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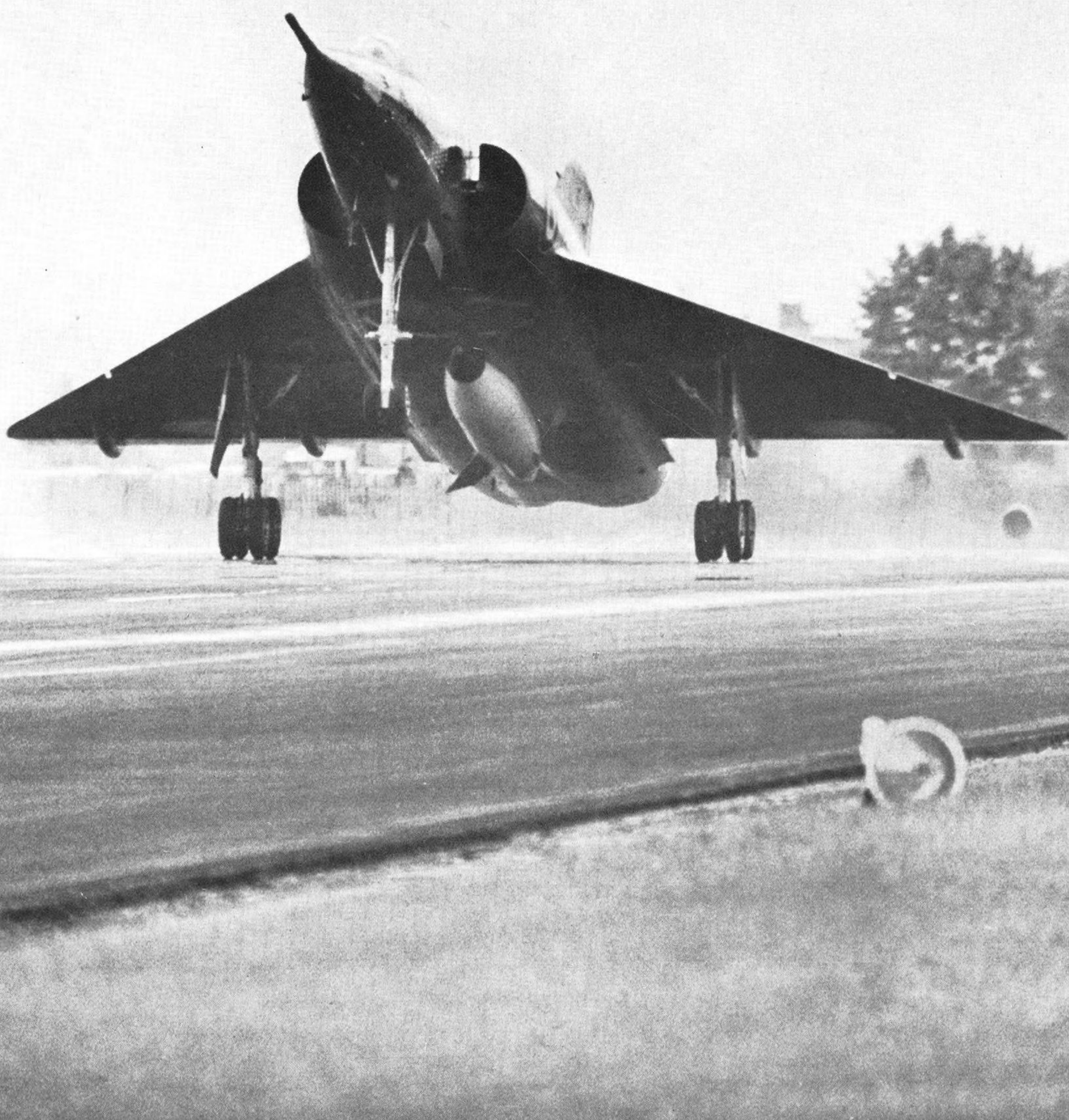
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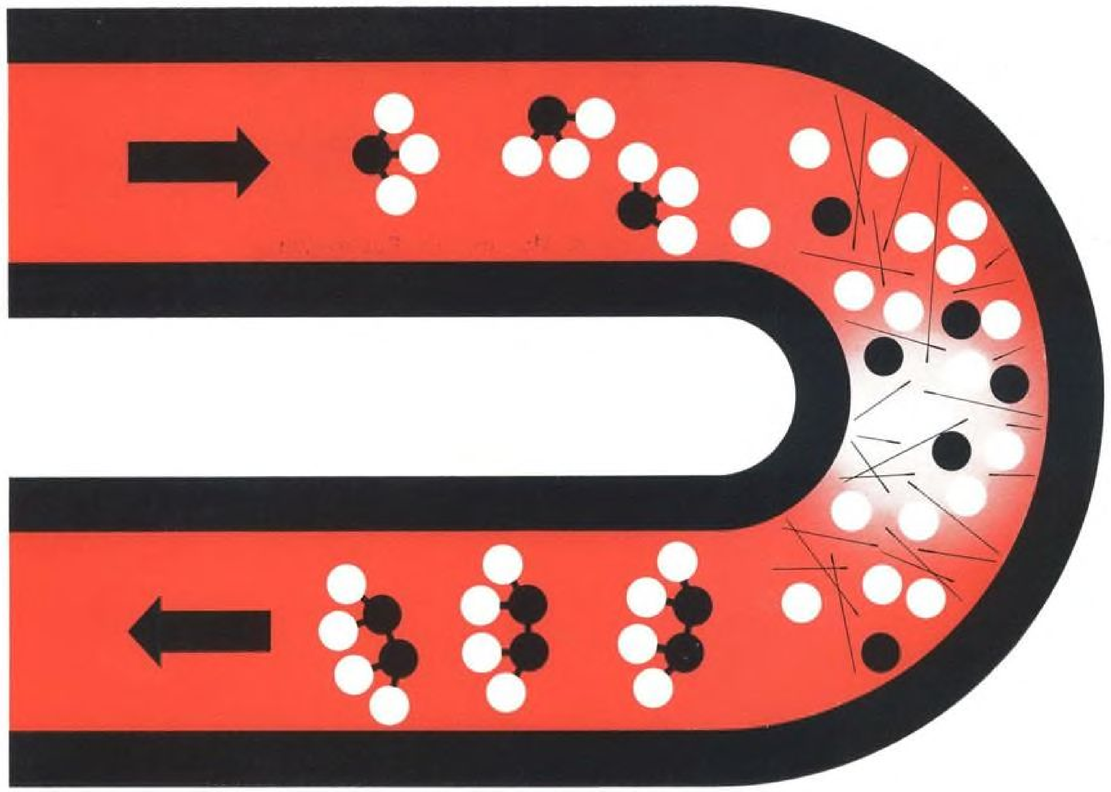
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July 8, 1963

Navy Planning Integrated ASW Avionics System

Dassault Mirage 4
Strategic Bomber





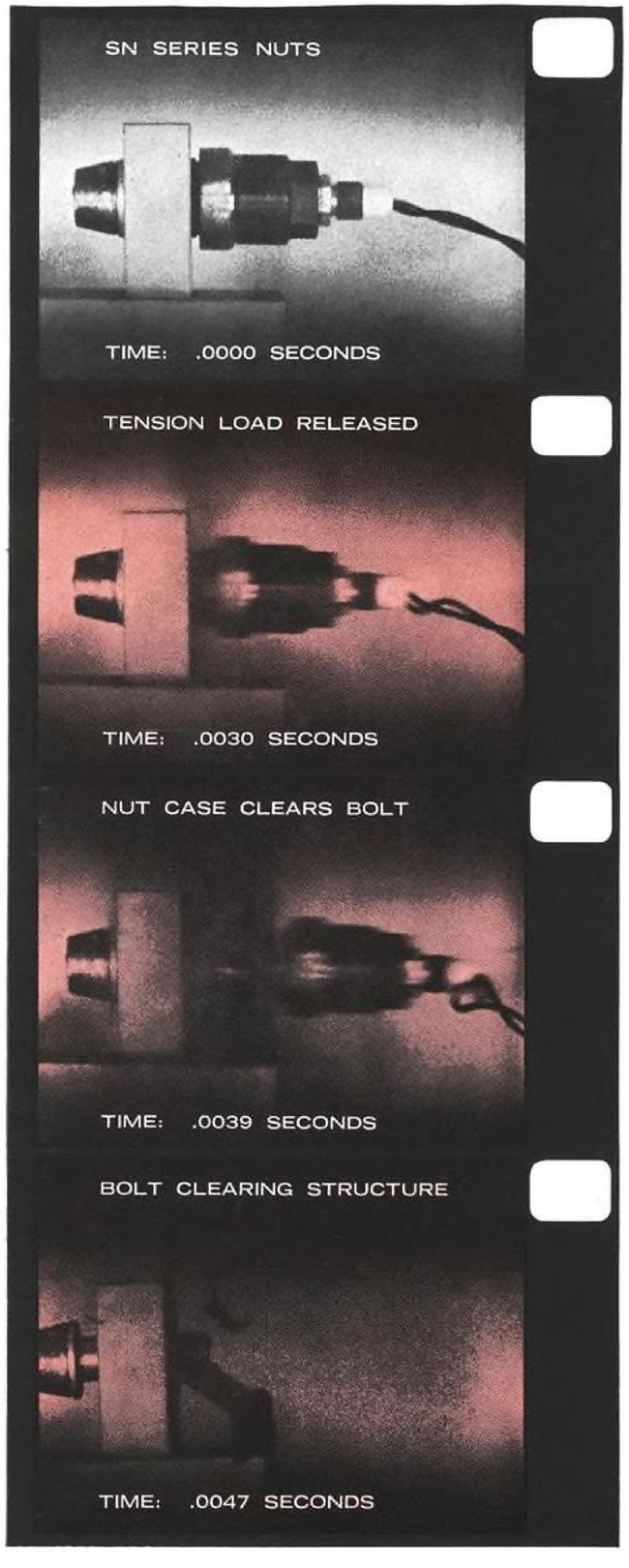
FISSIO-CHEMISTRY FOR CHEMICAL MANUFACTURING

A process that may represent a truly economical use of atomic power has recently been developed at Aerojet-General Nucleonics. ■ We call it fissio-chemistry. ■ We think it has great potential for the manufacture of high-energy compounds that now can be produced only by relatively inefficient and expensive means—and for the production of entirely new compounds, too. ■ Under Air Force sponsorship, AGN has already used fissio-chemistry to convert ammonia into hydrazine, the storable rocket fuel, at a rate projected to be just a fraction of the present cost. In the process, uranium fission fragments break up NH_3 molecules, which then reform into N_2H_4. ■ For the Atomic Energy Commission, AGN has also demonstrated the feasibility of fissio-chemical synthesis of NO_2 from air, suggesting the economical production of nitric acid and nitrogen fertilizers. This application may be of particular interest to emerging nations having limited domestic raw material sources. ■ AGN's continuing research in the field of fissio-chemistry is aimed at development of a production reactor in which the fissionable material is suspended directly in the reactants. This will make it possible to take full advantage of the high linear energy transfer and rapid quench inherent in a process that utilizes the recoil energy of fission fragments. ■ For additional information about fissio-chemical processing, write for AGN Active File No. 4.

