope was to be made, including the molecular weight of the plastic resin to be used.

Material handling and envelope fabrication posed many riddles. The plastic had to be very thin for weight considerations—actual thicknesses range from .0005 to .0025 in., thinner than a human hair.

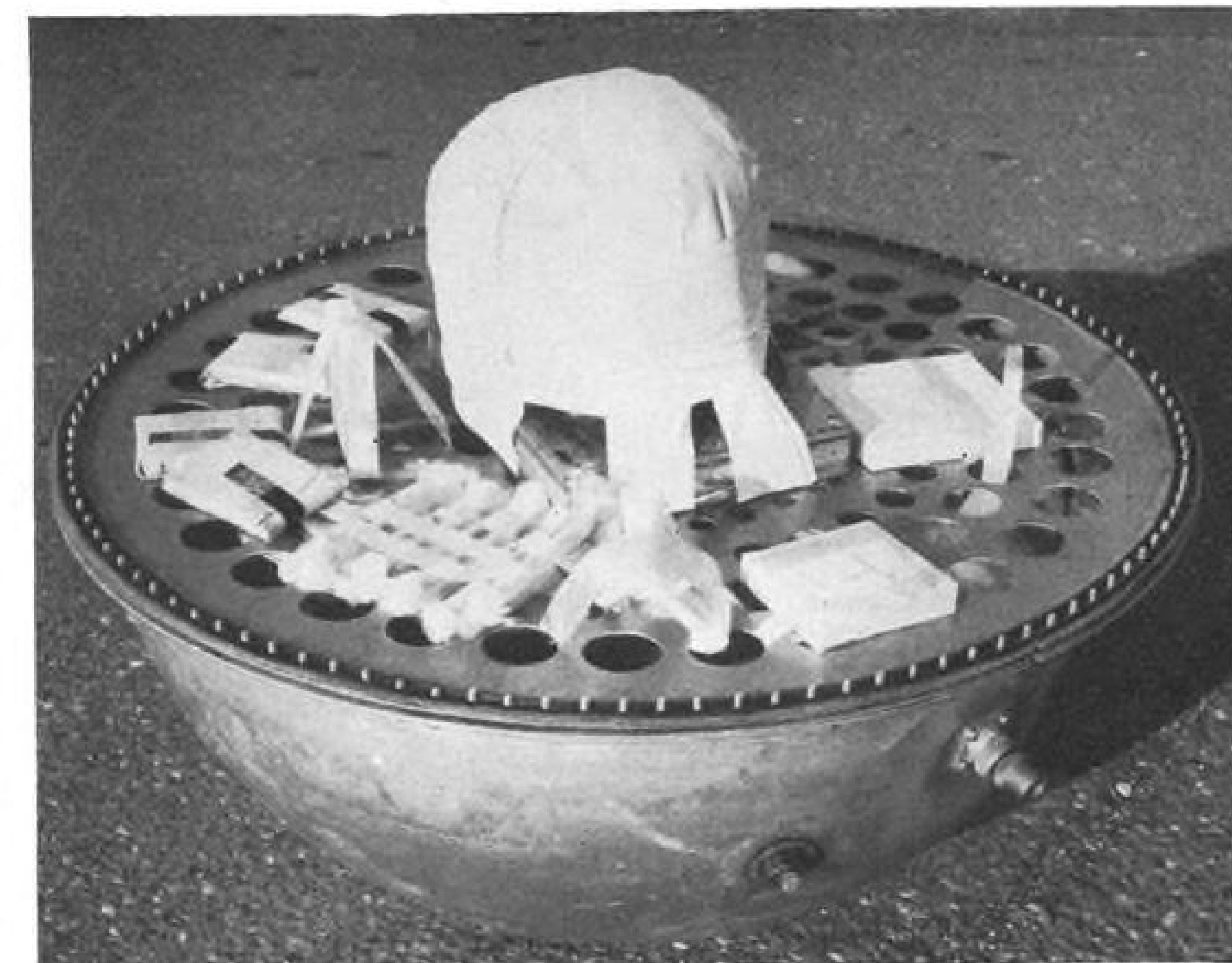
Assembling the large balloons involves handling acres of the thin plastic, which comes from the fabricator in large rolls. (The largest General Mills balloon, the Super Skyhook, is 282 ft. long, has a capacity of 3.2 million cu. ft. and uses approximately three acres of plastic.)

Methods had to be devised to lay sheet upon sheet of the thin material on 200-ft.-long work tables, to weld gore seams with hot gas or heated electric elements and cool the seams immediately with nitrogen. Specially shaped filler lines had to be inserted in the bases of the envelopes.

Means and facilities had to be perfected to handle, pack, store, ship, inflate and launch the fragile envelopes with a minimum of loss.

The finished plastic envelope has to withstand temperature extremes, especially cold (on one flight made from the Galapagos Islands, a low of -85C was encountered). It has to withstand a certain amount of flutter caused by rapid ascent or atmospheric turbulence. It has to resist exposure to intense ultraviolet and infrared solar rays, effects of ozone, bombardment by cosmic rays and other, unknown, stratospheric phenomena.

General Mills builds all its own telemetering equipment. Company technicians developed a radio sound data computer which takes information from the balloon and radar tracker, does all necessary computation continuously during flight of the balloon and prints out automatically such data as tempera-



### High-Altitude Skull Practice

Lower half of 30-in. air conditioned gondola holds a human skull and brain (center) and other tissue for flight to region above 100,000 ft., to study the effects of the intense cosmic radiation found at those altitudes. The flights are part of a very-high-altitude research program being conducted by Winzen Research, Inc., located in Minneapolis.

This particular cargo went on a flight which set a new altitude record of over 126,000 ft. Made for USAF's Aero Medical Laboratory, the flight was launched from Fleming Field, St. Paul, Minn., and landed eight hours later

near Sherwood, S. D. Other flights, some carrying mice and guinea pigs, are currently being conducted.

Winzen makes the same type of polyethylene plastic bags as General Mills in a variety of sizes ranging from 17 to 172 ft. in diameter, calls them "stratosphere balloons." It was one of the 172-ft. balloons (capacity, 2-million cu. ft.; height, 244 ft. in the launching condition) which set the recent altitude record. Winzen conducts entire flight balloon flight programs for both the Air Force and Navy, according to company spokesmen.

ture, pressure and humidity of the atmosphere through which the flight is passing and its altitude.

### Lab in the Sky

After the company's staff of meteorologists forecasts favorable weather, a field engineering group gathers the necessary equipment, does the launching and tracks the flight with theodolites, radio, radar, trucks, speed boats, helicopters and planes.

Then a data reduction staff takes over and prepares usable reports from the collected information.

Major problem in laying out Skyhook designs and flying the balloons is that actual flight conditions cannot be duplicated in the laboratory.

It is impractical to build a lab big enough to test a full-size balloon, and scale models cannot duplicate all the factors of actual flight. Moreover, so little is currently known about what happens in the upper altitudes, that true

flight conditions could not be duplicated in a ground lab.

Froehlich explained some of the problems of launching Skyhooks and having them reach into the stratosphere. For instance, launching a balloon that is over 200 feet high and has a huge sail area is very tricky because, in the slightest wind, envelopes tend to whip or oscillate and punctures can easily result. Winds of 15 mph. make launching very difficult; over 22 mph., it is just about impossible.

Once safely off the ground, other worries plague the upper air scientists. The rate of ascent must be kept below 800 fpm., or the balloon might shatter as it passed through the tropopause (base of the stratosphere at altitude ranging from 40,000-50,000 ft.). Here, the temperatures plummet to -75F, making the envelope very brittle. Excessive flutter, caused by the balloon passing through the air too fast, could cause the plastic to shatter.

High altitude turbulence, about



## SOLVING TOMORROW'S PROBLEMS



### Easiest way yet to tell where you are

Flying military aircraft over unfamiliar skyways is complicated enough without wondering where you are. Easiest answer yet is new radar beacon that automatically tells its range, bearing and *identity* to Air Force planes.

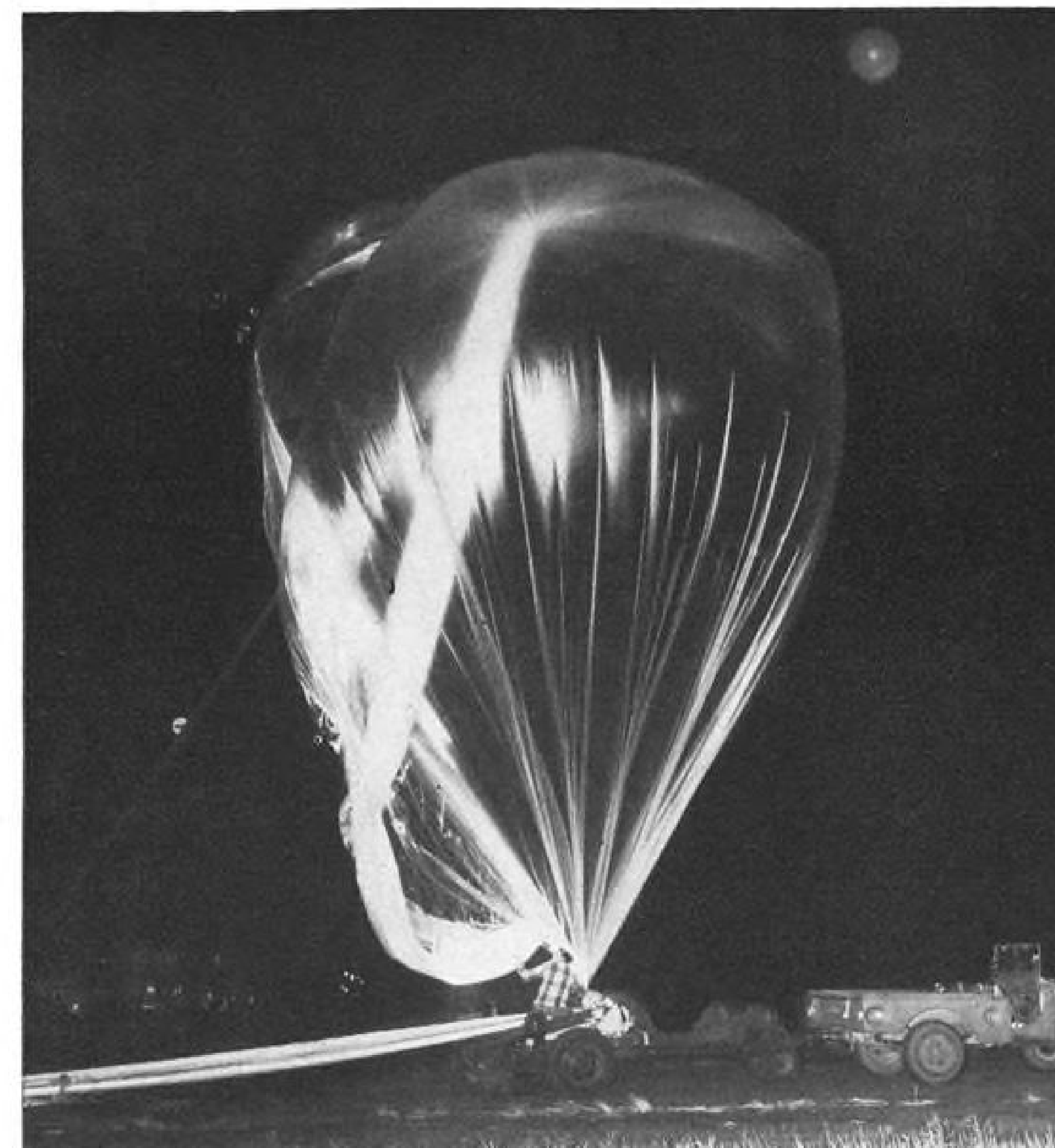
This beacon is built around Klystron tubes especially designed for this application by Webster-Chicago's Government Division . . . another example of how Webster-Chicago serves the Services—by helping solve tomorrow's problems today.

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**PLASTIC SKIN** becomes Skyhook balloon as General Mills' employees fill bag with helium.

which little is known, can punish the balloon severely, and sudden wind shear can rupture in its thin sides.

#### Magnetic Ballasting

To keep a balloon aloft overnight, some sort of ballasting device is needed. Otherwise, contraction of the gas due to cooling would cause the balloon to sink rapidly.

Various ballasting materials were tried. Sand, traditional balloonist ballast, gave trouble because, at high altitudes, its moisture would freeze, forming unmanageable sand cakes.

Kerosene worked better, but, with the development of a magnetic ballast control, steel shot came into use. In this system, steel shot ballast is placed in a hopper which feeds through a throat. A permanent magnet, mounted around the throat, establishes a magnetic field in the opening which prevents the steel shot from escaping.

An aneroid device, set to operate at a predetermined altitude, actuates a relay to energize an electromagnet. This neutralizes the permanent magnet's field, allowing shot to fall. A special device keeps shot from being released during initial ascent. It was necessary to design a super-sensitive aneroid for precise control of the bal-

loon's altitude—a 2% error at 100,000 ft. equals an altitude variation of 2,000 ft.

The control system incorporates several refinements: if the balloon comes down too rapidly, the system can start dropping ballast before the desired altitude is reached to slow its descent; release of ballast can be cycled to keep Skyhook from over- or under-shooting its prescribed altitude; system can sense when balloon starts rising and immediately stop dropping ballast, thus keeping balloon at a constant altitude and saving ballast.

#### Safety Provisions

General Mills takes many precautions to eliminate the possibility of collisions between Skyhooks and aircraft which might be in the vicinity of a projected flight.

The company gets Civil Aeronautics Administration clearance for a launching. NOTAM (Notices to Airmen) are sent out in advance, giving time and place of launching and anticipated location of the balloon when it descends below 28,000 ft.

If the flight is within the continental U.S., it usually has a plane tracking it. The plane notifies local CAA authorities where and when the balloon hits 28,000

## The Far-Sighted Mr. Woodward



"Woody" Woodward can "see" storm centers 150 miles away . . . for his DC-3 is the first radar-equipped executive aircraft in the world. He flies safely when other planes are grounded.

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*Charles "Woody" Woodward*

Chief Pilot  
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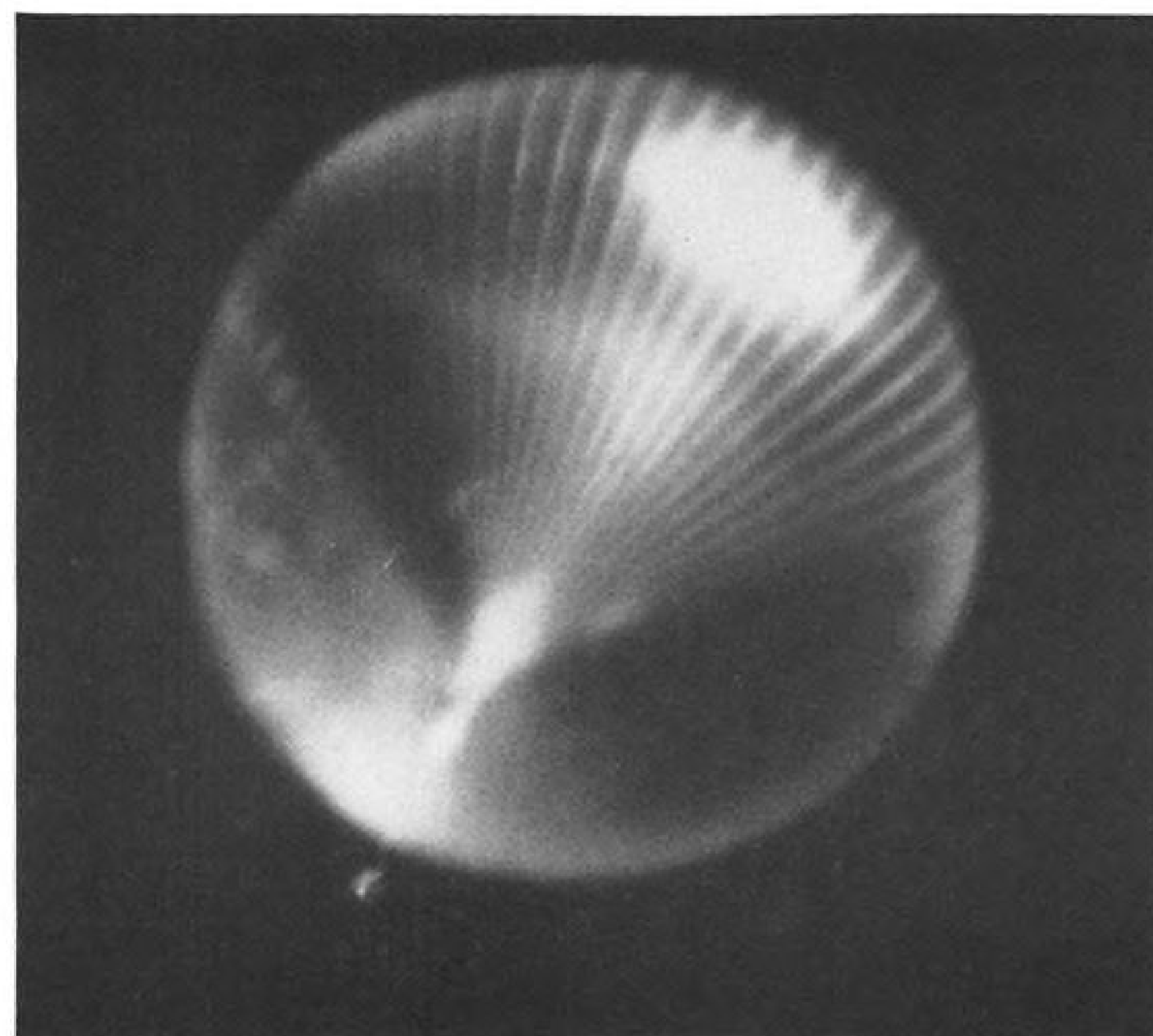
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SKYHOOK at 100,000-ft. assumes characteristics described in "flying-saucer" reports.

ft. and vectors in where it will probably  
hit the ground.

The balloon has lights which flick  
on at night or below 28,000 ft., and a  
transmitter which emits radio signals  
on a radio compass frequency.

General Mills says there have been  
no collisions since the inception of the  
Skyhook Program.

#### Cereals to Skyhooks

Here is how General Mills branched  
out from cereal products to the manu-  
facture of Skyhooks.

After the 72,394-ft. record flight  
made in 1935 by Capt. A. W. Stevens  
and O. S. Anderson in the Explorer II,  
a rubberized fabric balloon, two other

scientists conceived the idea of using  
a plastic envelope—which would be  
lighted—for an attempt at a manned  
ascent into the stratosphere.

The two men, were Prof. Jean Pic-  
card, brother of Prof. Auguste Piccard,  
the famed Swiss scientist, and Dr. J. D.  
Ackerman, head of the Department of  
Aeronautical Engineering at the Uni-  
versity of Minnesota. They went to  
General Mills, principally because the  
company was near by, and asked its me-  
chanical division to build the gondola  
for the project.

Then the two men went to plastics  
manufacturers asking them to build the  
bag. The plastics people said they lacked  
the technical knowledge required to

#### Propaganda Seeder

A new pamphlet-dropping device, combining a bicycle wheel, alarm clocks and  
razor blades, was developed over a week-end by two General Mills' engineers in  
response to a rush request from Free Europe Committee.

The device is attached to a General Mills' plastic balloon and can drop 450 lb.  
of pamphlets behind the Iron Curtain for FEC.

Nine-pound packets of leaflets are hung from the wheel's rim at regularly spaced  
intervals. At a pre-determined time, an alarm clock starts two motor-powered razors  
moving around the device's rim, cutting the cords as they proceed. As the razors  
are diametrically opposite each other, the wheel's equilibrium is maintained.

At first, small cannon were used to blast the cords loose, but it was learned that  
the Communists were using the cannon as counter-propaganda, claiming they were  
deadly weapons.

The balloons, which operate at an altitude of 25,000 ft., sometimes carry radio  
transmitters to send back altitude and locale information to check the accuracy of  
leaflet dropping. As the load is released, the balloons rise, and the change in altitude  
information tells FEC when and where the pamphlets were dropped.

## Executive meeting "upstairs"



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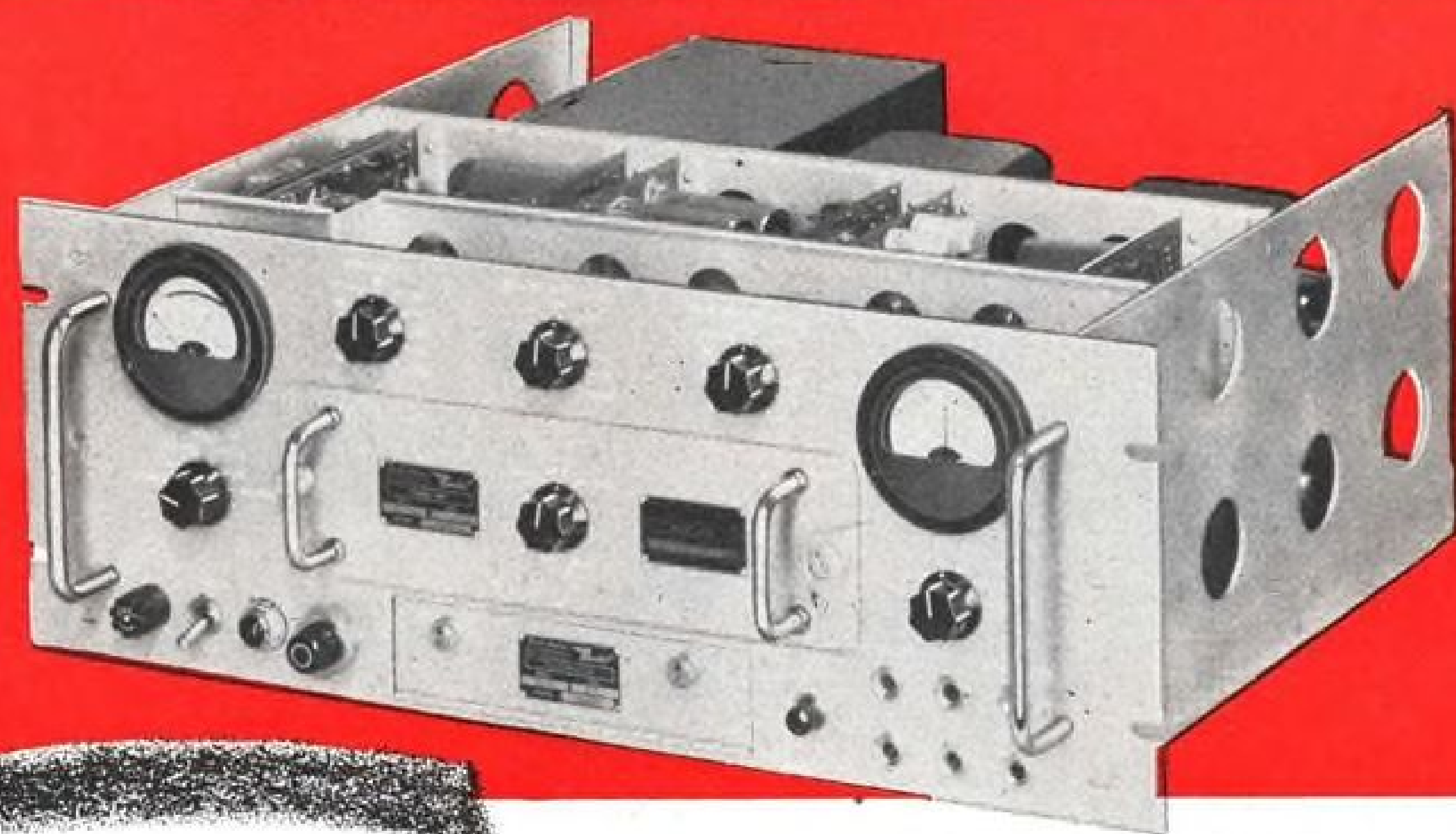


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Less than 1% of bandwidth change for 10 db input steps

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3 single ended outputs providing 20 ma of output current

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**Sensitivity Stability**  
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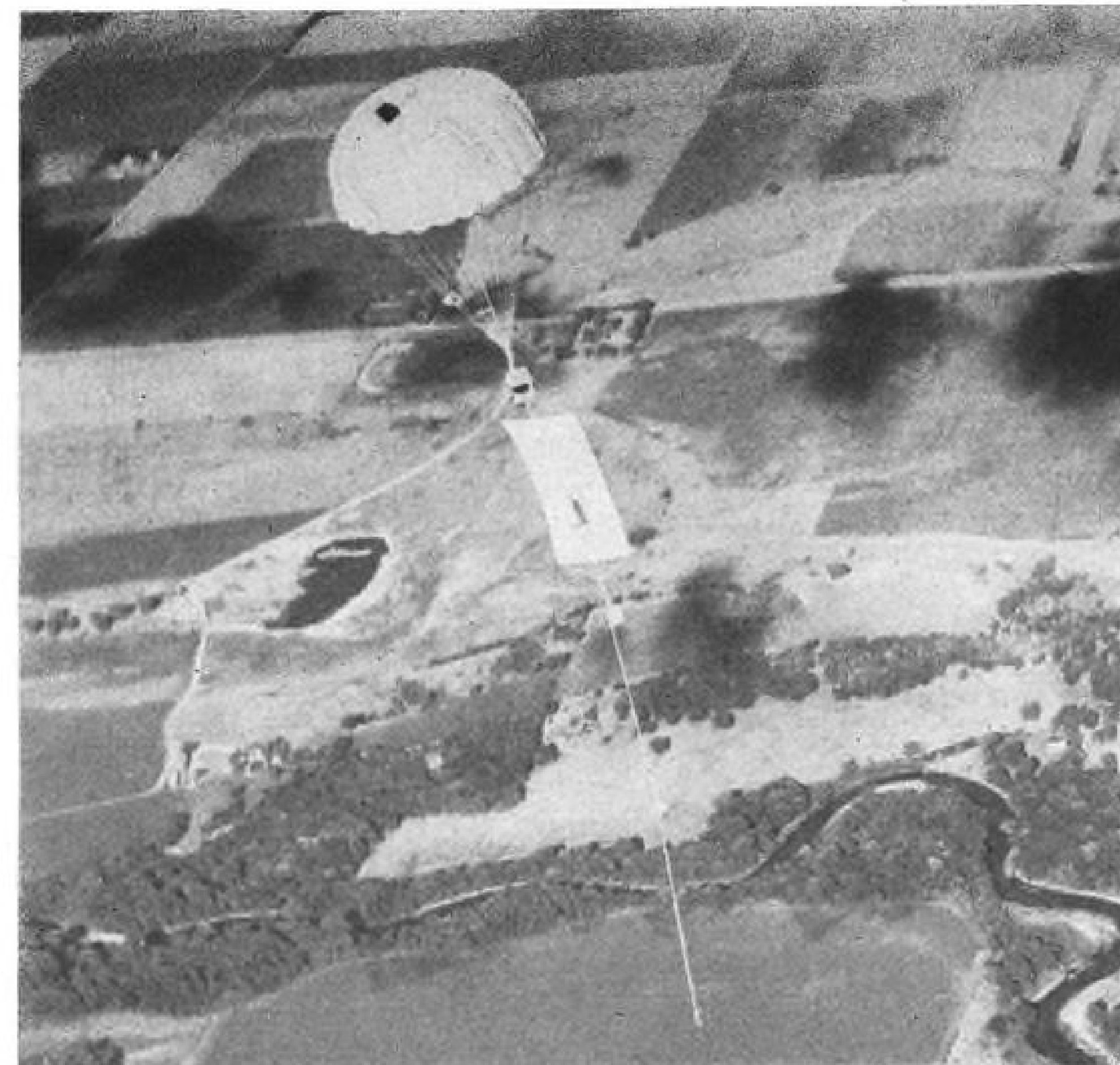
The design of the band pass filters used in the TDA-9 discriminator includes a flat response over the pass band, a linear phase shift characteristic to provide constant time delay of the intelligence signal, and selectivity to provide adequate channel rejection, preventing systems intermodulation.

Provisions for fine balance adjustment of center frequency from a remote location as well as wow and flutter compensation during tape recorder playback have been provided.

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INSTRUMENTS carried to upper space by a Skyhook bring back data via parachute.

handle something as large as the scientists required.

So they went to balloon makers, where they were told that the balloon people had no knowledge of plastics.

Although General Mills had no idea either on how to handle plastics or make balloons, they went ahead under a feasibility study called Project Helio sponsored by the Special Devices Center, Office of Naval Research.

## Big Bags

Here is a size and weight comparison of the three largest free balloons ever built in the world.

• STAR OF POLAND—4,370,000 cu. ft.; weight of envelope, 3,300 lb.

Built in Poland in 1939, balloon was inflated with helium donated by the U. S. It never flew because World War II interrupted the program.

• EXPLORER II—3,700,000 cu. ft.; weight of envelope, 6,500 lb.

Built in the U. S. in 1935, balloon set the world's altitude record of 72,394 ft. Piloted by Capt. A. W. Stevens and O. S. Anderson.

• SUPER SKYHOOK I—3,200,000 cu. ft.; weight of envelope, 850 lb.

Built by General Mills in 1954, it set the altitude record that year for unmanned balloons: 117,000 ft.

The conclusion reached by the study was that, to lift the proposed gondola, all of its equipment, its instruments and the two-man crew, would require 70 balloons of 200,000-cu. ft. capacity each—a total volume of 14 million cu. ft. This was much too big a package to be practical.

So, mechanical division scientists began cutting away an instrument here, a piece of equipment there and wound up imitating an unmanned balloon project—the birth of Operation Skyhook.

The company's largest balloon—the Super Skyhook—has a 3.2-million-cu. ft. capacity. Its envelope weighs 850 lb., compared to 6,500 lb. for the smaller Explorer II.

General Mills' scientists believe that Skyhooks are contributing much towards man's expanding research into outer space. They point out: "Our Skyhooks are operating today where, almost tomorrow, men will have to fly their supersonic planes and guide their rockets."

Dr. R. Brunetti, speaking of his company's keen interest in furthering Skyhook-type operations and techniques, says: "Today, we can undertake to put a platform in the sky at altitudes of well over 100,000 feet. They are capable of carrying several hundred pounds and can remain aloft several days. . . . We already have designs capable of outperforming existing equipment many times."

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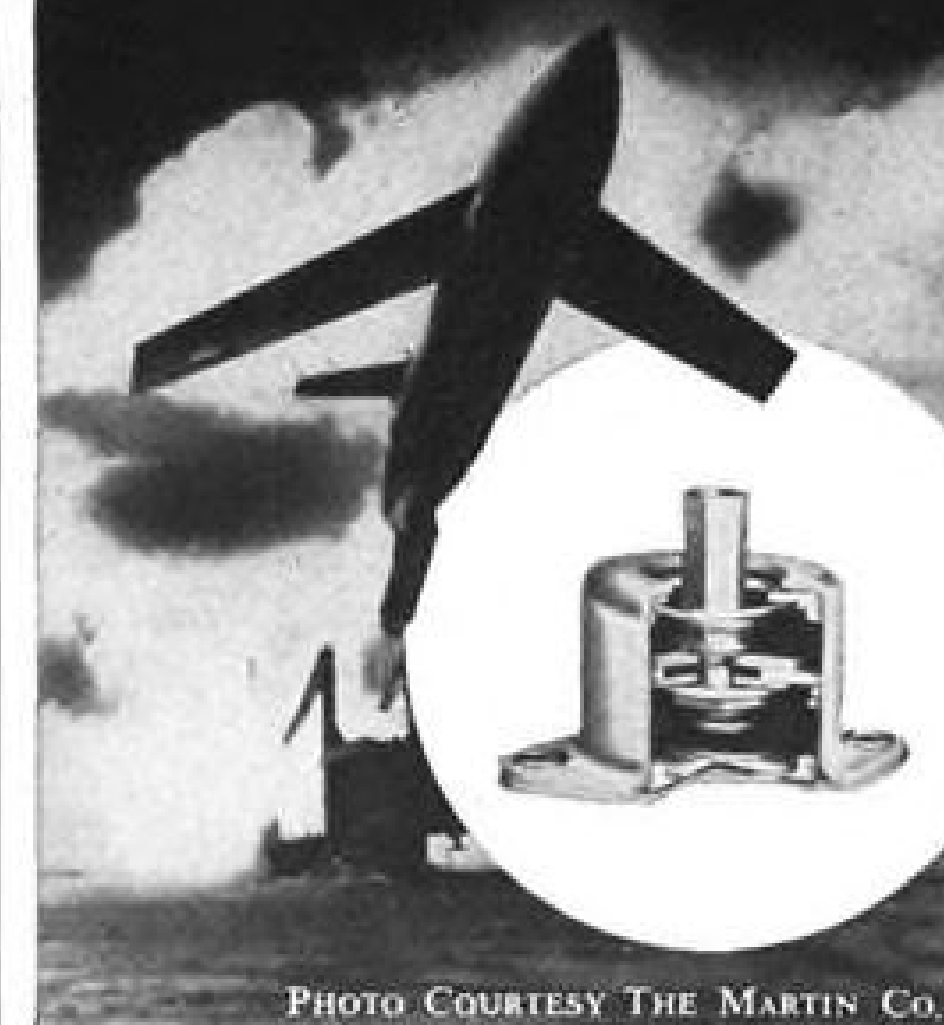
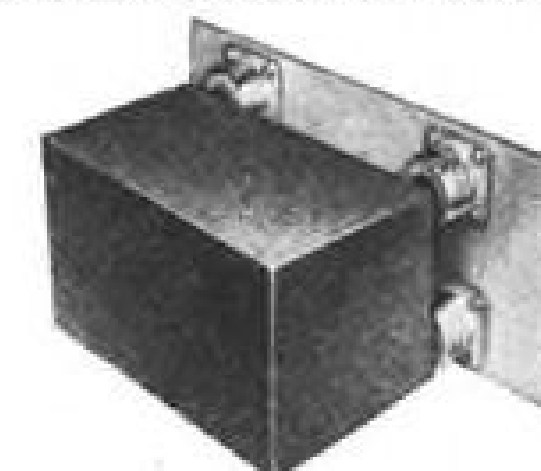


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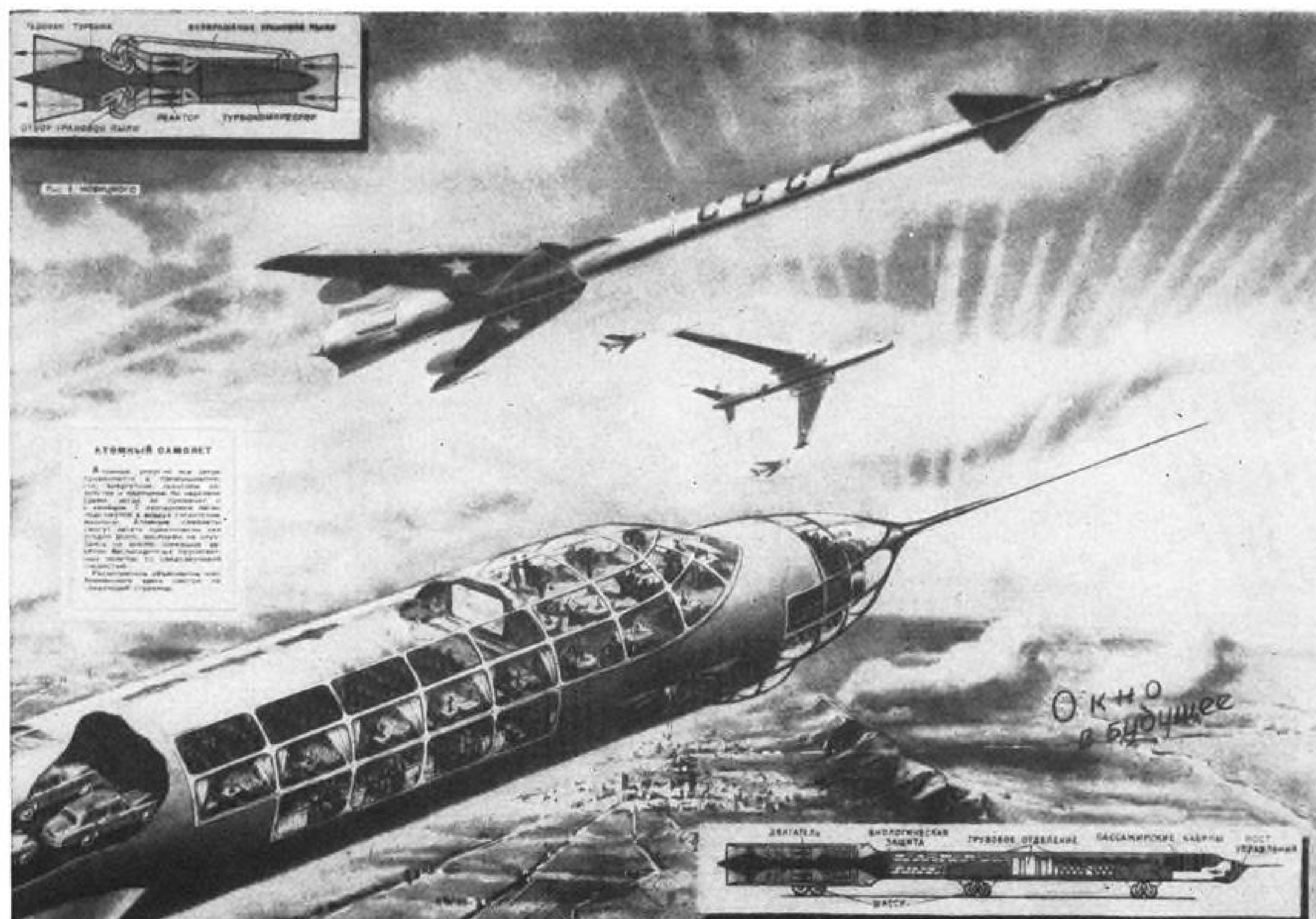
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## "Window into the Future"—Soviet Style

The caption superimposed on this artists' conception of an atomic aircraft in "Mechanics Youth," popular Russian monthly magazine, observes: "Atomic energy is being used more and more widely in industry, power engineering, agriculture and medicine. The time is not far off when it will also be used in aviation. Giant atomic aircraft will rise lightly from airdromes. They will be able to fly almost indefinitely—for months at a time—without landing, circling the earth dozens of times at supersonic speed."

"Proletariat" passengers in this airliner are certain to pick up good cases of radiation.