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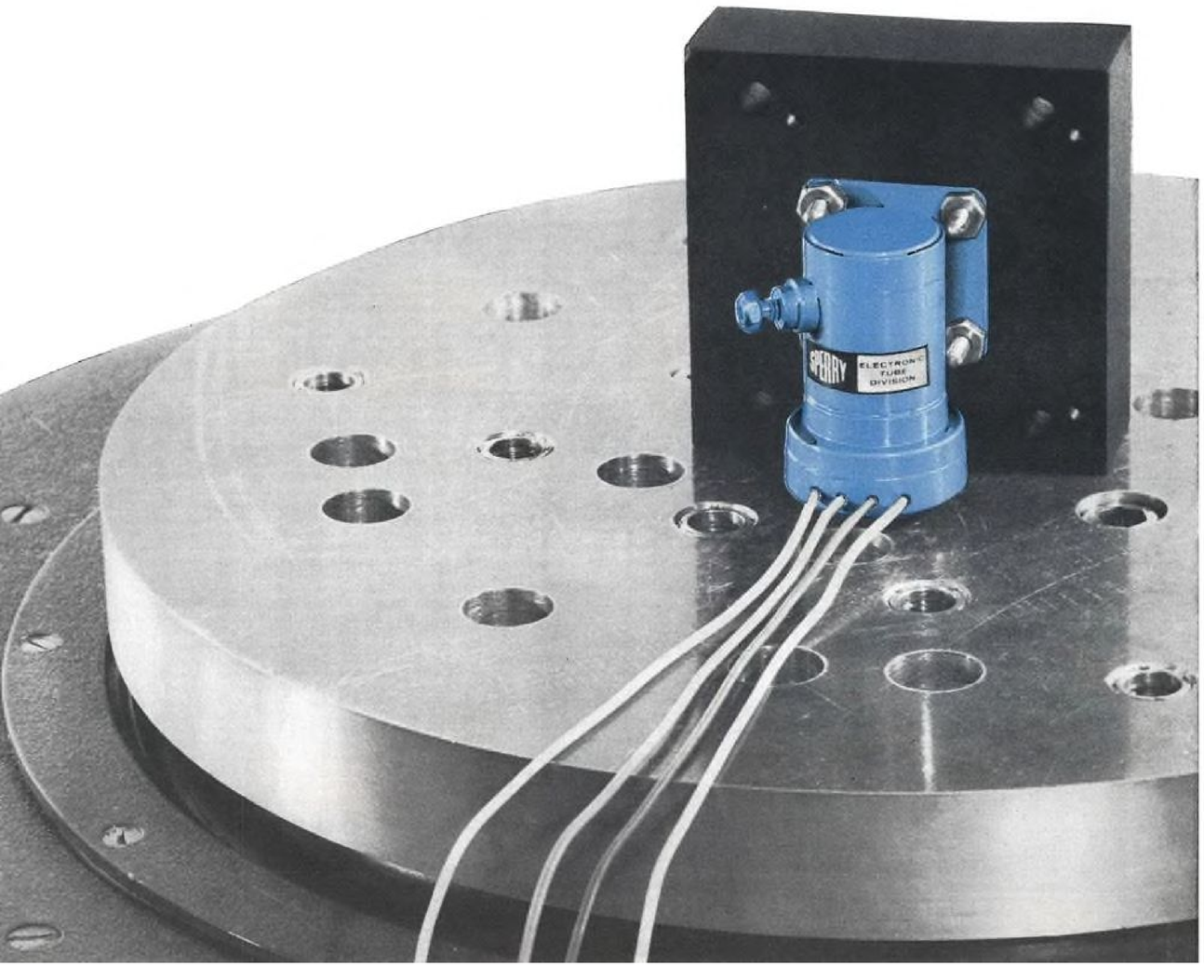
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AEROSPACE CALENDAR

July 18-20—30th Annual International Convention, The Ninety-Nines, Skirvin Hotel, Oklahoma City, Okla.

July 23-26—Torpedo Propulsion Conference (Confidential), American Institute of Aeronautics and Astronautics, U.S. Naval Underwater Ordnance Laboratory, Newport, R. I.

July 29-31—Symposium: Toxicity in the Closed Ecological System, Lockheed Research Laboratories, Palo Alto, Calif. Sponsors: U. S. Navy's Special Projects Office; Lockheed Missiles & Space Co.

July 30-Aug. 4—11th Annual Fly-In Convention, Experimental Aircraft Assn., Rockford, Ill.

Aug. 4-9—International Conference and Exhibit on Aerospace Support, Institute of Electrical and Electronics Engineers/American Society of Mechanical Engineers, Park Sheraton Hotel, Washington, D. C.

Aug. 4-16—Sixth Annual Institute on Missile and Space Technology, University of Connecticut, Storrs, Conn.

Aug. 5-9—Eighth Annual Technical Symposium, Society of Photographic Instrumentation Engineers, Ambassador Hotel, Los Angeles, Calif.

Aug. 12-14—Guidance and Control Conference, American Institute of Aeronautics and Astronautics, Massachusetts Institute of Technology, Cambridge, Mass.

Aug. 14-16—Fifth Biennial Gas Dynamics Symposium, Northwestern University/

(Continued on page 7)

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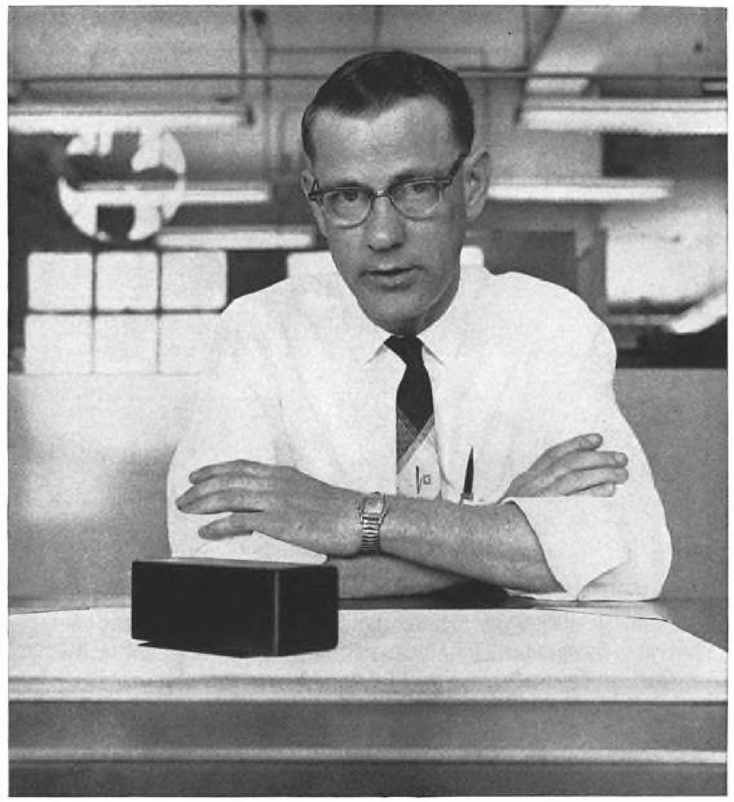
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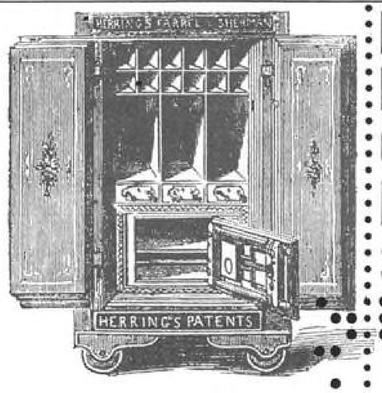
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AEROSPACE CALENDAR

(*Continued from page 5*)

American Institute of Aeronautics and Astronautics, Evanston, Ill.

Aug. 19-21 – Astrodynamics Conference, American Institute of Aeronautics and Astronautics, Yale University, New Haven.

Aug. 19-21—1963 Cryogenic Engineering Conference, Boulder, Colo. Sponsors: University of Colorado; NBS Cryogenic Engineering Laboratory.

Aug. 20-23—1963 Western Electronic Show and Convention (WESCON), Cow Palace, San Francisco, Calif.

Aug. 26-28—Simulation for Aerospace Flight Conference, American Institute of Aeronautics and Astronautics, Deshler-Hilton Hotel, Columbus, Ohio.

Aug. 26-28—Conference on Physics of Entry into Planetary Atmospheres, American Institute of Aeronautics and Astronautics, Massachusetts Institute of Technology, Cambridge, Mass.

Sept. 8-11—International Symposium on High-Temperature Technology, Asilomar, Calif. Sponsor: Stanford Research Institute.

Sept. 8-11—Annual Meeting, Air Industries Assn. of Canada, Manoir Richelieu, Murray Bay, Quebec.

Sept. 9-11—Seventh National Convention on Military Electronics, Institute of Electrical and Electronics Engineers, Shoreham Hotel, Washington, D. C.

Sept. 9-12—18th Annual Instrument-Automation Conference & Exhibit, Instrument Society of America, McCormick Place, Chicago, Ill.

Sept. 10-12—National Symposium on Space Rendezvous, Rescue and Recovery, Edwards AFB, Calif. Sponsors: American Astronautical Society; Air Force Flight Test Center.

Sept. 10-12—New York University's Third Annual Air Transport Conference, Washington Square Center, New York, N. Y.

Sept. 11-15—17th Annual National Convention & Aerospace Panorama, Air Force Assn., Sheraton-Park and Shoreham Hotels, Washington, D. C.

Sept. 16-18—International Aviation Research and Development Symposium, Atlantic City, N. J. Sponsor: Federal Aviation Agency.

Sept. 18-19—1963 Airwork Operations and Maintenance Symposium, Millville, N. J.

Sept. 20-29—Ninth Annual Houston International Trade & Travel Fair, Sam Houston Coliseum, Houston, Tex.

Sept. 23-27—National Aeronautic and Space Engineering and Manufacturing Meeting and Display, Society of Automotive Engineers, Ambassador Hotel, Los Angeles.

Sept. 23-27 – International Telemetering Conference, Savoy Place, London, England. Sponsors: Institution of Electrical Engineers (London); American Institute of Aeronautics and Astronautics; Institute of Electrical and Electronics Engineers; Instrument Society of America.

Sept. 25-26—Second Annual Symposium on the Physics of Failure in Electronics, Chicago, Ill. Sponsors: Rome Air Development Center; Armour Research Foundation.

Sept. 26-Oct. 1—14th Congress, International Astronautical Federation, Paris.

(*Continued on page 9*)

PROBLEMATICAL RECREATIONS 178



The area and volume of a certain sphere are both 4-digit numbers times π. What is the radius of the sphere? — *Contributed*

Inertial Systems Engineers interested in generating hardware should investigate positions now available in inertial navigation and astro-inertial systems at our Guidance and Control Systems Division. It helps to have experience in gyroscopes, accelerometers, servo-mechanisms and computers. Interested applicants are directed to send a résumé to Mr. J. T. Lacy. You will receive immediate attention.

ANSWER TO LAST WEEK'S PROBLEM: If n is odd, 14^n ends in 4. So does 11×14^n. Therefore $11 \times 14^n + 1$ ends in 5 and hence is divisible by 5. If n is even, say equal to 2 m, $11 \times 14^n + 1$ is equal to $11 \times 196^m + 1$. Since $196 = 3 \times 65 + 1$, $(3 \times 65 + 1)^m$ will always leave a remainder of 1 when divided by 3. Therefore $11 \times 196^m + 1$ is equal to $11\ (3k + 1) + 1$ or $33\ k + 12$. Hence when n is even, $11 \times 14^n + 1$ is always divisible by 3. Therefore $11 \times 14^n + 1$ is never a prime, being a multiple of 5 or 3 according as n is odd or even.

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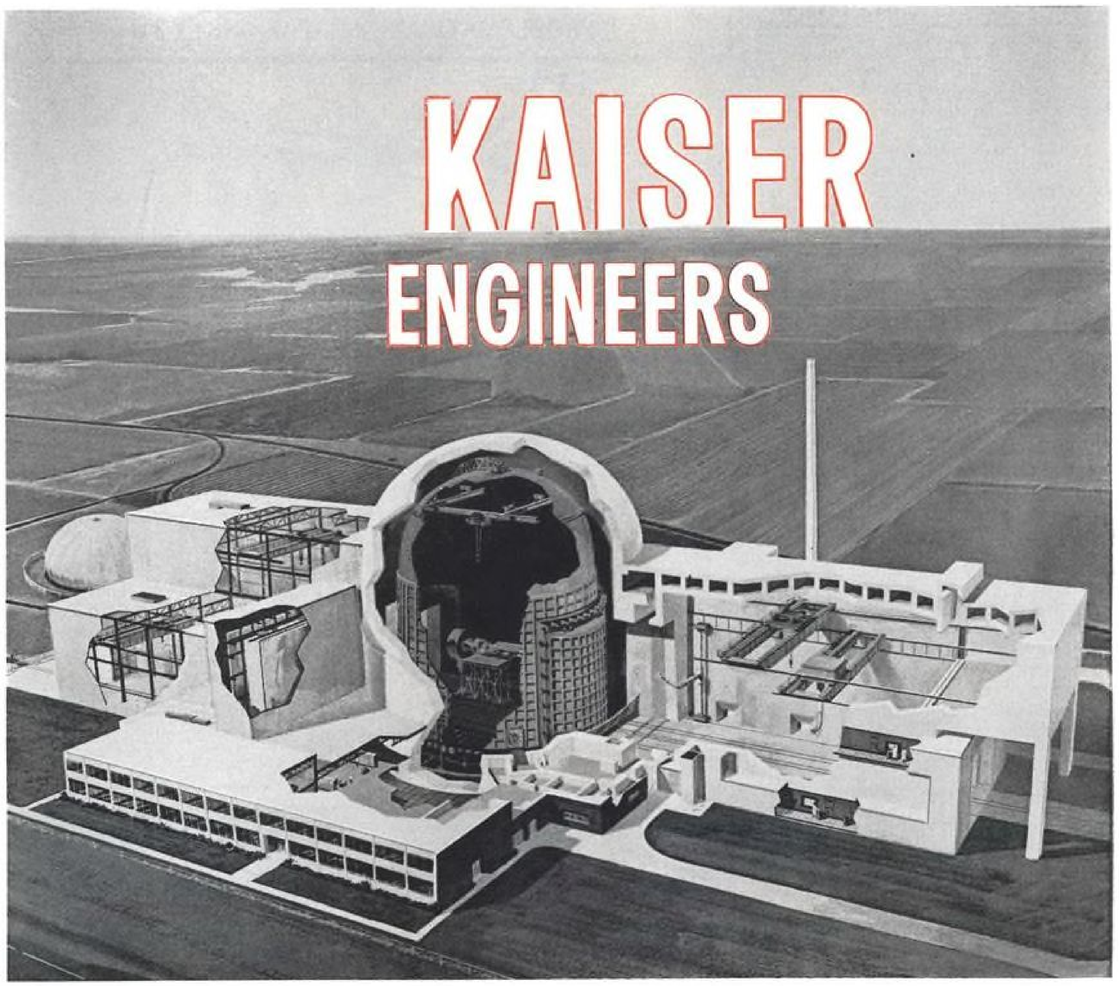


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AEROSPACE CALENDAR

(Continued from page 7)

Sept. 27-28—Society of Experimental Test Pilots' Seventh Annual Report to the Aerospace Profession and Awards Banquet, Beverly Hilton Hotel, Beverly Hills.

Sept. 30-Oct. 1—Manned Interplanetary Exploration Meeting, American Institute of Aeronautics and Astronautics, Cabana Motor Hotel, Palo Alto, Calif.

Sept. 30-Oct. 2—Canadian Electronics Conference, Institute of Electrical and Electronics Engineers, Exhibition Park, Toronto, Canada.

Oct. 1-3—Eighth National Symposium on Space Electronics, Institute of Electrical and Electronics Engineers, Fontainbleu Hotel, Miami Beach, Fla.

Oct. 1-3—National Aerospace Nuclear Safety Topical Meeting, American Nuclear Society, Albuquerque, N. M. Co-sponsors: Los Alamos Scientific Laboratory; AEC Albuquerque Operations Office; AF Special Weapons Center; AF Directorate of Nuclear Safety; Sandia Corp.; University of New Mexico.

Oct. 2-4—National Assn. of Air Traffic Specialists, Sheraton-Oklahoma Hotel, Oklahoma City, Okla.

Oct. 7-9—Ninth National Communications Symposium, Institute of Electrical and Electronics Engineers, Hotel Utica, Utica.

Oct. 7-11—International Air Transport Assn. 19th Annual General Meeting, Rome, Italy.

Oct. 8-10—10th Annual Air Force Science and Engineering Symposium, Air Force Academy, Colo. Sponsors: Office of Aerospace Research; AFSC.

Oct. 9-11—21st Annual Aerospace Electrical/Electronics Conference, Aerospace Electrical Society, Pan Pacific Auditorium, Los Angeles, Calif.

Oct. 13-17—16th Annual Meeting and Conference, Airport Operators Council, Roosevelt Hotel, New Orleans, La.

Oct. 14-16—Eighth Annual Exposition and Symposium, Air Traffic Control Assn., Statler Hilton Hotel, Dallas, Tex.

Oct. 15-18—Eighth Symposium on Ballistic Missile and Space Technology, Naval Training Center, San Diego, Calif. Sponsors: AF Space Systems Div.; AF Ballistic Systems Div.; Aerospace Corp.

Oct. 16-18—Tenth National Vacuum Symposium, American Vacuum Society, Statler Hilton Hotel, Boston, Mass.

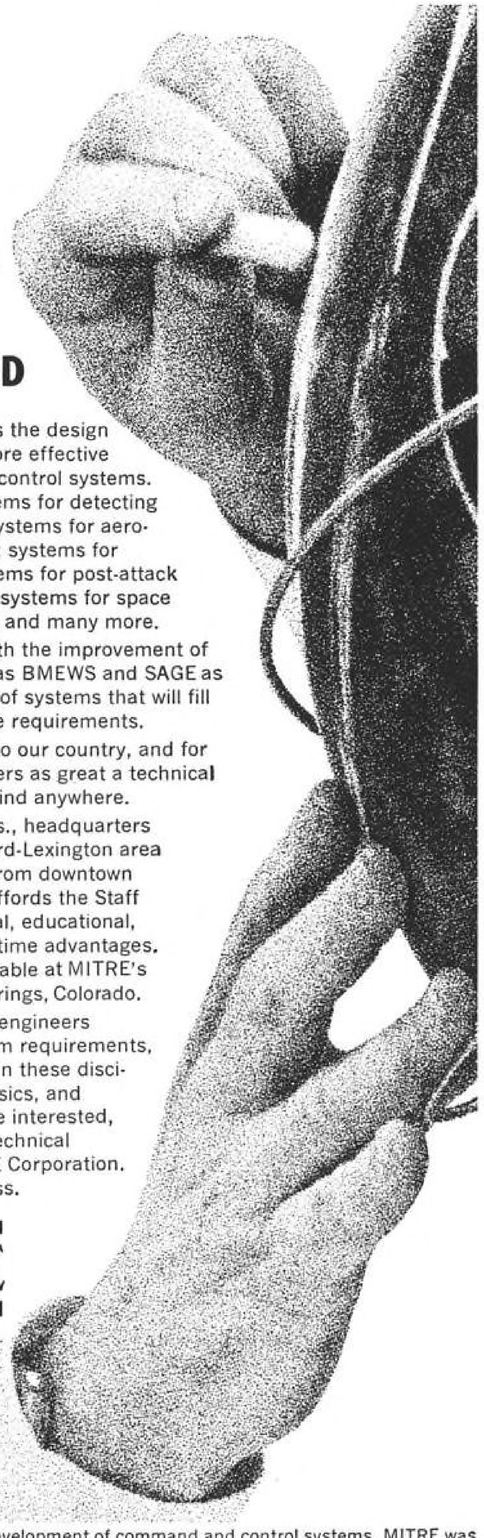
Oct. 17-18; Oct. 21-22—Ninth Anglo-American Conference, American Institute of Aeronautics and Astronautics-Canadian Aeronautics and Space Institute-Royal Aeronautical Society. Massachusetts Institute of Technology, Cambridge, Mass. (Oct. 17-18). Queen Elizabeth Hotel, Montreal, Canada (Oct. 21-22).

Oct. 21-23—Tenth Annual East Coast Conference on Aerospace and Navigational Electronics, Institute of Electrical and Electronics Engineers, Emerson Hotel, Baltimore, Md.

Oct. 22-24—Conference on Expandable Structures, National Cash Register Co.'s Sugar Camp, Dayton, Ohio. Sponsor: Aeronautical Systems Division's Propulsion and Flight Dynamics Laboratories.

Oct. 23-25—Annual Meeting, Human Factors Society, Ricky's Hyatt House, Palo Alto, Calif.

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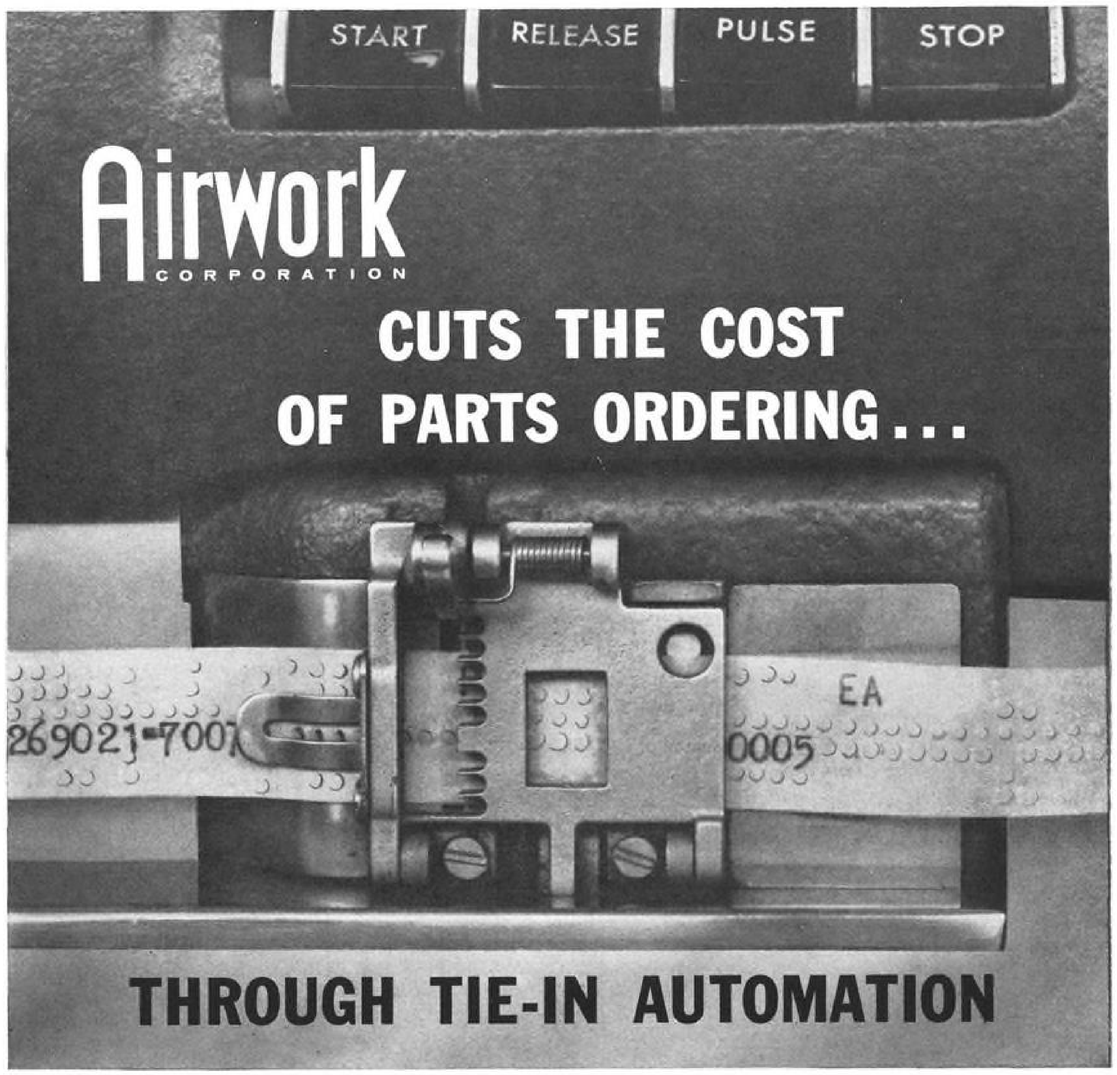
New Transport Equipment 13

COVER: Dassault Mirage 4 supersonic strategic bomber is shown taking off from Le Bourget during the recent Paris Air Show. The delta-wing aircraft is planned to furnish France's strategic nuclear weapon delivery capability. Operational version will be powered by Two Snecma Atar 9K turbojets with afterburners. For additional photos see pp. 44-45.

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EDITORIAL

New Transport Equipment

Less than two years after the prophets of doom, including some ill-informed representatives of the transport industry, predicted that the airlines had over-bought themselves into permanent ruin with jet equipment, these same carriers are shopping around for more jets and there is an international stirring of new technical developments for the transport market. The airlines are now well aware that they are shopping in a buyers' market and are in no haste to make their commitments in the next major round of aircraft-buying. They are also exercising technical and economic discrimination based on their rapidly expanding experience with jet equipment by carefully surveying the current and future crop of transports on the market.

Even though its operational debut is still a long way off, the supersonic transport is already on the airlines' shopping list and the sales competition in this area has already begun. It is rather fruitless for airline managements or politicians to argue over whether there should be a supersonic transport, for its development and use are inevitable. What is not quite so crystal clear at the moment is what kind of supersonic transport will dominate the market and what nations will reap the major harvest from its manufacture and sales.

We noted last fall at the time of Farnborough that the Anglo-French Mach 2.2 Concorde supersonic transport program was a far more sound and serious program than was generally credited at that time. Events have borne this out. Firm support from the British and French governments and a sufficiently rapid technical pace by the four major engine and airframe firms involved have stirred an American airline into ensuring a competitive spot on the Concorde production line, and spurred the American government into a flurry of near-panic over its own dawdling supersonic transport development program.