Schematic cross-section (lower right) shows only a shadow shield between the atomic-powered turbine engine and the freight-baggage-passenger compartment. U. S. engineers have determined that, in addition to the shadow shield, the engine and the crew compartments also must be shielded, if people are to safely fly in atomic-powered aircraft.

Engine (upper left) reveals imperfect jacketing of the uranium fuel for the reactor (peaktop). Separation and recirculation of fission fragments (literally uranium dust in Russian) to the turbo-compressor by the tube at top is impracticable according to American scientists and indicates that the reactor is inadequately "canned." Economical engines require jacketing which prevents escape of fission fragments.

## LETTERS

### S.B.A.C. Comment

Two comments, if you will allow me, on your Staff Correspondent's sour appraisal of the 1955 S.B.A.C. Display and Exhibition.

First, the President of the Society did not say at the Display Dinner that "Britain needed now to concentrate on development, not on production." He said: "The problem of aircraft manufacture nowadays is more than ever one of development and not of production . . . Delays and difficulties in development are not an exclusive feature of the British Aircraft Industry. They are common to aircraft development and manufacture everywhere in the world. We believe that our record of development of new types of aircraft and making them fit for

service can bear comparison with what is done elsewhere."

Second, our exhibitors appear to be unanimous that this latest show was the most successful yet. More worthwhile contacts were made and more business done than on any previous occasion. The more of such "disappointing" and "sad" and "dullest" Displays we can have, the better we shall like it!

Your Correspondent misunderstands the purpose of the Display, which is business and not to provide a technical circus. Again to quote the President of the Society, "When something new is shown (at the S.B.A.C. Displays) . . . it is usually shown because there is or will soon be a readiness to sell it. It must not be concluded that it is necessarily the latest idea; that is generally still in the experimental or developmental department and beyond that there is something else on the drawing boards. I say this with a view to moderating the impression that everything is brought to Farnborough

at the earliest possible moment."

EDWARD C. BOWYER, C. B. E.  
Director, S.B.A.C.,  
London, W.1, England

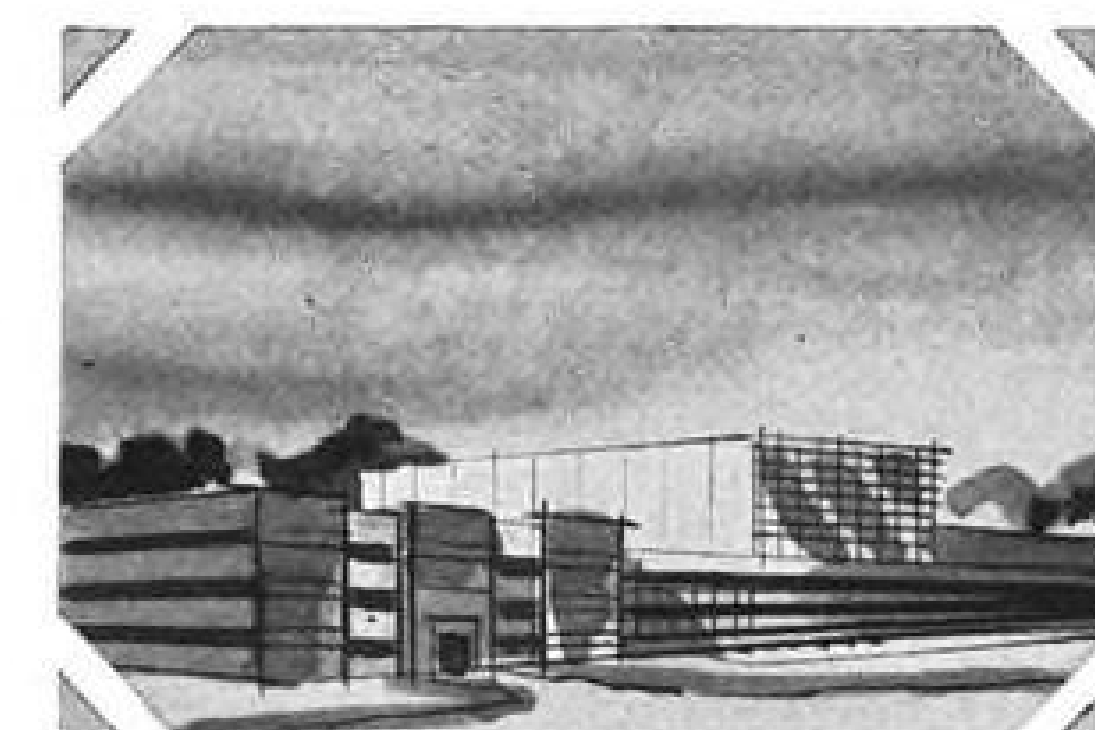
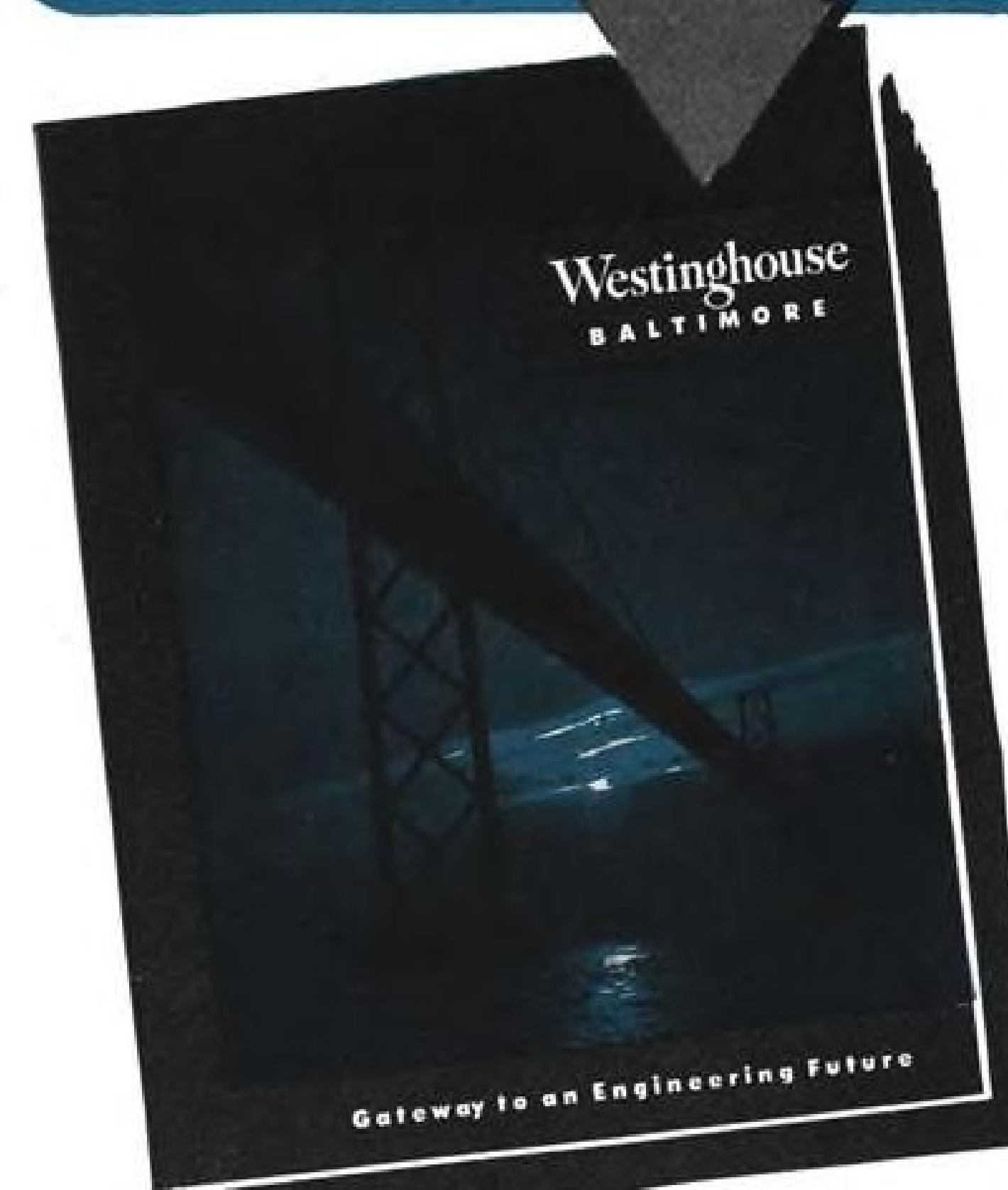
### Accident Prone

On Wednesday evening, August 3, 1955, about 9:20 p. m., I was approaching the San Francisco Airport on an arrival from Los Angeles in a small plane. It is customary in visual-flight-rules weather to call the San Francisco tower over the San Mateo Bridge, at which time you are generally cleared for a straight in approach . . .

Wednesday evening we were cleared, upon calling the tower, for a straight in approach on Runway 28R. About half-way between the San Mateo Bridge and Coyote Point the tower advised of local traffic in the nature of an F-86 making a simulated instrument landing system approach. Our course from the San Mateo Bridge, where the outer

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marker is located, straight in to Runway 28R, exactly follows the localizer beam. At our altitude of 1,000 feet, with a slight descent we would intercept the glide path somewhere in the vicinity of Coyote Point. We, of course, were not making an instrument landing system approach as visual flight rules conditions were present. But it was apparent that we would be directly in the flight path of the F-86 at the same time of his simulated approach.

After landing, I . . . observed the F-86 making several more simulated approaches with low passes over the field, turning on his afterburner for the pull up. I have also noticed F-86's making simulated approaches at the Oakland Airport.

I am not familiar with the program of the Air Force to install instrument landing sys-

tem facilities on fighter strips, but it gave me a gratifying sense of security to know that our fighter pilots devote considerable training time to obtain a high degree of efficiency in the use of the instrument landing system. This feeling was more pronounced on the ground than in the air because as we approached to land, we felt ourselves very much in the position often referred to "as an accident looking for a place to happen". This feeling is understandable, I am sure, as we were following the localizer path inbound and as we approached the intersection of the glide path at approximately the same time as the F-86, we were afraid that the F-86 pilot would not observe our slow moving aircraft below, especially with the moving traffic on the adjacent Bayshore Highway. . .

To anyone versed in instrument approach procedure, it will be obvious that the F-86 pilot, in order to receive any value from his training approach, would have to carefully monitor his several flight instruments essential to an instrument landing system approach. He certainly would have little or no time to observe other airport traffic. In view of his approach speed, the distance between the F-86 and another aircraft would be rapidly closed between the brief glances possibly permitted.

Furthermore, the F-86 in an approach pattern appears to have a nose high position, which would preclude him from seeing an aircraft below and directly in his flight path. If the instrument landing system approach was made with the aid of an approach coupler, the pilot might have a little more time for the observation of other traffic; however, the need for training with an approach coupler would be correspondingly less.

I do not know what an instrument landing system installation costs, but it would seem worthwhile to evaluate the cost of such equipment which could be installed in some outlying area without a runway, if necessary, for practice approaches, in relation to the cost of an airplane and the lives which may be the payment for the use of heavily congested terminals for use as a fighter low-approach practice area.

G. W. TOMPKINS,  
President Overseas National Airways  
Oakland International Airport, Calif.

## NATA and Industry

I have noted several cries of pain in your letter columns from Remmert-Werner, Inc. regarding certain industry practices.

I am afraid I can't sympathize with Mr. Remmert, for, as long as people in his capacity continue to disregard industry organization and Washington representation, I am certain that his voice will be but a cry in the wilderness despite the size and character of his operation. I further point out NATA is organized to represent the operator and is working on the problems covering many facets of such activities. Of special interest is the NATA formation of the National Aviation Maintenance Council, which group has endeavored to obtain top specialists on its 14-man National Board. The council was established in view of an existing need for a strong maintenance group to deal effectively with agencies of government and with the military on rules, regulations, establishment of industry and technical standards to improve and expand relations with the services on contract maintenance.

Remmert-Werner, Inc. was incidentally, asked to participate on this council but refused. Apparently there are many operators both large and small who have still not learned the fundamental lesson that only through strong industry organization and representation at top level where it can count an effective work result to develop helpful policies and reflect industry needs, as well as counter harmful proposals. So again, in view of the record, I cannot feel very sympathetic towards cries from various individuals until they have at least tried to help make an organized effort successful.

CHARLES A. PARKER, Executive Director  
National Aviation Trades Association  
Washington 6, D. C.



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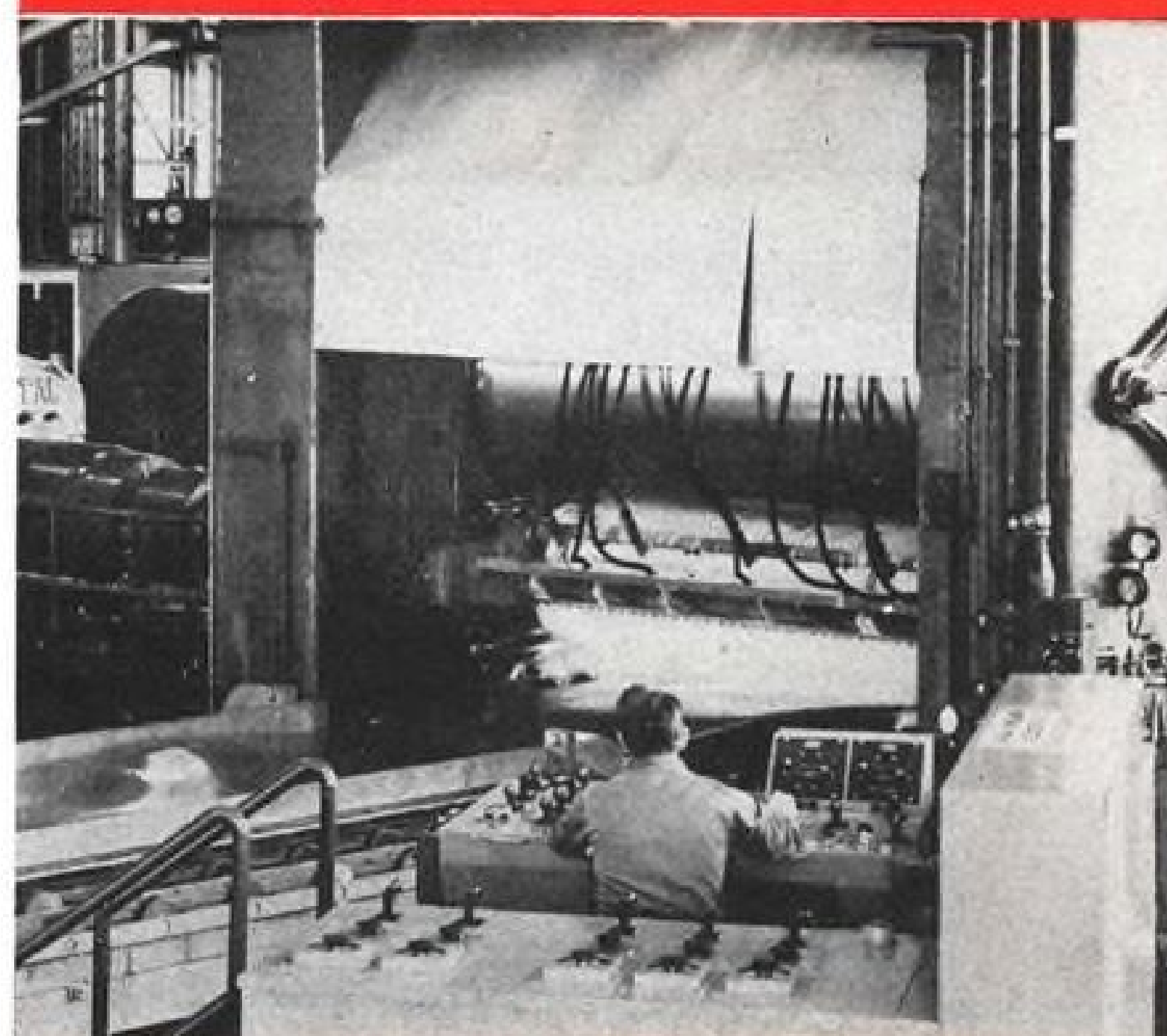
The latest developments in military procurement will be covered in a special report. Included in the detailed information to be presented will be: Air Materiel Command—Air Research and Development Command buying practices, personnel listings—by name, procurement centers, etc.; All-inclusive listings of manufacturers of aeronautical and allied products, sectionalized for maximum utility under six major headings: Aircraft, Missiles, Avionics, Supporting Groups, Nuclear Power Systems, Airlines and Airports.

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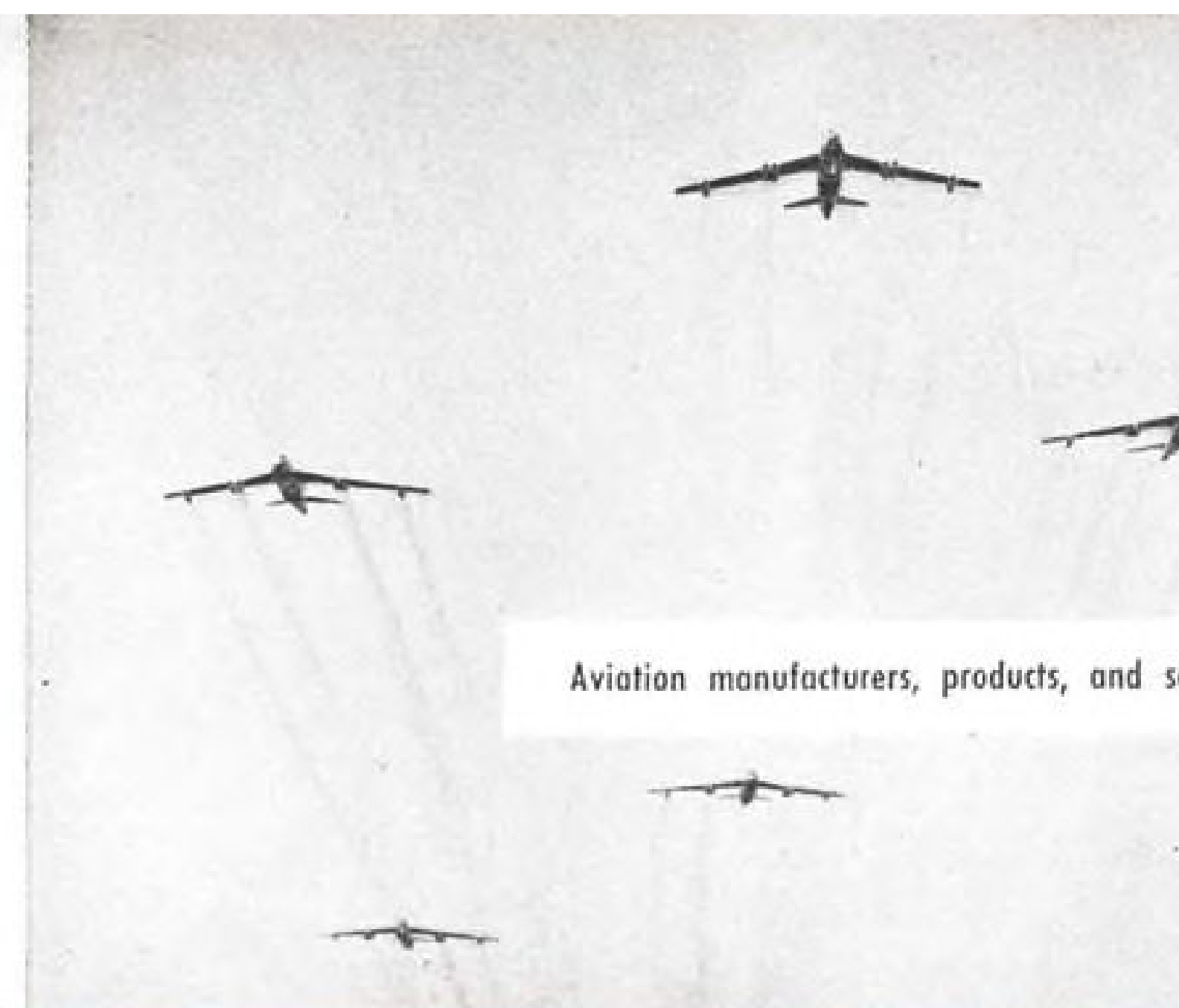
Airframe and components  
Equipment, including ground-handling,  
Powerplant



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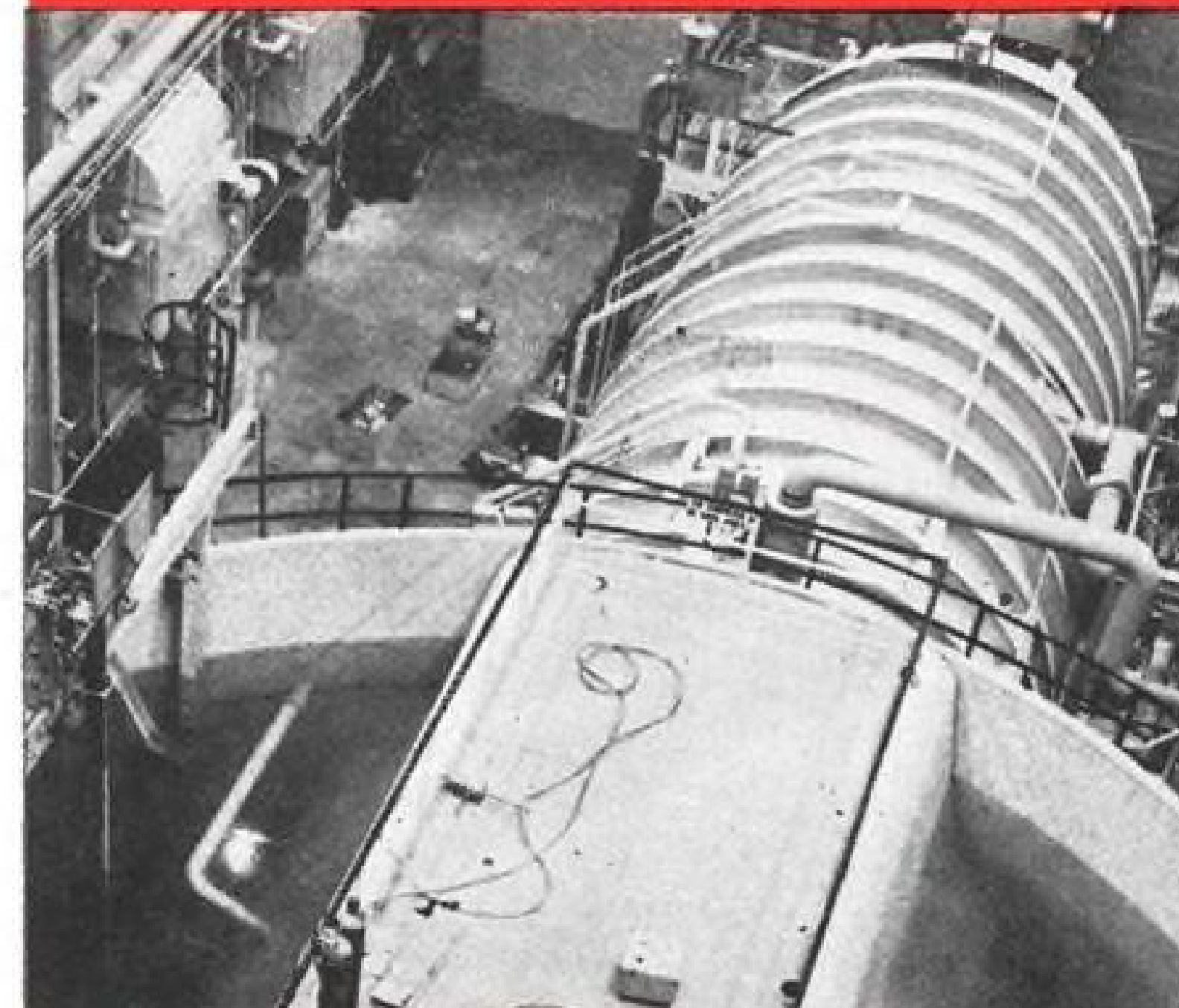
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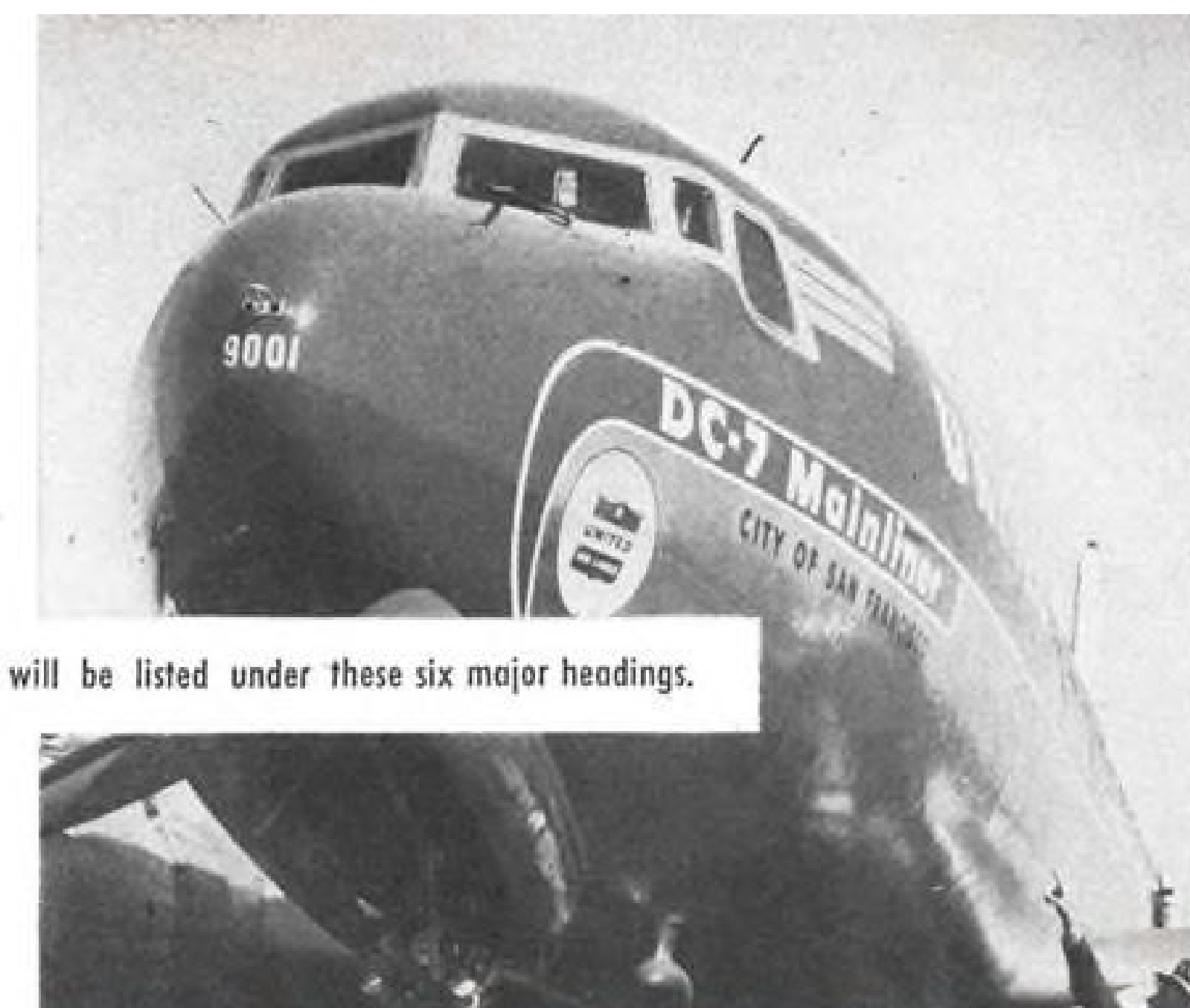
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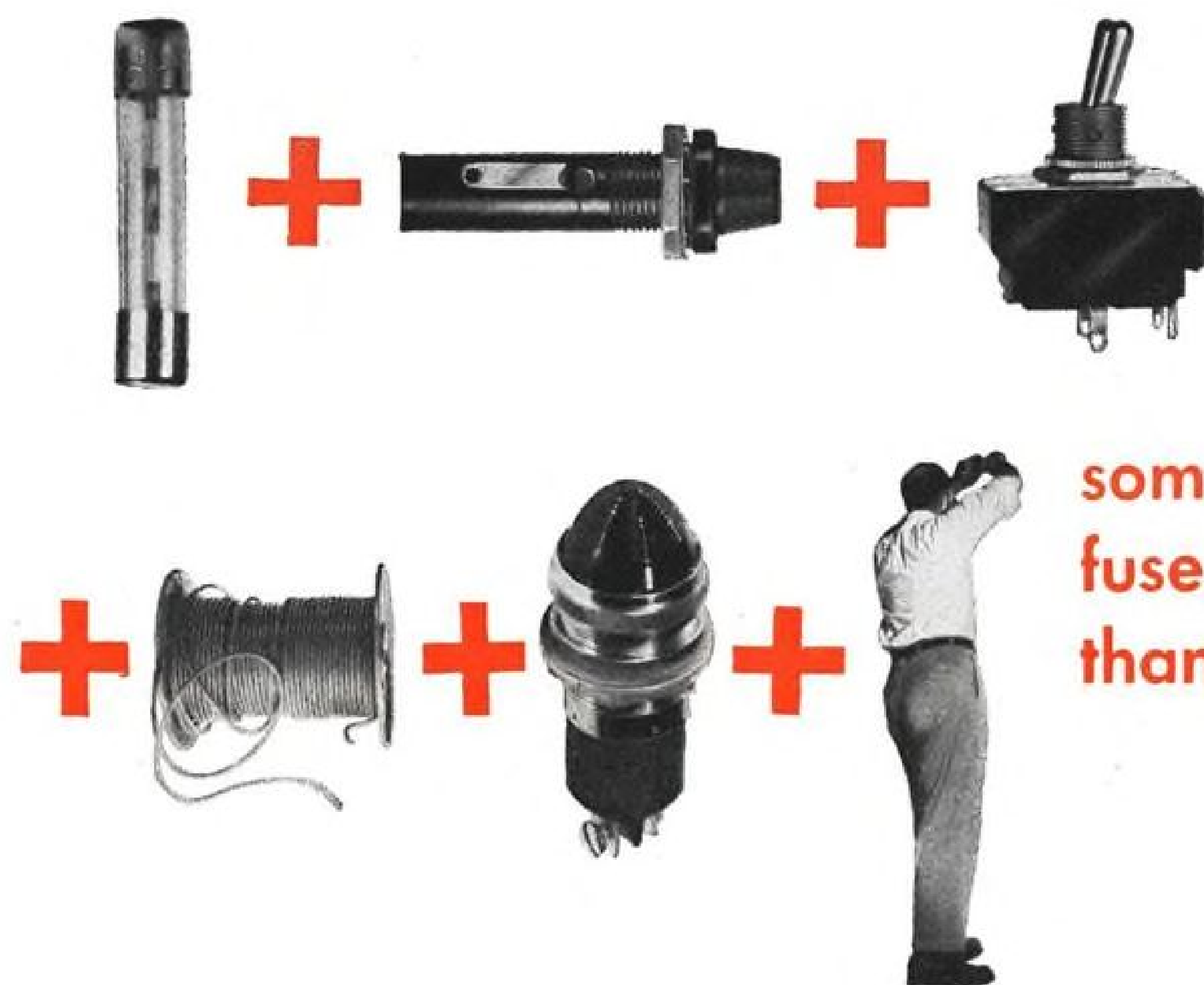
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some people think  
fuses are cheaper  
than circuit breakers

## ... some people don't

At first glance fuses do *look* cheaper . . . but that's not the way many companies are figuring these days.

**Company X** looked at total cost. Adding the cost of the fuse, fuse holder, power switch and pilot light plus wiring, space and labor cost, they found the one Heinemann circuit breaker performing all these functions had the cost advantage.

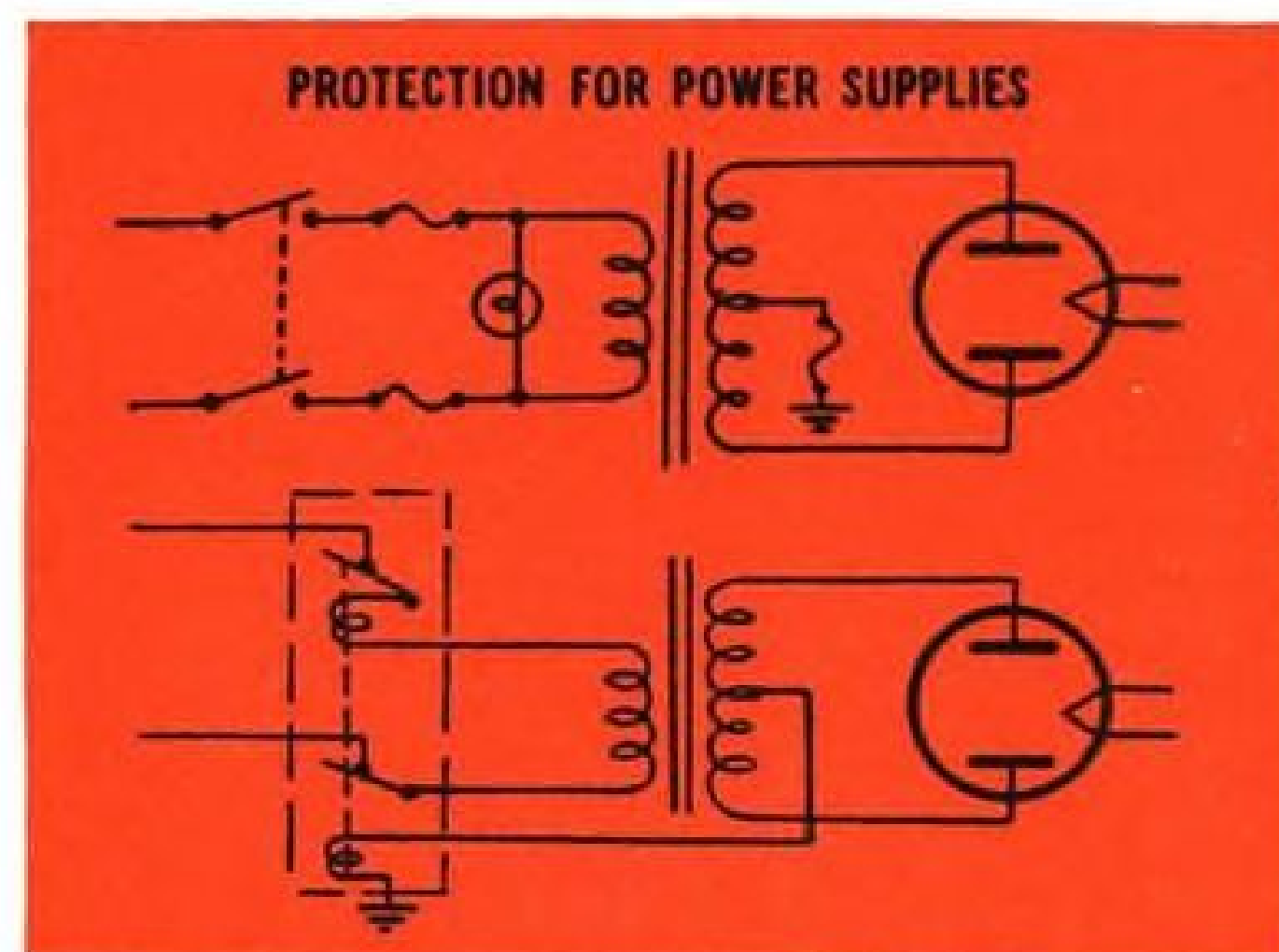
**Company Y** which formerly used fuses in their equipment had excessive service costs. Users often replaced blown fuses with the wrong rating, and the company couldn't take a "buyer beware" attitude with its customers. Heinemann circuit breakers ended this problem.

**Company Z** needed maximum protection with minimum outage time. They needed precise fractional ratings to protect sensitive components as well as special time delay characteristics allowing flash inrush. They also had to have immediate restoration of service following a fault . . . time was money for their customers. All these qualifications were fulfilled by Heinemann hydraulic-magnetic circuit breakers.

*Make a re-appraisal yourself.* Heinemann circuit breakers may provide you with better protection at a *total cost* close to fuses. Moreover, by combining functions in a circuit breaker, you may have a cost advantage.

Send for the CIRCUIT BREAKER ENGINEERING GUIDE, Bulletin 201.

Heinemann  
Aircraft Type  
Circuit Breaker



Typical full wave power supply with both primary and secondary circuits protected. Lower circuit shows one circuit breaker replacing three fuses, a switch and pilot light.