It is ironic to note the divergent approaches being taken by the Anglo-French consortium and the U. S. toward financing and managing the costly development program necessary to produce a supersonic transport. The Anglo-French effort is being managed entirely by the best technical brains of its industrial partners, with the government confining itself to financial support. The government-owned airlines, which have messed up so many other promising British transport developments with their technical nit-picking, have been carefully invited to abstain during the Concorde's development period. Thus it appears that the chances are brighter than ever before that the Anglo-French Concorde team will be free to produce its best technical effort, with a minimum of interference from either civil service types or officials of state-owned airlines.

In contrast, it appears that the U.S. is heading in the opposite direction, embroiling every possible government agency in the program and then compounding this bureaucratic maze by a welter of specially appointed committees and study groups. The old aircraft industry wheeze that "a camel is a race horse designed by a committee" was never more applicable than to what is now transpiring in the U.S. supersonic transport program.

If the time and money now being consumed by so-called research and study of the problem were devoted to getting on with the job, both the eventual airline users and the manufacturers of the supersonic transport might view the future with less concern. The U.S. has been flying the X-15 research aircraft through the supersonic speed range to Mach 5 for several years. This country has accumulated a good deal of varied experience from the North American RS-70 program and will continue to do so. And the U.S. has had a wide variety of sound research facilities working on the Mach 3-plus speed ranges for a number of years.

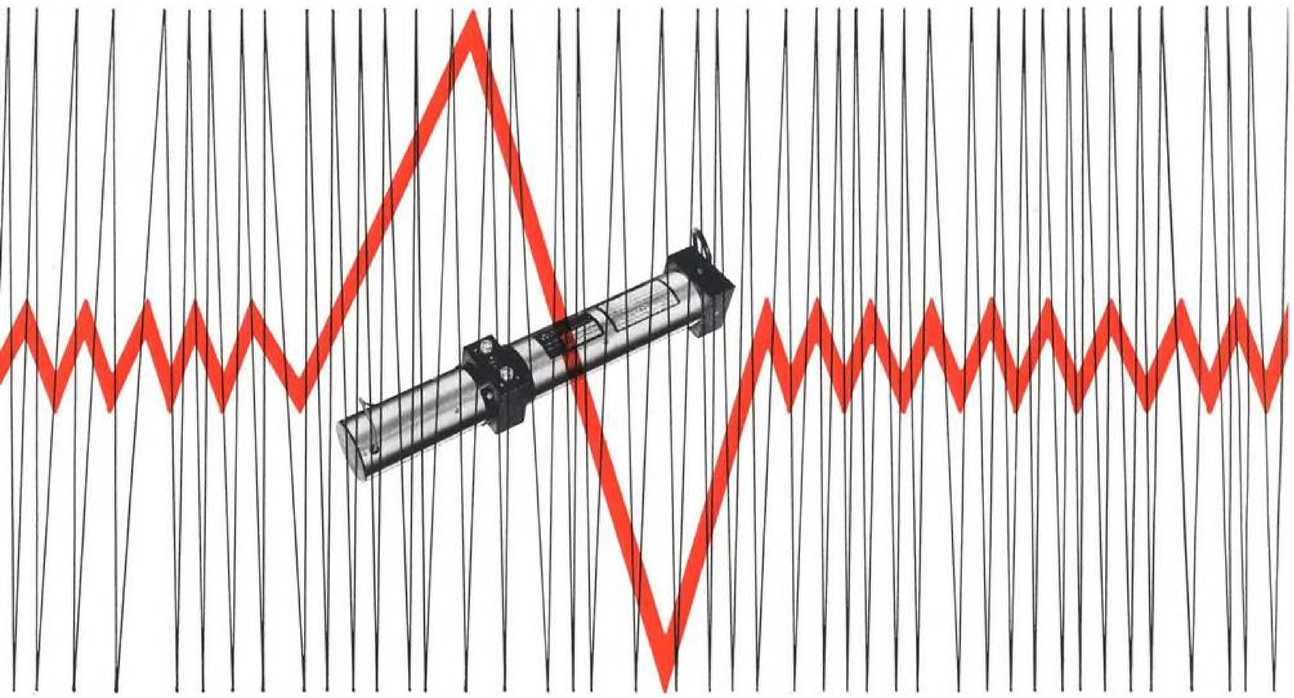
The technical people who will ultimately have to build the U.S. supersonic transport feel they can start the task immediately, with excellent prospects for a technically sound product in the early 1970s. There are enough varied design approaches among the five major manufacturers who are interested in tackling the supersonic transport job to ensure that all the possibilities could be considered if a design competition were started right now.

The Air Force, which has had more experience than any organization in the world in the procurement of supersonic aircraft, and which has certainly profited by its RS-70 experience, is unquestionably capable of running such a design competition and picking a sound winner. What then is all the fiddle-faddling about in the Federal Aviation Agency, the White House and the Congress? If President Kennedy is really serious about developing a U.S. supersonic transport that will dominate the commercial airways of the 1970-80 period the way the jet transports from San Diego, Santa Monica and Seattle dominate air commerce in this initial decade of the jet age, he can save time and money by authorizing a competitive design competition among the interested manufacturers with some federal support during this phase. This will at least give the program some direction and a goal, in contrast to the aimless muddling and fruitless re-study that now characterizes it.

While the Europeans have apparently profited by their earlier mistakes in entangling technical development with government bureaucracy, the U.S. is apparently abandoning its well-proven competitive system and following the thoroughly disproved British Ministry of Supply pattern. We think it would be a grave mistake for the U.S. to try to slide into the Anglo-French Concorde program at this late date (see p. 28). We think it would be an equally grave error to continue along the present path of the U.S. program, shouting "competitive free-enterprise" in public and entangling the technical development in the toils of an unbelievably complicated political maze. The U.S. should embark on a serious supersonic transport program because it will be an economic asset in the long run. But it should do so in such a manner that whatever government support is required does not hobble technology in a mass of bureaucratic red tape and committee-regurgitated compromises.

—Robert Hotz

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WHO'S WHERE

In the Front Office

Earl Dallam Johnson, vice chairman of General Dynamics Corp., has resigned as an officer and director but will continue to serve the company as a consultant.

Cyrus S. Collins, vice president and general manager of Pan American-Grace Airways, succeeding **Douglas Campbell,** retired (AW July 1, p. 36).

Anthony Vandyk, public relations director, International Air Transport Assn., Montreal. He was formerly Geneva bureau chief of American Aviation Publications.

Buckley C. Pierstorff, president and a director, Indatacon Corp., Newton, Mass., and **William C. Plouffe,** vice president, treasurer and a director. Also: **Dr. George M. Nonnemaker,** vice president-engineering and technical director; **Maynard J. Lebowitz,** vice president-marketing.

Dr. Walter A. Fraser, president, Hayward Scientific Glass Co., Whittier, Calif., a subsidiary of Hycon Mfg. Co.

Maj. Thomas C. Musgrave, Jr., (USAF, ret.), a vice president, Textron, Inc., with headquarters in Washington, D. C.

Dr. Thomas P. Cheatham, Jr., a corporate vice president, Litton Industries, with headquarters in Washington, D. C.

Dr. G. Russell Tatum, vice president, Vitro Corp. of America, responsible for all technological activities of the company; he continues as head of Vitro Laboratories Div., Silver Spring, Md.

Peter T. Albert, vice president-freight sales, The Flying Tiger Line, Inc., succeeding **John L. Higgins,** resigned.

Sanford C. Sigoloff, a vice president, Electro-Optical Systems, Inc., Pasadena, Calif.; he continues as corporate manager of operations.

Wendell R. Stevens, vice president-operations, Air Express International Corp., New York, N. Y.

Harvey J. Wexler, vice president-programs and plans, Slick Airways Div., The Slick Corp., Washington, D. C.

R. W. Phillips, vice president, Stratoflex, Inc., Ft. Worth, Texas.

Joseph F. Bartholomew, vice president, Epsco, Inc., Cambridge, Mass., and also marketing department manager of the newly formed Cambridge Div. of the company.

Morton Brooks, vice president-marketing, Telecomputing Corp., Los Angeles, Calif.

Honors and Elections

Col. Edwin E. Aldrin has been elected a Fellow of The American Society of Mechanical Engineers.

Dr. John C. Lane, an Australian civil flight surgeon, has received the Flight Safety Foundation's Award for Distinguished Service for ". . . [he] directs a very efficient department of civil aviation medicine for the entire Commonwealth of Australia. . . . has also been an author or co-author of eight separate human engineering reports relating to the prevention of landing accidents . . ." The Foundation's distinguished service awards are sponsored by *Aviation Week and Space Technology*.

(*Continued on page 89*)

INDUSTRY OBSERVER

► Attitude control propulsion capacity of the Douglas S-4B stage will limit to about 10 hr. the time the Apollo spacecraft can remain in earth orbit before proceeding to the moon in the Apollo lunar landing mission. Lunar Excursion Module will make at least one complete orbit of the moon before descending to the surface, but the landing must occur by the end of the third orbit or be aborted.

► **North American Aviation's Space and Information Systems Div. has briefed groups from USAF's Space Systems Div. on potential of a "Blue Apollo" for Air Force space missions. SSD may not be receptive, partly because the Apollo spacecraft would be available only after National Aeronautics and Space Administration experiments, and the USAF funds required could buy more sophisticated spacecraft which are in keeping with the state-of-the-art projected for 1970.**

► Industry proposals for the high-storage-capacity data processing and display equipment for the airborne post-attack command and control system (PACCS) will be requested soon by USAF's Aeronautical Systems Div. Equipment will be installed in a Boeing KC-135 to give Strategic Air Command a completely automated, survivable command post. PACCS would replace SAC's present KC-135 flying command post, which largely uses manual command and control techniques.

► **Manned Spacecraft Center's last two Fiscal 1964 space station studies will be awarded effective Aug. 1 to Lockheed Missiles & Space Co. and Douglas Aircraft Co. Lockheed will study the large, rotating station under a $300,000 contract and Douglas will study a large, zero-g station under a $150,000 award. Langley Research Center will award a preliminary space station laboratory design contract to Boeing or Douglas this fall.**

► NASA's Langley Research Center is expected to issue requests for proposals by mid-July for an unmanned lunar orbiter. Program has been delayed by lack of funds, but NASA feels the lunar photographic vehicle is essential to pick moon landing sites for Apollo mission and probably will implement the program for at least four spacecraft before funding plans are definite. Operational target for the orbiter is late 1964 or early 1965. Photographs may be taken in successively lower orbits, down to about 25 n. mi. from the lunar surface.

► **Use of beryllium as an additive to ammonium perchlorate solid propellants has produced specific impulses of 260-265 sec., compared with 245-250 sec. produced by aluminum, according to Advanced Research Projects Agency. ARPA is also investigating the possibility of achieving specific impulses of 270-275 sec. with aluminum hydride and 290-295 sec. with beryllium hydride. A specific impulse of 280 sec. would permit the payload of a missile similar to the Minuteman to be doubled, or the size and weight of such a missile to be reduced 50%.**

► Allotment of 10 cu. ft. has been made for scientific experiments aboard the Apollo Lunar Excursion Module. Although the experiments have not yet been selected by NASA, they are expected to consist mainly of lunar geology measurement devices.

► **Recent Navy tour of laboratories throughout the country in search of fresh approaches to high-energy lasers led to submission of more than 200 unsolicited proposals to Office of Naval Research. Visits were spurred by discouraging progress on the Advanced Research Projects Agency's device-oriented laser radiation weapons program (AW June 17, p. 23), which ONR administers. Navy is awarding a large series of experimental and research contracts on high-energy devices such as nuclear pump lasers, exploding film Q-switches, liquid lasers and improved xenon flash lamps (AW July 1, p. 90) with additional ARPA funds.**

► Contract for 13 S-2 stages, including nine flyable units, has been definitized by NASA at about $320 million for North American Aviation's Space and Information Systems Div. The S-2, second stage of the Saturn 5, will incorporate five Rocketdyne J-2 engines burning liquid hydrogen and oxygen.



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Washington Roundup

Man-in-Space Upkeep

National Aeronautics and Space Administration plans to spend four times as much on manned space flight between now and the end of Fiscal 1969 as it did in the five years from the beginning of the space program in Fiscal 1959 through Fiscal 1963—$14.3 billion compared with $3.3 billion.

Total cost of the manned lunar landing effort becomes $19.7 billion when the agency's own associated costs are counted. The $19.7-billion estimate is the "hard-core" funding program for Mercury, Gemini and Apollo and does not allow for spending for manned flight efforts beyond the moon.

At least one such advanced program is expected to be approved before 1970. Leading candidates are a lunar logistics system estimated to cost $500 million; a space station costing between $2 billion and $4 billion; a Mars mission, which could cost as much as $50 billion, and a moon base, which has no firm cost estimates yet.

Manned space flight funding this fiscal year is estimated at $3.4 billion under the hard-core program. This Fiscal 1964 figure approximates the $3.3 billion spent on manned space flight in the five-year period from Fiscal 1959 through Fiscal 1963. NASA's estimate for Fiscal 1965 through 1969 is $10.9 billion, indicating that Fiscal 1964 may be the crest of the spending wave.

NASA's Internal Ills

NASA insiders complain there has been a weakening of the powerful leadership once exerted on manned space flight by its departing director, D. Brainerd Holmes (AW June 17, p. 37). Holmes often worked a 12-hr. day before his troubles with Administrator James E. Webb caused him to resign, effective this fall. Now Holmes' day is more like nine to five. Webb last week tried to restore leadership harmony by conferring at length with Manned Spacecraft Center officials at Houston, Tex., about their programs.

New director of the Advanced Research Projects Agency will be Dr. Robert L. Sproull, physics professor and director of the materials science center at Cornell. He reports in September. Dr. Jack P. Ruina, ARPA's former director, will serve as a consultant to the Communications Satellite Corp. this summer and then will join the faculty of Massachusetts Institute of Technology as an electrical engineering professor in the fall.

Tighter AEC Control

Congress is tightening its grip on the Atomic Energy Commission by requiring the agency to submit its research budget to the Joint Congressional Atomic Energy Committee as well as to the House and Senate appropriation committees. Currently, the joint committee only has approval authority over the AEC construction program, which accounts for about 8% of the total budget.

Sen. John O. Pastore, committee chairman, contends the AEC research budget is so complex that the extra congressional supervision is needed. Legislation providing the authority already has passed the Senate and is certain to pass the House. Sen. Pastore's action exemplifies a more skeptical approach toward AEC activities. He already is looking into the politically touchy question of whether the agency is over-producing nuclear weapons.

A major reason why Rep. Oren Harris called hearings on the supersonic transport was to help establish his House Commerce Committee's jurisdiction over that expanding program. House Science and Astronautics Committee approved supersonic transport research funds this year and may compete for jurisdiction.

VAX Outlook Gloomy

Role that the VAX tri-service attack fighter should fill will not be decided until Defense Dept. settles on the aircraft needed for close troop support in counter-insurgency operations. VAX will be designed to fill the gap between this COIN aircraft and the F-111 (TFX). COIN is getting priority consideration, with September looming as the deadline for establishing a specific budget request.

Dr. Harold Brown, director of defense research and engineering, is evaluating various proposals at present. He recently told Congress that VAX technology is not the problem. "The question is what you really want," he said. He estimates development and production cost of the VAX would be about half of that for the TFX, or about $3.5 billion, for 1,700 aircraft. He estimates development alone for 24 aircraft would cost about $500 million.

In the face of pessimistic USAF reports, North American is still making preparations for the first flight of its RS-70 some time this summer, even to the point of picking Al White of the firm as pilot and USAF Lt. Col. Fitzhugh Fulton as copilot. First flight would be subsonic and probably no more than 90 min. long. Rep. Gerald R. Ford, ranking Republican on the House Defense Appropriations Subcommittee, brushed aside all official predictions recently and told the House "My own forecast is that the first flight will take place in October."

General Accounting Office, congressional watchdog feared by the services, put this diplomatic title on a recent blunt report: "Improvident Disposals of Crane Shovels and Unnecessary Procurement of Outboard Motors Under a Modernization Program of the Department of the Army."

—Washington Staff

USAF Space, Large Solids Efforts Periled

Moves to cut U. S. research by industry threaten aerospace plane, 156-in., 260-in. motor development.

By Larry Booda

Washington—Air Force manned space mission development and the joint USAF-NASA large solid-propellant booster program face a possible slowdown as the result of recent actions aimed at reducing the level of basic and applied research being performed for the government by industry.

One action taken by Dr. Harold Brown, director of defense research and engineering, would emasculate the Fiscal 1964 budget request already made to Congress for component, or exploratory, development of the aerospace plane, a horizontal-takeoff, manned, earth-to-space vehicle (AW July 1, p. 33). The other threatens the Air Force-National Aeronautics and Space Administration exploratory development of 156-in. and 260-in.-dia. solid boosters.

The cuts suggested by Dr. Brown would also reduce the number of study contracts let by the Navy and Army.

At the interdepartmental level, Dr. Jerome B. Wiesner, science adviser to the President, is implementing a policy that would strengthen government-operated laboratories. Dr. Wiesner, who is also chairman of the Federal Council on Science and Technology, has directed that Fiscal 1965 budget requests related to research support be prepared in two ways—one at the current level of spending and the other incorporating a substantial cut. The latter would reduce industry participation.

Dr. Wiesner wields this power because, as chairman of the council, he is coordinator for research for the entire executive branch of the government, and as such is Budget Bureau adviser.

Dr. Brown's action, outlined in a memorandum to the services June 21, has stirred vehement protests from industry. Most of the protests center on the apparent change in a policy that has encouraged industry to hire scientists and engineers to perform research for the government. As a consequence, many companies have developed large organizations, in some instances with more than 1,000 professional personnel in one laboratory. The industry protestors say that if contract research is reduced, these professionals will have to be discharged.

Acting for the defense secretary, Dr. Brown has apportionment power over the research, development, test and evaluation money. He can withhold or order reapportionment in all the categories in this area.

In the case of the Air Force, he arbitrarily slashed study programs in the basic research and exploratory development categories, and asked for comment. The Navy and Army were simply told that a certain cut in the funds was necessary and to identify where the cuts should be made.

Air Force Fiscal 1964 requests as presented to Congress were: $88.8 million for research; $329.9 million for exploratory development; $546.1 million for advanced development; and $891.7 million for engineering development, for a total of nearly $1.857 billion. Management and support would add another $678.9 million.

From actions taken by Dr. Brown in recent weeks, the Air Force cuts could total $200 million or more, $100 million of which was gained through the cancellation of the Skybolt air-to-surface missile.

Of the six aerospace plane studies, only one would be funded under Dr. Brown's proposed reapportionment. It is SR 651C, the Mach 8 subsonic flow ramjet, for which $3 million is requested. The remaining five categories, the air separator, advanced liquid air cycle engine (LACE), supersonic flow combustion, turbo accelerator and advanced structures—a total of $16 million—were eliminated from direct funding. This does not rule out in-house studies, but would eliminate paid industry contracts that would include component development.

In the large solid-propellant booster area, the funds for 120-in. strap-on solid motors of the Titan 3 multi-purpose booster would remain untouched. A total of $324.6 million has been requested for Titan 3.

But the program for exploratory development of 156-in.-dia. and 260-in.-dia. solid-propellant boosters could be slowed or stopped altogether. Contract awards were announced in April for static firings of different configurations of the two sizes of motors (AW Apr. 22, p. 32). Thiokol Chemical Corp. was to do work on a half-length 260-in.-dia. motor, a 3-million lb. thrust, two-segment 156-in.-dia. motor and a 1-million lb. thrust 156-in.-dia. motor with movable nozzles. Aerojet-General Corp. was to do work on the 260-in.-dia. motor.

USAF Plans Space Station Bid Request

Washington—Air Force plans to award three contracts in August for four-month parallel studies into a conceptual configuration for a military orbital space station system (OSSS).

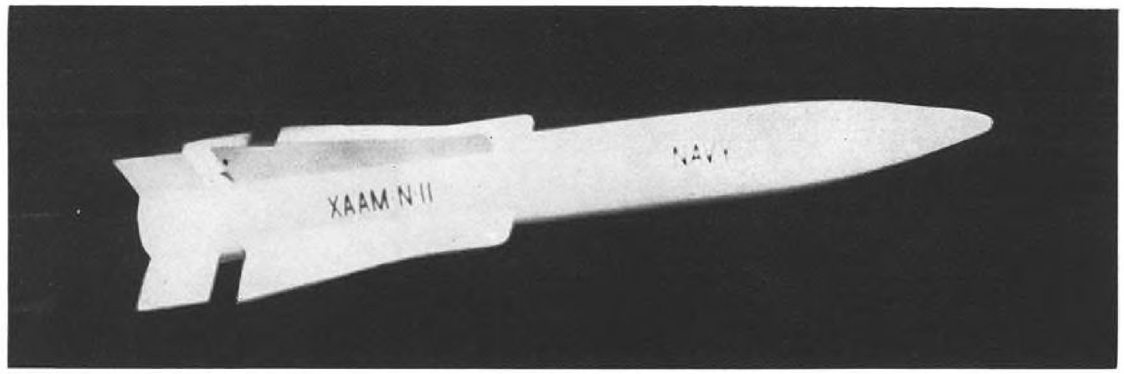
Over-all program definition for OSSS will begin late this year if the Air Force receives approval for the program. Next step would be selection of a contractor next spring for preliminary design of the space station, which the Air Force hopes to have in operation by about 1967 or 1968.

Requests for proposals are to be sent to Aerojet-General, Aeronutronic, Bell Aerosystems, Boeing, Douglas, Garrett Corp., Fairchild Stratos, General Dynamics, General Electric, Goodyear, Grumman, Hughes, IBM, ITT, Ling-Temco-Vought, Lockheed, Martin, McDonnell, North American, Northrop, RCA, Republic, Ryan, Space Technology Laboratories, United Aircraft and Westinghouse.

Other firms interested in the competition may request the work statement from the Air Force Space Systems Div., Los Angeles, Calif. They are asked to show a capability or access to subcontractor support in the areas of military missions, systems synthesis, systems analysis, operations analysis, design of experiments, electronic data-handling techniques, guidance and control, rendezvous and docking techniques, ground support equipment and bioastronautics.

Although a notice of intent to send out requests for proposals has been published, the Air Force does not have the $1 million the three parallel studies will cost. It has not been decided whether to issue the requests for proposals in the hope of receiving Defense Dept. approval for the expenditure, or to postpone issuance of requests until approval is granted.

National Aeronautics and Space Administration is negotiating contracts with the Boeing Co. and the Douglas Aircraft Co. for three-month studies on manned orbital research laboratory studies (AW June 10, p. 37, p. 141). Results of Air Force and NASA studies are to be compared, and a joint space station program has been discussed by NASA and the Defense Dept.



Model of Phoenix Missile for F-111B Shown

Model of the Phoenix air-to-air missile that is being developed for the Navy version of the F-111B (TFX) variable wing tactical fighter is shown above. It is a two-stage weapon with an extended range capability similar to the Eagle missile which was proposed for the canceled Navy Missileer fighter. It will have a secondary mission capability of attacking surface targets. Hughes Aircraft Co. will develop and produce the air-to-air missile for the Navy.

Whether reclamas submitted by the Air Force will result in restoration of any of the above funds is not yet known. Tradeoffs could be made, but experience has shown the services that when they offer to cut other programs to save those threatened, the defense secretary's office usually accepts this information as indicating what areas are "soft" and then adds them to the cut or elimination list.

The Navy's research, development test and evaluation (RDT&E) program calls for $1.573 billion in Fiscal 1964. Its task, different from that of the Air Force, is to identify programs to be cut or eliminated. In a modest way the Navy is still interested in space activities for sea surveillance, anti-submarine warfare and oceanography.

The Army, with a request of $1.475 billion, faces a problem similar to that of the Navy—it must recommend its own cuts.

Just how a change in policy would affect government laboratories is not yet known. The Air Force Cambridge Research Laboratory and the Naval Research Laboratory make wide use of private contractors.

Much of their basic research is performed in university and other nonprofit laboratories. This work would be affected little. In many instances, the government organizations contract for applied research to be done in their own laboratories. The private organization receiving the contract furnishes the researchers.

Since Dr. Wiesner sets the policy and the Defense Dept. spends the greater portion of research funds, future moves by Dr. Brown regarding both the Fiscal 1964 fund apportionment and the fate of study requirements in the Fiscal 1965 budget requests will indicate the proportion of future industry participation in basic and applied research.

Korth Defends TFX Choice, Hears Charge He Used 'Raw Judgment'

By George C. Wilson

Washington—Navy Secretary Fred Korth encountered hostile questioning and accusations of using "raw judgment" as he detailed for the Senate Permanent Investigations Subcommittee last week why he chose the General Dynamics-Grumman F-111 (TFX) proposal over Boeing's.