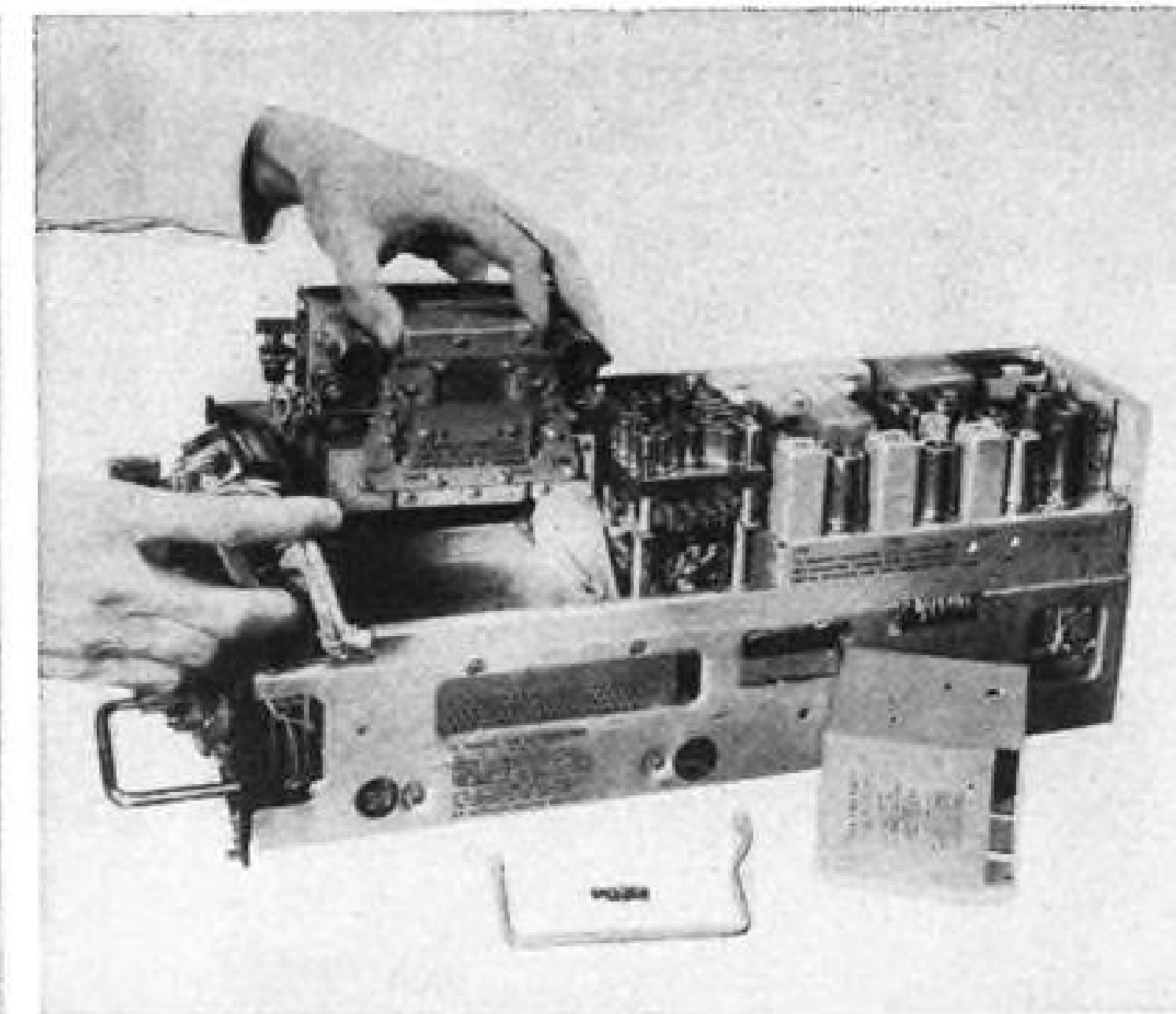
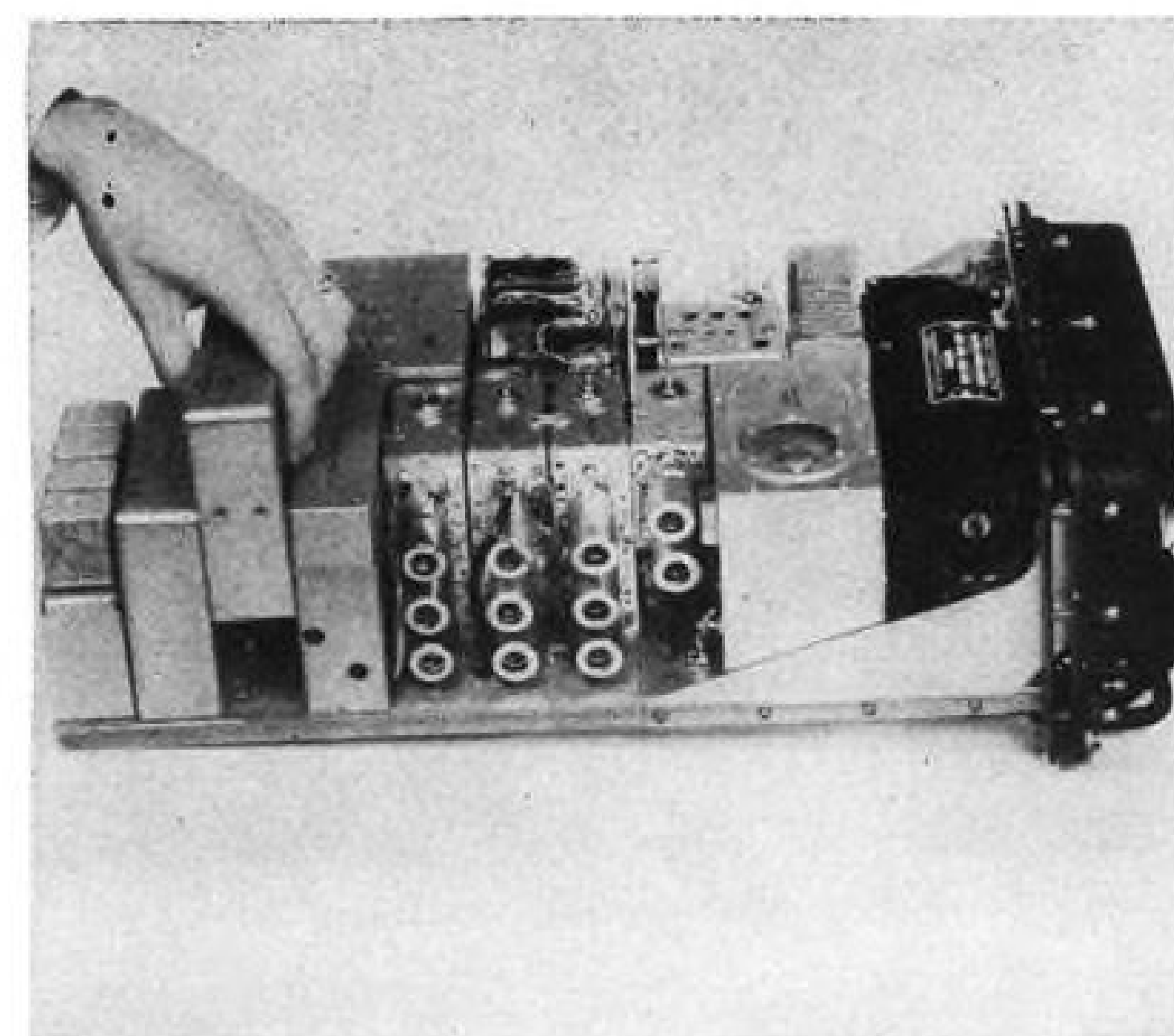
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ELECTRIC COMPANY  
158 Plum Street, Trenton 2, N.J.

*Circuit breakers*



## AVIONICS



**DIFFERENCES** between avionics equipment designed for airlines (left) and the military (right) are not readily apparent but exist nevertheless. These differences in design philosophies and practices are described below.

## New Handbook to Guide Design Of Airlines' Avionics Equipment

A new avionics handbook pinpointing for industry designers the differences between equipment requirements of the airlines and the military was prepared recently by the Airlines Electronic Engineering Committee of Aeronautical Radio, Inc. In the following article, S. B. Poritzky, secretary of the committee, discusses the handbook—entitled "Guidance for Designer of Airborne Electronic Equipment, (Report No. 403)"—its recommendations and implications.

Whereas a military aircraft and its avionics equipment may sit idle for much of their useful life, an airliner and its equipment must operate reliably for 10 or more hours a day—easily 10 times the use-hours of ordinary military aircraft.

The Arinc Report No. 403 offers specific data on design practices and construction methods, always with an eye to reliability, a subject on which the airlines have become expert through years of dealing with the problem on a dollars-and-cents basis.

For example, the Arinc report recommends:

- Use removable sub-assemblies widely but avoid sealed and potted components groups which must be discarded when a single component fails.

- Design conservatively enough, with adequate cooling, so blowers are not required in the equipment.

- Avoid printed components and sealed relays.

- Exercise caution in use of semi-conductors so that they don't become maintenance headaches in the process of discovering their shortcomings.

- Avoid subminiature and soldered-in electron tubes. The net saving in space is small, and the subminiature tube lacks the miniature tube's long pedigree of experience.

If some of these recommendations differ sharply from military avionics design practices, the airlines believe there is good reason:

### Airlines vs. Military

The commercial carrier must place top priority on long-term, trouble-free operation. Although the military obviously want this too, they must pioneer the newest techniques and innovations to keep abreast of an enemy with fast-rising capability.

Extreme miniaturization is a must for jam-packed military aircraft, whereas the airlines feel they must wait until such developments meet their reliability requirements.

The report offers guidance to the designer, just as military general specifications are set up to do. The difference in approach, however, is immediately evident in the content and style of the Arinc handbook.

There are no arbitrary requirements—not a single "shall" or "must." Each

desired practice is explained in terms of the need and the probable effect on equipment performance. The report is not intended to be a policeman for the designer. Responsibility for good design still rests with the designer because compliance with an generalized set of rules does not necessarily produce reliability.

The Arinc report urges caution in the use of radical innovations, but does not restrict the designer if he can prove a new technique is sound and reliable.

### For Guidance Only

The Arinc report emphasizes that it is intended solely as a guide because, in the last analysis, the airlines are sold on the basis of the best mousetrap at the best price (both initial cost and maintenance expense over the equipment's lifetime).

However, the Arinc report does give the avionics designer data on the airline environment in which the equipment will be used, and general airline views on testing and maintenance practices.

It urges avionics manufacturers to provide equipment interchangeability voluntarily. In this way, an airline can buy equipment from company "A" for one group of aircraft, and fit another late procurement of similar aircraft with equipment from manufacturer "B" without changing aircraft wiring or installation provisions.

Furthermore, the avionics manufacturer who loses the first sale still has the opportunity to sell the airline in the next round, if his equipment is interchangeable.

Because the expected service life of



# the NOSE GEAR SWITCH



DOUGLAS GETS DEPENDABLE SWITCHING ON THE RB-66 Air Force-Douglas Bomber with Electro-Snap Hermetically-Sealed Limit Switches. Close-up of RB-66 nose gear assembly shows how Electro-Snap Switch is mounted to indicate when gear is locked down.



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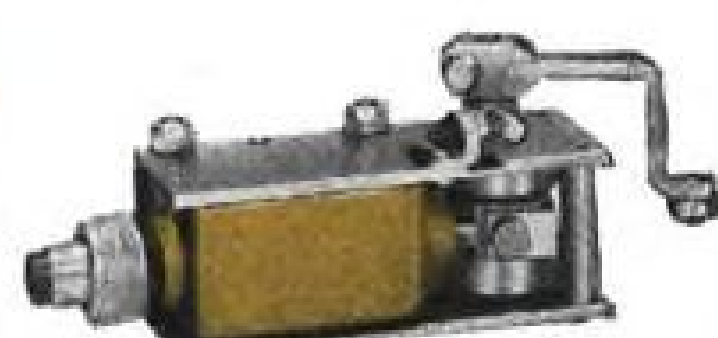
**Flap Switch**  
When flap closes and depresses actuator, switch simultaneously operates four 10 amp, 30v DC circuits.



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**Fuel Tank Transfer Switch**  
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**Turret Switch**  
Rotary actuator gives long over-travel, flexibility in mounting. Extremely compact, lightweight case.

airline equipment usually is much longer than that of the military avionics, careful consideration must be given to the long-term economics of servicing and maintenance. Printed circuit boards or potted assemblies may be an expensive luxury if the entire unit must be destroyed in order to replace a two-cent resistor.

Although printed wiring has many attractive advantages, techniques must be devised to permit the speedy replacement of individual components without destroying the integrity of the printed circuit.

On the other hand, the airlines encourage the use of removable sub-assemblies, such as IF amplifiers, resonant cavities and the more conventional forms of modular construction. Emphasis always is on ready accessibility and ease of trouble-shooting and servicing.

Designers are encouraged to provide facilities for performing in-chassis testing in order to isolate the fault to a particular tube or module without having to remove and test these components. Arinc also recommends that designers provide means for checking overall equipment performance for deterioration so that potential failures can be spotted in advance.

## Airliner Environment

Although equipment is desired with provisions for utilizing external cooling systems in future aircraft, it must operate satisfactorily without external cooling. The cooling provisions should be used merely to give even more reliable long-term service and longer periods between overhaul. They should never be required to keep the equipment from burning up.

Although airline equipment tests are conducted over ambient temperature limits of  $-40^{\circ}$ C to  $55^{\circ}$ C, the equipment normally is located in passenger or crew-occupied areas. Thus, the lower temperature is largely academic, whereas on occasion the upper temperature limit may reach  $70^{\circ}$ C.

Studies of avionics equipment in actual airline service indicate that shock and vibration are not significant factors in the failure of equipment or electron tubes. Rather, airline experience indicates that equipment gets its roughest treatment while being transported and handled on the ground.

Most airline avionics equipment is located in the aircraft radio rack or other pressurized areas. For this reason, pressurization of individual equipments is not required for present or now-contemplated aircraft. The equipment should be capable of operation without damage at altitudes higher than 20,000 feet for short periods in

event of loss of cabin pressurization. If required to meet this condition, individual sub-assemblies may be sealed in pressurized containers.

## Available Power

The report describes the kinds and quantities of power available in modern aircraft, and the way in which voltage variations occur in service.

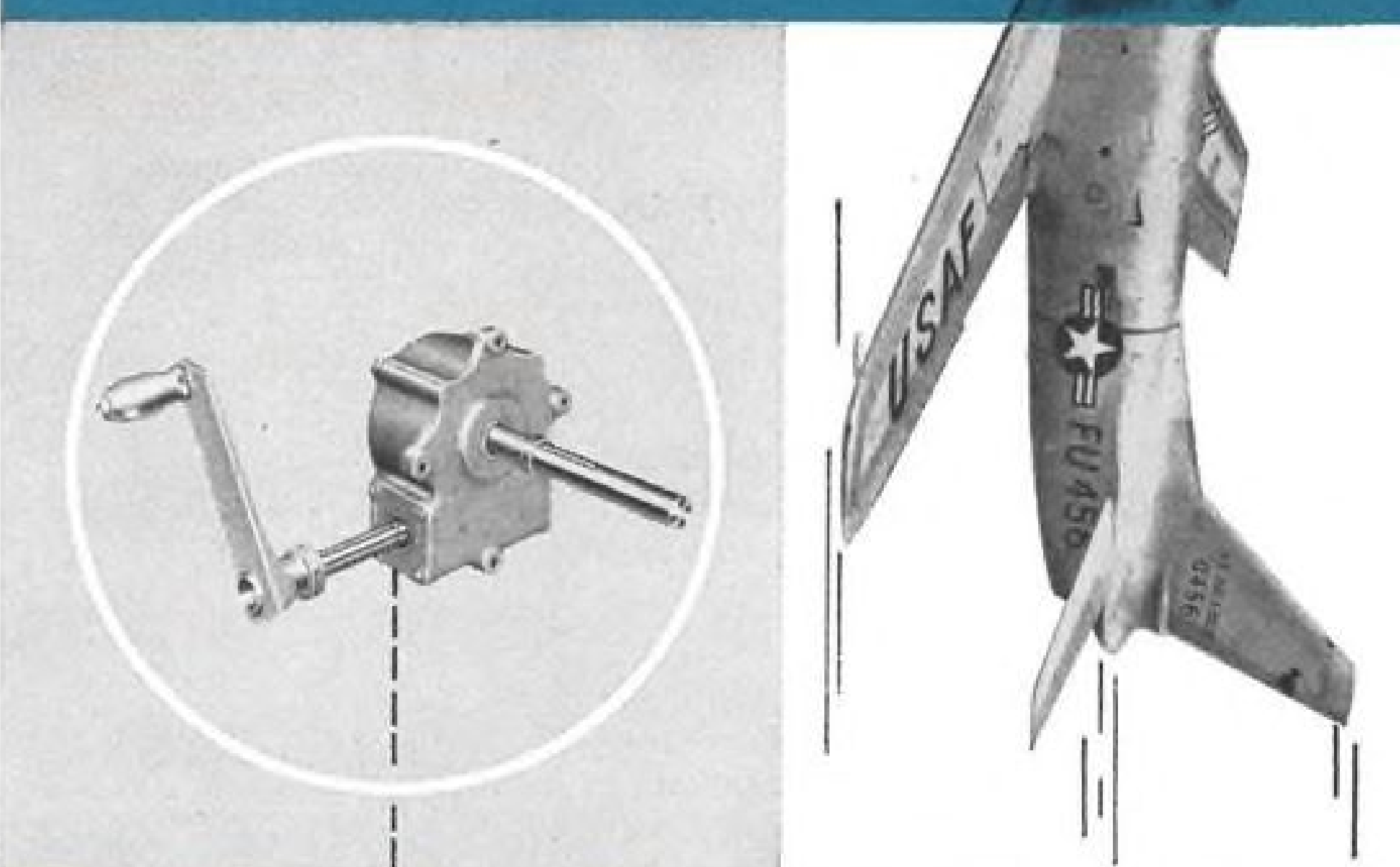
Avionics engineers are urged to design their equipment to use variable-frequency (300 to 1,000 cps) loosely regulated (plus 10%) a.c. power whenever possible, to deduce demands upon closely-regulated (both frequency and voltage) 400 cps sources. This close

regulation increases the weight and cost of these power sources.

Although the airlines generally accept the airframe manufacturer's preference for a.c. as the primary power source, many operators have only limited a.c. available in present aircraft. Equipment should be designed to operate from several different power source arrangements if possible to make it universally applicable to a variety of aircraft types.

A few of the many other pointers suggested in the Arinc report include:  
• Add an extra tube stage or use a component with a higher-than-absolutely-necessary rating in order to avoid

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the team that helps build  
the North American F-86D**



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squeezing every ounce of performance out of components. Operating airlines cannot afford to depend upon maintaining critically-high stage gains over the long period between overhauls in the face of the large supply voltage variations encountered in actual service.

- Lack of mil-spec approval need not prevent the use of new components and techniques if the designer has comprehensive data to prove they are superior to their mil-spec counterparts. Otherwise, the airlines encourage the use of mil-spec devices.

- Avoid wrapping component lead around a terminal board or tube socket

terminal just to provide mechanical support.

With a good soldered connection, this is not necessary and may result in spoiling the terminal board or tube socket when it becomes necessary to replace the component.

#### Avionics and Competition

The fact that airline avionics equipment almost always is developed on the manufacturer's initiative, and at his own expense, provides the best incentive for him to determine airline needs and to specifically build to these requirements.

The relationship between the equip-

ment maker and the people who buy and use the equipment is frequently much more intimate than in military avionics procurements. This enables the equipment designer to get a real understanding of the airline's equipment problems.

The report emphasizes that a manufacturer's success depends not only on getting the first sale. Because each airline performs its maintenance at one or two central bases, field performance data feeds back quickly to airline engineers who buy avionics equipment. If the equipment proves to be a "lemon," word spreads quickly through the airline industry.

Copies of Report No. 403 may be obtained from Aeronautical Radio, Inc., Airlines Electronic Engineering Committee, 1523 "L" St. N. W., Washington, D. C.

### Navy to Test TV As Airport Monitor

Closed circuit TV for controlling aircraft landings and takeoffs, and for monitoring runway movements, will undergo trial evaluation soon at Alameda Naval Air Station near Oakland, Calif.

Three TV cameras, located along Runway 25R and connected by co-axial cable to viewing screens in the control tower half a mile away, will enable tower operators to view aircraft along the runway, including individual aircraft identification markings. The cameras also will give tower operators a view of vehicle traffic on an access road near the flight strip.

The need for improved tower vision was brought about by extension of the runway strips and the higher-speed aircraft now based at Alameda. The closed-circuit TV installation will cost around \$50,000, about one-tenth the estimated cost of moving the control tower or increasing its height to give operators better runway vision.

Cameras will be waterproofed and equipped with electric wipers.

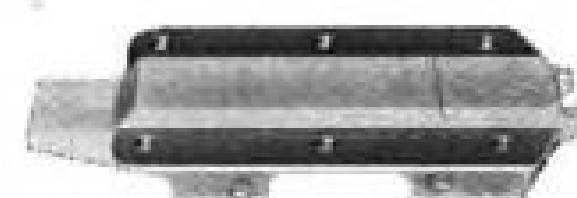
### Main Reference Code For Tacan Is East

The main reference code, which is used by airborne Tacan receivers to establish the airplane's bearing to the station, is transmitted at the instant that the cardioid pattern sweeps past magnetic East, not magnetic North, as reported in the September 26 issue, p. 63. (Magnetic North is used as reference in present VORs.) Stated another way, the main reference code is transmitted at the instant that the inner parasitic element points toward magnetic West.

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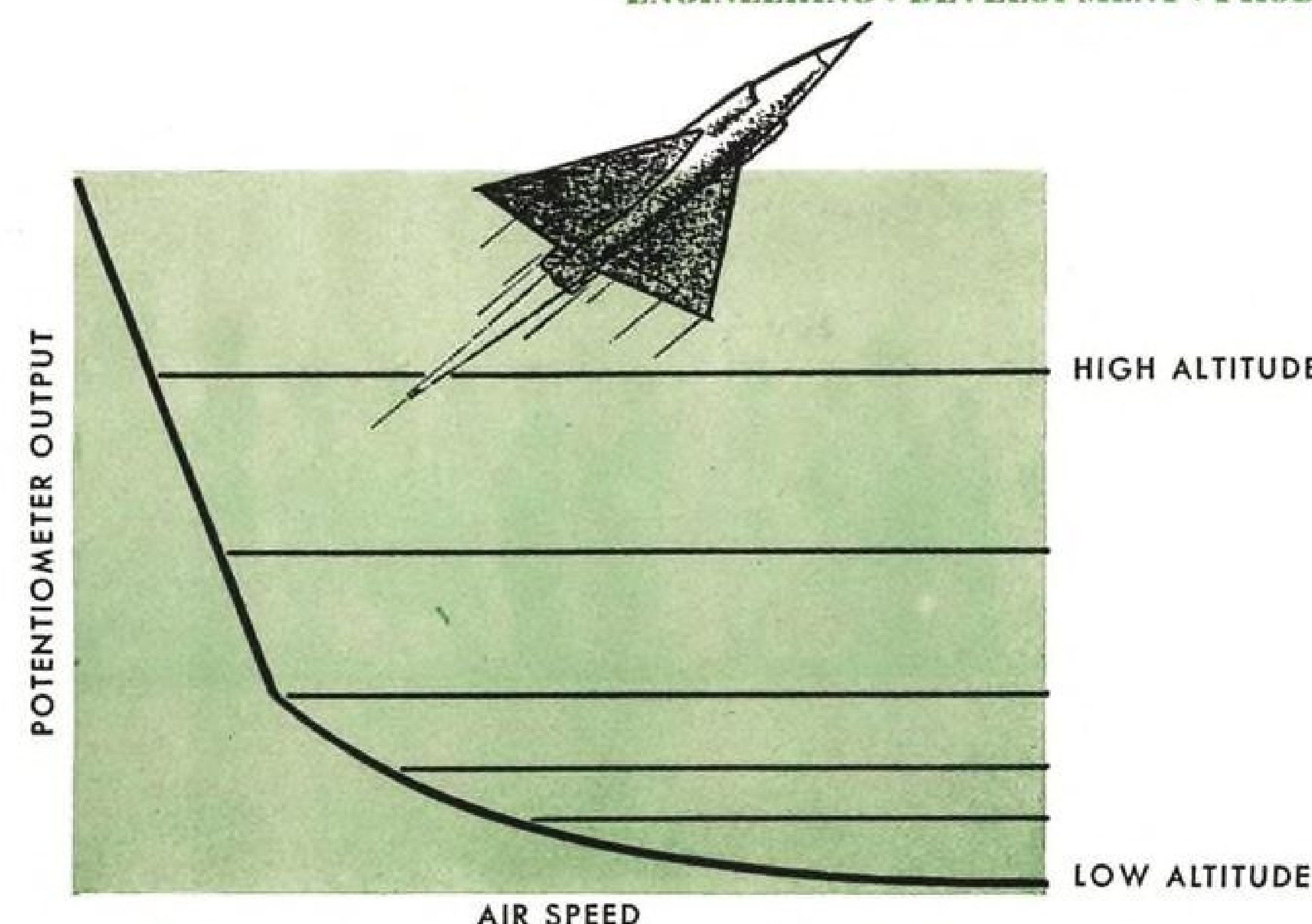


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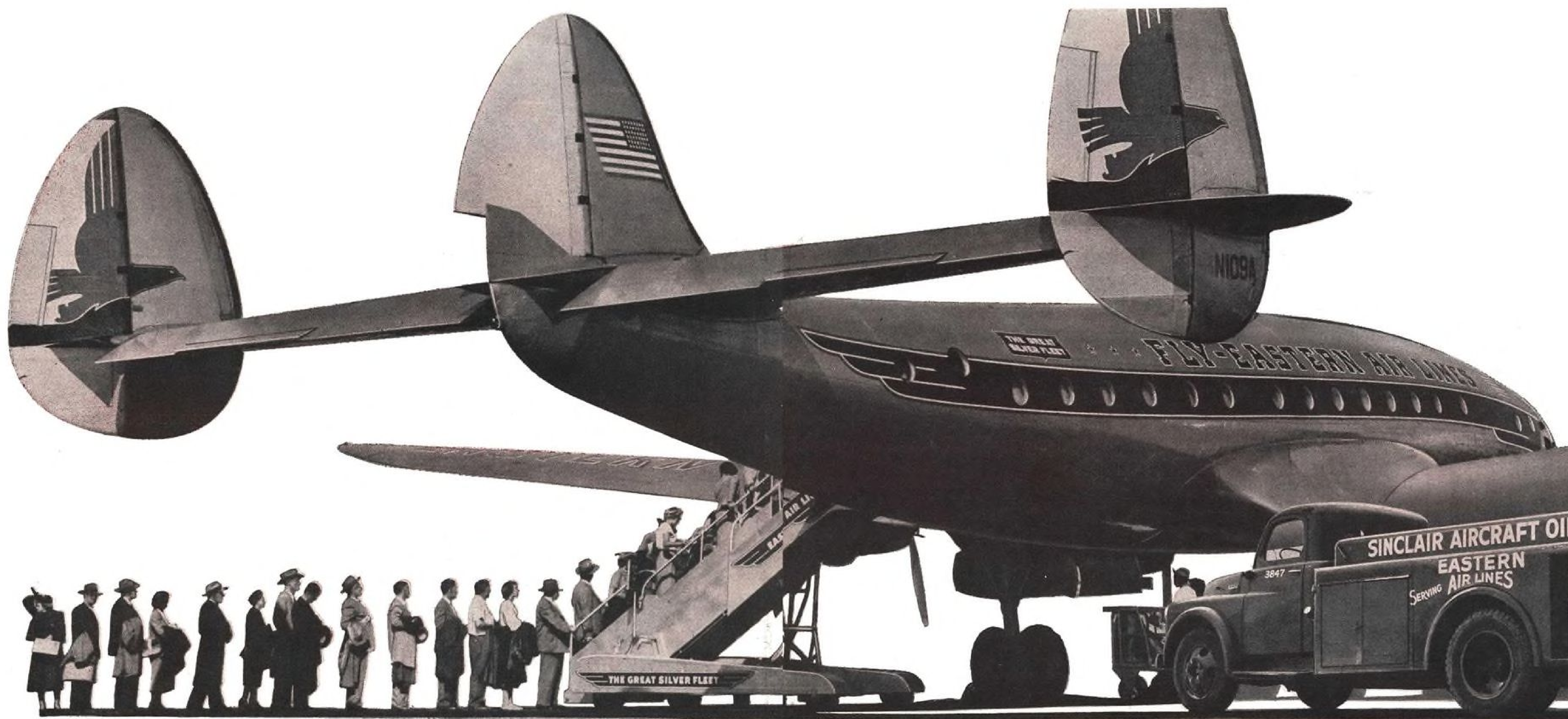
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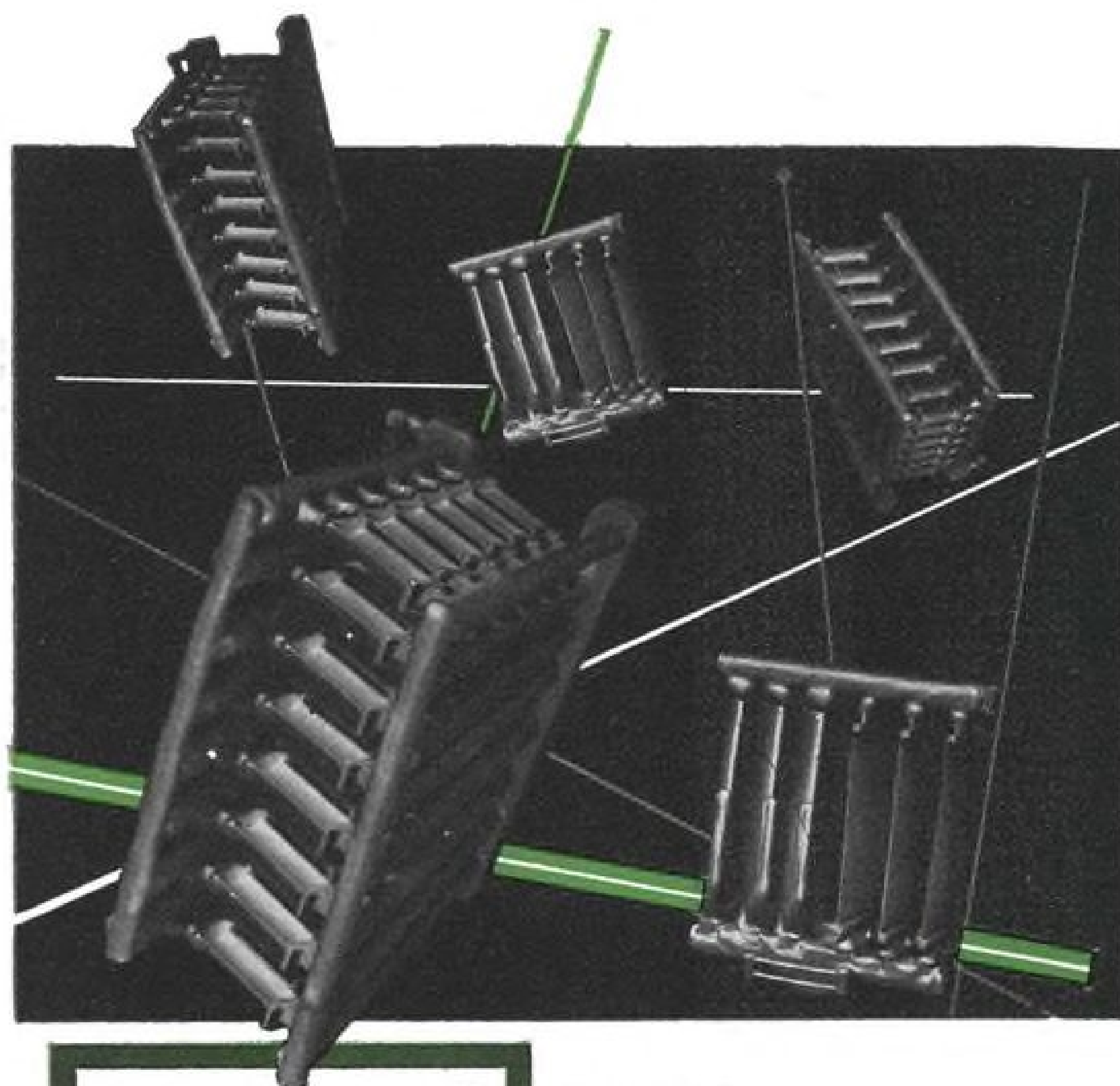
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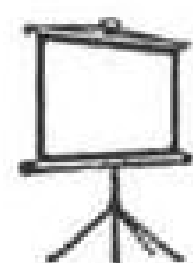
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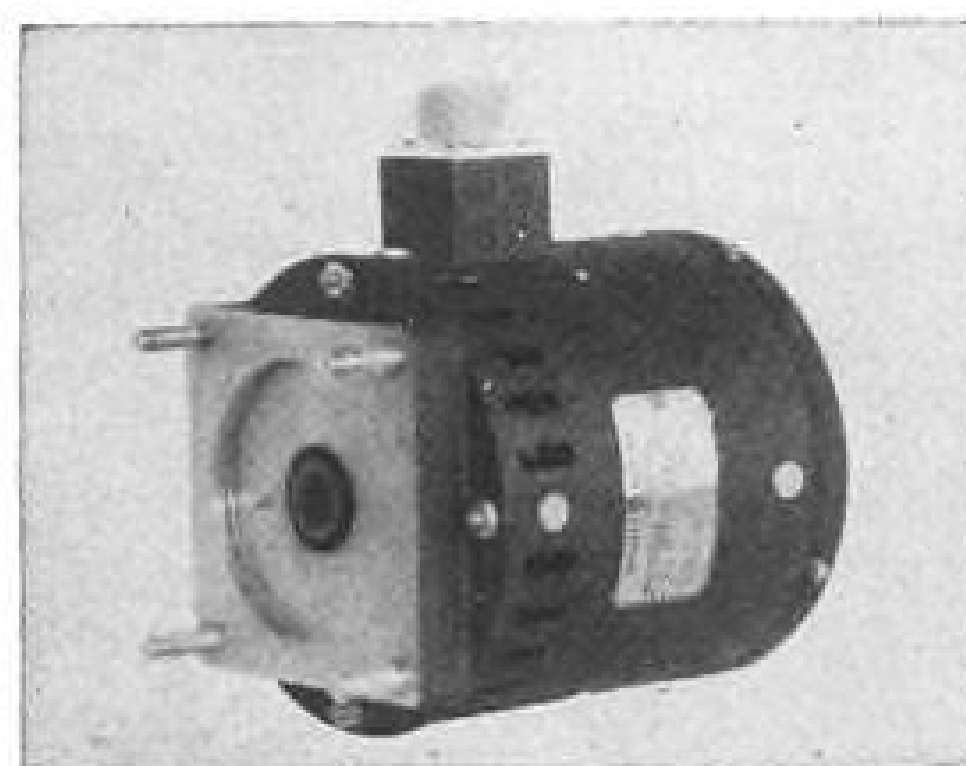
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## NEW AVIONIC PRODUCTS

### Components & Devices

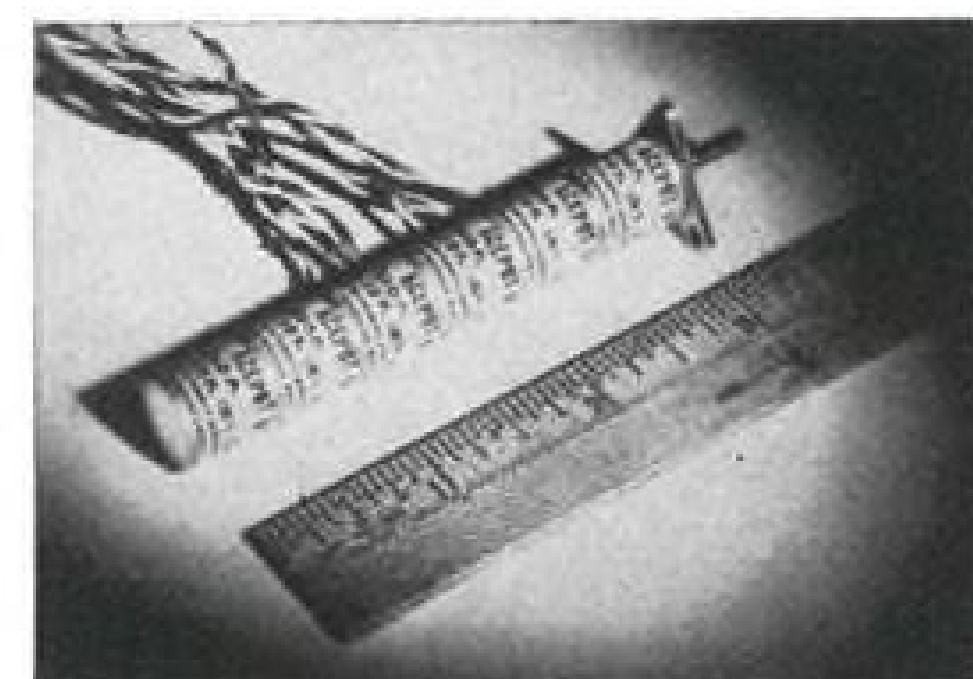
• Alternator (400 cps) for missile and aircraft use, is designed to withstand extreme environmental requirements for short duration. Unit is a three-phase, 115 v., wye-connected generator, with permanent magnet field, and can be



rated as high as 2,000 va. at unity power factor. Alternator weighs 15 lb., a figure which can be cut by substituting an AND 20001 mounting pad for the AND 10261 pad. General Electric Co., Specialty Component Motor Dept., Ft. Wayne, Ind.

• Thermal time delay, thermal type, Series H, available with delay intervals of  $\frac{1}{16}$  to 5 sec., has rapid recovery rate to permit recycling after only a few seconds. Units are available in standard operating voltages from 6.3 to 28 v., either d.c. or a.c. (any frequency). Time delay relay measures  $\frac{3}{4}$  in. dia. x  $2\frac{3}{8}$  in., comes in flanged or 7-pin miniature plug-in form, and weighs 1 oz. Contacts are SPST, either normally open or closed, rated 3 amps at 115 v.a.c. Relays are compensated for ambient temperatures of -70C to 100C. G-V Controls Inc., 28 Hollywood Plaza, East Orange, N. J.

• Sub-miniature gauged precision potentiometers, measuring only  $\frac{1}{4}$  in. dia., are now available with six or more wire wound pots. Unit is available in resistances of 200 to 100,000 ohms.