Theme of his presentation was that there was no "overriding preference" for Boeing within the Navy and that he felt General Dynamics offered a less complicated proposal. His testimony marked the start of the Defense Dept. summation before the investigating subcommittee.

Still to be heard are Air Force Secretary Eugene M. Zuckert, Deputy Defense Secretary Roswell L. Gilpatric and Defense Secretary Robert S. McNamara. All have been preparing their testimony for weeks, with Zuckert's statement running 102 pages. But Korth's treatment showed that the subcommittee is in no mood to settle for generalized explanations and will instead keep thrusting at chinks in the Defense Dept.'s armor.

One such chink, in the view of Chairman John L. McClellan (D.-Ark.), is Korth's self-admitted ignorance about how General Dynamics and Grumman are going to build the 1,700 F-111 variable-sweep wing fighter-bombers. The plan, according to Sen. McClellan, is for Grumman to build the 1,400 USAF versions—from the landing gear aft—in its Bethpage, L. I., plant and ship these fuselages to the General Dynamics plant in Ft. Worth, Tex., for complete assembly. General Dynamics, in turn, plans to ship the front end of the 231 Navy F-111s to Bethpage for complete assembly there.

Sen. McClellan said this would mean two assembly lines and two testing operations half a nation apart. He recalled that Albert W. Blackburn, former F-111 project officer in the office of defense research and engineering, claimed such a dispersal of facilities would defeat the purpose of commonality, and that McNamara had previously forbade separate operations for producing McDonnell F-4Cs (AW May 27, p. 32). Korth said he did not know whether this production plan would be followed for the F-111, and that right now the services were concentrating on development of the aircraft. He said he did not know the geographical plan for producing the F-111s either, leading to this exchange:

Sen. Henry M. Jackson (D.-Wash.). Isn't this something that should have been determined at the time the award was made in order to know what the costs were going to be?

Korth. Certainly . . . but I likewise say, if my information is correct, you are not shipping the portion of the aircraft of which you speak fully loaded. It is merely the shell, the fuselage.

Sen. Jackson. In determining the cost, and that was a big point made by the secretary of defense, can you tell me . . . whether or not they took into consideration the division of labor that has been mentioned by the chairman here?

Korth. I am sure it was taken into consideration but certainly, insofar as the over-all cost in production, it would be relatively inconsequential.

Sen. Jackson. You think it would be

Korth Compares GD, Boeing F-111 Designs

Navy Secretary Fred Korth gave this comparison of the Boeing and General Dynamics-Grumman F-111 (TFX) designs while testifying before the Senate Permanent Investigations Subcommittee:

	Boeing	GD-Grumman
Hours on station		
Fleet air defense	Bettered reqmt.[1] by 6%.	Equaled reqmt.
Beachhead support	60% of reqmt. with max. internal fuel.	Bettered reqmt. by 50%.
Maximum speed[2]		
Sea level	Equaled reqmt.	Bettered reqmt. by 20%.
At altitude	Equaled reqmt.	Bettered reqmt. by 25%.
WOD[3] for take-off	Bettered reqmt. by 10 kt.	Bettered reqmt. by 10 kt.
WOD for landing	Bettered reqmt. by 14 kt.	Bettered reqmt. by 6 kt.
Take-off weight (Fleet defense mission)	12% greater than Navy desired.	15% greater than Navy desired.
Height	Acceptable with folding tail.	Acceptable with folding tail; 9 in. lower than Boeing's.
Length	Acceptable, with folding nose.	Acceptable. With nose folded, 3.1 ft. shorter than Boeing's, thus easier to handle.
Carrier handling,[4] accommodation		Five more aircraft can be accommodated. Superior in handling.

[1] Reqmt.—Requirement. [2] Does not take into account changes Boeing proposed to increase speed. [3] WOD—wind over deck. [4] No specific requirement made.

relatively inconsequential to have two assembly lines, one for one part of the plane in Long Island, at Grumman, and the other at Ft. Worth?

Korth. I think so, yes sir.

Sen. Karl E. Mundt (R.-S. D.) How could you arrive at the conclusion [that the General Dynamics proposal would be cheaper] or any conclusion without at least knowing whether the planes are going to be built in the same plant or whether they are going to be separate by 2,500 mi., and you have to ship planes back and forth in a sort of shuttle at an expense which would exceed $100 million [estimated cost to produce the F-4C in separate plants] because this is a bigger contract.

Korth. I think the big question is not the transportation itself, but the complexity of the two designs themselves.

Sen. McClellan. Tell me how in the world you could take into consideration what impact this would have on cost of the production without knowing in advance how these companies were going to operate, where they were going to build this plane.

Korth. It is going to be built . . . on the most efficient and cheapest basis.

Sen. McClellan. Anybody can say that. Anybody. . . . If Secretary McNamara used rough judgment, I declare from this situation it seems to me like you are using raw judgment; without knowing where they are going to build it; which is building what.

Korth. I think it is very good judgment . . . I am more convinced now than ever before . . . You are magnifying this out of proportion. . . .

Basic reasons for favoring the General Dynamics proposal, Korth said, was that "it is quite obvious from an examination of the plane, that the Boeing plane is certainly the more complex plane, requiring greater developmental risk, than is the General Dynamics-Grumman plane which is more conventional and which uses conventional materials."

He said his judgment "was based upon my own observation and experience over the years . . . not only of those two companies, of many companies." Also, Korth said, "the fact that Grumman was associated with General Dynamics was a factor which entered into my consideration. I was well aware of the fact that Grumman has furnished more than 50% of the carrier-based aircraft used by the Navy to date."

The Navy secretary denied repeatedly that he reversed his top officers by choosing General Dynamics over Boeing, declaring that he fully protected the Navy's interest all during the F-111 competition and had been told there was "no significant preference" between the contractors.

"Conscious that my home is in Ft. Worth," Korth said, "and recognizing the minor part that the Navy has in the total procurement, I therefore deliberately refrained from taking a leading role in reaching the decision and consciously viewed the two proposals with complete objectivity. With these circumstances in mind, I reached my conclusion independently on the basis of all the information available to me. I, in my own best judgment, made the decision for the Navy and I stand firm today in the conviction that the General Dynamics-Grumman TFX offers the Navy the best aircraft in the time available, and at the least program cost."

Korth said that since the Bureau of Naval Weapons, in its report on the fourth evaluation, said "there is no significant preference between the Navy versions of the two designs as submitted," he did not actually overrule the evaluation group. As for the expressed preference for Boeing of such Navy leaders as Adm. George W. Anderson, outgoing chief of naval operations, and Rear Adm. Frederick Ashworth, Navy's voting member on the source selection board, Korth said they at no time urged him to recommend Boeing.

Capt. John Shepherd, top Navy representative on the Navy-USAF group which evaluated F-111 proposals, briefed Korth on the competing designs at a meeting Nov. 8, 1962. Korth said officials attending included Adms. Anderson and Ashworth. At the close of the meeting, Korth said, "I summed up what I understood to be the expressed consensus: that the Navy position is to be . . . that Navy would be happy with either proposal. I then asked if my summation was correct. Those present either expressed assent or said nothing to contradict my summation. There were certainly no objections. Had there been any strong preference, I would certainly have expected it to have been voiced to me at this time."

Korth stuck to this contention when asked about the report of Air Force Council, concurred in by Adm. Anderson, which said "there is a clear and substantial advantage in the Boeing proposal over the General Dynamics proposal which is magnified by the environment found under the austere conditions usually inherent in limited war action." Korth said Adm. Anderson had never come to him and declared the General Dynamics decision was the wrong one. "As a matter of fact," Korth said, "the statement [was] made to me [on Nov. 23, 1962, when the decision was announced] by Adm. Anderson that he was glad a decision had been made, that he wanted to proceed with the development of the TFX as rapidly as possible."

Adm. Anderson told the subcommittee on Apr. 5 that he was not consulted between the time Korth was briefed and the decision was made. "Had I realized that a decision [of the source selection board] was going to be reversed, had I realized that there was not going to be an opportunity for reclama or discussion," he said, "I would certainly have been much more insistent with my briefings to the Secretary of the Navy and my discussions with him" (AW Apr. 15, p. 27). Adm. Anderson said he "did not make it sufficiently clear" to Korth the importance of operational areas where the Boeing design appeared superior.

Besides stressing that the Navy evaluators said either proposal was acceptable, Korth cited these specific technical and cost advantages of the General Dynamics design in justifying his decision to the subcommittee in hearings June 28 and July 1:

- **Speed.** Because General Dynamics used the same structure for both USAF and Navy versions, it offered both services the same speed, while Boeing's lightened structure for the Navy F-111 offered less speed under such conditions as supersonic dash on the deck.
- **Thrust reversers.** Since the length of roll over the deck in an arrested landing is only a few hundred feet, the effect of the Boeing thrust reversers would not be significant and did threaten to entail development problems.
- **Commonality.** Korth said "that General Dynamics-Grumman more nearly met the second requirement of minimum divergence from a common design appears to me to be clear."
- **Titanium.** Korth said Navy evaluators had expressed preference for aluminum and steel.
- **Single wheels.** Navy prefers the larger single wheels over dual smaller ones partly because the former roll more easily over such carrier deck equipment as arresting wires, sills and other protuberances.

V for Vexatious

Washington—Service secretaries are among those who have trouble explaining aircraft designations, as evidenced by this exchange among Navy Secretary Fred Korth, Dr. James Wakelin, Jr., assistant secretary for research and development, and Chairman John L. McClellan (D.-Ark.) of the Senate subcommittee investigating the F-111 (TFX) contract award:

Sen. McClellan: What does VAX mean?

Korth: That means an attack aircraft, sir.

Sen. McClellan: I don't see how that would be.

Wakelin: VAX stands for aircraft, attack, experimental.

Sen. McClellan: Where do you get a V for that?

Korth: Mr. Chairman, I have asked this question of senior naval officers and they unfortunately do not know. . . .

Probers Told of Navy's Qualms About Bi-Service TFX Program

Washington—One important question the F-111 (TFX) will answer once it flies is whether the Navy was right in strongly opposing bi-service development of the advanced tactical fighter on grounds that the necessary compromises would penalize performance too severely.

Extent of Navy fears about joining with the Air Force in developing the F-111 is indicated in several formerly secret documents made public last week by the Senate subcommittee investigating the contract award. Navy argued it would be better to go it alone or not at all, rather than take the bi-service approach.

Ironically, Dr. James H. Wakelin, Jr., assistant secretary of the Navy for research and development, had to contradict his own memorandum in defending the decision of Navy Secretary Fred Korth to proceed with an Air Force-Navy F-111 and to let General Dynamics-Grumman develop it, even though the top Navy officers had recommended Boeing.

On Mar. 9, 1961, Wakelin wrote the director of defense research and engineering that "the Navy considers that the TFX is not suitable for Navy use since it has little or no application to Navy or Marine missions. Further, the Army has indicated that the TFX will not meet its close air support requirements. The Navy has better aircraft for our purposes in being and in development." He went so far as to declare that a single aircraft for both services would not be "consistent with national defense interests."

Chairman John L. McClellan (D.-Ark.) of the Senate Permanent Investigations Subcommittee used the memorandum in arguing that the Defense Dept.'s civilian managers, by insisting on a common aircraft for both services, had sacrificed too many operational advantages. These were the major points in the Wakelin memorandum that formed the backdrop for this argument about performance of the compromise F-111:

- **Army, Navy and Marine Corps** "consider that the TFX would not be a satisfactory close support aircraft. Also, it would be unsuitable for carrier operations and Navy requirements."
- **TFX "is a large, complex,** expensive aircraft basically unsuited for limited war missions."
- **McDonnell F-4B Phantom 2** and Douglas F-6D Missileer—canceled Apr. 12, 1961—"will be far superior to the TFX in the air superiority role." F-4B "has better air superiority characteristics than the TFX—better radar, better missiles and better tactical air control. The Eagle-Missileer will have much better air superiority characteristics than the TFX and the F-4H [now designated the F-4B] and fits our requirements in anti-air warfare particularly well with the [Grumman] W-2F [now E-2A] and SAMs [surface-to-air missiles] to give our task force defense in depth from sea level to 100,000 ft. The F-6D and the TFX, if programed, could be available for service about the same time, with the great advantage in performance to the F-6D."
- **Navy is interested** in research and development programs "for light attack, close air support aircraft which would incorporate variable sweep wing design and turbofan engines. . . The TFX program should be reoriented in order to provide a good light attack aircraft to meet the close air support requirements of the Army and Marines. We also have in mind interdiction and reconnaissance—in other words a versatile aircraft with emphasis on limited warfare missions." He said the Navy should manage the development of such a light attack aircraft.