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AVIATION WEEK, October 10, 1955

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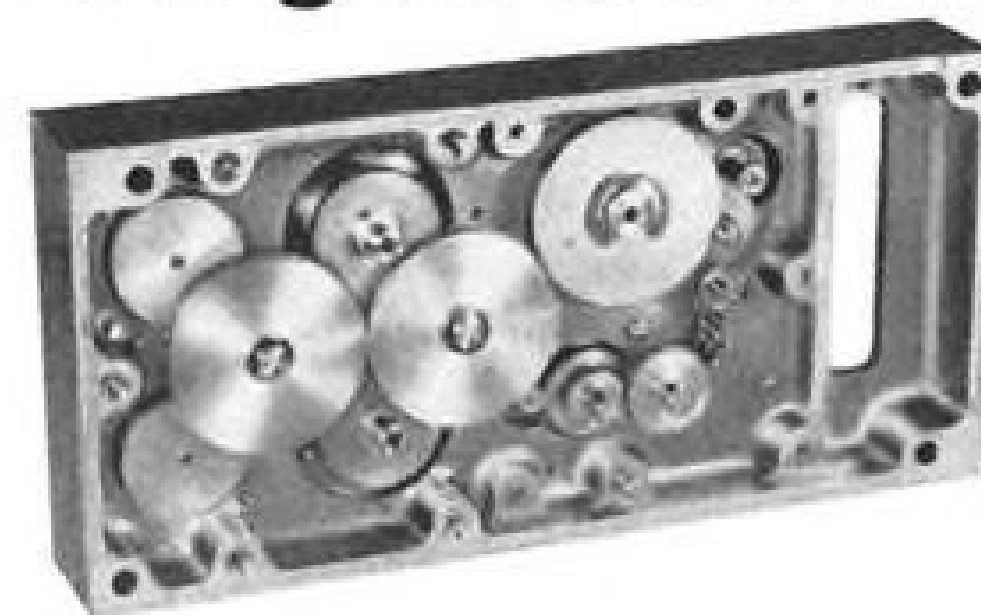




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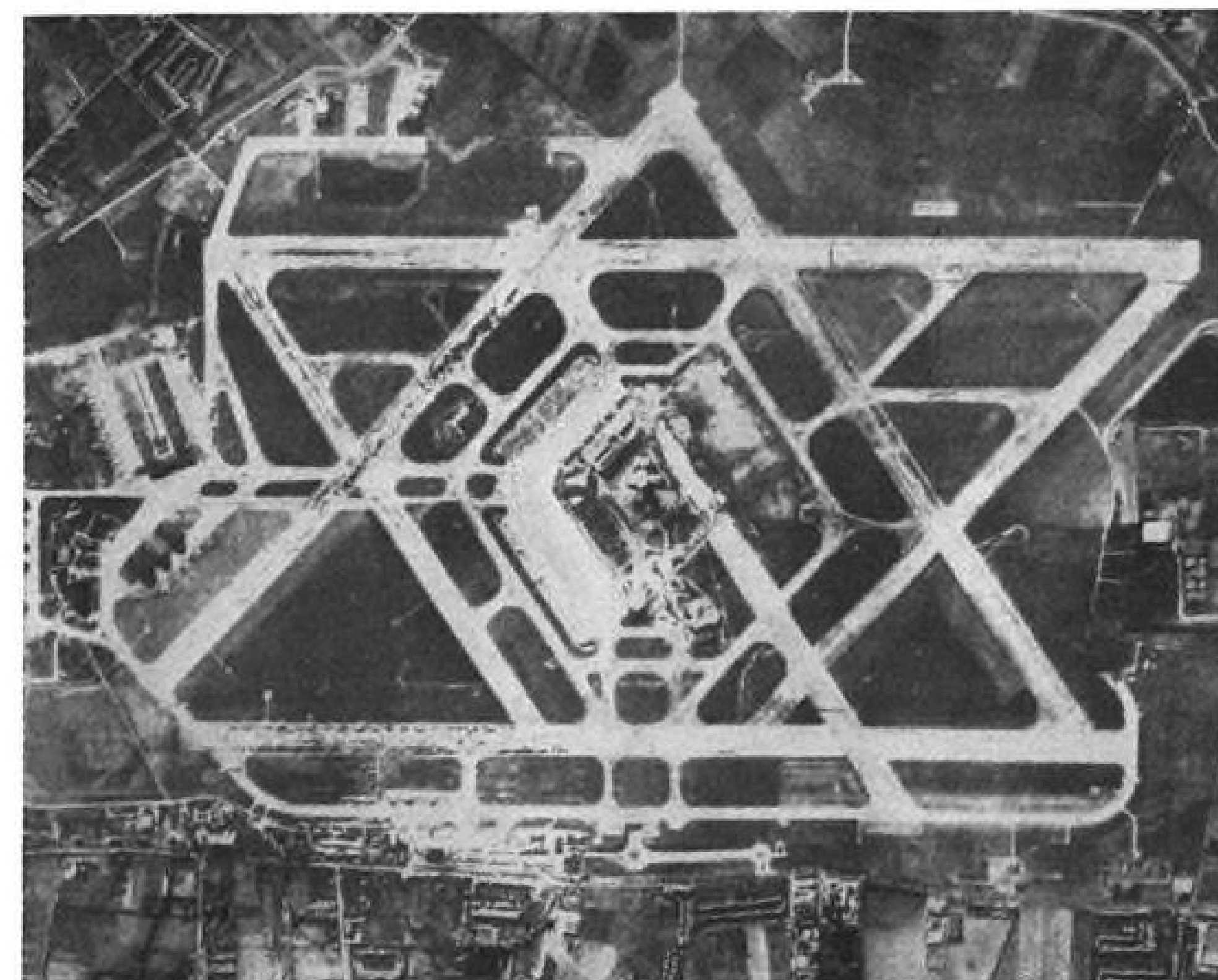
Satellite drawing courtesy Popular Science Monthly

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## AVIATION SAFETY



LONDON AIRPORT, where a BEA Viscount crashed into a ground barrier on takeoff.

### Poor Runway Markings Misled Pilot in Viscount Takeoff Crash

Report

Of the Public Inquiry Into the Causes and Circumstances of the Accident to the Viscount Aircraft G-AMOK on 16th January, 1955.

1. At approximately 11:50 a.m. on 16th January, 1955, a British European Airways Viscount aircraft G-AMOK, whilst taking off at London Airport in conditions of bad visibility due to fog, crashed into a barrier in its path erected in connection with construction work which was then, and for some time previously had been, taking place in the central area of the Airport.

The Captain and First Officer of the aircraft were both convinced before they commenced their takeoff that the aircraft was on Runway No. 6, also known as 15R, and they had received radio-telephone clearance from the Airport Control authorities to take off. In fact the aircraft was on a disused runway, which I will hereafter call "the strip," which had not been used as a runway since 28th June, 1949, when building operations in the central area caused it to be closed.

Although the aircraft was at the time of the crash into the barrier almost airborne and suffered considerable damage, there were most fortunately no casualties amongst either passengers or crew and indeed only relatively minor injuries to the Captain and one of the passengers.

2. The accident is therefore somewhat remarkable when compared with previous aircraft accidents which have been the subject of a Public Inquiry in that there is no doubt as to what happened; the major

question is—why did the accident happen? In investigating this it is necessary carefully to examine (i) the action taken by the Captain and First Officer, (ii) the action taken by the Control staff of the Airport and (iii) the layout of the Airport and the various facilities which it affords to the crew of a taxiing aircraft to find their way to the place ordered for takeoff.

Apart from these three main lines of investigation, each of which requires examination for the purpose of determining responsibility for the accident, the fact that such an accident could occur at so important and busy an airport led me and my Assessors throughout the course of the public hearing and after most carefully to consider all the evidence with a view to making recommendations to prevent any possibility of a similar accident of this type.

3. The ensuing paragraphs of this report fall into the following main sections:—

- A. Layout, markings and lighting system of London Airport.
- B. Ground control system.
- C. Narrative.
- D. Discussion of the cause of and responsibility for the accident.
- E. Questions and Answers.
- F. Recommendations.

#### A. LAYOUT, MARKINGS AND LIGHTING SYSTEM OF LONDON AIRPORT.

4. Since, as I have already said, the Captain and First Officer were convinced that their aircraft was in the right place when they began their take-off, it is clearly of the first importance to give a brief description of the various runways and taxi-ways at

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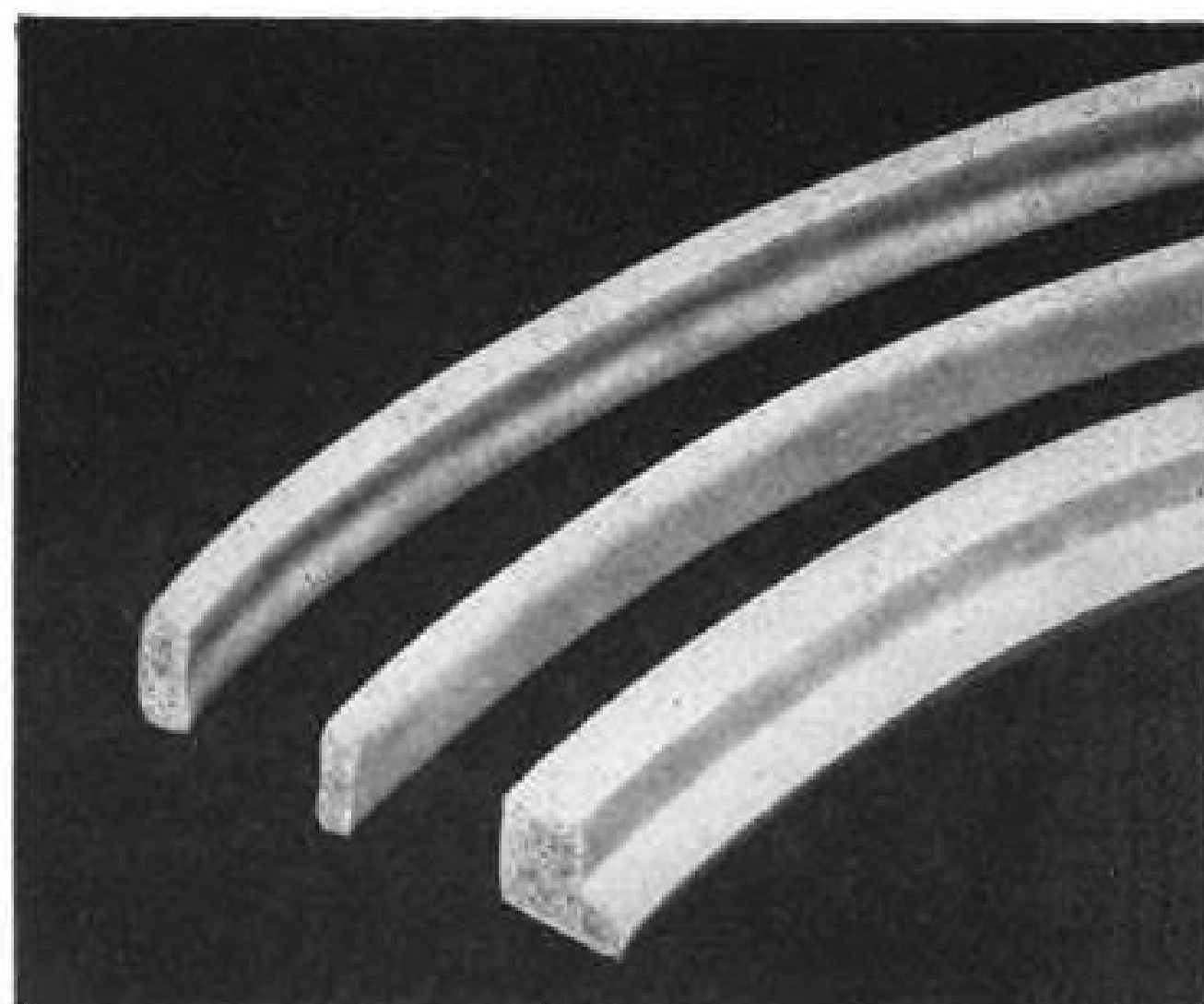
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## NEW PRODUCTS



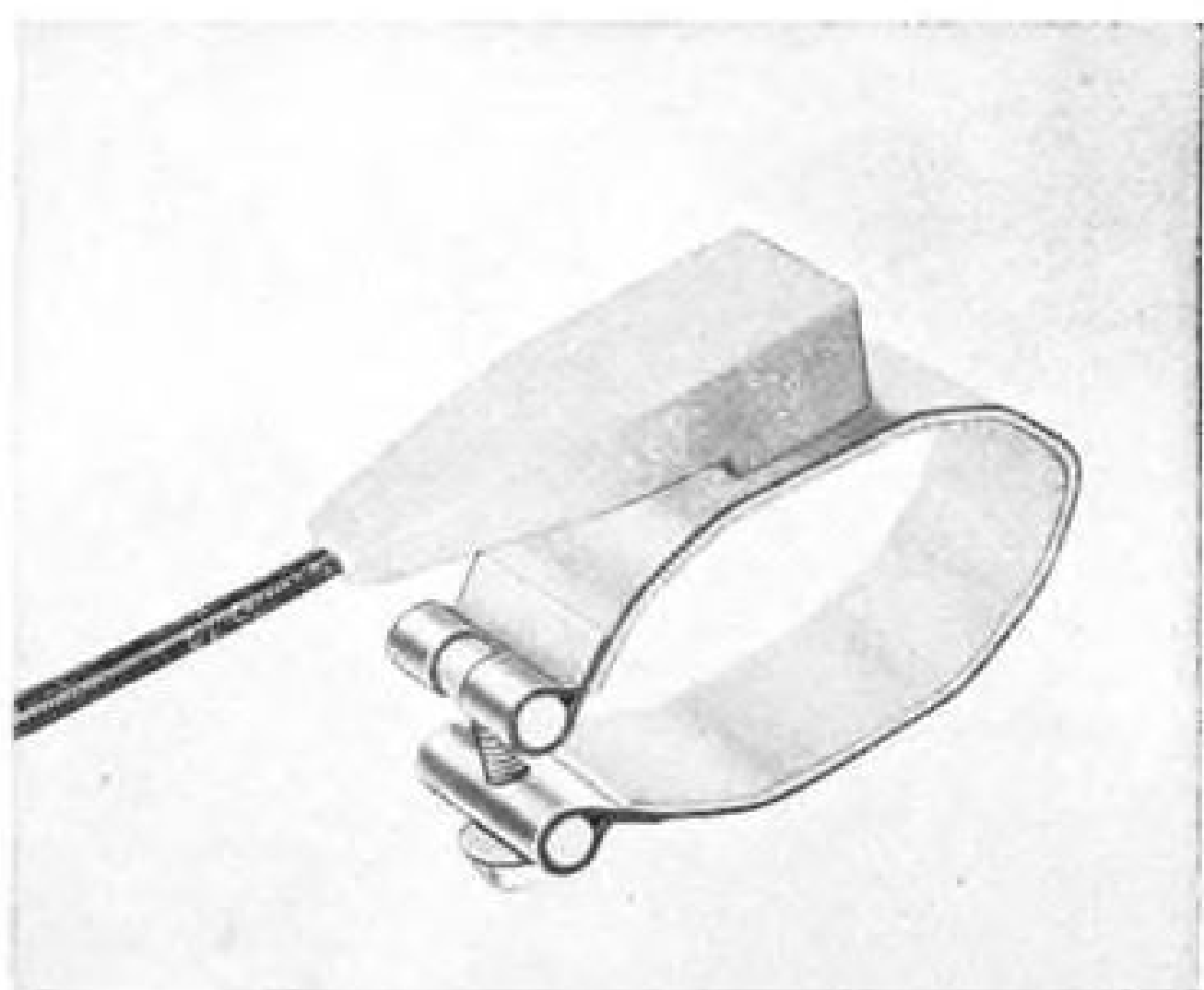
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A new White Silicone Sponge Rubber has been developed by The Connecticut Hard Rubber Company to meet increasing requirements for greater reflectivity. Known as COHRLastic 11489, it can be extruded in various shapes and lengths. This medium-firm white sponge has good compression set resistance at temperatures -100°F. to 500°F. and possesses excellent dielectric properties. Additional information available on request.



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London Airport and the facilities by way of marks, boards and lights to assist a pilot in finding his way about them.

The airport is one of the largest and busiest in the world and in consequence there is perhaps both a greater likelihood of a pilot losing his way at London Airport than at most other airports and also a consequentially greater need for clear directions to enable him to find his way. Moreover, the size of the airport may make methods used at smaller airports inapplicable. A further consideration is that London Airport has been ever since the war in the course of development which has not yet been completed.

In consequence, there was on the 16th January, 1955, a lack of uniformity about marks and direction signs, etc., which was to some extent inevitable in view of the rapid development of the Airport.

The description of the layout, markings and lighting set out below is of necessity somewhat complicated; this is, however, only a reflection of the factual situation prevailing at the airport at the time. I have had to consider to what extent this complexity and lack of uniformity can be said to have caused or have contributed to the accident and whether and to what extent it is desirable that changes should be made for the future.

5. London Airport was originally built for the R.A.F. to a heavy bomber standard and it was not until the end of the war that it was decided to adapt the aerodrome for use as the main civil airport for London. At the time when the airport was taken over for civil aviation there were three runways either completed or in the course of completion forming a triangle with its base running in an east and west direction parallel to and just south of the Bath road.

As part of the conversion to a civil airport it was decided (a) to superimpose upon the original triangle of runways a second triangle which would ensure there being two parallel runways running in each of the three directions of the original triangle and (b) to secure a greater length for the runways. The latter was done by an extension of the runway forming the base of the original triangle and one of the runways forming one of its sides and by building for the third side a new runway considerably further to the west running from north-west to south-east and parallel to the third runway constituting the original triangle.

Completion of this new runway and the prolongation of the two remaining runways constituting the original triangle made it unnecessary any longer to use the original north-west/south-east runway. Moreover development work upon the central area of the airport involved the obstruction and building upon part of the old runway. It accordingly ceased to be used as a runway on the 28th June, 1949.

On the other hand, the building and development work only took place on the centre portion of the old runway and those parts of it to the north-west and south-east of such work were of the same width and composition as runways in use at the Airport and also ran in the same direction as the new runway constructed further to the west. This disused runway is what I have called the strip and the accident occurred when the

Viscount attempted to takeoff in a south-easterly direction from near its north-western end. The general layout of the runways and taxi-ways of the Airport and of the strip as they were at the time of the accident is best appreciated by the aerial photograph, a copy of which is attached to this report as Appendix 1.

6. The six runways in existence at the airport at the time of the accident were known and referred to in two different ways. One method of distinction was to number the runways from 1 to 7 omitting number 3, which had been the number of the strip at the time when it was in use as a runway.

Another method, which is more generally used and particularly for the purpose of giving instructions to pilots either landing

or preparing to takeoff, is designed to distinguish the direction of the particular runway to which reference is being made. Under this nomenclature runways are numbered by a two-figure number which represents the first two figures of the magnetic compass heading of the runway. Thus a runway which runs due east and west magnetic, runs in a compass direction of 270° or 90° and such a runway under this system would be called, if one were proceeding from east to west, Runway 27 and, if proceeding in the opposite direction, Runway 09.

Since at London Airport there are two runways in each of the three directions, they have to be distinguished from one another; this is done by calling them Right

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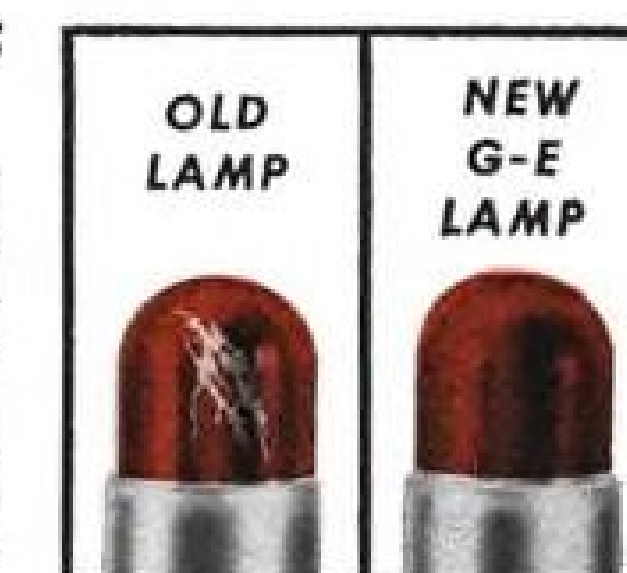
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Both lamps were scratched during installation. Old lamp (left) lets white light escape. G-E "Stained-Red" lamp doesn't.

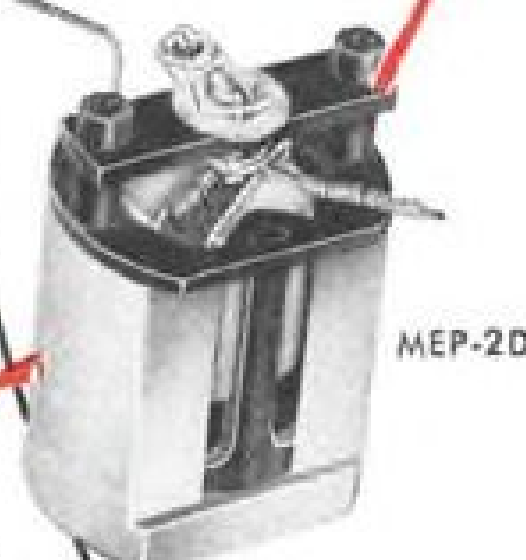
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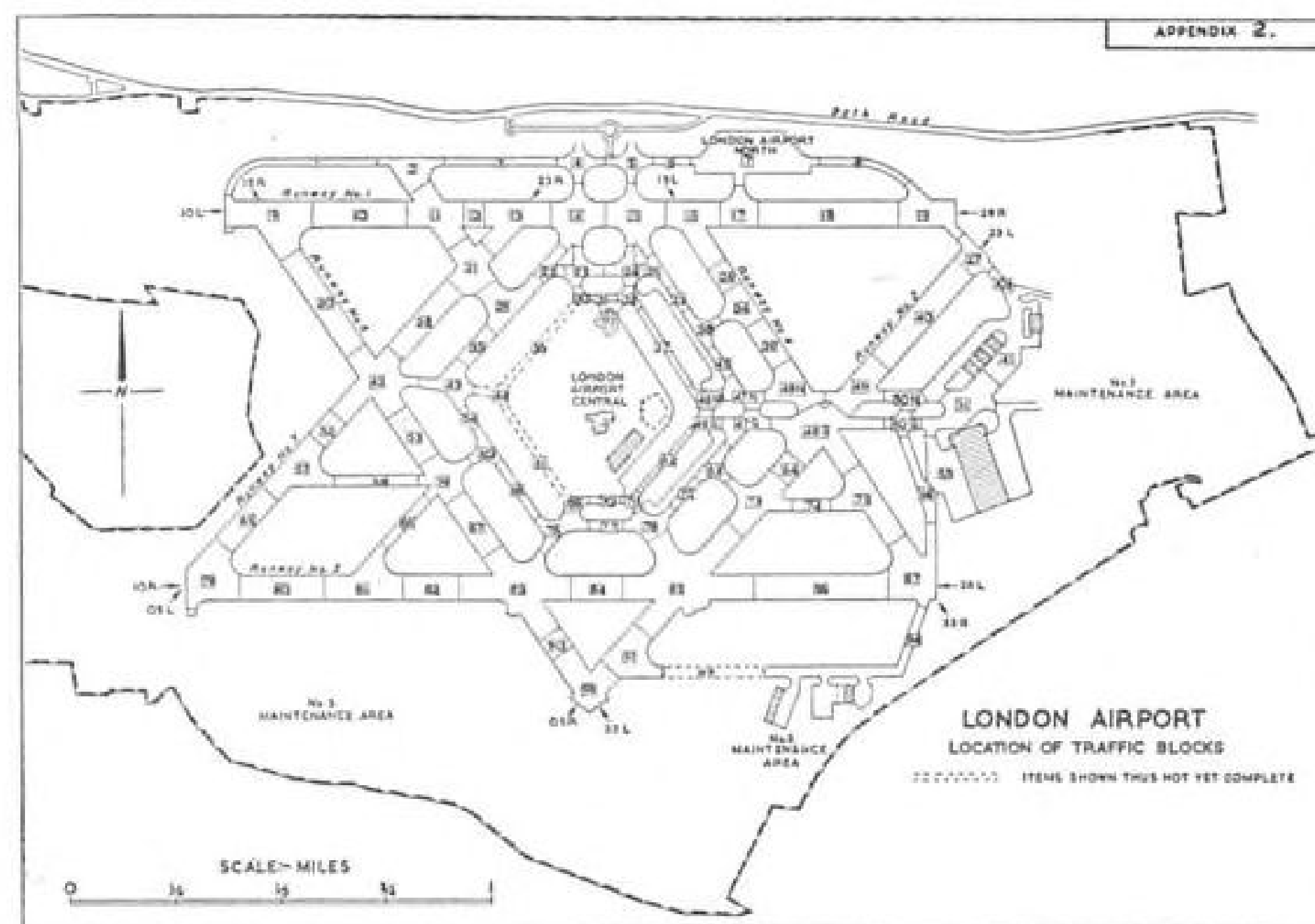
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or Left as seen from an approaching aircraft. The following table demonstrates the two systems of numbering at London Airport which I have described above.

Numerical Number	Direction	Compass bearing No.
Runway No. 1	East and West	28R/10L
Runway No. 2	North-east South-west	05R/23L
Runway No. 4	North-west South-east	33R/15L
Runway No. 5	East and West	28L/10R
Runway No. 6	North-west South-east	33L/15R
Runway No. 7	North-east South-west	05L/23R

A small plan of London Airport showing both systems of numbering as well as other details to which I refer below is attached to this report as Appendix 2.

7. The length of the runways at London Airport is in the region of 7,000 ft. and thus affords very ample room for the takeoff and landing of Viscount aircraft. Each of the runways is 300 ft. wide (save two which are 250 ft.) and is constructed of square concrete slabs. The taxi-ways are similarly constructed of concrete slabs but are only 125 ft. wide. So far as dimensions and construction go, the strip corresponded to the runways and not to the taxi-ways; it was, like Runway 15R, 300 feet wide.

8. Various methods are employed at London Airport for distinguishing the runways and assisting pilots in finding their way about the airport. There are in addition certain objects and signs at the airport not intended for the purpose of giving directions but which, nevertheless, could in certain circumstances be used to assist in identifying one's position.

I will deal with these matters under the headings of (i) marks on the ground, (ii) notice boards and sign posts, (iii) lights, (iv) other objects of identification.

9. Marks on the ground. There were at the material time no painted marks of any kind upon either the strip or any of the taxi-ways. On the other hand there was a variety of marks painted upon some of the runways as follows:

(a) Runway designation marks, also called QDM marks. At the time of the accident these marks, consisting only of the compass heading designation of the runway in large letters, were painted at the beginning of Runways 10L and 10R/28L.

(b) Runway threshold markings, also known as threshold strips. These markings, consisting of a number of parallel white lines 100 ft. long, were only painted at the beginning or thresholds of runways 10R and 28L.

(c) Runway centre line marking. A broken centre line of white paint appeared only on the two East/West runways namely 28R/10L and 28L/10R.

(d) White crosses. At the time of the accident there were no white crosses painted on the surface of any of the runways or taxi-ways or upon the strip. A white cross had been painted upon the strip just south of its intersection with Runway 28R/10L when the original runway was closed on the 28th June 1949, but it had subsequently worn out as a result of contractors' vehicles using the strip and it had never been re-painted. The white cross had consisted of arms not less than 20 ft. long and 3 ft. in width.

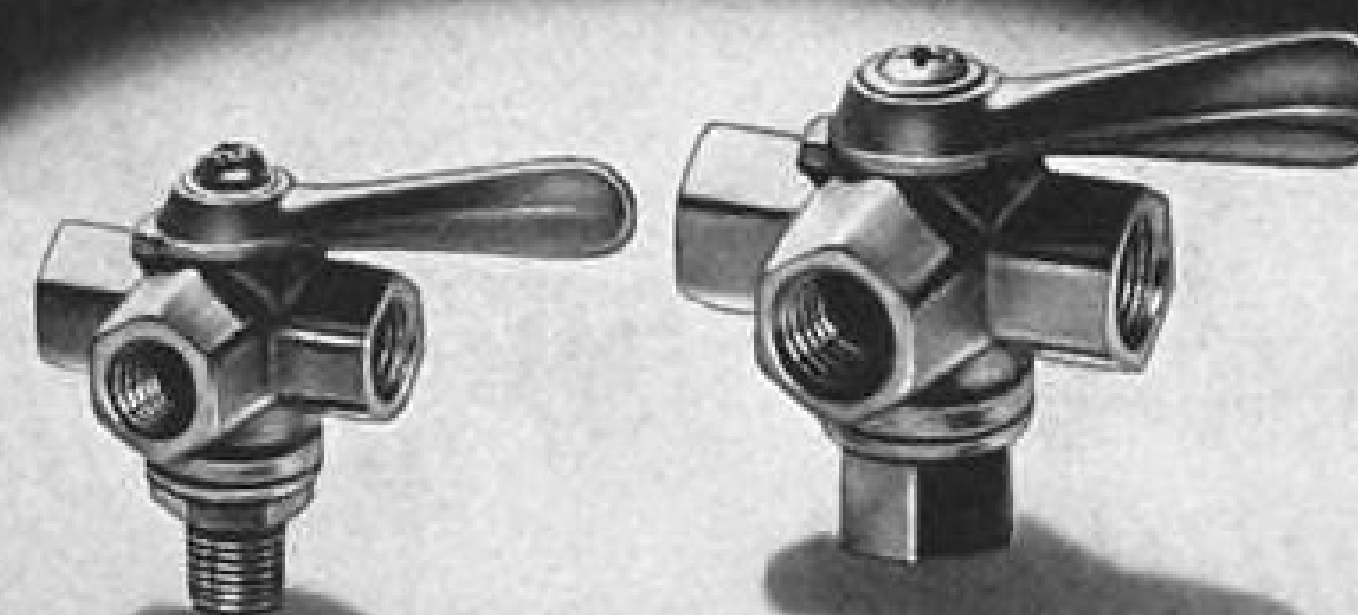
10. Notice boards and sign posts.

(a) Daylight route indicators. These consisted of boards at the side of runways or taxi-ways containing arms indicating various directions open to a pilot passing the board, somewhat similar to the boards which appear on the roads shortly before a junction as an indication to motorists. The appropriate arm on the daylight indicator board is intended to be illuminated so as to indicate to the pilot the direction that he is to follow.

These daylight route indicator boards are popular with pilots and readily understood by them, but at the time of the accident the completion of the erection of these boards and their electrical equipment was far from complete and none was available to show those in the Viscount the right way to take on the morning of the accident.

(b) Position indicator or block num-

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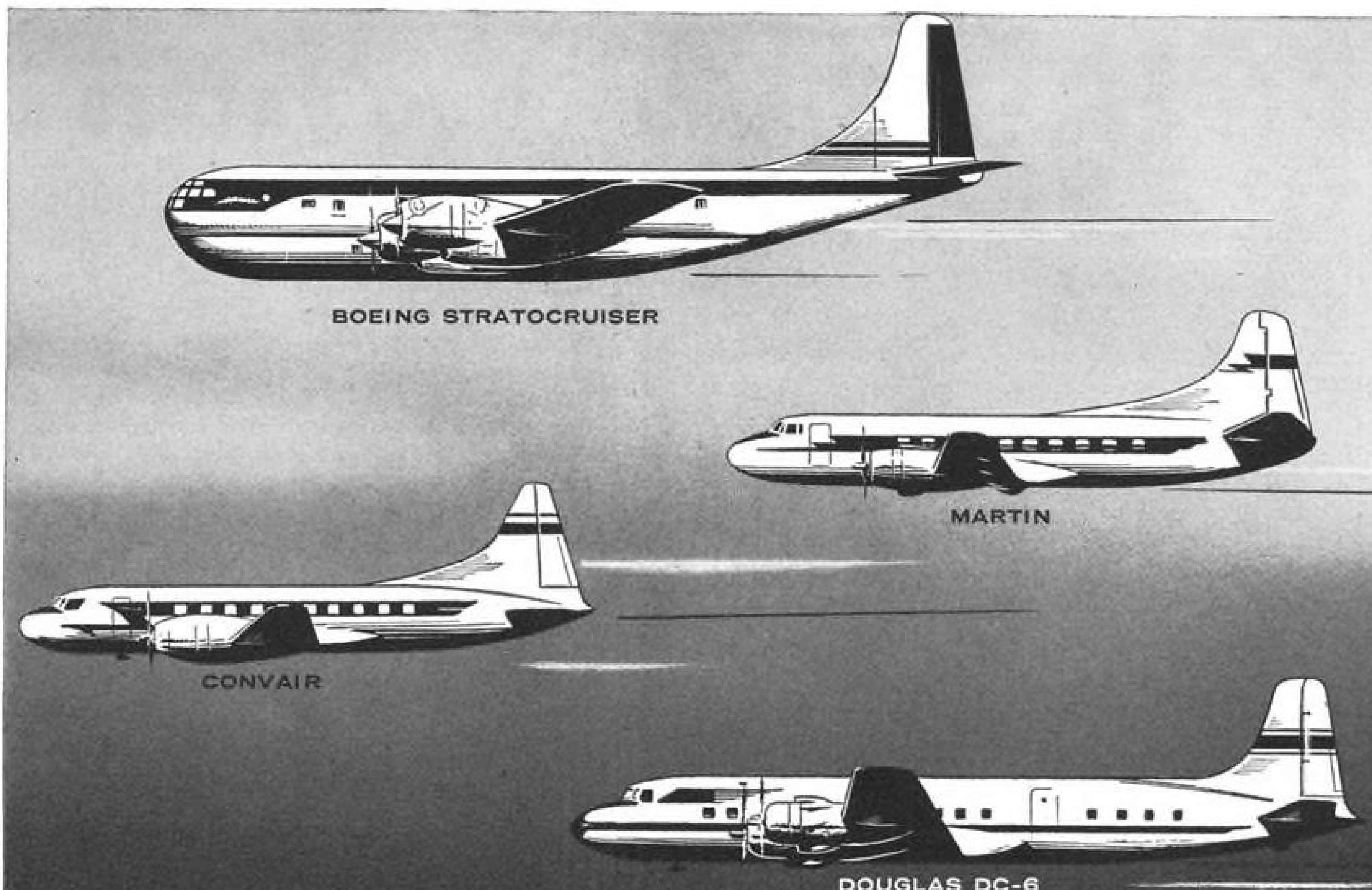
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ber boards. The whole of the operational part of London Airport including taxi-ways as well as runways has been divided up into blocks, each of which has been given a number. Small boards at the side of the runway and taxi-ways indicate the boundary between one block and the other by showing on their face the numbers of the two blocks in question. The division into blocks is clearly shown in Appendix 2 (see page 74).

The block number boards are relatively small, the numbers thereon being slightly larger than the route numbers on a London omnibus. The system of dividing the operational part of the airport into numbered blocks and the use of block number boards is apparently peculiar to London airport and is an extremely useful way of readily identifying a particular portion of the surface of the Airport.

(c) QDM Boards. These are large boards at the side of a runway indicating that one is shortly approaching another runway by showing in large figures the compass heading number of the new runway. At the time of the accident these existed in every case at the side of each runway shortly before the intersection or junction with another, except in the case of the junction of Runways 28R and 15L.

(d) Run-up boards. These are notice boards at the side of runways shortly before an intersection or junction with another runway indicating by words such as "Run-up for 15R" in large letters and figures that the position has been reached at which aircraft about to use the runway ahead should stop for the purpose of running-up their engines.

At the time of the accident run-up boards bearing clear and consistent words and figures were in position in all appropriate places at the Airport, except at the junction of Runway 28R with 15L where an old run-up board bearing the phrase "Run-up 1" was in existence. In some cases, however, there were run-up boards on both sides of the runway and in some cases only on one side.

### 11. Lighting system.

For the purposes of this report it is only necessary to deal with three different categories of lighting.

(a) Taxi-way lights. These are omnidirectional lights let into the surface of the concrete and were present both in the runways and the strip. Their purpose is to guide aircraft to or from a particular position on the airport. The lights are 80 ft. apart on straight stretches and more closely together at the curves. So far as the runways are concerned these lights are not placed at the centre of the runway but are closer to that side which is nearer to the central area. The lights are so placed that if an aircraft straddles them it will be able to proceed in safety.

(b) Stop bar lights. The division between each of the blocks into which the operational part of the airport is divided is capable of being illuminated by red stop bars, which are similarly let into the surface of the concrete. In the case of taxi-ways the red lighting proceeds in an unbroken line from one side to the other, but in the case of runways the red lighting is broken

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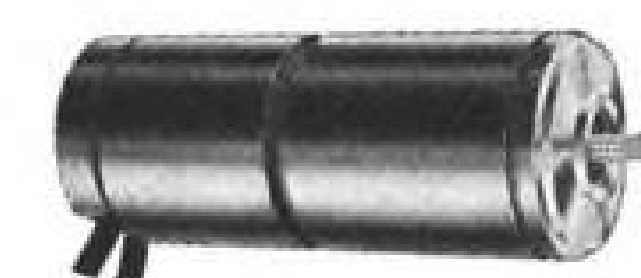
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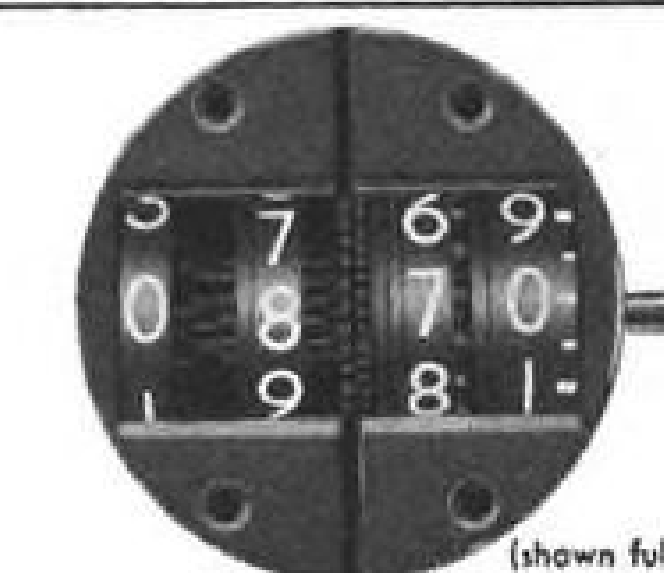
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towards the centre so as not to interfere in any way with the nose wheel of aircraft landing or taking off.

At the time of the accident the taxi-way lighting was fully installed and capable of being used as desired. It provided a clear indication when switched on at night and also in day time during a dark fog. In the case of bright sunshine or fog accompanied by bright light the green taxi-way lighting was not obvious, though it could be seen if specially looked for.

The installation of red stop bar lighting had not been completed at the time of the accident and it was only in use at night time. The system is designed so that the green taxi-way lights and the red stop bars can be used in conjunction, the former indicating to a pilot the way he has to go and the latter both protecting his route from others and also serving the secondary purpose of keeping him on the way indicated by the green taxi lights.

(c) **Runway lights.** These are a double row of lights let into the concrete of the runways and shining up and down the runway only. Their use was and is for the assistance of pilots taking off and landing in darkness or in conditions of poor visibility. At the time of the accident all runways were equipped with these lights except Runway 15L/33R. There were no such lights on the strip.

12. At the beginning of the runways at London Airport and some 70 yards to one side of their edge is a hard standing place for what is called the Runway Controller's caravan. This caravan is moved from the beginning of one runway to another in accordance with the decision of the Airport authorities from time to time as to which runway is to be used.

13. In addition to the above, information regarding the various runways and taxi-ways at London Airport is published from time to time for the use of aircraft operators and their pilots.

Captain Waits and First Officer Barratt had available to them in their aircraft a publication issued by International Aeradio Limited (known as "the Aerad"), which on one plan, called the Landing Chart, indicated the direction and compass heading numbers of the runways at London Airport as well as showing the strip and the taxi-ways, and on another plan, called the Traffic Blocks Plan, showed the system of block numbering to which I have previously referred.

### B. GROUND CONTROL SYSTEM

14. No aircraft at London Airport is allowed to move along the taxi-ways or runways unless prior approval has been obtained from the appropriate controller.

For the purposes of this report I can limit myself to a short description of the control exercised on aircraft on the ground by two controllers called the Ground Movement Controller and the Aerodrome Control Officer (Air). They are assisted by information obtained by them from the Runway Controllers at the runways in use at the particular time. The Ground Movement Controller and the Aerodrome Control Officer (Air) at the time in question worked side by side in the old control tower to the north of Runway 1 and just south of the Bath road; they now work in similar

proximity in the new control tower.

The Ground Movement Controller (subsequently called the "Ground Controller") is responsible for the control of taxiing aircraft and also that of directing aircraft and all vehicles on the movement area. His colleague, who is generally known for short as the "Air Controller", has the duty of controlling the takeoff and landing of aircraft. When conditions are good he has also more extensive duties in relating to landing aircraft, but on the 16th January at the time in question all landings were instrument landings and the Air Controller was in consequence only concerned with approaching aircraft when they had become the next to land.

15. Each of these two controllers is in radio-telephonic communication with air-

craft. Each uses a different radio frequency and is not able to listen in to the frequency of his colleague.

In the case of aircraft proceeding to a take-off position it is, in the case of piston-engined aircraft, the duty of the Ground Controller to direct the aircraft and control it during its passage from the parking area to the run-up point for the runway in question. If the approach of the aircraft to the run-up point necessitates the crossing of a runway in use, the Ground Controller will not allow the aircraft to cross such runway until he has received permission from the Air Controller.

In case of piston-engined aircraft, the Ground Controller will normally hand over the aircraft to the Air Controller once it has reached the run-up point. It then be-



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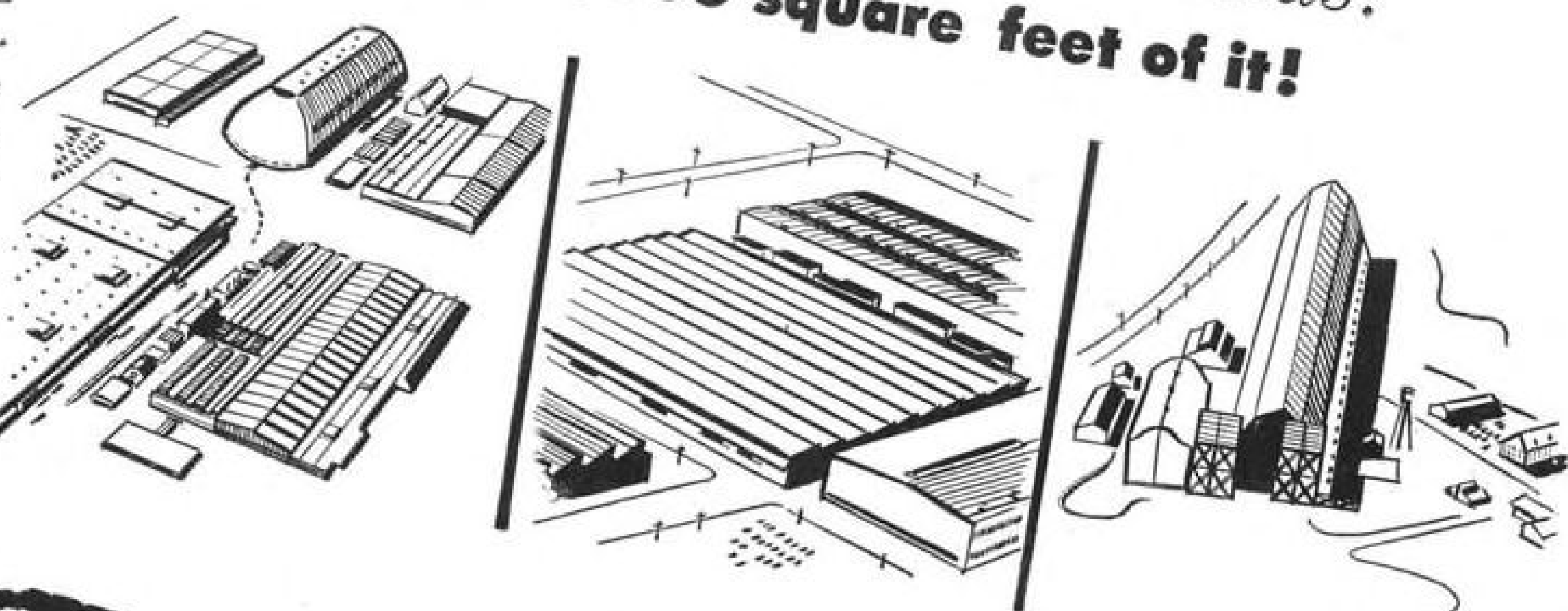
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comes the duty of the Air Controller to take the aircraft to the take-off point and in due course give it clearance for take-off.

16. A difference of practice, of some importance in this Inquiry, obtains in the case of turbine-engined aircraft since these require a much shorter period for running up their engines before taking-off than do piston-engined aircraft and lengthy running of turbine engines on the ground is to be avoided because of the uneconomic consumption of fuel thereby entailed. Accordingly in the case of turbine-engined aircraft it has been the practice for the Ground Controller to hand such aircraft over to the Air Controller whilst the aircraft in question is approaching what for a piston engined aircraft would be the run-up position.

The object of this difference in practice is to avoid unnecessary delay to turbine-engined aircraft, which will, if at all possible, in consequence not pause at the run-up position but proceed straight to the take-off point and there do any necessary running up of their engines.

17. In the case of its being necessary for a taxiing aircraft to cross a runway in use, not only is permission sought by the Ground Controller from the Air Controller before the crossing is permitted but, once such permission has been given, the Air Controller places a strip marked "Runway Obstructed" across the plan of the runway on the board in front of him so as to ensure that he should not by any oversight give clearance to an aircraft to takeoff or land before the taxiing aircraft has completed the crossing.

18. Assistance to the Ground and Air Controllers in the control tower was and is provided in certain circumstances by the Runway Controller in his caravan at the beginning of each of the runways in use at any particular time.

The Runway Controller's caravan is connected by three radio-telephone loudspeakers to the circuits of the Ground Controller, the Air Controller and the Ground Controlled Approach. He is also connected by telephone to the control tower and to the switchboard of the Airport. His duties are to log the time of aircraft taking-off and landing, to see that runways in use are kept clear and that there is nothing amiss with aircraft passing him to take off or about to land.

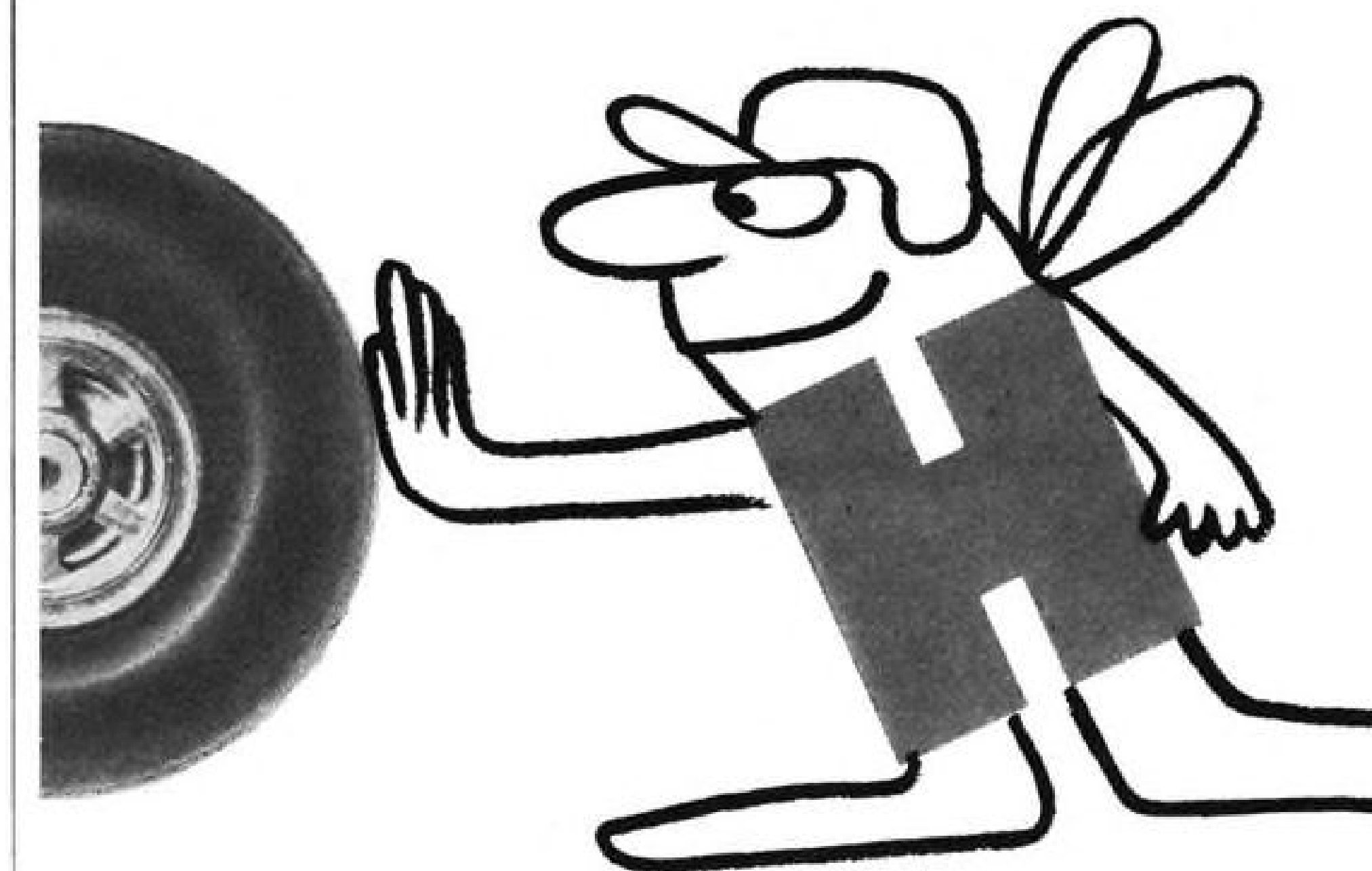
When visibility is bad the duties of the Runway Controller are increased and also become of much greater importance since, in addition to his duties in clear weather which remain, he has the additional task of calculating the runway visual range by reference either to the marks situated at the sides of the runway, to which I have already referred, or to lights and flares situated at certain fixed distances along the side of the runway in question. The duty of calculating the runway visual range falls upon the Runway Controller whenever visibility falls below 1200 yards and he has to report any change in runway visual range by telephone to the Control Tower.

It is worthy of note that the practice of using Runway Controllers as described above, which is often of value as an additional safeguard, is, I understand, only followed at United Kingdom airports.

C. NARRATIVE

19. The Viscount in question was re-

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ferred to and known by the last two letters of its registration number, namely, Oboe King, and I will accordingly refer to it as such in my description of what took place on the 16th January, 1955. On that day Captain E. J. Waits was detailed to act as captain of Oboe King on flight No. BE130 to Rome and Athens and subsequently on to Istanbul, with departure time at 10 a.m. Captain Waits had been employed as a captain by British European Airways since April 1946 and had had approximately 7,800 flying hours of which 1,150 had been on Viscount aircraft.

20. First Officer R. S. Barratt was detailed as first officer on the flight in question. From 1946 to 1950 he had been employed by Skyways as a Captain. He had joined British European Airways in January, 1951, as a first officer and had had 7,860 hours flying experience at the date of the accident of which 995 hours were on Viscount Aircraft. Both Captain and First Officer held valid Air Line Transport Pilot's Licences.

21. Captain Waits and First Officer Barratt went to their aircraft some 50 minutes before the scheduled time for take-off in order to carry out the necessary checks and Captain Waits decided, and informed First Officer Barratt of his decision, that the First Officer would pilot the aircraft on the first leg of the journey to Rome. This is a system frequently adopted in aircraft operated by British European Airways and is approved by the operator not only because it affords a method of giving handling experience to first officers, who are potential captains, but also because the Captain can more readily monitor the operation of the aircraft.

22. Visibility was too bad for Oboe King to attempt to takeoff at the scheduled time and it was not until about 11:20 a.m. that there was sufficient visibility on the runways for the Captain to consider moving Oboe King from the parking place, which was in block 18 at the extreme east end of Runway No. 1 or 28R. Captain Waits, being in radio-telephonic communication with the Ground Controller, heard the periodical statements issued by him of the runway visual range at each of the two runways in use that morning, namely Runway No. 6, or 15R, and Runway No. 5, or 10R.

The minimum runway visual range laid down by British European Airways as required for a Viscount to takeoff at London Airport was 150 yards, this being considered the minimum necessary to enable a pilot to keep his aircraft on a straight course when moving along a runway to takeoff. At 11:23 Captain Waits informed the Ground Controller he would like to start if the then runway visual range of 150 yards was maintained and at 11:33 Oboe King was given permission to and did start its engines.

23. Shortly after this Captain Waits informed the Ground Controller that he wished to use Runway 15R and this was approved. He had only once previously taken off on that runway, but chose it on this occasion since he was late and it was the nearer of the two runways in use. There was also some indication that it had the better visibility. He then received his airways clearance, or initial routing instructions, for Rome and at 11:38 a.m. received permission to taxi west along Runway 28R to

### FASTENER PROBLEM



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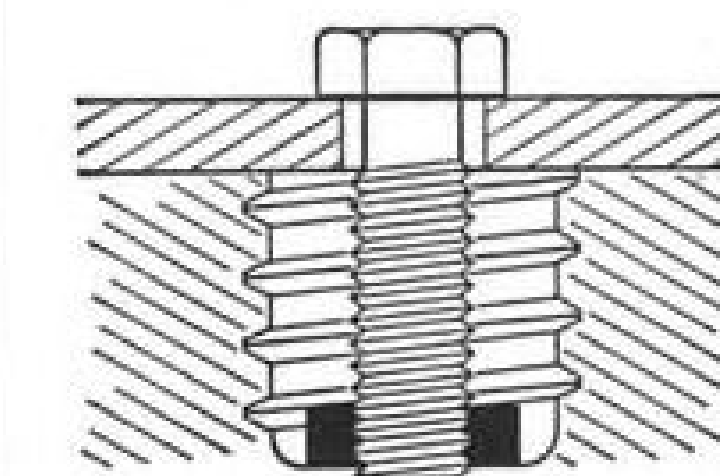
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2409	10	1 3/16"	Flange	.13	9,000	2.3	18	18	Hi Temp application
2155	10	31/32"	Synchro	.24	4,800	4.5	52	52	
2162	10	31/32"	Synchro	.24	4,800	5.5	26	26	
2201	10	31/32"	Synchro	.24	5,000	5.2	26	52	
2442	10	1.156"	Synchro	.13	10,000	3.2	18	18	
3009	10	1.156"	Synchro	.13	10,000	2.5	18	54	1400 OHM cont. ph. Z
3040	10	.975"	Synchro	.149	10,000	2.6	18	54	1400 OHM cont. ph. Z
3053	10	.975"	Synchro	.15	10,000	2.8	18	18	
3185	10	.968"	Synchro	.3	8,000	6.2	26	26	avail. up to 125°C
2156	.960" OD	.965"	Synchro	.15	8,000	5.	27.5	14	125°C
2307	1" OD	1.5"	Synchro	.25	10,000	10.	115	115	
3188	1" OD	1.611"	Flat	.35	10,000	12.6	115	115	
3199	11	1.703"	Synchro	.63	8,200	7.	115	115	Mark 14 Mod O
3151	15	1.312"	Flange	.45	5,000	5.8	26	50	
3148	15	1.640"	Synchro	1.45	4,800	12.2	115	115	Mark 7 Mod O
2287	15	1.640"	Synchro	1.45	4,800	12.2	115	115	avail. up to 150°C
3159	15	1.640"	Synchro	1.45	4,800	12.2	115	230	
3271	15	1.640"	Synchro	1.0	10,000		115	115	
3272	15	1.640"	Synchro	1.0	10,000		115	230	
3273	18	2."	Synchro	2.35	4,800	18.4	115	115	
3217	18	2."	Synchro	2.35	4,800	18.5	115	282	
3270	18	2."	Synchro	1.4	9,800	18.0	115	115	
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the holding position for Runway 15R.

The Ground Controller at the same time asked Captain Waits to let the Controller know as a check when Oboe King passed the Control Tower and when it was clear of Runway 23R. The Control Tower would have to be passed to starboard at a distance of some 300 yards, whilst Runway 23R would have to be passed to port some 500 yards beyond the Control Tower.

24. Captain Waits and First Officer Barratt, who had never previously taken off from Runway 15R, consulted the Aerad they had on board in order to ascertain their route to 15R before moving off from their parking place. They observed that they simply had to proceed straight for the full length of 28R in order to arrive at 15R. The pages of the Aerad which they consulted showed the various turnings off 28R in the course of its length, including Runway 23R and the strip.

There was no clear indication on the plan that the strip was not in use and none that it was obstructed at any point in its length.

The Aerad was kept open between Captain Waits and First Officer Barratt in the cockpit whilst Oboe King taxied to its assumed takeoff position, but it was never again consulted by either of them. Neither pilot attempted to count from the Aerad the turnings that would have to be passed before the end of Runway 28R was reached so as to be able to check the number as the aircraft passed them.

25. First Officer Barratt at the controls concentrated on keeping the aircraft on the centre line of the runway. Captain Waits also had a close regard to this, but also noticed green taxi lights cross his path from starboard to port and lead off down Runway 23R. He saw no other green taxi-way lights and First Officer Barratt noticed none at all.

I am satisfied that the green taxi-lights leading to the end of the runway were switched on at the time and could have been seen after the junction with 23R had Captain Waits or First Officer Barratt been concerned to pick them up.

Captain Waits was able to see the Control Tower as he passed it and reported this as requested. He next reported passing Runway 23R as he had also been requested.

26. The distance from the edge of the concrete at the entrance to 23R to the nearest edge of the concrete at the entrance to the strip is only some 150 yards, whereas the distance from the same edge of 23R to the end of Runway 28R is about 1100 yards.

Notwithstanding this, both Captain Waits and First Officer Barratt when they came to the junction between the strip and Runway 28R thought they had come to the end of the latter.

They both thought they saw ahead of them the end of the concrete, they saw something which so far as width and surface were concerned appeared to be a runway on their port side, and they observed that its magnetic heading was 150°. They both accordingly felt quite sure they had reached 15R and Oboe King was swung round to port so as to be ready to takeoff. No steps were taken by either pilot to check their position although they did observe a block number board on their port side, the number on which they could not read as it was edge-ways on to them.

At the time in question, the fog was ex-

tremely dark and the conditions were such as Captain Waits had never before experienced. Apart from a military transport operation in wartime First Officer Barratt had never takenoff in similar conditions without the aid of lights. There were no lights, whether taxi-way or runway, showing on the strip at the time.

27. Shortly before reaching its position on the strip Oboe King, pursuant to the practice with turbine-engined aircraft already mentioned, was passed over from the Ground to the Air Controller.

At 11:43 the pilot reported to the latter as being in the holding position on Runway 15R whereas in truth the aircraft was on the strip.

Runway visual range had then deteriorated to 100 yards on 15R so Oboe King had to await an improvement. Whilst taxiing to this position Captain Waits had heard conversations between Ground Control and a Trans-Canada Constellation which, owing to bad visibility, was returning from Runway 10R to the parking place via Runway 05L, which in the reverse direction is 23R and crosses the strip towards its north-eastern end.

At 11:45, whilst waiting in position at the strip, Captain Waits thought he saw the Constellation and reported to the Air Controller that he saw it cross the takeoff end of 15R and enter 10L, i.e., cross in front of Oboe King and turn to the right in the direction of the parking place from which Oboe King had come.

In fact Captain Waits did see the Constellation, but he saw it at the intersection of Runway 23R and the strip and not at the

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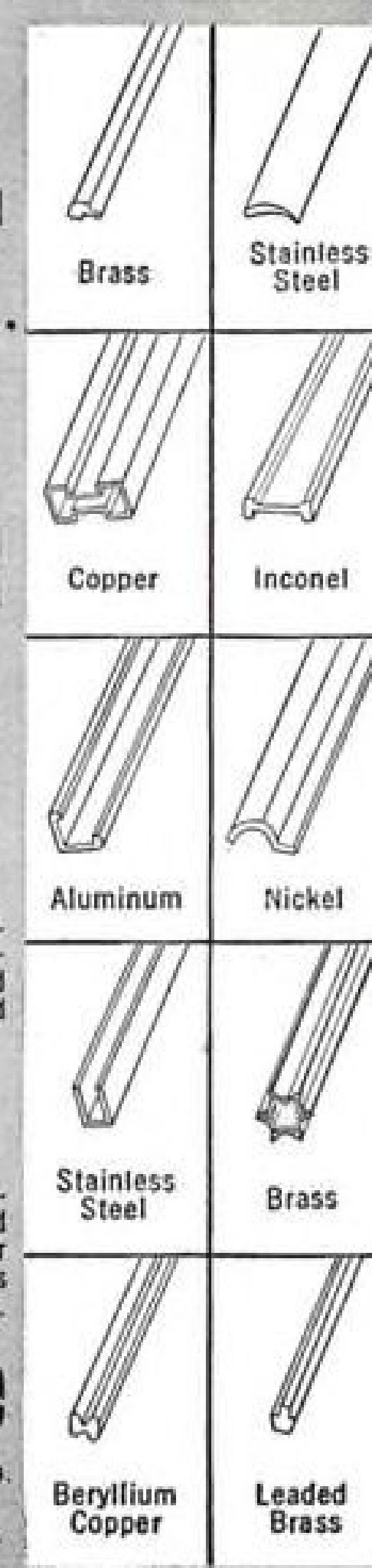
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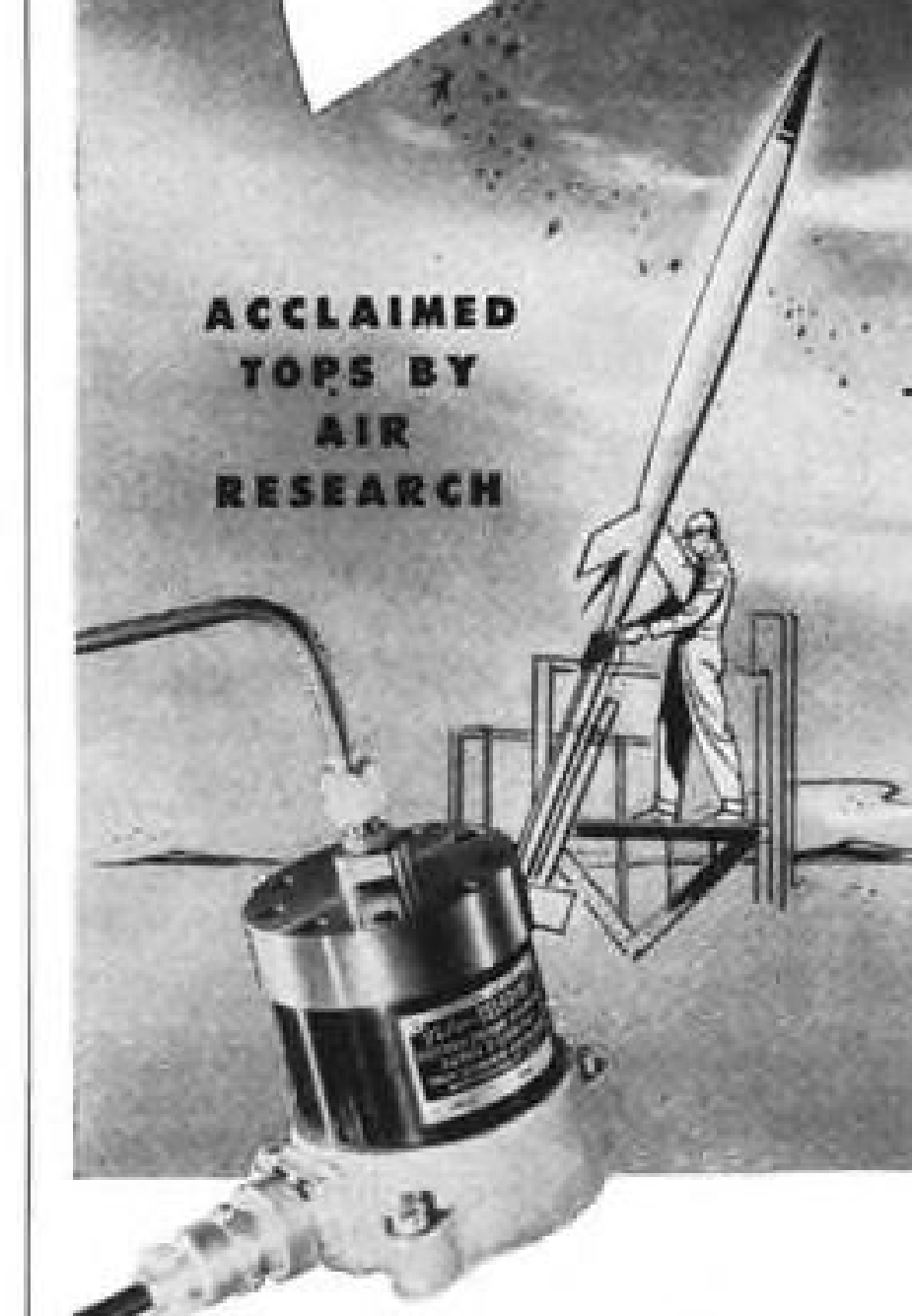
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intersection of Runway 23R with Runway 15R at the beginning of which Captain Waits thought he was.

I discuss later whether these messages about the Constellation should have indicated to the control officers that Oboe King was not in fact where it had been reported as being.

28. At 11:48 runway visual range on 15R was reported as 200 yards and Captain Waits requested clearance to takeoff which he was given. He was told the runway was clear and that there were no other taxiing aircraft. He then commenced his takeoff along the strip and when about to become airborne crashed into the barrier.

Between starting to move down the strip and the moment of the crash the Air Controller asked him whether he was some distance down 15R and was told that he was "rolling" about 200 yards down 15R. This request by the Air Controller had been prompted by a telephone call to him from the Runway Controller at the beginning of 15R, who could not see Oboe King, but who from the sound of its engines had thought it was some way down Runway 15R, possibly at the intersection with Runway 23R.

I will discuss later whether the Runway Controller should have suspected there was something amiss any earlier. The action that he took when he took it was too late to have prevented the accident.

29. The Runway Controller heard the sound of the crash and reported this to the Air Controller at once. The alarm was immediately given, but since no one at the time knew Oboe King had taken off on the strip and vision was obscured by the fog, the rescue teams were originally given inaccurate directions. In consequence they did not reach the scene of the accident until some ten minutes later. I am satisfied that no one is to blame for this delay.

### D. DISCUSSION OF THE CAUSE OF AND RESPONSIBILITY FOR THE ACCIDENT

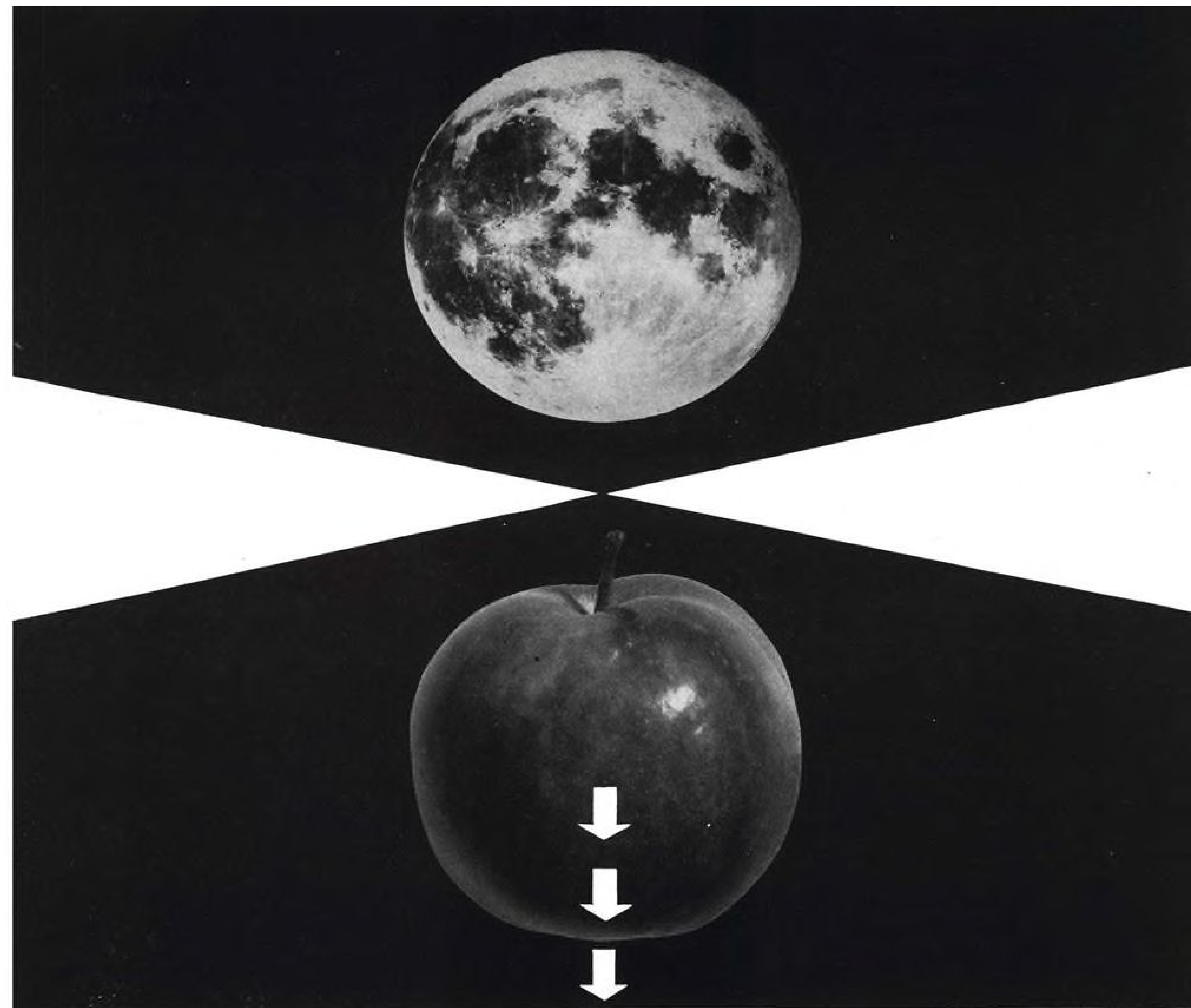
30. In the course of the Public Inquiry it became clear that the cause of and responsibility for the accident could only rest in whole or in part with (a) Captain Waits or Captain Waits and First Officer Barret (b) the Ground or Air Controller on duty at the time or both of them (c) the Runway Controller on duty at the beginning of runway 15R and (d) the Ministry of Transport and Civil Aviation as owner of the airport.

I will consider each of these possibilities in turn.

31. Captain Waits was in command of the aircraft at the time and was, in accordance with the Operations Manual of British European Airways, responsible for exercising operational control of his aircraft. He frankly recognised at the Inquiry that in taking off on the strip he had made a mistake.

As between himself and First Officer Barret he accepted full responsibility for what had happened and in giving his evidence, which he did frankly and clearly, he endeavoured in a manner which one could not but admire to absolve his first officer from any measure of responsibility.

32. It is clear that no accident would have happened but for the fog. It is also clear that both the Captain and First Officer had no doubt whatever of their position;



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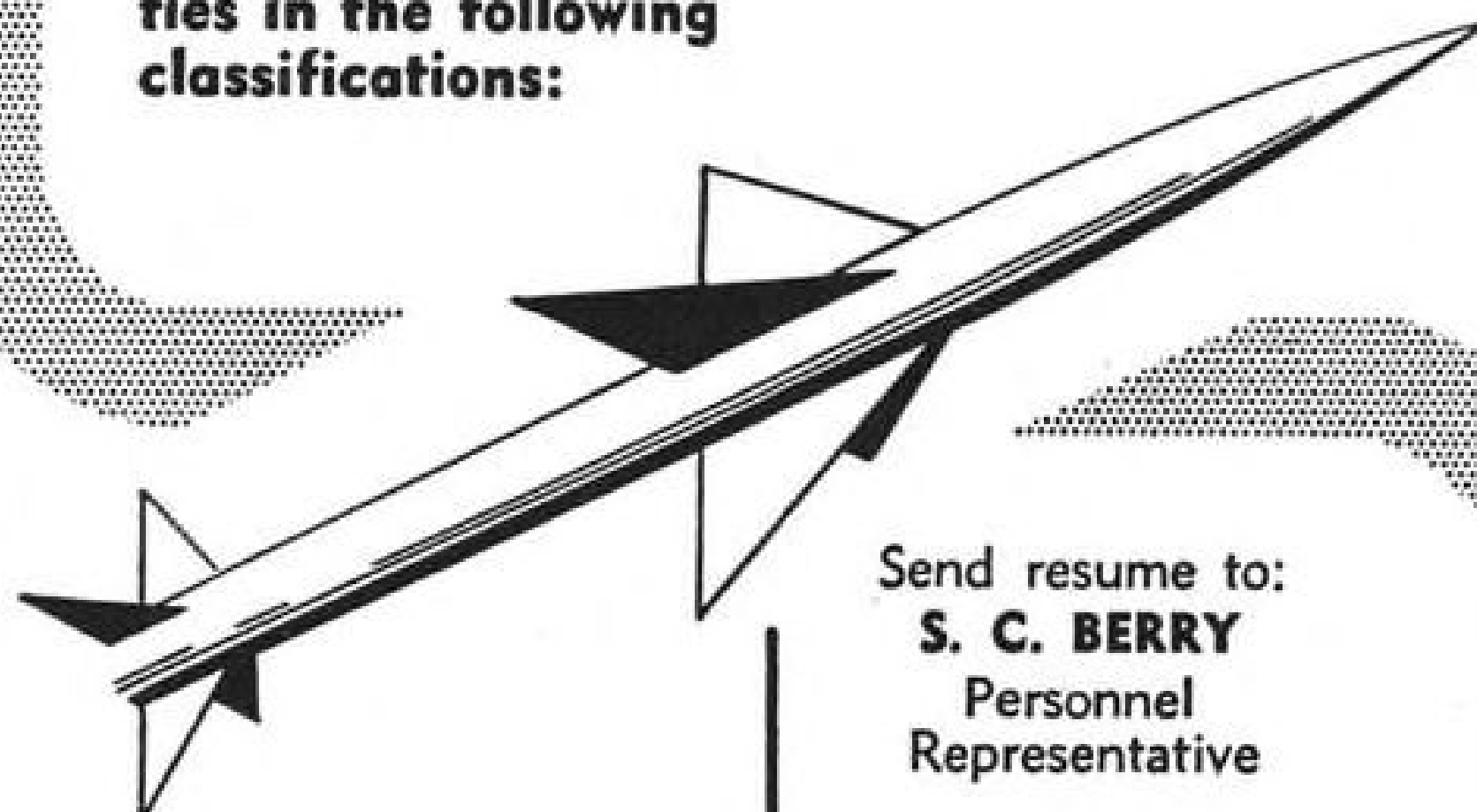
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had they been in doubt there were various methods available to them of checking where they were which they would no doubt have used.

The question, however, is whether in the circumstances then prevailing they should have allowed themselves to be so confident of their position that they did not seek any check to make certain that their confidence was well founded.

33. In favour of both pilots it can be said that there was no positive mark or sign visible to them to indicate that they were not in the correct position to takeoff, that the strip was, so far as width and surface material were concerned, indistinguishable from a runway, that its magnetic heading was correct and that before takingoff, Oboe King had been specifically informed in answer to an enquiry that the runway was clear.

34. As against these considerations, however, both pilots appreciated that in proceeding from their parking place along Runway 28R to their assumed takeoff position they had been moving in conditions of very poor visibility resulting from a dark fog.

It is common knowledge that in foggy conditions it is difficult to judge distances and easy to imagine things at or near the extreme range of vision which are not in fact what they appear to be.

In my judgment Captain Waits should not have relied, as he did, without any other check upon what he thought he saw in the dark fog to be the end of the concrete of Runway 28R, even though this was coupled with the existence on the right compass heading of the concrete surface of the strip. The conditions for takeoff which confronted him when he turned into the strip were such as he had never previously experienced in London Airport in that there was a dark fog and there were no runway lights to assist the takeoff.

Had he not been over-confident I find it difficult to believe that he could have mistaken the 150 yards distance from the entrance of Runway 23R, which he correctly identified and reported to the Control Tower, with the distance of about 850 yards which he should have traversed after leaving the junction with 23R before reaching his correct position at the beginning of Runway 15R.

He did not make a full use of the Aerad Landing Chart; he could, had he been concerned to verify his position, have picked up the green taxi-way lights, at intervals of 80 yards, leading on from the junction with Runway 23R to the correct position for takeoff.

He could, when he saw no taxi-way lights ahead and no runway lights on the strip, have communicated with the Air Controller and asked for these to be switched on.

It is also true that he could, had he been in any doubt, have checked his position accurately by approaching nearer to the side of the strip so as to have been able to read the numbers upon the block number board which he did notice edgewise on at the side of the strip.