After making the above points, Wakelin recommended this program to meet the needs of the Navy, Marine Corps and Army:

- **"Drop** the TFX altogether."
- **Procure Douglas A-4D-5** Skyhawks "to meet the requirements of all services for early close air support under visual flight conditions," Grumman A-6A Intruders to meet their requirements "for all-weather close air support and interdiction," and procure F-4Bs "to meet the requirements of all services for air superiority aircraft, to be followed by the Eagle-Missileer."
- **Provide reconnaissance pods** for A-4D-5s "and possibly" A-6A "for battlefield reconnaissance."
- **Authorize Navy to develop,** with Army and-or Air Force participation, a follow-on to the A-4D-5, with these "major improvements:" better weapon and fuel load capability; better fuel specifics (turbofan engine); better STOL characteristics; better versatility in attack, close support and reconnaissance missions; better landing gear for advanced base operations, better armor and fuel tank protection. Wakelin said the follow-on should weigh about 25,000 to 30,000 lb. maximum gross and "might well be a variable geometry aircraft."

Acting Navy Secretary Paul B. Fay, Jr., wrote Defense Secretary Robert S. McNamara on Aug. 22, 1961, that on



CH-3C Picked for SOR 190 Role

Sikorsky CH-3C rear-loading version of the S-61 twin-turbine helicopter last week was selected to fulfill the Air Force Specific Operational Requirement 190 in a second competition for a USAF long-range support helicopter. Boeing Vertol had won the initial competition last summer, but no contract was signed to confirm the selection. USAF bought the CH-3C as an interim aircraft and opened a second competition between Sikorsky and Vertol this spring for the final award. Sikorsky rolled out the first rear-loading version last month and flew it a month ahead of schedule. The CH-3C has a range of 810 mi. with a 2,400-lb. load.

the basis of exhaustive Air Force and Navy negotiations, "it is concluded that Air Force and Navy concepts for mission accomplishment, their basing postures, weapons system phasing and resultant weapon system characteristics differ to such a degree that development of a single TFX aircraft to fulfill stated requirements of both services is not now technically feasible and would place severe operational penalties upon the Air Force and the Navy."

He enclosed a separate list of these operational penalties, including: "only 37% over-all effectiveness in carrier based air-to-air combat," reduction in both the number of aircraft which could be placed on a carrier and the number of carriers big enough to handle the compromise USAF-Navy TFX, "increased hazards to safety of flight deck operations," more risk in the aircraft development program, higher procurement and operational cost "than are warranted," reduced reliability and increased maintenance of the radar caused by the folding nose of the TFX.

On Sept. 1, 1961, after reviewing Navy and Air Force objections to bi-service F-111 development, McNamara ordered that it be done, and said that "the Navy version of the basic aircraft to be developed under this program shall be capable of performing the Navy fleet air defense mission. . . ." Wakelin said his memo objecting to the bi-service F-111 was written before the Douglas Missileer project was canceled. "So, in effect, TFX Navy version is taking over with greater aircraft capability the whole mission of Eagle Missileer," Wakelin told the Senate group.

Sen. McClellan asked: "You never did agree, did you, that this TFX was a wise course until after the secretary of defense ordered it?" Wakelin replied that after the industry proposals for the F-111 were submitted, "it appeared quite likely that the major requirements of the Navy would in fact be met by a plane of slightly larger weight, but the mission requirements, the time on station, and speed requirements would easily be met. This was a surprise to all of us, and this certainly changed my mind with respect to it."

Space Station Power

Washington—Lewis Research Center last week awarded contracts to the General Electric Co. and the Martin Co. for study of nuclear electric power systems for manned space stations.

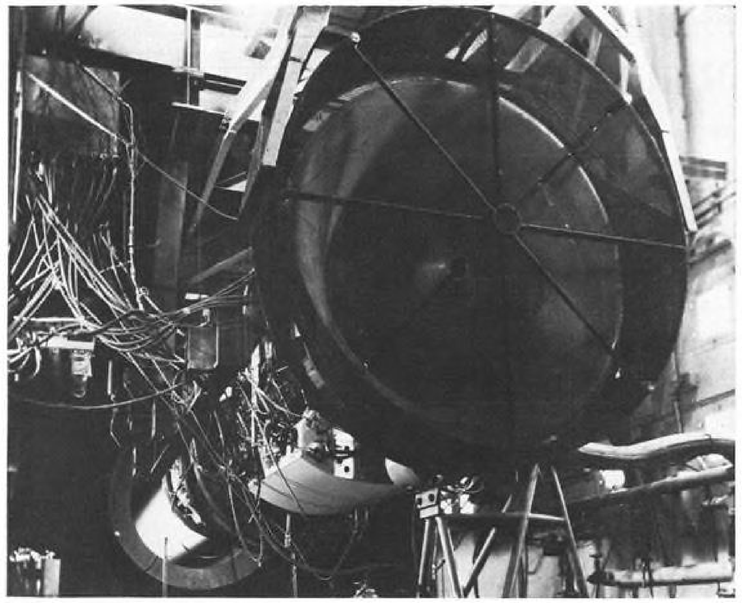
GE Nuclear Div. in Philadelphia will study reactor heat sources using both thermo-electric and dynamic power conversion systems. The company is funding about half the cost of the $166,000, one-year study. Martin will study isotope heat sources for power conversion under a 10-month, $40,000 study.

Two classes of space stations will be considered in the studies: cylindrical station capable of supporting three to six men for from one to two years and requiring a 2-5 kw. powerplant, with the earliest flight scheduled in 1976; and a rotating Y-shaped space station capable of maintaining as many as 30 men for as long as five years, requiring 12-35 kw. of power, with the earliest flight likely between 1967 and 1969.

When Sen. McClellan asked Korth how he could square the conclusions in the Fay memorandum with Korth's support of the bi-service F-111, the Navy secretary replied: "This [Fay memo] was a conscious and honest statement made at the time quite obviously proven wrong by subsequent events, because we do now have an operational aircraft which does indeed meet the requirements of the Navy as certified by the chief of naval operations."

Subcommittee members stressed that the Navy already is paying heavy penalties in performance because of compromises with the Air Force, including a combat ceiling 6,900 ft. less than desired and an aircraft weight 13,500 lb. more than desired. Sens. McClellan, Henry M. Jackson (D.-Wash.) and Karl E. Mundt, (R.-S. D.) intend to make penalties exacted by the compromise aircraft a central point as they challenge in coming weeks the F-111 decision made by Korth, McNamara, Deputy Defense Secretary Roswell L. Gilpatric and Air Force Secretary Eugene M. Zuckert.

But the real proof must wait until the F-111 actually flies. Several top-ranking Air Force and Navy officers fear that technical difficulties and the performance shortcomings of the F-111 may become so evident that McNamara may cancel the program before it reaches the production stage. But there is no strong evidence now that this will happen. McNamara appears more likely to insist on completing the development to demonstrate the soundness of his decision.



GE YJ93 Test Run Shown

General Electric YJ93, 30,000 lb. thrust turbojet developed for use in the North American Aviation, Inc., RS-70, is shown during a test run at General Electric's large jet engine test cell. Engine completed its Preliminary Flight Rating Test last year (AW May 7, 1962, p. 35) and currently is designed for a 100-hr. time between overhaul (TBO).

Senate Unit Collects Evidence To Challenge Nuclear Test Ban

By Katherine Johnsen

Washington — Senate Preparedness Investigating Subcommittee is completing a comprehensive record of testimony to challenge almost any conceivable nuclear test ban agreement that could emanate from top-level U.S.-British-Soviet negotiations, scheduled to start July 15 in Moscow.

The subcommittee's closed-door sessions, directed at the need for nuclear testing to maintain the U.S. military posture, started early in May and have produced 1,119 pages of testimony. The witnesses have been Gen. Curtis LeMay, USAF chief of staff, and Adm. George W. Anderson, outgoing chief of naval operations, and the top officials of Defense Dept.'s Defense Atomic Support Agency, Central Intelligence Agency, Atomic Energy Commission, and the Arms Control and Disarmament Agency (ACDA).

The subcommittee's hearings will extend a few more weeks and include testimony from Gen. Earle Wheeler, Army's chief of staff, Dr. Harold Brown, director of defense research and engineering, and several atomic scientists.

The attitude of the subcommittee toward a nuclear test ban agreement was presented by Sen. John Stennis (D.-Miss.), the chairman, in his statement to the Senate:

"In this crucial area—upon which the very survival of our country might depend—we must be certain, not only beyond all reasonable doubt, but to the exclusion of every reasonable hypothesis of a doubt."

W. Averell Harriman, under secretary of state for political affairs, will represent the U.S. at the Moscow negotiations. He will be assisted by Adrian S. Fisher, deputy director of the Arms Control and Disarmament Agency.

Thirty-four senators, led by Sen. Thomas S. Dodd (D.-Conn.), have sponsored a resolution calling for a ban on atmospheric and underwater testing (AW June 17, p. 25).

It states that "a ban on all tests that contaminate the atmosphere or the oceans can be effectively monitored and requires no on-site inspection apparatus, would completely eliminate the danger of cumulative atmospheric fallout, and would constitute a beginning in curtailing the arms race."

In the past, the USSR has refused to consider a partial ban, claiming that U.S. technology is farther advanced and its capability greater for underground testing. Last week Soviet Chairman Khrushchev altered this position, saying Russia would accept a ban on atmospheric and underwater testing, but only as part of a broader disarmament agreement.

Sen. Stennis said:

"From atmospheric testing have come all of our major nuclear weapons developments and our knowledge of the means to employ them most effectively in the defense of our country if it should become necessary. For my part I would support an atmospheric nuclear test ban only if I was entirely convinced that there is absolutely no relationship between continued testing by this country and the ability of our retaliatory or second strike forces to survive a surprise nuclear attack."

Sen. Stennis indicated that atmospheric testing is required to achieve these goals: defense against Soviet intercontinental ballistic missiles; a capability to penetrate a Soviet missile defense employing nuclear warheads; assurance of the immunity of our second-strike missile system to a surprise enemy nuclear attack; and specialized nuclear warheads for defense against satellite bombs and other terror weapons.

Senate support for an atmospheric test ban is the one notable exception to the skeptical attitude of Congress toward disarmament proposals and to the Arms Control and Disarmament agency.

ACDA's growth is being restricted. It is being accused of promoting disarmament propaganda—with the result that the Senate has passed legislation prohibiting ACDA from using its funds "to pay for the dissemination within the United States of general propaganda in support of any pending legislation concerning the work of the Arms Control and Disarmament Agency."

Sen. J. William Fulbright (D.-Ark.), chairman of Senate Foreign Relations Committee, said that while his committee was considering ACDA's Fiscal 1964 budget, "members were subjected to what appeared to be a highly organized campaign . . . No other legislation or treaty handled by the committee has provoked quite such activity."

The outlook is that the House will follow the lead of the Senate and keep ACDA on the basis of a temporary agency. The Senate authorized ACDA $20 million for Fiscal 1964 and 1965.

The President opposed the authorization ceiling. He sought to have ACDA put on the same basis as most other government agencies which present their budgets annually to Congress, without any legal ceiling.

ACDA was launched in Fiscal 1962 with a $1.8-million appropriation. It received $6.5 million for Fiscal 1963. The President asked $15 million for Fiscal 1964.

Mass Air Attack Seen Unlikely; Defenses Shifted, Radars Closed

Washington—U. S. intelligence estimate that a massive air attack against North America is highly unlikely is being reflected in a series of realignments that will concentrate more operational responsibilities at Air Defense Command semi-automatic ground environment (Sage) combat centers and the Army's Air Defense Command Regions (Aradcoms).

In addition, the Air Force will close 17 long-range radar sites in Arizona, New Mexico, Texas, Louisiana, Arkansas, North Carolina, Washington, Vermont and two Texas towers off the U. S. East Coast. Ten low-altitude gap-filler radars in Texas and Louisiana will also be phased out.

Air Force is also beginning widespread dispersal of air interceptor units, similar to the Strategic Air Command's dispersal of its bombers to meet the threat of Soviet missile attack. Squadrons will rotate aircraft from parent fields to municipal and military fields for periods of temporary duty.