I do not feel, however, that in this respect alone he could be criticised if he had in any other way verified his position. These block number boards are small, peculiar to London Airport, and their use does not readily appeal to pilots, who cannot be ex-



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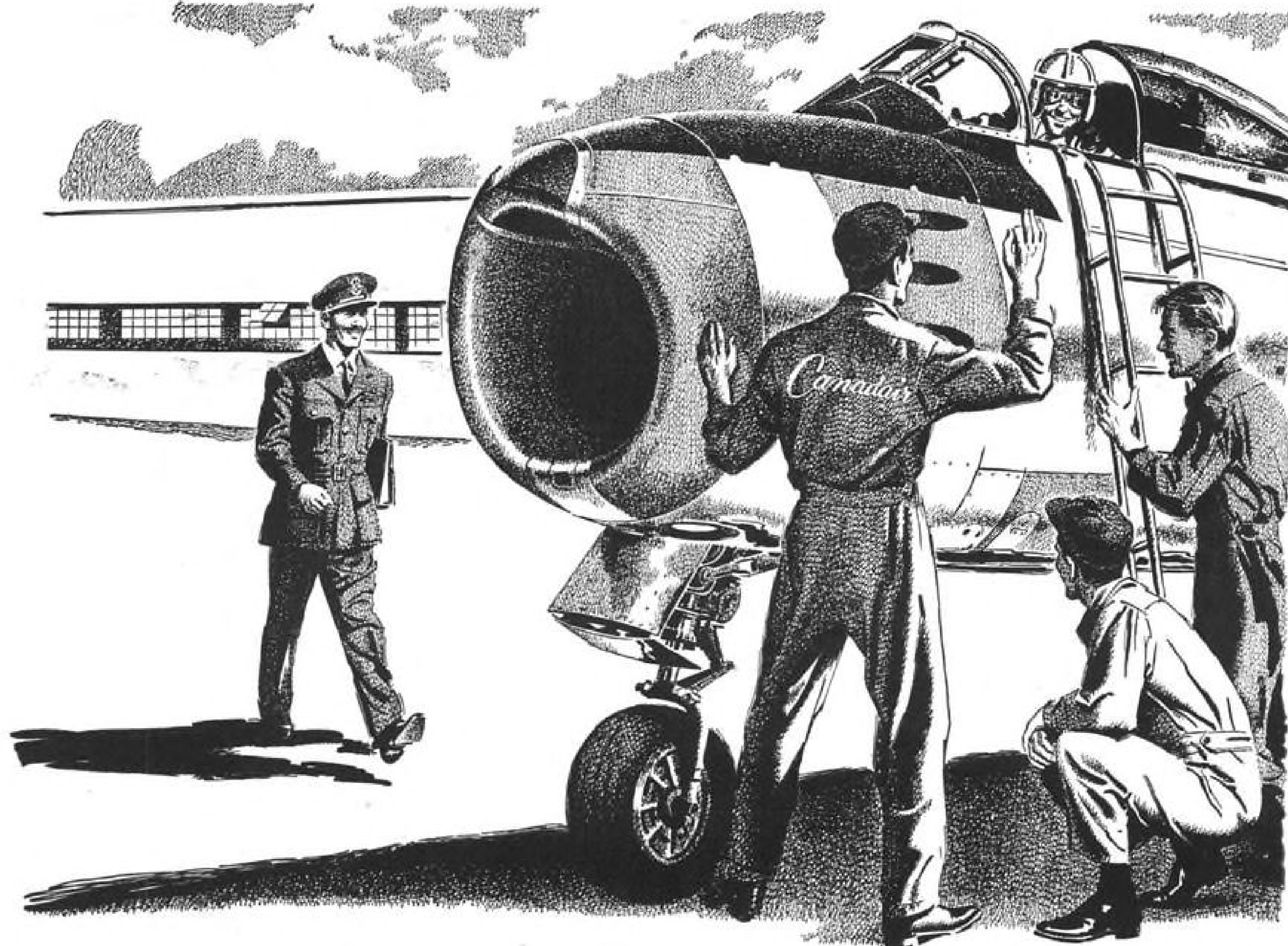
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pected to remember the numbers if read and must check them by reference either to the Control Tower or a detailed plan in their Aerad.

35. My conclusion therefore is that so far as Captain Waits is concerned he made a mistake due to over-confidence. He should have checked his position, and his omission to do so was a cause of the accident.

36. First Officer Barratt was not, of course, in command of Oboe King.

He was, however, controlling the aircraft and had the same opportunity for observation as had his captain. I have anxiously considered whether the presence of Captain Waits in command of the aircraft can completely exonerate First Officer Barratt, but I do not think that such a conclusion would be right.

If the argument were accepted that in circumstances similar to this case the first officer could rely exclusively upon his captain taking full responsibility, I think there might be a serious risk of a reduction in the high standard of care at present exercised by, and indeed expected of, first officers. Since First Officer Barratt was in physical control of the aircraft he should, in my opinion, have satisfied himself that he was in the right position before he tookoff; the position might be different had he expressed doubts as to his position to his captain and been over-ruled by him.

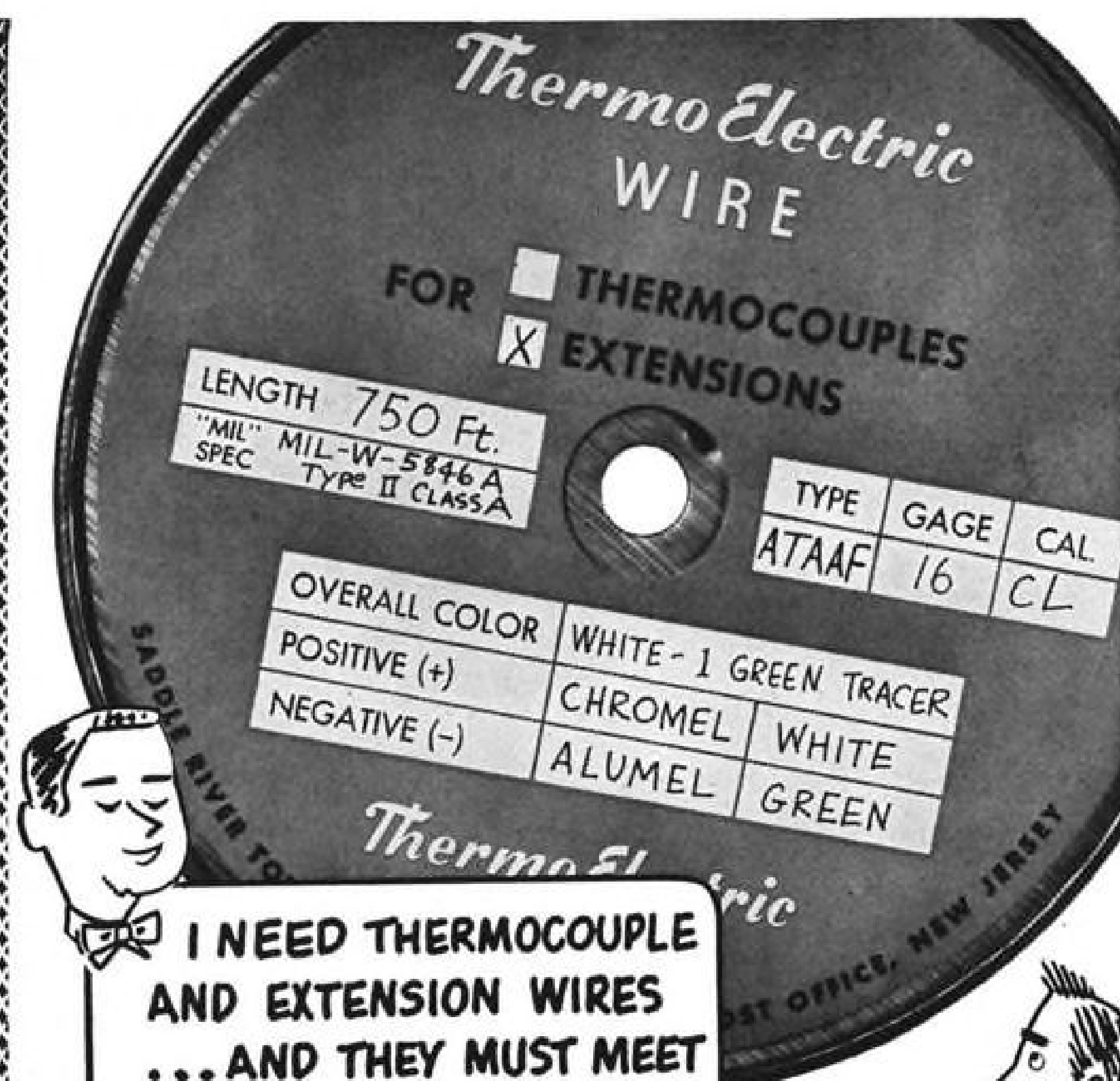
In my judgment, First Officer Barratt was as equally over-confident as Captain Waits and like him should have checked his position before takingoff. I find that his over-confidence was also a cause of the accident, though his responsibility was less than that of Captain Waits.

37. In dealing with the above matters I have not relied upon or mentioned the lack, on or near to the entrance to the strip, of any of the various marks on the ground referred to in Paragraph 9 above or of the notice boards and sign posts, referred to in Paragraph 10 above, other than the block number board. I have excluded the lack of these various indications, which might have caused doubt to those in the aircraft of their position, because of the lack of uniformity at London Airport at the time of the accident to which I have made reference in Section A of this report.

It was difficult enough when members of the Airport staff were giving evidence for them to remember what particular notice boards or marks were to be found at or about the entrance to any particular runway and I am quite satisfied that no pilot, using London Airport amongst many others, could hope to memorise the various differences.

Moreover the lack of uniformity, to which pilots using London Airport have become accustomed during the many changes consequent upon its rapid development, has not unnaturally led them not to place too much reliance upon the absence or presence of any particular marks or notice boards.

Nor do I think that those in the aircraft can be blamed for not having noticed the absence of the Runway Controller's caravan. In any case this would have been some 70 yards from the side of the runway and, in the conditions of fog prevailing, might not have been visible. Moreover the exact position of the caravan at the beginning of particular runways is subject to some variation, as I was able to observe during my



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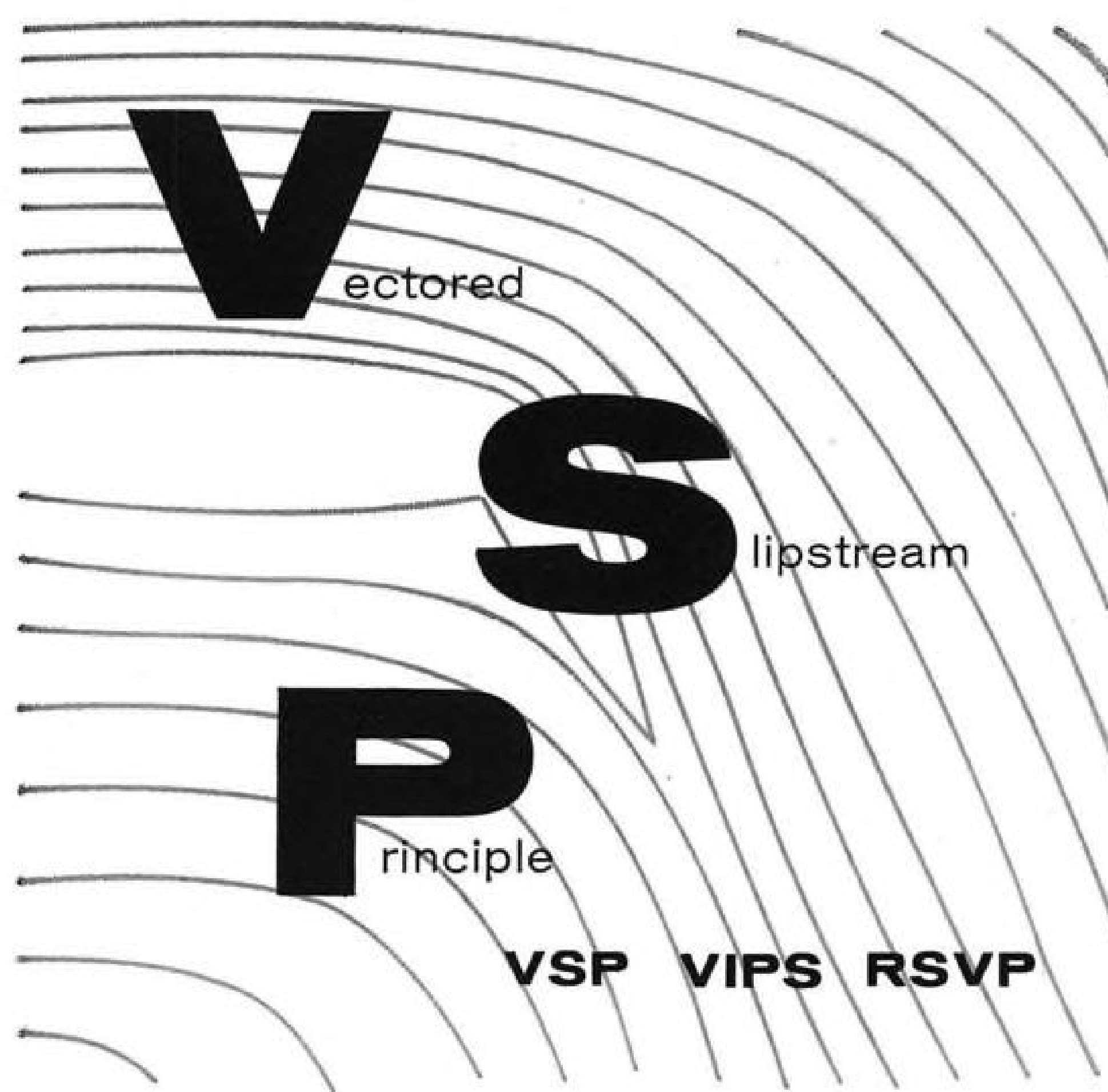
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## SAFETY

visit to London Airport.

38. So far as the action of the Ground and Air Controllers was concerned, they had available between them information which, if present to one mind, might well have led to action preventing the accident.

Thus the Ground Controller, having passed over Oboe King to the Air Controller at about 11:42, did not hear the subsequent conversation between the Air Controller and Oboe King regarding the Trans-Canada Constellation. On the other hand, the Ground Controller knew, at about the time of such conversations with the Air Controller, of the exact position of the Constellation, which had been verified by a conversation between the Constellation and the Ground Controller himself by reference to a block number board.

If the Ground Controller had known that Oboe King, from what was assumed to have been the holding position at the beginning of Runway 15R, had seen the Constellation cross the takeoff end of that runway and enter Runway 10L, he would probably have realized that something was wrong.

I am satisfied, however, that the separate knowledge, which each of the two Controllers had, was not by itself sufficient to indicate to either that Oboe King was out of position.

I am also satisfied that the work to be carried out in the Control Tower necessitates a division between the Ground and Air Controllers and that it would be impossible to combine their duties.

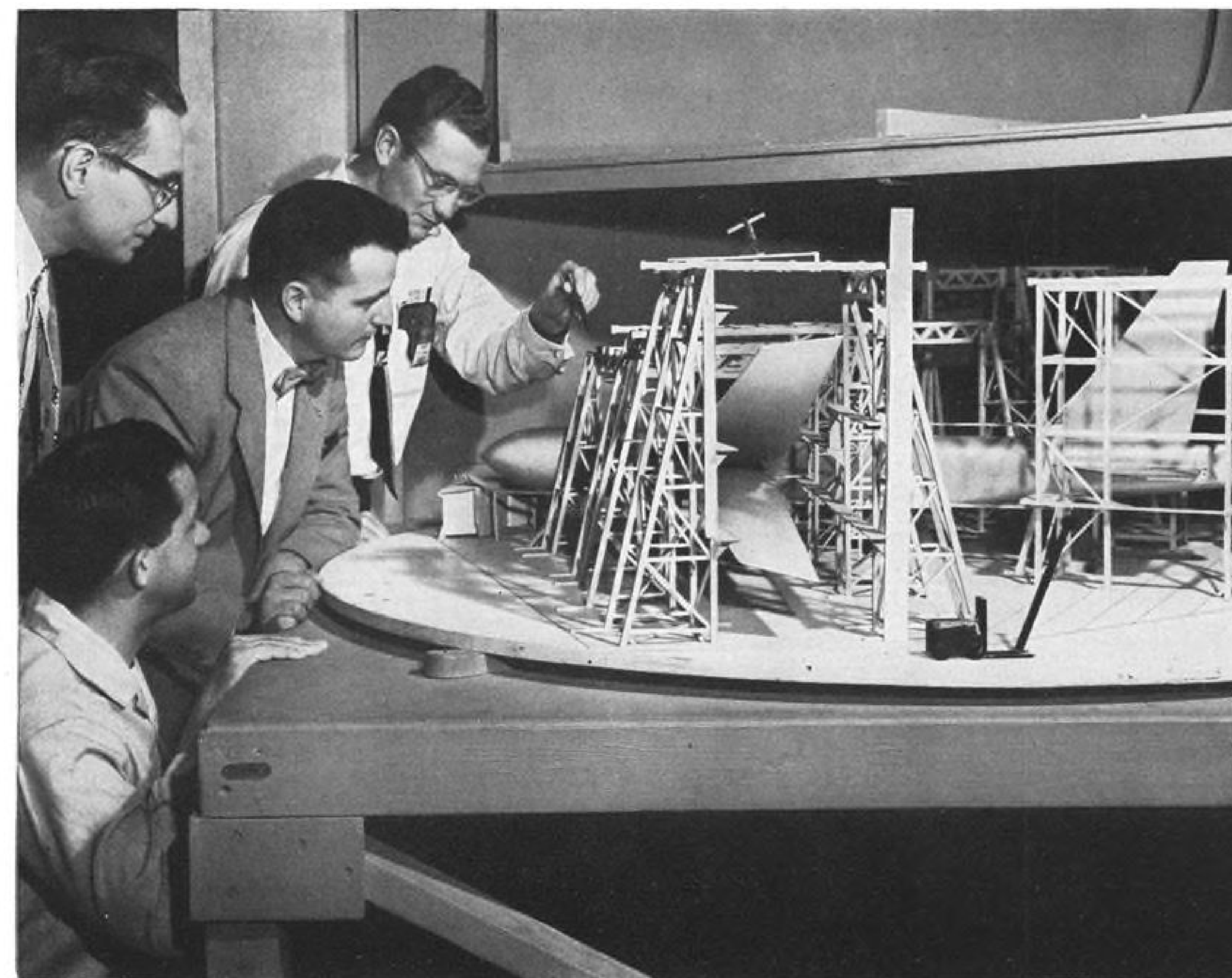
On the other hand, some alteration may well be desirable, in conditions of bad visibility, in the practice mentioned above of the Ground Controller handing over to the Air Controller turbine-engined aircraft at an earlier time than piston-engined aircraft are handed over. This point is dealt with in my recommendations later in this Report.

I think I should further add that the Ministry of Transport and Civil Aviation are in the course of installing at London Airport a radar device, called ASMI, which when in working order will allow the Controllers in the Tower to see on the radar screen any aircraft or vehicle moving upon any of the runways even in conditions of dense fog.

39. I have set out in Paragraph 18 above the duties of the Runway Controller and have pointed out that in conditions of bad visibility these duties are both increased and become of much greater importance.

At the time of the accident there was a Runway Controller in his caravan some 70 yards to the east of the edge of Runway 15R and very near its beginning. The Controller in question had three radio-telephonic loud speakers operating at the same time in his caravan, though one of these was toned down, and also had to be constantly estimating the runway visual range and reporting this by telephone to the Control Tower.

Had the Controller been able to give unfettered attention to what was being said on the two loud speakers connected to the Ground Controller and the Air Controller, he might have realized that whereas Oboe King had reported that it was at the holding position on Runway 15R, the aircraft



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was not visible from his caravan nor could its engines be heard.

The Controller in question frankly admitted that had he heard Oboe King's report of its position he would immediately have informed the Tower that the aircraft was not where it had reported itself to be and the accident would have been prevented.

It is noteworthy that once Oboe King had started its takeoff the Controller was the first person to realize that something was amiss. He heard Oboe King receive clearance to takeoff and expected to see the aircraft turn on to 15R Runway. In fact he did not see the aircraft and heard what sounded like a Viscount's engines coming from a south-easterly direction. He immediately telephoned to the Control Tower as a result of which the Air Controller spoke to Oboe King while it was actually running down the strip, a matter of seconds before the crash as I have already narrated, but this intervention was then too late.

I am satisfied that Mr. F. Richardson, the Runway Controller on duty at the time, was in no way to blame for what occurred and that his inaction in not reporting the absence of Oboe King at the true takeoff position for Runway 15R was not a matter for which he can be held responsible. In my opinion his duties in conditions of bad visibility were more than anyone, however competent and careful, could reasonably hope to discharge to the full and I make a recommendation to meet this later in this Report.

40. At the hearing it was argued that in more than one respect the action or inaction of the Ministry of Transport and Civil Aviation, the owners of London Airport, was responsible for and a cause of the accident.

In the first place it was suggested that the entrance to the strip should have borne a white painted cross upon the concrete in accordance with Paragraph 51 of the "Rules of the Air and Air Traffic Control" in Schedule II to the Air Navigation Order, 1954.

The relevant part of this rule provides that "at an aerodrome which has one or more runways, clearly visible white crosses shall be displayed at each extremity of a runway which becomes unfit for use." It was argued that the strip was a runway which had become unfit for use and that accordingly white crosses should have been used at its extremities.

It was further pointed out that when the runway was originally closed a white cross had been painted on the concrete at more or less the position occupied by Oboe King when waiting for take-off clearance.

I do not consider this argument sound since the strip, although it had once been a runway and in some respects still looked like a runway, was not in fact at the material time a "runway" within the meaning of the rule. The word "runway" must, I think, on its true construction, mean something which is normally used for the take-off and landing of aircraft and this was in no sense the use made of the strip at the material time. There is a somewhat similar provision in Annex 14 to the Convention on International Civil Aviation, which, in Part V, Chapter 3 at Paragraphs 3. 4. 1

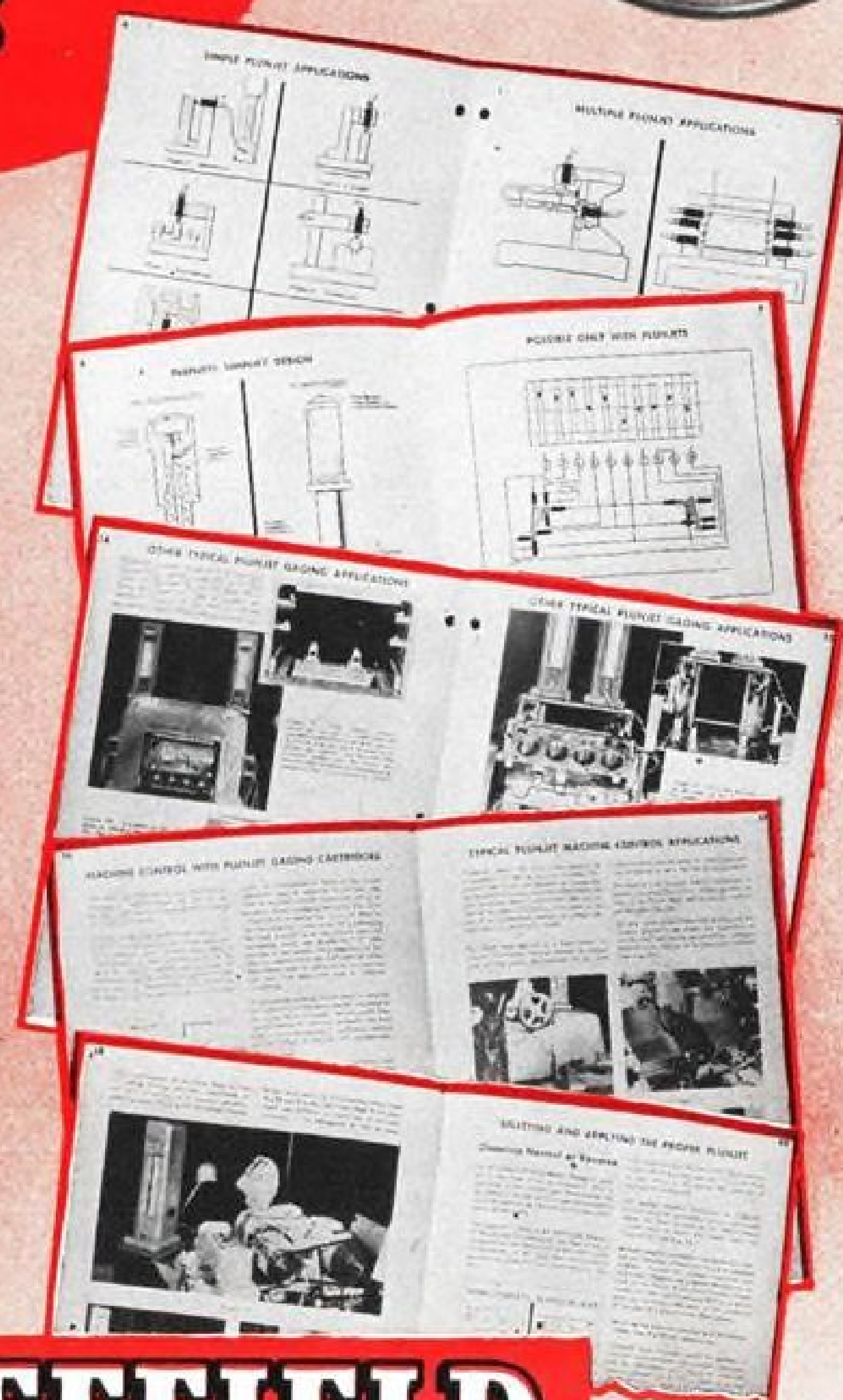
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1. 16 and under Length up to 3 times width		65	63	62	55	55	55	10.0	6.0	4.0
2. 16 and under Length over 3 times width		65	63	62	55	55	55	10.0	5.0	3.0
3. Over 16 to 36 incl. Length up to 3 times width		65	63	62	53	53	53	9.0	5.0	3.0
4. Over 16 to 36 incl. Length over 3 times width		65	63	62	53	53	53	9.0	3.0	2.0
5. Over 36 to 144 incl. Length up to 3 times width		62	59	59	53	52	52	7.0	3.0	2.0
6. Over 36 to 144 incl. Length over 3 times width		62	59	59	53	52	52	7.0	2.5	2.0
7. Over 144 to 256 incl. Length up to 3 times width		60	58	55	52	50	50	5.0	2.0	2.0
8. Over 144 to 256 incl. Length over 3 times width		60	58	55	52	50	50	5.0	2.0	2.0

\*The elongation requirement applies only to test specimens having a gage length diameter not less than 0.25".

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		Longi- tudinal	Long Trans.	Short Trans.	Longi- tudinal	Long Trans.	Short Trans.	Longi- tudinal	Long Trans.	Short Trans.
1. 16 and under Length up to 3 times width		65	65	65	55	55	55	10.0	6.0	6.0
2. 16 and under Length over 3 times width		65	65	65	55	55	55	10.0	6.0	6.0
3. Over 16 to 36 incl. Length up to 3 times width		65	65	63	55	55	55	9.0	5.0	5.0
4. Over 16 to 36 incl. Length over 3 times width		65	65	63	55	55	55	9.0	5.0	5.0
5. Over 36 to 144 incl. Length up to 3 times width		64	64	61	53	53	53	7.0	4.0	4.0
6. Over 36 to 144 incl. Length over 3 times width		64	64	61	53	53	53	7.0	4.0	3.0
7. Over 144 to 256 incl. Length up to 3 times width		61	60	59	52	51	51	5.0	4.0	3.0
8. Over 144 to 256 incl. Length over 3 times width		61	60	59	52	51	51	5.0	4.0	3.0

\*The elongation requirement applies only to test specimens having a gage length diameter not less than 0.25".

SPECIAL PRODUCT KAISER ALUMINUM HAND FORGINGS										
GUARANTEED MINIMUM MECHANICAL PROPERTIES FOR 2014-T6										
Class	Cross Sectional Area in Sq. In.	Tensile Strength, 1000 PSI			Yield Strength, 1000 PSI			% Elongation in 2" or 40"		
		Longi- tudinal	Long Trans.	Short Trans.	Longi- tudinal	Long Trans.	Short Trans.	Longi- tudinal	Long Trans.	Short Trans.
1. 16 and under Length up to 3 times width		65	65	65	55	55	55	10.0	6.0	6.0
2. 16 and under Length over 3 times width		65	65	65	55	55	55	10.0	6.0	6.0
3. Over 16 to 36 incl. Length up to 3 times width		65	65	63	55	55	55	9.0	5.0	5.0
4. Over 16 to 36 incl. Length over 3 times width		65	65	63	55	55	55	9.0	5.0	5.0
5. Over 36 to 144 incl. Length up to 3 times width		64	64	61	53	53	53	7.0	4.0	4.0
6. Over 36 to 144 incl. Length over 3 times width		64	64	61	53	53	53	7.0	4.0	3.0
7. Over 144 to 256 incl. Length up to 3 times width		61	60	59	52	51	51	5.0	4.0	3.0
8. Over 144 to 256 incl. Length over 3 times width		61	60	59	52	51	51	5.0	4.0	3.0

KAISER ALUMINUM STANDARD HAND FORGINGS GUARANTEED MINIMUM MECHANICAL PROPERTIES FOR 7075-T6										
Class	Cross Sectional Area in Sq. In.	Tensile Strength, 1000 PSI			Yield Strength, 1000 PSI			%Elongation in 2" or 40"		
		Longi- tudinal	Long Trans.	Short Trans.	Longi- tudinal	Long Trans.	Short Trans.	Longi- tudinal	Long Trans.	Short Trans.
1. 16 and under Length up to 3 times width		75	75	72	64	63	63	9.0	4.0	2.0
2. 16 and under Length over 3 times width		75	73	70	63	61	61	9.0	4.0	2.0
3. Over 16 to 36 incl. Length up to 3 times width		73	71	68	61	60	60	7.0	3.0	2.0
4. Over 16 to 36 incl. Length over 3 times width		73	71	68	60	59	59	7.0	3.0	2.0
5. Over 36 to 144 incl. Length up to 3 times width		71	69	66	60	58	58	4.0	2.0	1.0
6. Over 36 to 144 incl. Length over 3 times width		71	69	66	59	57	57	4.0	2.0	1.0
7. Over 144 to 256 incl. Length up to 3 times width		70	67	64	58	56	56	4.0	2.0	1.0
8. Over 144 to 256 incl. Length over 3 times width		70	67	64	58	56	56	4.0	2.0	1.0

\*The elongation requirement applies only to test specimens having a gage length diameter not less than 0.25".

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Class	Cross Sectional Area in Sq. In.	Tensile Strength, 1000 PSI			Yield Strength, 1000 PSI			%Elongation in 2" or 40"		
		Longi- tudinal	Long Trans.	Short Trans.	Longi- tudinal	Long Trans.	Short Trans.	Longi- tudinal	Long Trans.	Short Trans.
1. 16 and under Length up to 3 times width		75	75	72	65	65	63	10.0	7.0	6.0
2. 16 and under Length over 3 times width		75	75	72	65	65	62	10.0	6.0	5.0
3. Over 16 to 36 incl. Length up to 3 times width		75	74	70	63	62	60	8.0	6.0	5.0
4. Over 16 to 36 incl. Length over 3 times width		75	74	70	63	62	60	8.0	5.0	4.0
5. Over 36 to 144 incl. Length up to 3 times width		74	72	68	61	60	59	6.0	4.0	3.0
6. Over 36 to 144 incl. Length over 3 times width		74	72	68	60	59	58	6.0	4.0	3.0
7. Over 144 to 256 incl. Length up to 3 times width		71	69	66	59	57	56	5.0	4.0	3.0
8. Over 144 to 256 incl. Length over 3 times width		71	69	66	58	57	56	5.0	3.0	2.0

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SPECIAL PRODUCT KAISER ALUMINUM HAND FORGINGS										
GUARANTEED MINIMUM MECHANICAL PROPERTIES FOR 7075-T6										
Class	Cross Sectional Area in Sq. In.	Tensile Strength, 1000 PSI			Yield Strength, 1000 PSI			% Elongation in 2" or 40"		
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3.	Over 16 to 36 incl. Length up to 3 times width	75	74	70	63	62	60	8.0	6.0	5.0
4.	Over 16 to 36 incl. Length over 3 times width	75	74	70	63	62	60	8.0	5.0	4.0
5.	Over 36 to 144 incl. Length up to 3 times width	74	72	68	61	60	59	6.0	4.0	3.0
6.	Over 36 to 144 incl. Length over 3 times width	74	72	68	60	59	58	6.0	4.0	3.0
7.	Over 144 to 256 incl. Length up to 3 times width	71	69	66	59	57	56	5.0	4.0	3.0
8.	Over 144 to 256 incl. Length over 3 times width	71	69	66	58	57	56	5.0	3.0	2.0





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and 3, 4, 4., provides for the use of a white cross to indicate that any part of the movement area of an aerodrome is unfit for the movement of aircraft.

The strip was, however, not unfit for the movement of aircraft for the purpose of taxiing and was in fact considerably used in this way.

It cannot therefore be said that there was any departure from this Standard.

41. A more serious charge against the Ministry was that there should have been QDM marks, or runway designation markings on each runway at the airport. This is provided for in Part VI, Chapter 2, Paragraph 2, 2. 2 of the same Annex 14, and is also a Standard. A Standard is a practice which by definition "is recognised as necessary for the safety or regularity of international air navigation and to which the Contracting States will conform in accordance with the Convention; in the event of impossibility of compliance notification to the Council is compulsory under Article 38 of the Convention."

The United Kingdom is one of the Contracting States and the Ministry should accordingly have complied with this particular Standard.

No notification of the impossibility of compliance had been given, nor was it argued that compliance was in fact impossible. It was admitted before me on behalf of the Ministry that there had in fact been a failure to comply with this particular Standard and it was argued on behalf of Captain Waits and First Officer Barratt that, had the Standard been complied with, the absence of QDM marks on the strip would have indicated to them that they were not on a runway. QDM marks are intended to assist the pilot in an aircraft about to land and are not used for the purposes of takeoff.

Whilst it is just possible that, had QDM marks been in position on all the runways in use at London Airport, the absence of such marks on the strip might have caused Captain Waits and First Officer Barratt to have had some doubt as to their position, I find it impossible to satisfy myself that such a result would have been probable.

I accordingly cannot find that the absence of QDM marks was a cause of the accident.

42. There is a further Recommendation in Annex 14 to the Convention on International Civil Aviation of considerable importance. This is contained in Part VI, Chapter 2, Paragraph 2. 6. 1.

It is recommended that a longitudinal marking consisting of a continuous white line six inches wide should be painted along the centre line of all paved taxi-ways. It is suggested that, if this Recommendation had been carried out, such a white line down the centre of the strip would have been a clear indication to those in Oboe King that it was not on a runway and the accident would have been prevented.

It is possible that the existence of such a white line would have prevented the accident, though I do not feel able to find this with any certainty.

The Ministry had given considerable thought to whether or not this Recommendation should be adopted both at London Airport and elsewhere in the United

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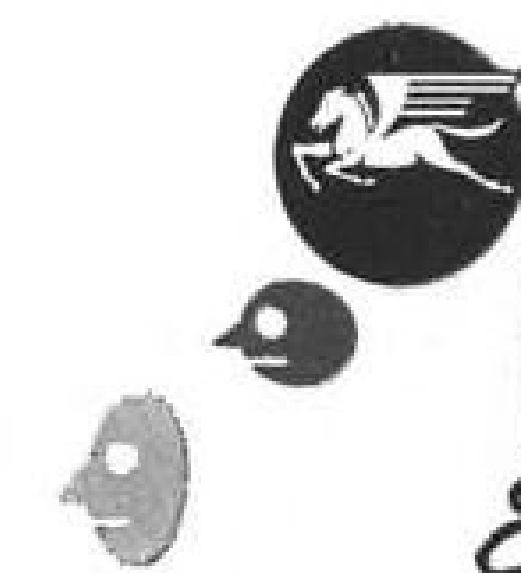
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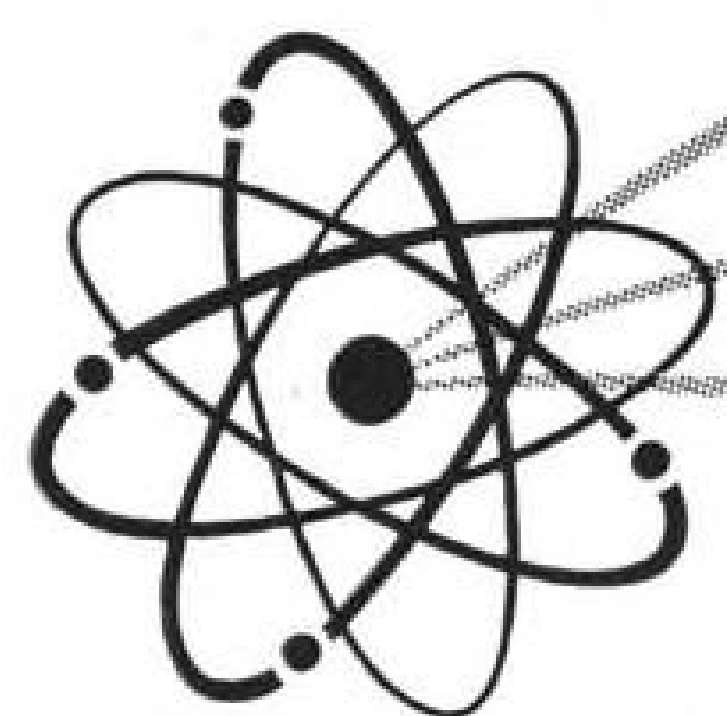
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Kingdom and had decided against it for reasons which are discussed later in the section of this report dealing with my recommendations.

Whatever may be the right conclusion whether or not this Recommendation should on general grounds have been complied with, I do not think it possible to find that the Ministry and those who are responsible for London Airport can in any way be said to have been lacking in care or foresight in not anticipating that, in the absence of such a continuous white line, an aircraft would, in conditions of bad visibility, have attempted to takeoff from the strip in mistake for a runway.

43. Some evidence was given at the Inquiry that on three separate occasions in bad visibility the pilots of aircraft taxiing either along Runway 28R or Runway 23R had, on coming to the junction with the strip, momentarily doubted their position and thought that the strip might in fact be a runway. Nothing happened in any of these three cases since the pilot in question was able to make sure of his position, almost as soon as the doubt occurred to him, in one way or another. None of these three incidents, if incidents they can be called, was ever reported to the authorities responsible for the airport.

44. The Ministry and airport authorities are fully conscious of the undesirability of a lack of uniformity in the markings and sign posts and other indications of position in use at the airport. Some of the lack of uniformity has been due to the development of the airport since the war which is still not yet completed.

But notwithstanding the undesirability of lack of uniformity I cannot find that either the Ministry or the authorities at the airport through what they did or omitted to do as regards the markings or sign posting of runways, taxi-ways and the strip can be held responsible for the most unusual combination of circumstances which led to the present accident, or can be said to have caused such accident within the meaning of the word "cause" in Paragraph 9 (17) of the Civil Aviation (Investigation of Accidents) Regulations, 1951.

45. Questions of causation are notoriously difficult both in fact and in law and in considering the word "cause" in the Regulations just mentioned regard must be had to the context in which the word is used. I have found that the failure of Captain Waits to make a check as to his position before he took off was a cause of the accident and I have made a similar finding regarding First Officer Barratt.

Since I have also reached the conclusion that nothing done or omitted to be done by the Ground and Air Controllers, the Runway Controller and the Ministry and those responsible for the airport was a cause of the accident within the meaning of the word "cause" in the Regulations, it follows that there was no other material cause than the failures of Captain Waits and First Officer Barratt.

### E. QUESTIONS AND ANSWERS

46. The questions asked the Court by the Attorney-General were as follows:

1. What was the cause of the accident?
2. Was the accident due to the act or




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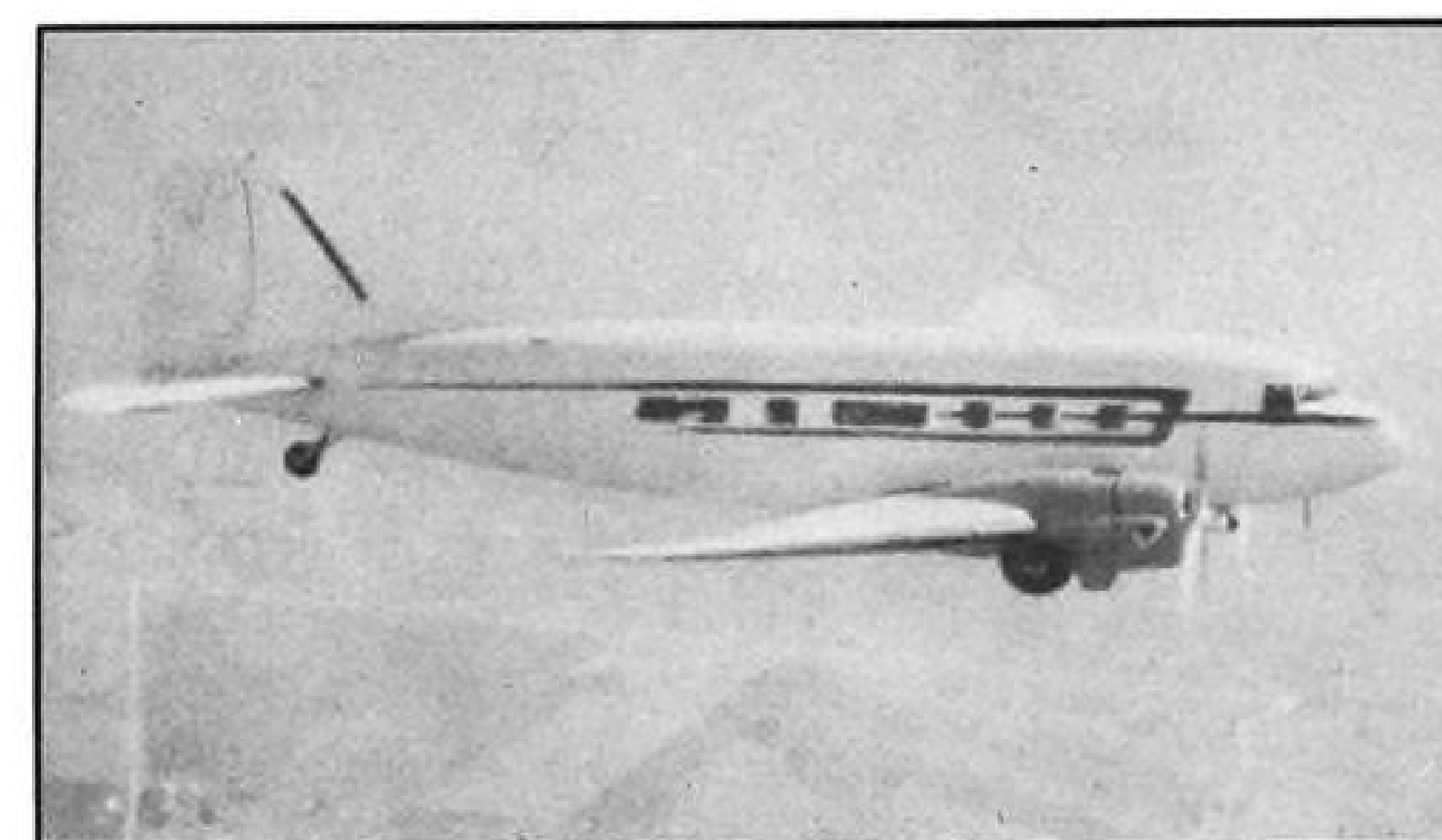
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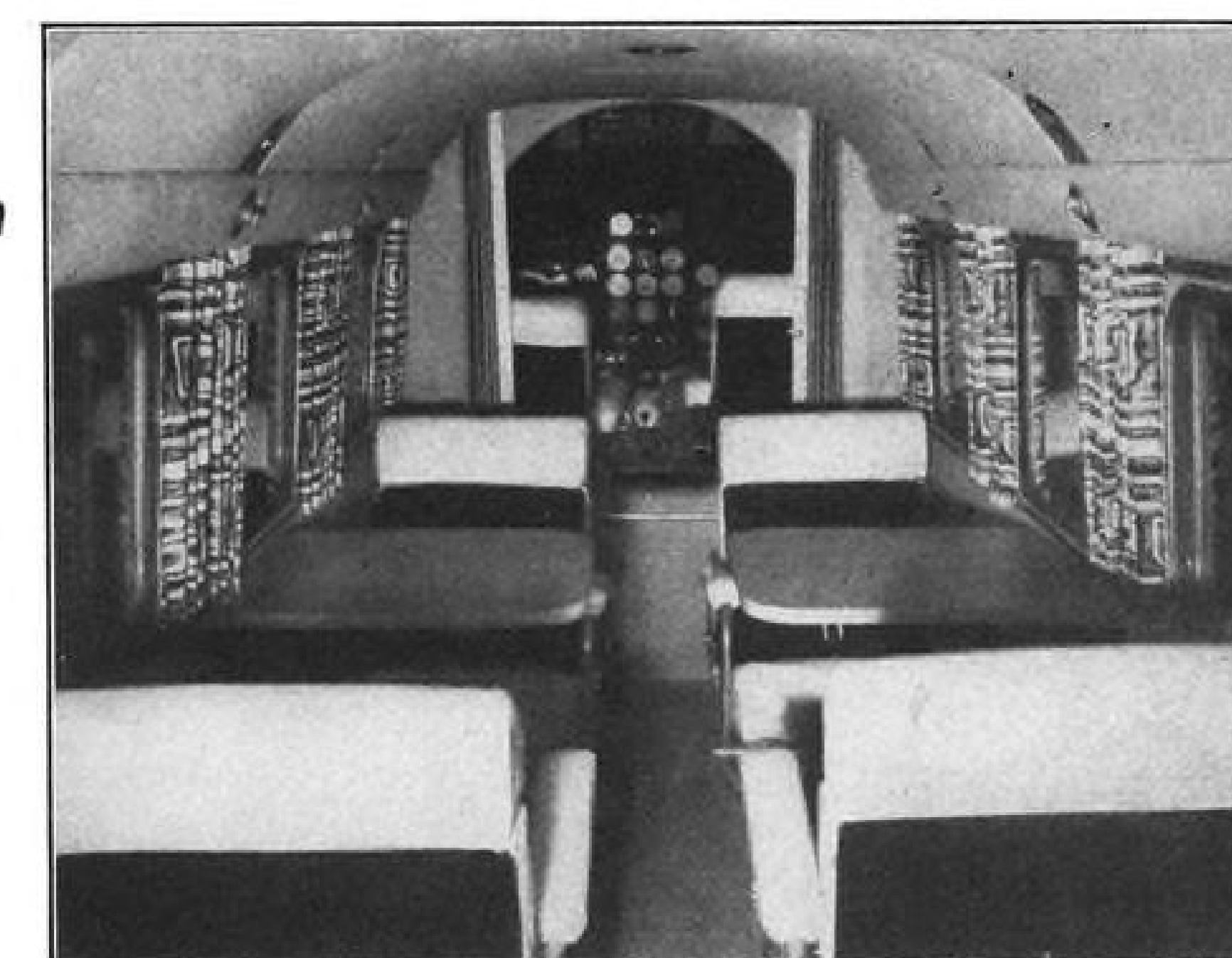
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## • SAFETY

default or negligence of any party or of  
any person in the employment of that  
party?

My answers to the above questions are,  
for the reasons which I have set out above,  
as follows:

1. The cause of the accident was the  
collision with the barrier and other ob-  
stacles on the strip consequent upon  
Oboe King commencing to take-off on  
the strip instead of on Runway 15R for  
which the aircraft had been cleared to  
take-off.

2. The accident was due to the default  
of both Captain Waits in command and  
to a lesser degree to that of First Officer  
Barratt at the controls of Oboe King in  
failing, before attempting to take-off, to  
make any reasonable check in the con-  
ditions of bad visibility then obtaining  
that they were in fact lined up on Run-  
way 15R for which they had received  
clearance for take-off.

## F. RECOMMENDATIONS

47. It seems highly improbable that an  
accident of this type will ever occur again  
upon the strip since a most unusual set  
of circumstances is necessary before it can  
occur. Further, the introduction in due  
course of ASMI, to which I have already  
referred, should as long as that apparatus  
is in working order and properly used ren-  
der such an accident impossible.

On the other hand, the accident did  
occur and might have had disastrous results.

Clearly all reasonable steps must be taken  
to prevent any possibility of its recurring  
and it will not be satisfactory to rely ex-  
clusively on ASMI which may well, even  
after its introduction in full working order,  
from time to time become unserviceable.

48. I think it is clearly desirable, as was  
indeed recognised by the Ministry, that  
appropriate notice boards should be erected  
at either end of the strip so as to give  
warning in conditions of bad visibility that  
the strip is not to be used as a runway.

I recommend that at the entrance to  
the strip in blocks 2, 11, 21 and 85 notice  
boards on each side of the strip at least  
as large as those used for run-up boards  
should be set up bearing the words "Taxi-  
way only."

I also recommend that at the entrance  
to the strip in blocks 2, 11, 21 and 85 the  
words "Taxi-way only" should be painted  
in large white letters across the concrete of  
the strip.

49. I have already commented, in sec-  
tion (D) of this report, on the fact that if  
the information possessed by each of the  
Controllers in the Control Tower had been  
available to only one of them, it is possible  
or even probable that the accident would  
have been avoided. Such information would  
have been available to the Ground Con-  
troller had he not handed over Oboe King  
to the Air Controller before it reached the  
run-up position for Runway 15R in accord-  
ance with the practice followed in the case  
of turbine-engined aircraft.

In conditions of bad visibility it seems  
to me unwise that the Ground Controller  
should relinquish control of any aircraft  
until it is reported as having reached either  
the run-up or takeoff positions.

I accordingly recommend that in condi-  
tions of bad visibility, by which I mean



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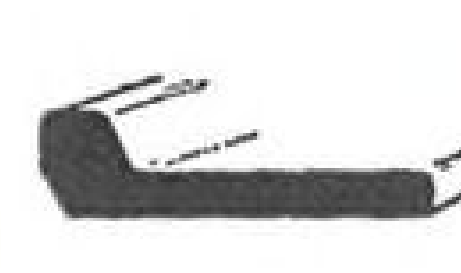
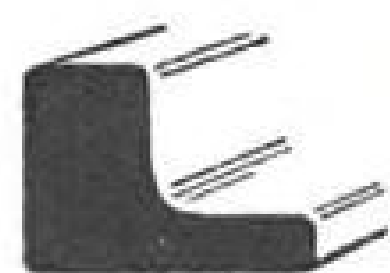
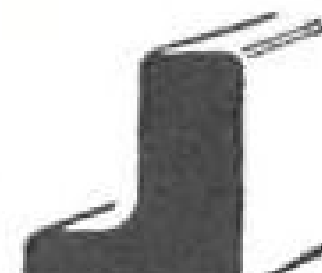
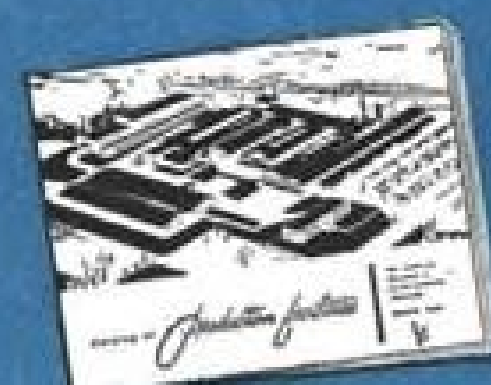
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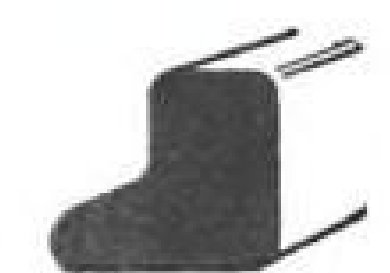
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conditions in which runway visual range is being ascertained and reported, the Ground Controller should not hand over control of turbine-engined aircraft until they have reached either the run-up position or the takeoff position for the particular runway to be used.

50. The Runway Controllers at London Airport clearly have a very useful function to perform in conditions of bad visibility. In such circumstances, however, they have more to do in my opinion than they can hope always to carry out to their complete satisfaction and in consequence their value is thereby so much reduced.

It would, in my opinion, be a wise precaution if clearance for takeoff was never given in conditions of bad visibility by the Control Tower to any aircraft until the Control Tower had received from the appropriate Runway Controller a telephonic report that the aircraft was in the proper takeoff position for the runway in question. I accordingly recommend that this practice be adopted for the future in conditions of bad visibility.

51. I would add that the recommendations in Paragraphs 49 and 50 are of general application and are not limited to conditions at London Airport.

52. During the evidence of Captain Waits I asked him whether he was satisfied with the minimum visibility for take-off of 150 yards laid down by British European Airways for London Airport.

His answer was that he thought it rather low and that he would prefer the figure of 600 yards, which is the minimum visibility for landing, since 150 yards would in the majority of cases be quite inadequate for a pilot to take avoiding action should there be any obstruction on the runway.

He made it clear, however, that he had no fault to find with the minimum of 150 yards, provided that it was possible to be absolutely sure that there was no obstruction in the way, as would be the case for example when ASMI or some similar radar device was in operation.

53. The minimum visibility for takeoff at London Airport laid down by British European Airways for Viscount Aircraft is (a) based on the assumption that the runway is free from obstruction, (b) designed to ensure that the pilot can keep his aircraft on a straight course, and (c) always subject to the decision of the captain of the aircraft himself.

In other words, notwithstanding the existence of the minimum visibility, the captain is free to decide whether in all the circumstances he should or should not takeoff.

The course of Oboe King along the strip up to the moment of impact was perfectly straight, as was demonstrated by the wheel marks on the concrete, and accordingly confirmed the suitability of the minimum so far as keeping a straight course is concerned.

I do not consider that the most unusual facts of this accident are sufficient to justify a recommendation that the minimum should be increased. The concurring factors leading to this accident are most unlikely to be repeated and should be rendered well nigh impossible if my above recommendations are put into effect.

54. The final question which has exer-

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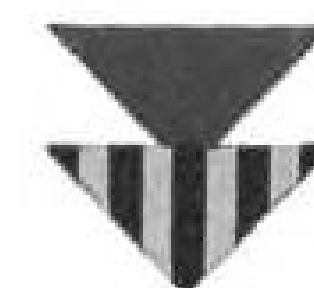


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### • SAFETY

cised my mind considerably both at the Public Inquiry and since is whether I should recommend that the Ministry of Transport and Civil Aviation take steps both at London Airport and elsewhere, but particularly at London Airport, to carry into effect the Recommendation as to a continuous thin white line down the centre of taxi-ways contained in Annex 14 to the Convention on International Civil Aviation, Part VI, Chapter 2, Paragraph 2. 6. 1.

One of the problems that has exercised the authorities responsible for London Airport in connection with the strip is to find some mark or indication which would, whilst indicating that the strip was not a runway, also indicate that it was appropriate for use as a taxi-way.

The continuous white line device would seem at first glance to satisfy the necessary requirements and has the additional use, which is its main purpose, of assisting taxiing aircraft to keep to the centre of the taxi-way in low visibility.

55. Apart from the weight naturally to be given to a Recommendation of the International Civil Aviation Organization, evidence was given that the continuous white line device was in use at various Continental and Irish airports. It has, however, not been adopted at any United Kingdom airport under the control of the Ministry.

The chief witness called on behalf of the Ministry did not consider that as a matter of general application this Recommendation was a useful one, since he thought that taxi-way lights and daylight route indicators were a more valuable indication as to the use of taxi-ways. Furthermore, a continuous white line would involve considerable expense both in its installation and maintenance.

In regard to London Airport, in addition to the above disadvantages, the continuous white line would, he thought, give rise to confusion at intersections rather than facilitate the task of pilots finding their way about.

Further, he pointed out that at London Airport it is often necessary to use one or more runways as a taxi-way, but it would be clearly impossible to paint the continuous white line down runways. This would at once result in a lack of uniformity in the meaning of a continuous white line down the centre of a concrete paved way.

56. The Ministry favoured the extensive use of taxi-way lights, stop bars showing red lights and daylight route indicators as the best solution of the problem and there is no doubt that the system of lighting at London Airport, which works in conjunction with the block number system, is one of much ingenuity and has been designed and installed with great care and no inconsiderable expense.

The system has the whole-hearted support of the experienced pilots using London Airport who were called to give evidence before me, but they all stressed that it was essential that an intelligent use should be made of the lighting system by those in control. They urged that an aircraft should not be expected, for example, to have to cross any line of green taxi-way lights as was Oboe King on the day of the accident in relation to the lights leading from the direction of the old Control Tower across



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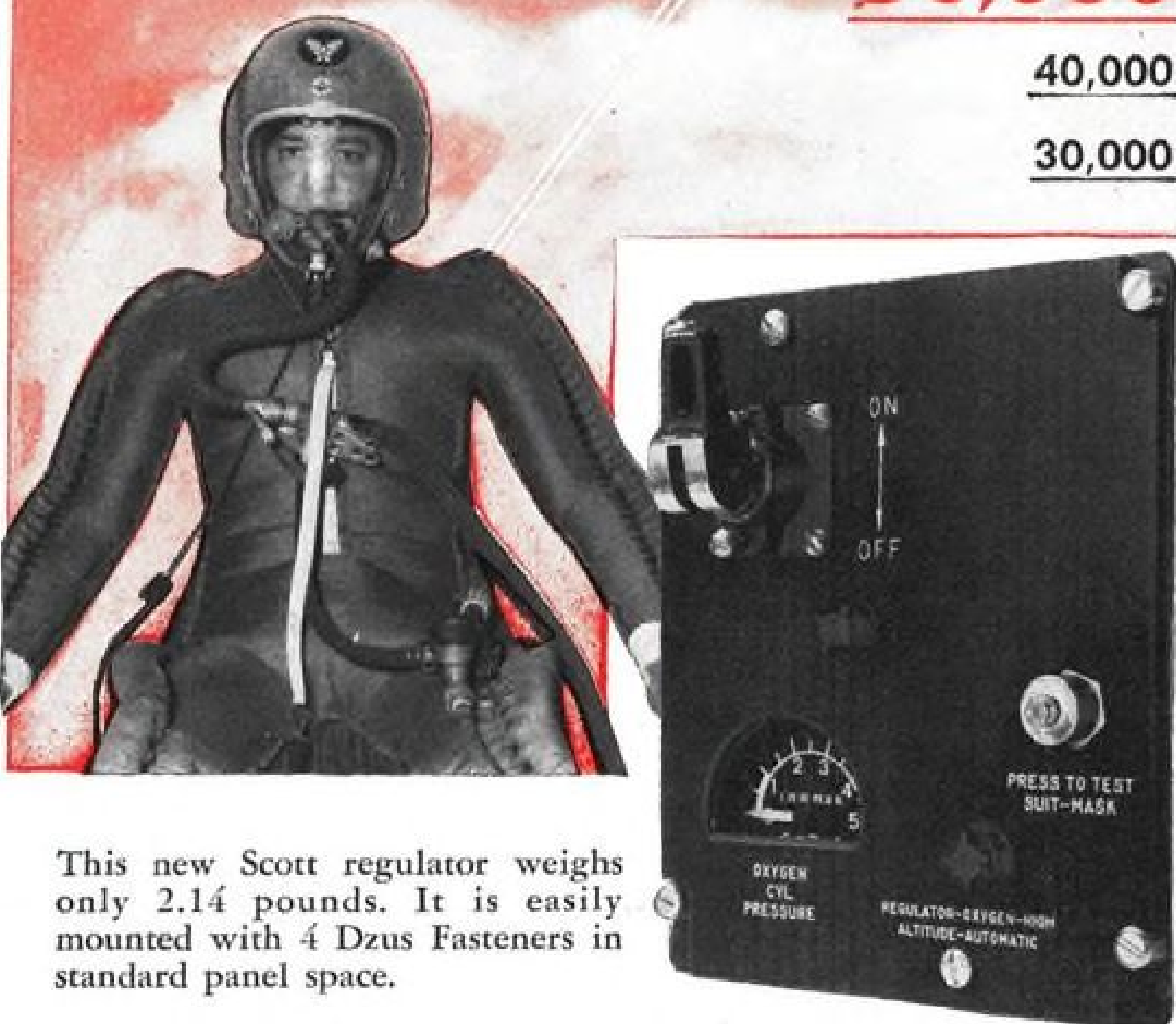
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I have little doubt that, when the completion of the installation of the daylight route indicators and all the taxi-way lights and stop bars has taken place, the control staff of London Airport will make the fullest and most intelligent use of this elaborate and expensive directional apparatus which will be at their disposal. Moreover experience will indicate its best use.

So far as is known, London Airport is the only airport at present installing the ASMI radar apparatus. This fact indicates both the care for the safety of those using London Airport exercised by the responsible authorities and the likely reduction to the barest minimum in the future of any serious consequences of the pilot losing his way should this by some mischance prove possible.

57. If all runways at London Airport were provided with runway centre line markings of the broken line type, as recommended and described in Annex 14 to the Convention on International Civil Aviation, Pt. VI, Chapter 2, Paragraphs 2.2.7 and 2.2.8, then the absence of any longitudinal markings on the taxi-ways would provide a definite indication to a pilot that, when he was on a concrete strip devoid of longitudinal markings, he was not on a runway.

58. I do not feel able myself, on the basis of the limited evidence available to me of the use of taxi-ways and runways in London Airport, to make a general recommendation that the Ministry should forthwith institute the continuous white line on taxi-ways at all airports under their control in the United Kingdom. There appears to me to be weight in some of the objections of the Ministry, which I have summarized, to such a recommendation. Nor was it at present favoured by British European Airways.

59. I recommend that the Ministry give further study to this problem with a view to choosing a system of marking which will provide a continuous indication to aircraft on the ground whether they are on a taxi-way or on a runway.

Among systems at present approved internationally the choice seems to lie between painting longitudinal centre line markings along all taxiways in accordance with the Recommendation in Annex 14 to the above Convention, Pt. VI, Chapter 2, Paragraph 2.6.1, or painting centre line markings of the broken line type described in Paragraph 2.2.8 in accordance with the Recommendation in Paragraph 2.2.7 on all runways, leaving all taxi-ways unmarked by any longitudinal paint markings.

In the course of their further study I have no doubt that the Ministry will in particular collect evidence as to the success or otherwise of the use of the longitudinal white line on taxi-ways at large and busy airports in other countries. Such experience will probably in time resolve in one way or another the doubts expressed as to the desirability of adopting the longitudinal white line on taxi-ways in this country in general and at London Airport in particular.

(Signed)

A. A. Mocatta  
R. W. O'Sullivan  
H. K. Gordon-Burge

AVIATION WEEK, October 10, 1955

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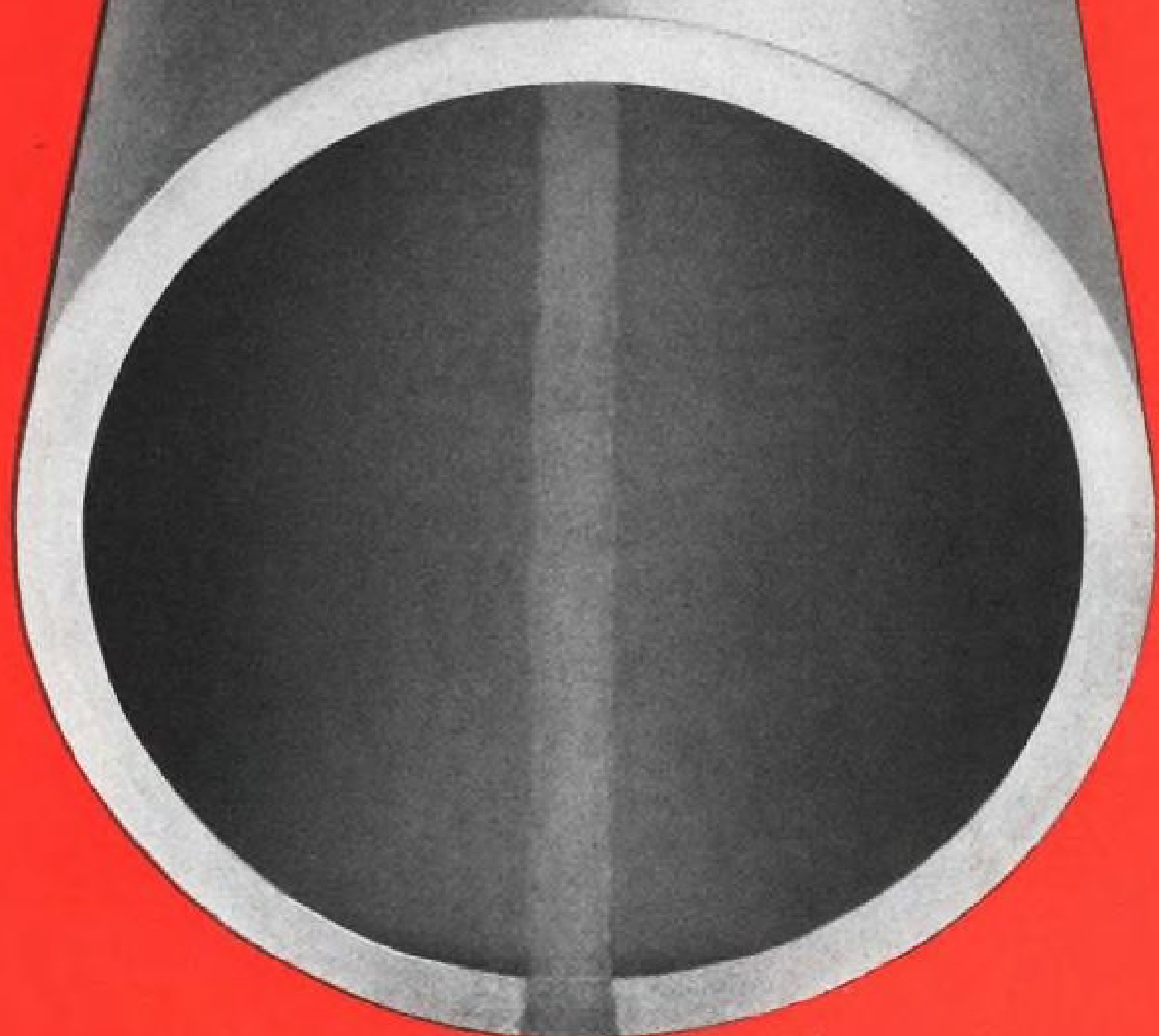


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Photograph of Contour-Welded 2½" OD x .154 wall pipe—as welded, annealed and pickled.

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\*Contour-Weld is the trade mark of the Trent Tube Co. for its process of welding pipe and tubing which is protected under U. S. Patent 2,716,692.

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Here's the conventional way of welding pipe. Gravity pulls some of the molten metal down into the pipe to form a bead that is extremely difficult to remove by cold working. This is particularly troublesome in heavier gages. Cold working of the inside bead can lead to undercuts, focal points for erosive and corrosive attack. Cleaning is difficult.



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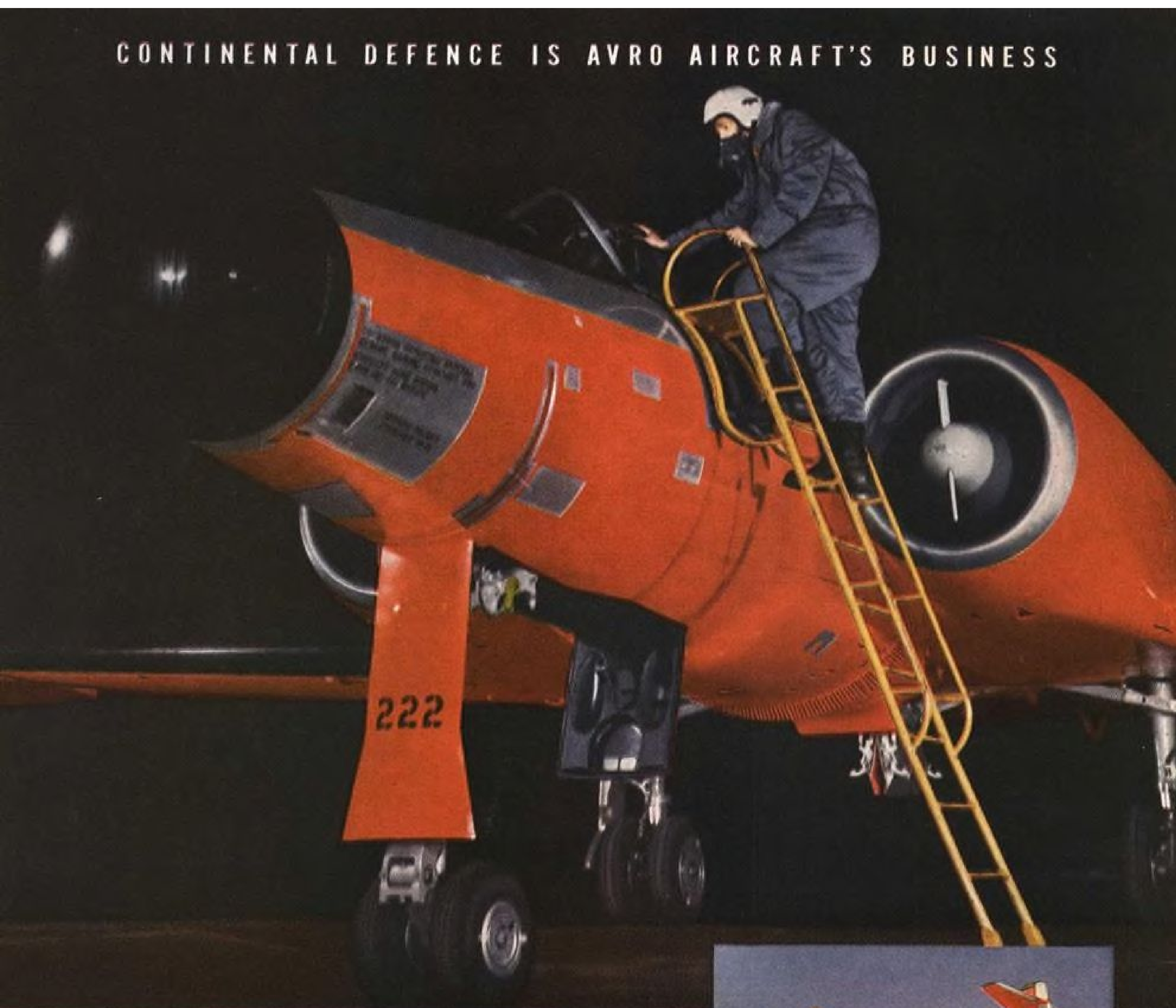
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## AIR TRANSPORT

# Traffic Gains Spur New Route Patterns

**CAB leans toward strengthening regional lines; three major cases await decision from Board.**

By Craig Lewis

Washington—The healthy prosperity of the airline industry appears to be heralding a new approach in federal regulation.

As traffic, revenues and profits continue their phenomenal rise during 1955 (see p. 117), a trend to greater competition and a strengthening of the smaller trunk carriers is shaping up in a series of major route cases under consideration by the Civil Aeronautics Board.

With subsidy a diminishing factor in trunkline operations and with last year's worries about narrow profit margins substantially eased, CAB appears set on a course of strengthening the national air pattern by introducing more competition and by building the regional carriers as major competitive factors on the routes long dominated by the Big Four—American Airlines, Eastern Air Lines, Trans World Airlines and United Air Lines.

### Major Cases Before CAB

Indications of the new approach are seen in a variety of ways, including the lifting of nonstop restrictions and the trend away from the old reliance on interchanges to provide new services. But the basic evidence lies in the way the Board decided the New York-Chicago case and is handling three other major cases:

• **The New York-Chicago Case**, decided last month, established Capital Airlines as a major competitor in the New York-Chicago and other large population markets in the East (AW Sept. 12, p. 139). In this case, CAB also strengthened Northwest Airlines' position on its transcontinental route.

• **The Denver Service Case**, now awaiting CAB decision, deals with the need for new east-west service at Kansas City, Denver, Salt Lake City and Reno, Nev. (AW Aug. 8, p. 99). An examiner has recommended new routes for Continental Air Lines and Western Air Lines.

• **The Northeast-Southwest Case**, also before the Board, concerns service between cities in the Northeast and the Southwest and service to several points in the South (AW Sept. 5, p. 95). The examiner has recommended the strengthening of Capital and new com-

petition among American, Eastern and TWA.

• **The New York-Florida Case**, in which hearings have just closed, is concerned with possible new competition for Eastern and National Airlines on the rich north-south routes along the East Coast. This case offers a variety of possibilities for certification of a new carrier.

Capital was the major winner in the New York-Chicago Case. CAB decided to remove restrictions on Capital's operations which will let the carrier operate nonstop services between New York and Chicago, Toledo, Pittsburgh and Detroit. It also chose Capital for competitive service between Philadelphia and Cleveland and Detroit.

The carrier was awarded a new New York-Rochester-Buffalo-Detroit route competitive with American Airlines. These awards, coupled with the appeal of Capital's new Vickers Viscounts, are expected to boost the carrier's standing on the major eastern routes.

In its decision, the Board also strengthened Northwest in the Chicago market by permitting it to use the mid-west point on its transcontinental flight. Northwest also was picked to furnish new competition on the New York-Detroit route.

Adjustments were made in the routes of Eastern, United and TWA to improve service at Detroit, Philadelphia, Pittsburgh and Ft. Wayne.

The Board cited two basic reasons for its findings:

First was the need for more competition, which the Board felt could best be furnished by the regional carrier—Capital.

Second was the need for strengthen-

ing Capital's route structure. The same thinking applied to the Northwest awards.

The Denver Service Case is the next one up for decision. This one deals with the east-west service needs of Kansas City, Denver, Reno and Salt Lake City on routes between Chicago and Los Angeles and San Francisco. A basic question is that of competition for TWA at Kansas City and United at Denver, each an east-west monopoly and main base for the carriers.

### Favor Regional Carriers

The examiner favored two small trunklines for new service in the area. He would give Continental a Chicago-Kansas City-Denver-Los Angeles route and fill in a gap in Western's route structure with a Denver-Salt Lake City-Reno-San Francisco route.

Continental still requires subsidy support for its operation and Western is the smallest trunk airline not receiving subsidy. The new routes would substantially strengthen both carriers.

In addition to building the economic position of the two carriers, the examiner felt that they would be better able to supply the regional type of service required by the cities involved. A major complaint from the cities is that United and TWA's transcontinental schedules are made for the convenience of passengers from the East and West Coasts and result in some very awkward arrival and departure times in the Mid-west and Rocky Mountain areas.

In favoring Continental and Western, the examiner turned down applications of United for Kansas City and TWA for Denver and favored the strengthening of the smaller carriers as competitors of the big trunk lines.

The examiner also advised CAB to remove restrictions on American which prevent it from operating nonstop serv-

## Pan American Copter Service

Pan American Airways announced last week that, in an agreement with New York Airways, it will offer its passengers helicopter service between New York International, LaGuardia and Newark Airports beginning Nov. 1.

Under the plan, which is still subject to Civil Aeronautics Board approval, the shuttle service will be available to all passengers arriving at either LaGuardia or Newark who hold Pan American reservations out of New York International.

The plan also grants Pan American passengers lower fares—\$3 between Idlewild and LaGuardia and \$5 between Idlewild and Newark—than New York Airways regularly charges for the runs—\$4.09 and \$8.64. The S-55 helicopter flights will be operated every hour on the hour except between 11 p.m. and 7 a.m.



ices from certain eastern cities to Los Angeles and San Francisco and offering competition to United and TWA on the routes.

This case offers the Board a clear choice between added competition among the large carriers and added competition for the large carriers from small regional carriers.

#### More Competition

In the third case, the Northeast-Southwest Case, the issue is not so clearly drawn, but there is ample opportunity for the CAB to strengthen regional route structures.

The findings of the examiner in this case favor both greater competition among the big four and more competition from a smaller line. He recommends that American be allowed to compete with Eastern for the Houston-New York market and that Eastern be allowed to crack American's monopoly on the New York-Dallas/Ft. Worth market. He would also allow TWA to compete with American at Tulsa and Oklahoma City.

On the East Coast, the examiner favors the strengthening of Capital as a competitor of Eastern. He would amend Capital's route structure so the carrier could operate effectively between New York and Atlanta and New Orleans via both Pittsburgh and Washington. Capital now operates in the area, but its routes are so scrambled it is eliminated from competition.

The best prospect among those left out of the examiner's recommendation is Delta Air Lines which serves most of the points involved in the South and Southwest and wants badly to get into the New York market.

#### New East Route Approaches

The fourth case, dealing with New York-Florida routes, is just out of the hearing stage and months away from decisions. But it offers a variety of approaches in development of the Eastern route pattern.

Eastern and National, which have been bitter competitors for traffic along the East Coast, are now fighting together to keep a third carrier out of the very rich New York-Florida market. With Eastern claiming second place among domestic trunk carriers and National reporting operating revenues of \$6,604,576 on \$48,616,468 total revenue for Fiscal 1955, there isn't much doubt that there is room for another carrier on the route.

Right now, the strongest contenders for the route are Northeast Airlines, Delta Air Lines and Capital Airlines. Northeast, along with Colonial Airlines, has a limited route structure in the northeastern area.

Certification of either of the small carriers would take it off subsidy and

#### Viscount to Bermuda

The British Overseas Airways Corp. will place a Vickers Viscount turboprop airliner on its New York-Bermuda run beginning Nov. 12.

The Viscount will operate on a twice-weekly, first-class schedule as part of a New York-Trinidad route operated jointly by BOAC and its Caribbean subsidiary, British West Indian Airways. The sector from Bermuda to Port of Spain, via San Juan and Barbados, will be the responsibility of BWIA.

BOAC also will operate a daily New York-Bermuda tourist-class service with Lockheed Super Constellations and has plans for a similarly-scheduled first-class service beginning in mid-January.

turn it into a major eastern carrier, just as certification of National on the same route five years ago brought that carrier to its present strong position.

Colonial's deal to merge with Eastern is currently before the Board, and if it goes through, Colonial will be eliminated from the running.

National has made a public offer to take over Northeast, but the smaller carrier doesn't want anything to do with such a deal, at least until a decision is reached in the New York-Florida Case.

#### Delta Seeks New York

Capital and Delta are the two regional carriers whose route structures fit into the New York-Florida route most easily. Delta is making a major effort to get into the New York market, and Capital would like to add the long route to its predominantly short-haul pattern.

TWA and United are after a small segment of the route. They want to connect their eastern terminals and operate over the heavily traveled Washington-Baltimore-Philadelphia-Newark-New York-Boston route now shared by Eastern and American.

Eastern and National have applications in the case to strengthen their own routes along the East Coast.

The remaining six applications call for new services the CAB is unlikely to grant. Pan American World Airways is asking for a domestic route between Boston and Miami. Braniff Airways wants an East Coast route which would be entirely outside its western area of operation.

Riddle Airlines wants the Board to certificate it for passenger service along its present cargo routes, and Resort Airlines would like to become a scheduled operator. Two nonscheduled operators, North American Airlines and Peninsular Air Transport want certificates for scheduled service.

## N. American Airlines Loses Right to Name

Los Angeles—North American Airlines, fighting to retain the use of its name, last week lost the second round of a legal battle with North American Aviation, Inc.

The U. S. Court of Appeals for the 9th District unanimously upheld a lower court ruling which granted the airframe manufacturer an injunction restraining the non-scheduled airline from use of the name.

The non-scheduled carrier announced immediately afterwards it would appeal the decision to the Supreme Court.

North American Aviation, Inc., first petitioned for the injunction against North American Airlines and affiliated companies and airline officials in August, 1951. U. S. District Court Judge Peirson M. Hall ruled in favor of the airframe manufacturer and the case was then appealed to the circuit court.

Last week, Judge James Alger Fee of the Appellate Court delivered the opinion which supported in full Judge Hall's findings.

The ruling prohibits the non-scheduled carrier and affiliated companies and individuals from using the name "North American" in any phase of aviation.

Use of the name "North American" by the airline has confused the public, the court said, misleading numerous people into believing that a connection exists between the carrier and the airplane builder. In adopting the phrase "Fly the North American Way," they have relied upon the good will and reputation of the airplane manufacturer and "have spent money freely and in tremendous sums to encourage the belief that they were North American Aviation."

He pointed out that the airplane manufacturer has used the slogan, "The North American Way," extensively since some time in 1941.

Use of this slogan and of a symbol similar to the one used by North American Aviation is "conclusive evidence" that the airline was doing all it could to identify itself with the airplane builder and "capitalize on the reputation which plaintiff had built up under this exclusive name," Fee said. He added:

"North American Aircoach Systems, Inc., is nothing but a ticket drummer. Therefore, in advertising itself as North American Airlines, it is not only appropriating from plaintiff, but it is also falsely describing itself to the public."

Fee said the airline has pursued its course persistently and has entirely disregarded all warnings. "The hands they stretch out in prayer are unclean," he added.

## Airline Profits Double in First 6 Months

Washington—Profits of the U. S. scheduled airline industry increased 100% for the first six months of 1955 over the same period in 1954.

Industry net profit after taxes amounted to \$39,758,000 in the first half of 1955—double the \$19,868,000 reported for the 1954 period, according to the Air Transport Assn.

An ATA consolidated industry summary for the first six months covering 43 certificated member airlines reports first quarter profits of \$9,253,000 combined with a second quarter net of \$30,505,000 in making up the record half year return.

Industry observers predict 1955 will be a record profit year for the airlines. The phenomenal first quarter provided the impetus. The trend was maintained in the second quarter, profits up 24% over the same period in 1954, and there is every indication that the high level of business will be retained in the second half. Passenger traffic, as usual, provided the bulk of the business with a 19.4% gain to 11,630,366,000 revenue passenger-miles flown from January through June of 1955.

Sixteen carriers, representing two of the six industry segments, accounted for 97% of the total profits. The 13 domestic trunklines earned a net profit of \$29,738,000 on total operating revenues of \$549,769,000. U. S. carriers operating international or overseas services, which includes nine of the trunklines with international divisions plus Caribbean Atlantic Airlines and Pan American World and Pan American-Grace Airways, netted another \$9,193,000

from gross revenues of \$187,294,000.

The ATA report showed the income and revenues of the other four industry segments as follows: 13 local service airlines earned a net profit of \$219,000 on total operating revenues of \$26,723,000; nine Alaskan airlines, \$675,000 and \$10,817,000; three helicopter airlines, \$141,000 and \$1,626,000; and two territorial airlines, a net loss of \$208,000 with gross revenues of \$3,411,000.

Industry gross revenues totaled \$779,640,000 for a gain of 15% over the first six months of 1954. The industry is dominated, of course, by the 13 trunk airlines which again, along with their international operations, brought in 95% of the business. The domestic trunklines grossed \$550 million on which they realized a net operating income of \$59 million (AW July 11, p. 12). A forecast of year-end results indicates revenues exceeding \$1 billion, net operating income of more than \$100 million, and profits of \$75 million for the domestic scheduled trunklines.

Significant development in the airline financial picture is the elimination of dependence on the government for subsidies. In the first half of 1955 only three of the trunklines received any subsidy and that had been reduced by 65% from a year ago. Even service mail pay accounted for less than 2% of the total revenues of the trunkline group.

The local service carrier group has materially reduced its reliance on federal subsidy which previously amounted to half of their income. Passenger revenues and other income is being in-

creased by feeders and in first half had climbed to 60% of all revenues.

International and overseas operations of U. S. airlines still account for the largest share of subsidy payments, but this segment of the industry is making great strides toward reducing subsidy needs. Subsidy payments to the group so far this year of \$10.8 million have been 37% less than in the same period of 1954. At the same time, total revenues gained 10% while the operating costs were held to a 9% gain. With the returns in the third quarter, which was a record summer season (AW Oct. 3, p. 14), international services are assured of new highs in profits.

Helicopter operators, which include Chicago's Helicopter Air Service, Los Angeles Airways and New York Airways, have reported gains in all categories of traffic revenue. Federal subsidies, however, are still required and in the first half amounted to 80% of total revenues. Other outstanding revenue gains: passenger service climbed 300%, express 240% and freight, 100%.

The two territorial air carriers, Hawaiian Airlines and Trans-Pacific Airlines, were the only group that failed to show a profit, reporting a net loss of \$152,000 in the first half. Operating expenses outstripped revenues which remained constant at \$3.4 million. Nine Alaskan airlines also are struggling with the problem of increasing expenses. Revenues gained 18% over the preceding year, but expenses increased 23%. The Alaskan group made a profit of \$675,000 on revenues of \$10.8 million in the first half.

### Revenues and Profits During First Six Months of 1955 For Scheduled U. S. Carriers

CARRIERS	Gross Operating Revenues	Percentage of Total	Net Operating Income	Percentage of Total	Net Profit or Loss After Taxes	Percentage of Total
13 Trunklines.....	\$549,769,000	70.5	\$59,006,000	80.8	\$29,738,000	74.7
12 Int'l. and Overseas*.....	187,294,000	24.3	12,949,000	17.7	9,193,000	23.1
13 Local Service.....	26,723,000	3.3	410,000	.5	219,000	.5
9 Alaskan.....	10,817,000	1.3	652,000	.8	675,000	1.5
2 Territorials.....	3,411,000	.4	(152,000)	.....	(208,000)	.....
3 Helicopter.....	1,626,000	.2	199,000	.2	141,000	.2
52* Total.....	\$779,640,000	100	\$73,064,000	100	\$39,758,000	100

\* Total number of Air Transport Assn. airline members is 43, but nine of the 13 domestic trunks also operate international divisions. They are American Airlines, Braniff Airways, Colonial Airlines, Delta Airlines, Eastern Airlines, National Airlines, Northwest Airlines, Trans World Airlines and United Airlines. Four trunklines operating domestic services only are Capital, Continental, Northeast and Western Airlines.



## TWA Loses Move to Bar Rizley

The Civil Aeronautics Board has rejected a move by Trans World Airlines to bar CAB Chairman Ross Rizley from voting on the reopened trans-Atlantic final mail rate case and has refused the carrier's request for reconsideration.

Trans World Airlines sought to disqualify Rizley from participation in the case on the grounds that he was Solicitor of the Post Office Department at a time when the Department was involved in the case.

The disqualification move came after the Board split 3-2 on the issue of a \$3 million TWA tax reserve. CAB decided not to allow the deferred tax reserve as an expense, and Rizley voted against the TWA position.

TWA pointed out that Rizley served as Solicitor of the Post Office Department from March to December, 1953, a period when the mail rate case was pending before the Board. CAB answers that the specific tax matter was not an issue in the case in that period.

The Board points out that TWA didn't move for disqualification until after the adverse ruling was made. "TWA might have been playing it both ways," said the Board, "or might have had an afterthought, and there is no effective way of determining otherwise in a situation such as this."

CAB also rejected a TWA request that Chairman Rizley be disqualified from further consideration in the case, which is incomplete. TWA can still file a motion to disqualify on specific issues before they are submitted to the Board for decision.

The Board denied TWA's request for reconsideration on the basis of arguments already covered in its decision. It also pointed out that accounting practices, no matter how well recognized, don't necessarily determine "vital substantive questions that arise under the rate-making and subsidy standards of our Act."

"The all-important question before us is not accounting practice, but 'need', as that concept appears in our Act and has been interpreted by the courts," CAB said.

## ICAO Group Proposes Air Traffic Revisions

Revisions of rules governing air traffic control were proposed by the Air Navigation Conference sponsored by the International Civil Aviation Organization in Montreal, Canada.

Here are the proposals made to ICAO's member states:

- **Amended rules of the air** to bring under traffic control procedures a number of flights now being made under visual flight rules. The Conference also suggested an educational program to persuade pilots not to fly VFR whenever there is doubt about completing the flight under those rules. The group also recommended increasing the controlled airspace to provide separate in-bound and out-bound routes, improvement of current air traffic services techniques and increased use of radar.

- **Arrange a system of reporting** "near misses" between aircraft in flight. The Conference said that the purpose is not to take disciplinary action against the pilots but to analyze the "near misses" in order to avoid them in the future.

- **Forward to ICAO the results of experiments** with flashing high intensity lights which increase chances of recognition under night flying or dull weather conditions. The new lights soon will become mandatory for at least one ICAO member.

- **Change the international rules** to prohibit all flights in controlled airspace between sunrise and sunset unless they are carried out under air traffic control rules from the ground. This would prevent night flights being carried out under VFR without specific permission.

- **Increase the distance** aircraft must keep away from clouds to avoid collisions. New standard would require forward visibility to be at least 5 miles, and distance from the cloud to be 1 mile horizontally and 1,000 feet vertically. Present standards are 3 miles for forward visibility, 2,000 feet for horizontal distance from cloud and 500 feet vertical distance.

Representatives of 29 nations and five international organizations attended the month-long conference.

## AAL Crash Blamed On Crew's Inattention

The crash of an American Airlines Convair at Springfield, Mo., probably was caused by the crew's inattention to flight instruments and a possible sensory illusion, according to the Civil Aeronautics Board's accident report.

The CAB report found that the American Convair flight didn't execute the Civil Aeronautics Administration approved VOR instrument approach procedure at Springfield but flew directly from the station toward the airport.

Analysis of weather conditions indicates that visual reference with the ground was possible before the aircraft turned toward the airport, but it wasn't probable at the required altitude.

The accident occurred Mar. 20, 1955, on American Flight 711, multi-stop Convair 240 flight from Newark to Tulsa, Okla. The flight stopped at St. Louis, then proceeded to Springfield where it was cleared for an approach.

The plane struck the ground in a field about 1½ miles north-northwest of Springfield Municipal Airport. Eleven of 32 passengers, the copilot and stewardess were fatally injured. The pilot and all but one of the remaining passengers were seriously injured.

## \$24 Million Aviation Loan Goes to Ethiopia

Ethiopia is receiving a \$24 million loan from the Export-Import Bank of Washington for development of commercial aviation.

The money will be used by Ethiopia to construct air fields and aviation facilities and to purchase new aircraft for use on international and domestic routes.

Ethiopian Air Lines, a state corporation, currently serves Cairo, Athens, Nairobi, Djibouti, Aden and Beirut from the capital, Addis Ababa. The airline also operates extensive cargo services within Ethiopia where ground transportation is difficult because of terrain and lack of roads.

The loan will be repaid at 5% interest in semi-annual installments over a twenty year period.

Ethiopian Air Lines, a state corporation, currently serves Cairo, Athens, Nairobi, Djibouti, Aden and Beirut from the capital, Addis Ababa. The airline also operates extensive cargo services within Ethiopia where ground transportation is difficult because of terrain and lack of roads.

## CAB ORDERS

### GRANTED:

Seaboard and Western Airlines an exemption to provide free transportation to G. D. Holcomb, Jr., an insurance underwriter, on a roundtrip flight between the United States and Europe for purposes of in-flight observation.

Central Airlines an exemption to serve Sherman-Denison, Tex., as an intermediate point between Dallas and McAlester, Okla., in lieu of service to the point on the segment between Ardmore, Okla., and Dallas.

City of El Paso, Tex., permission to intervene in the Texas-California interchange cases.

Slick Airways an exemption to serve Nashville, Tenn., and Pocatello, Idaho, on its transcontinental truck-air-truck service; and Oklahoma City and Wichita, Kan., on its regular scheduled operation, until 60 days after a final decision in the air freight renewal case.

### APPROVED:

Agreements between American Airlines, Trans World Airlines and various other carriers relating to inter-carrier arrangements.

### ORDERED:

Eastern Air Lines route consolidation case expanded to include Delta Air Lines' application for service to Nashville, Louisville and Cincinnati.

Frontier Airlines' final mail rate fixed at the rate proposed by the Board in its show cause order for the period starting Sept. 15, 1954.

Large Irregular Case record reopened to receive additional evidence from All Ameri-

can Airways, American Air Export and Import Co., Capital Airways, Central Air Transport, Economy Airways, Great Lakes Airlines, Overseas National Airways, Trans Caribbean Airways and United States Overseas Airlines.

## Surface-Mail-By-Air Rates To Be Extended

Temporary rates for the surface-mail-by-air program will be extended by Civil Aeronautics Board pending a decision on final rates for the Post Office Department experiment.

Rates for the eastern portion of the surface mail program expired Sept. 30. The Board proposes to extend them on a temporary basis for services between New York and Washington and Chicago, and between these three cities and points in Florida.

The rates paid the airlines for hauling surface mail are roughly comparable to average air freight tariffs.

When the Post Office experiment began, CAB set rates which expired Sept. 30, 1954. These rates were subsequently extended for a year to allow added time for the collection of data.

A final rate proceeding has been started, but hearings start Oct. 11, and the Board will not reach a decision for several weeks after hearings close. The Postmaster General has asked for interim rates to cover the period from Oct. 1 to the setting of final rates.

The Board concludes that the request of the Postmaster General should be granted pending a full evaluation of the program for rate-making purposes.

Airlines affected by the order are American Airlines, Capital Airlines, Delta Air Lines, Eastern Air Lines, National Airlines, Northwest Airlines, Trans World Airlines, United Air Lines, Slick Airways, the Flying Tiger Line and Riddle Airlines.

## Carrier Liability Increased to \$16,582

Liability of air carriers for a passenger killed or injured on an international flight will be increased to \$16,582, double the present amount, under terms of an air protocol signed by a conference of 26 nations at The Hague sponsored by the International Civil Aviation Organization. Ratification by 30 countries is required.

The \$8,291 limit now provided was adopted at the Warsaw Convention in 1929 and governs the liability of the air carriers. This international agreement provides that when an accident which causes injury or death to a passenger occurs there is a presumption of liability against the carrier. It is the responsibility of the air line to prove it was not negligent.

## Airlines Use Music To Drown Engine Noise

Use of tape-recorded music to drown out engine noise is catching on with the U. S. airline industry.

Nine carriers have installed, or are testing, Travel Muzak taped orchestration which they rent for an average of eight dollars per month for each aircraft.

Special music recorded at a frequency range higher than that of the engine noise is played on a 35-lb. \$460 APB-12 tape reproducer made by Presto Recording Corp., Paramus, N. J., that fits a standard ATR rack.

United Air Lines is installing the Travel Muzak package on its entire DC-7 fleet and Pan American is having the machines installed on all of its DC-7Cs.

Other carriers using or testing the equipment: Western Air Lines, Capital, Braniff, Avianca, Trans-Caribbean, Seaboard & Western and National.

Travel Muzak says that it also will try to sell corporations on installing the airborne musical dispensers on their business aircraft.

## SHORTLINES

► **British Overseas Airways Corp.** has issued a booklet for air cargo users listing rates, collect and C.O.D. services, valuation charges and insurance premiums from New York to 133 overseas points.

► **Riddle Airlines** reports operating revenue of \$3,279,301 for the year ending June 30. Net income after taxes was \$359,231 compared with a loss of \$111,672 on revenues of \$2,296,998 in 1954. Total assets of the company increased from \$1,064,270 in 1954 to \$5,392,554 this year.

► **Seaboard and Western Airlines** has signed an agreement with Railway Express Agency providing for a single waybill from 15,000 points in the United States to major cities in Europe, the Middle East, Africa and the Far East. . . . Seaboard has signed a through freight agreement with United Air Lines.

► **Trans World Airlines** has started work on its \$15 million Atlantic region maintenance base at New York International Airport. The project is scheduled for completion by mid-1957. . . . At the present time TWA is scheduling nine eastbound and nine westbound combination tourist-first class flights daily.



**Britannia at Tempelhof**

The Bristol Britannia, Britain's long range turboprop transport, was used to fly Peter Thomeycroft, president of the British Board of Trade, to Berlin for the recent German Industries Fair and, incidentally, to place itself on display as a lure for any potential customers. Parked at Tempelhof Aerodrome (above), the Britannia was inspected by officials of the recently-revived West German Lufthansa Airlines. Lufthansa is at the present time in the market for new types of transports to place in service on present as well as planned routes (AW Aug. 22, p. 99).





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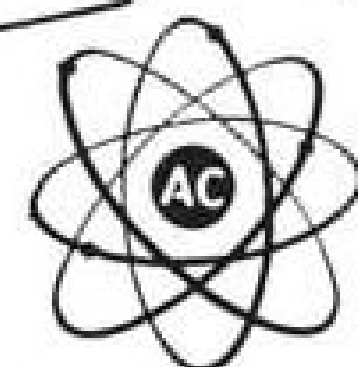
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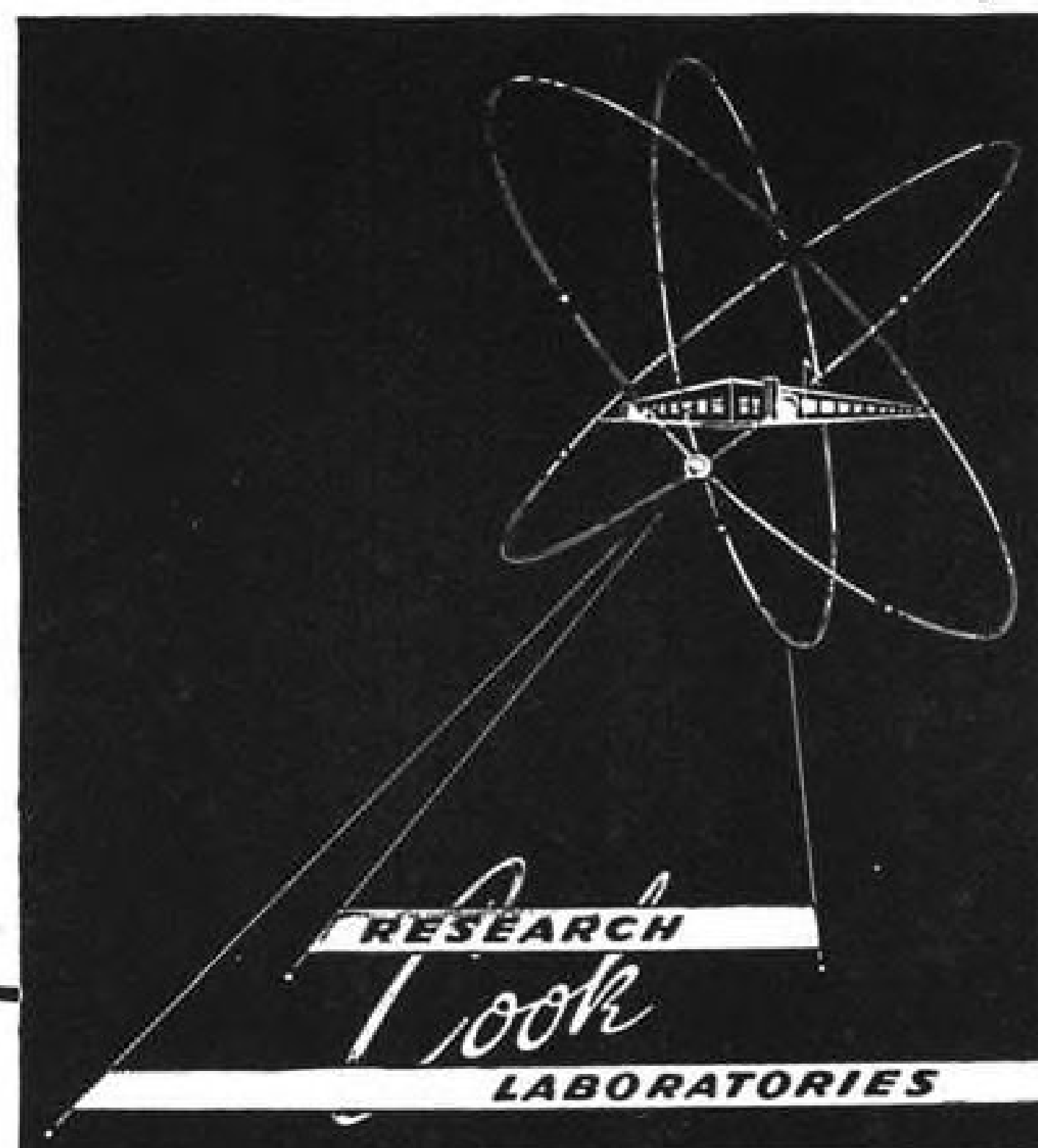
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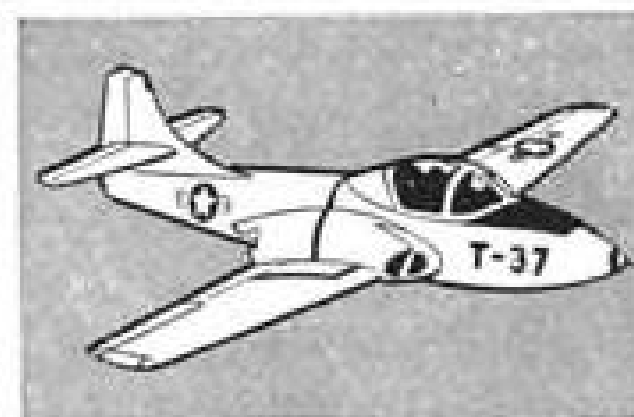
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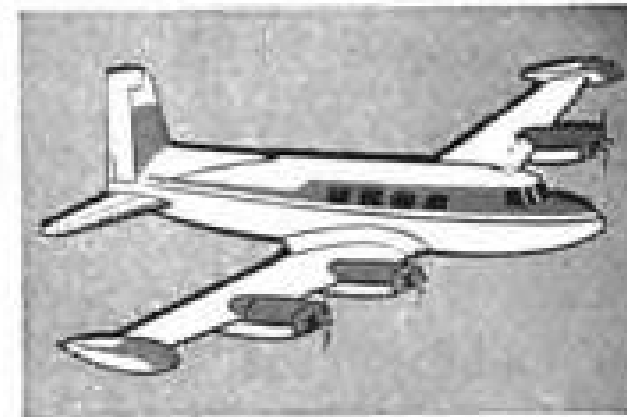
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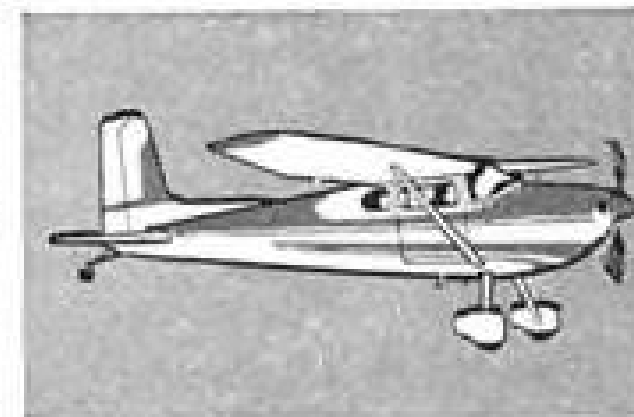
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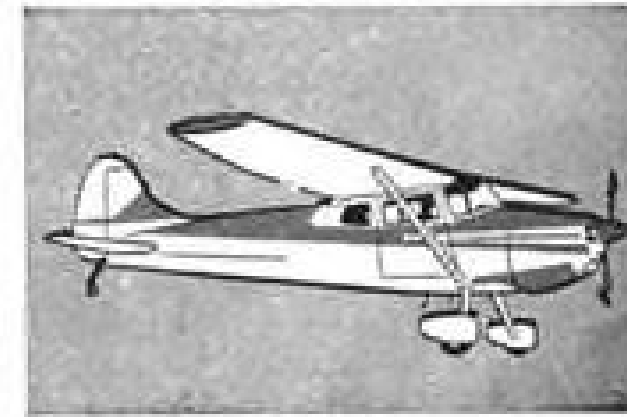
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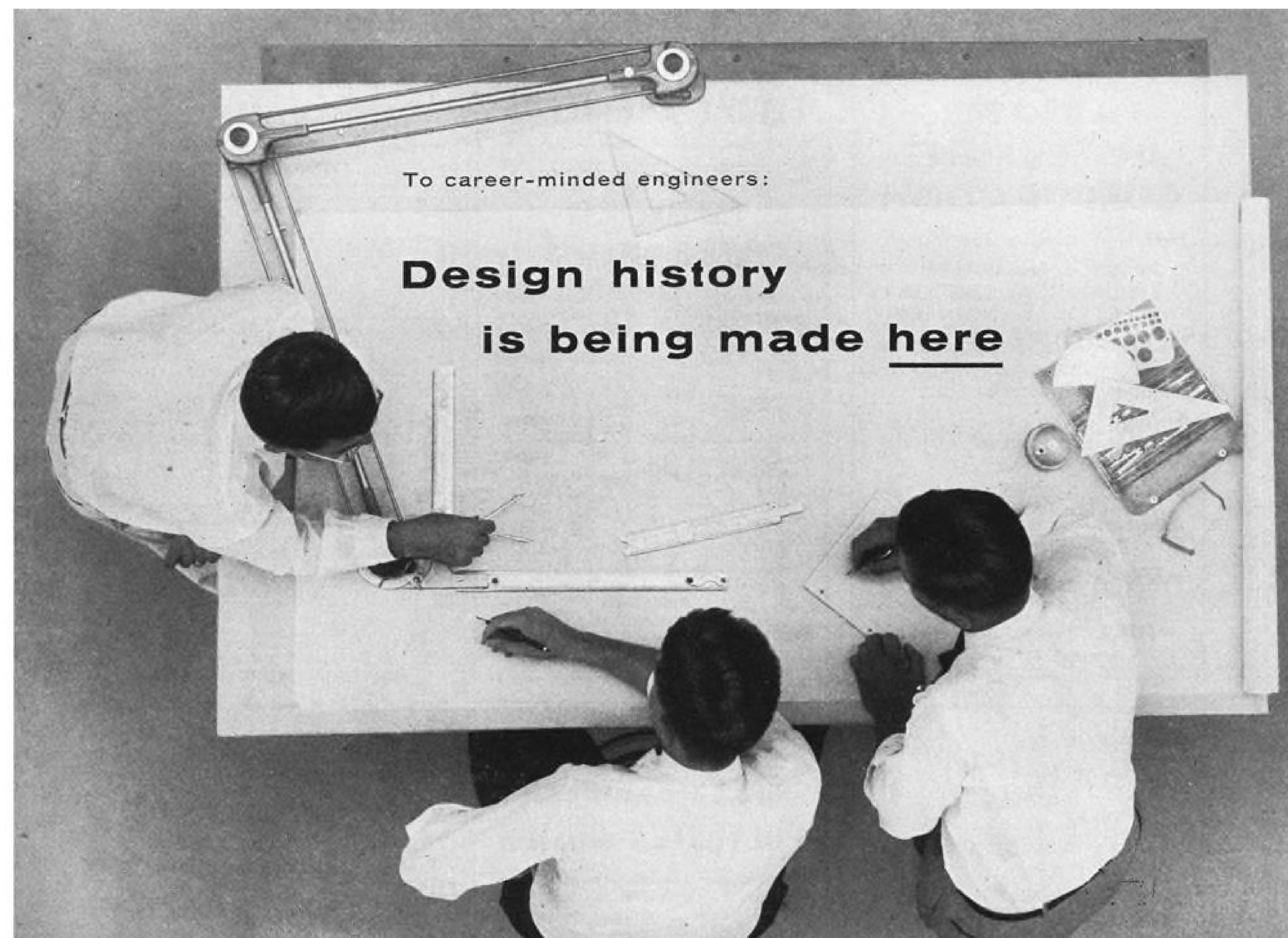
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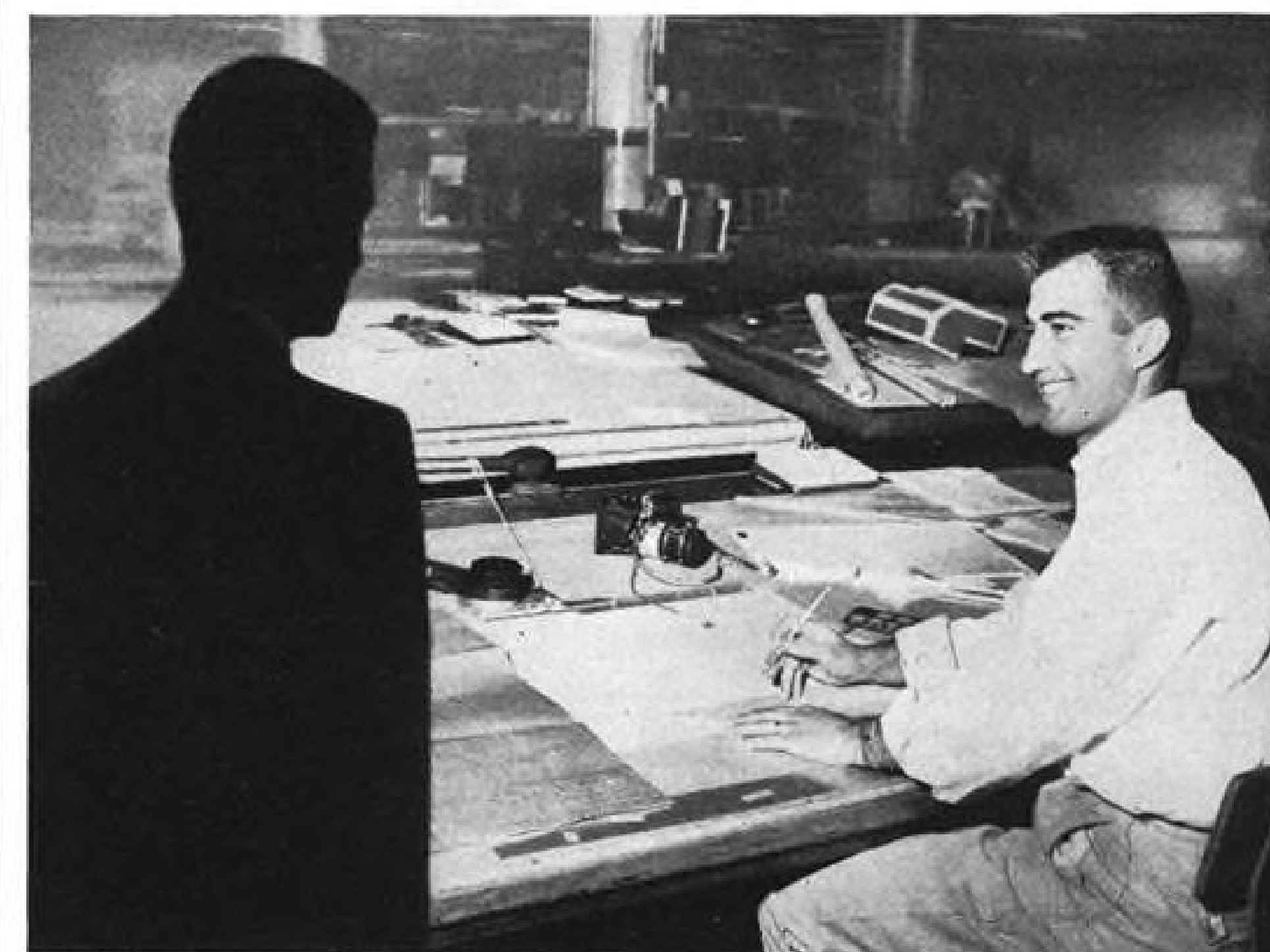
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## EDITORIAL

### Static in the Control Tower

A series of recent public blasts by military and civil transport experts on the inadequacy of the present air traffic control system and the efforts toward future system planning are further indication of the growing crisis in airspace. These blasts were delivered at the annual Radio Technical Committee for Aeronautics meeting in Washington by Lt. Gen. Joseph Smith, commander of the Military Air Transport Service which operates a sizable fleet of aircraft over the domestic airways system, and Sam Saint, veteran American Air Lines pilot, consultant to the Air Navigation and Development Board and an indefatigable worker in the cause of better air traffic control. General Smith's views were endorsed by Milton Arnold, operations vice-president of the Air Transport Association and another recognized authority on the subject.

#### Future vs. Present

A week later Civil Aeronautics Administrator Fred Lee made a speech to business aircraft operators in Detroit reflecting the CAA party line on the traffic control problem. The RTCA blasts and Lee's speech present some interesting contrasts that explain much of the military and civil dissatisfaction with the CAA's past, and present attitude toward the federal airways system.

Fred Lee spoke glowingly of a ten-year "grand-scale" CAA planning effort aimed at meeting the air traffic control problem of the future.

General Smith warned bluntly that the traffic control problem is acute already and the current airway system is "inadequate and obsolete" for even current combined civil-military needs. He called for emergency action immediately instead of more grandiose future planning.

Fred Lee said CAA must prepare to meet the problems of the jet age.

General Smith pointed out that the jet age is here with thousands of military jets flying in the United States that must be integrated into the current air traffic control system.

Fred Lee expressed concern that inadequate future airways planning by CAA might "prove to be a stumbling block to the industry" and throttle future growth.

#### Radar Conversion

Any airline operations executive can tell him that air traffic control is now throttling future airline traffic growth. When the New York area bottleneck is jammed in instrument weather, airline traffic is delayed and

stopped as far away as the Midwest, Miami and New England. During IFR weather the East Coast short haul airlines often run at an average ramp to ramp speed no faster than the Pennsylvania Railroad.

Fred Lee says the CAA answer to the problem is radar, radar and more radar. This must be encouraging news to the people who have been beating on CAA ever since 1946 to apply radar to traffic control problems. Not until 1952 did CAA begin to operate a radar traffic control center. Only last summer it conducted a typical pigeon-holing, double-talking rear guard action in the Air Coordinating Committee, blocking effective integration of military air defense radar into a unified air traffic control system.

As Sam Saint points out so accurately, the technology in the avionics field has far outstripped the budget and policy administrators. The major problems in organizing an effective traffic control system to handle today's traffic and planning its development to take care of tomorrow's expanding volume are political, philosophical and financial, not technical. Until agreement is reached on the three basic problems raised by Saint there is little hope for welding the black boxes that are now and soon will be available into an effective traffic control system that meets both civil and military needs.

#### Public Debate Needed

It is good to see these bitter debates over air traffic control emerging from behind the closed door committee meetings and panels into the fresh air of public debate.

For the public has a vast stake in the issue. Every taxpayer who helps pay for military airpower in the belief that it will defend our country has a stake in air traffic control. Every citizen who buys an airline ticket and every corporation executive who travels in a company transport also has legitimate stakes in this problem.

Above and beyond all this endless debate and tortuously-slow progress toward a vital goal, lurk the twin spectres of a sieve-like air defense and mid-air collisions involving 40- to 60-passenger transports over the heavily populated metropolitan areas that lie underneath the most congested air traffic centers.

Ten-year ultimate goal studies are necessary to keep pace with the rapid expansion of air traffic, but the air-space control problem is with us now in a most dangerous form. It requires immediate action along with future planning, if we are to avoid the twin disasters cited above. If CAA does not take the necessary action immediately, Congress will have to designate some other agency to solve the problem.

—Robert Hotz

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