Both Air Force and Army capabilities in Southeast U. S., especially the Florida peninsula, will remain at a level higher than that which existed prior to the Cuban crisis last fall. Air Defense Command (ADC) will rotate squadrons on temporary duty from southeast states to Homestead AFB, Fla. and the Naval Air Station, Key West, Fla. Aradcom will continue deployment of surface-to-air missiles on the Florida peninsula.

Since the middle 1950s, the North American Air Defense Command's organization has been ready to handle a saturation-type of air attack by having the lowest elements–ADC sectors, each controlled by a Sage direction center, and Aradcom defense areas–capable of taking a heavy load of intercept and tracking operations from the next higher levels of control.

Now it is believed that the Soviet long-range bomber capability no longer poses the threat of a mass attack. This intelligence analysis has no bearing on the Soviet medium-range bomber threat to Europe, which is considered serious because the Russians have been producing medium-range jet bombers in quantity.

Air defenses by aircraft are organized, in ascending order, as air defense sectors, ADC air divisions, and North American Air Defense Command (Norad) regions. Two Norad region headquarters will be relocated and one air division will be eliminated. Four Sage direction centers, which are at the sector level, will be closed.

The 26th Norad Region will move from Hancock Field, Syracuse, N. Y. to Stewart AFB, N. Y. and the 32nd Norad Region at Oklahoma City will move to Montgomery, Ala., where it will enhance command control capabilities in Southeastern U. S.

The 26th Air Div. will move from Hancock Field to Stewart AFB and the 32nd Air Div. at Oklahoma City will be closed. Sage direction centers at Beale AFB, Marysville, Calif., Larson AFB, Moses Lake, Wash., Sawyer AFB, Marquette, Mich., and Stewart AFB will be closed.

The Army, in parallel moves with its tactical air defense missile forces–also under Norad–will eliminate the 2nd Air Defense Region at Oklahoma City, leaving five regions under Aradcom.

The first region at Ft. Totten, N. Y. and the fourth region at Richards-Gebauer AFB, Mo., will gain a total of 11 defense areas in the command reorganization, thus further concentrating control of missile defenses of cities and military installations.

Air Force's speed in dispersing interceptors will depend on money Congress provides in the Fiscal 1964 military construction program. Until facilities have been built in many locations, aircraft will be dispersed for a matter of hours rather than for a day at a time. Daily rotation will begin as facilities for housing personnel and servicing aircraft become available.

ADC units in Arizona, California, Delaware, Michigan, Minnesota, Missouri, New Jersey, New York, North Carolina, North Dakota, Ohio, Oregon, South Carolina, Texas, Virginia, Washington and Wisconsin will rotate their aircraft to fields relatively short distances away.

In most instances the alternate fields that will be used are located less than 100 mi. away.

Japanese Select Hughes System

Japanese Self-Defense Agency has decided to accept Hughes Aircraft's low bid for a Sage-type early warning and aircraft control system for Japan–despite General Electric's offers to reduce the price of its system to a figure within the $51-million limit allotted for the program.

The announcement was made jointly by Kenjiro Shiga, director general of the Japanese Self-Defense Agency, and Takeshi Matsuda, chief of the Japanese air staff.

GE was originally the high bidder for the system at $57 million, with two contractors–Hughes and Litton Industries–bidding at $37 million and $47 million, respectively (AW June 17, p. 39).

General Electric made a late offer to reduce the price of its Sage-type system to approximate that of Litton's. GE said the reduced price was made possible by a decision to grant Toshiba–its Japanese partner–a 5% royalty fee license for portions of the system to be produced in Japan. The company acknowledged that other price adjustments would be necessary but no equipment changes were involved.

Shiga said he was aware that the price of the Hughes system would increase because of additional capabilities requested by the American military. He said he thought the Americans should pay the entire extra cost for the additional capabilities, but he doubted that the U. S. would. A 50-50 split between Japan and the U. S. for extra costs would be acceptable, Shiga added.

The decision was reached July 1, the day following the return of an inspection team headed by Lt. Gen. Shigeru Ura from a visit to Hughes' and Litton's plants in the U. S. Ura's team watched a demonstration of the Hughes system and said that its development was almost complete. The Hughes system should meet technical requirements and the completion schedule, the team reported.

The decision was expedited because of the possibility of a shakeup in Japan's Diet in the middle of the month. A shuffle could have resulted in the appointment of a new defense agency director general, causing further delays in the warning system.

Douglas Wage Boosts

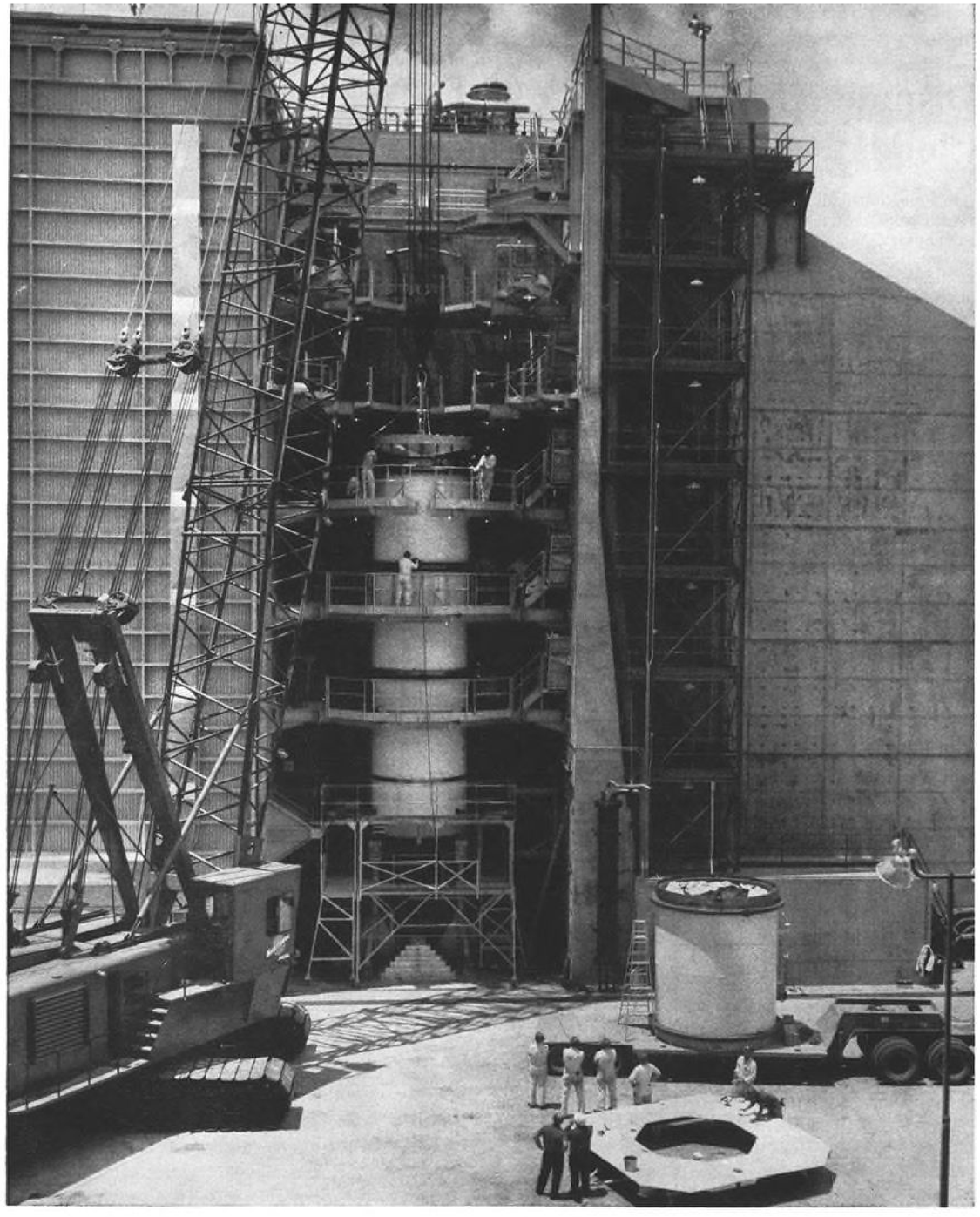
Wage increases of 6 to 10 cents an hour will go into effect between now and October for 25,300 hourly employes of Douglas Aircraft Co.

The automatic increases are included in the three-year collective bargaining agreements with 12 unions signed by the company in July 1962.

The latest round of increases will add $3,600,000 annually to Douglas Aircraft's payroll.

Last year hourly employes received boosts of five to eight cents an hour, and in 1964 hourly wages will be raised six to nine cents.

Employes at Douglas plants in Santa Monica and Long Beach, Calif., Tulsa, Okla., and Charlotte, N. C., will receive the latest increase. Workers not represented by a union also are being given the wage hike.



UTC Readies 120-in. Motor for Development Firing

Loaded third segment in a five-segment configuration of a 120-in. dia. solid motor is positioned on a stack by crane at United Technology Center's vertical test bay at Coyote, Calif. The motor is being prepared for the first development firing, scheduled July 20. A loaded fourth segment rests on a truck bed (right foreground), ready for hoisting into position. The five-segment motor is scheduled to serve as a strap-on unit for Air Force's Titan 3 space booster. Test stand is 95 ft. high and has a pressurizing facility and sphere at the top for secondary injection fluid to check thrust vector control. Motor will be fired with its 10-ft.-long nozzle pointed up, giving the complete rocket a length of about 85 ft. Load cells at the bottom and sides of the bay will measure forces in restraint during firing. The 120-in., five-segment motor is expected to develop about 1 million lb. thrust, but the bay is designed to accommodate 4 million lb.-thrust motors. Thrust block at the bottom of the bay is 30 ft. square and 20 ft. thick. Huge sliding door (left), together with a sliding roof, can enclose the motor to maintain proper environment in inclement weather.

Dispute Among Large Carriers Clouds Role of U.S. Comsat Corp.

Washington—Radio Corp. of America last week protested the "erroneous presumption" that its subsidiary, RCA Communications, Inc., is for sale, in identical letters to Sen. Warren Magnuson (D.-Wash.), chairman of Senate Commerce Committee, and Rep. Oren Harris (D.-Ark.), chairman of House Commerce Committee.

The letters, written by RCA Board Chairman David Sarnoff, were the latest move in an erupting policy conflict among the international communications carriers that is muddying the role of Communications Satellite Corp., now being organized as the U.S. segment of a worldwide network of communications via satellite (AW Mar. 25, p. 28). Under legislation passed by Congress last year, 50% of the firm's stock is to be offered to the public and 50% reserved for purchase by communications common carriers.

Most Profitable Carrier

Sarnoff declared that the subsidiary "is the most experienced and most profitable of the American international record carriers. It has reinvested 85% of its earnings over the past 10 years in development and modernization of its facilities.

"We are now engaged in a further expansion program involving a capital expenditure of more than $35 million. Such a program would hardly be undertaken by RCA if it wished to jettison its communications business."

RCA is advocating unification of all U.S. international telephone and telegraph facilities and operations within the satellite firm (AW Aug. 13, 1962 p. 35). This would include RCA, International Telephone & Telegraph Corp., American Telephone & Telegraph Co., and Western Union Telegraph Co.

ITT President Harold S. Geneen inferred from this "that RCA is willing to sell its international communication services" in a letter to Magnuson that prompted Sarnoff's reply.

Merger Plan

ITT is pushing for a merger of international record carriers—RCA, ITT, and Western Union. This would create a monopoly in the international record communication field comparable to AT&T's monopoly in the international voice field.

Western Union is under legislative mandate to divest itself of its international cable operations.

According to Geneen's plan, the proposed record communication company and AT&T would use the satellite firm as "a carrier's carrier." The satellite corporation should not enter into competition with the carriers that use it, he said.

AT&T is supporting the status quo and plans to become a major investor in the communications satellite company.

A unified company, Sarnoff said in his letter to the congressional committee chairman, "could start with an immediate revenue base provided by the traffic of existing U.S. international communications carriers. In 1962, this totaled $160 million."

Cable Development

AT&T's progress in the development of high-capacity transistorized cables, Sarnoff noted, raises uncertainty as to how soon the satellite firm, as now organized, can expect to operate at a profit.

AT&T's U.S.-Europe cables now have 48 voice channels. A transistorized version of an undersea cable on which the company started development last year will carry 720 circuits—about 15 times this capacity—and also handle television, according to J. E. Dingman, AT&T's executive vice president.

Sarnoff remarked in his letter to the committee chairman that "our satellites must be more than mere space transmission belts for possible overflow cable traffic in the future."

Diamant Funding

Paris—French military missile effort is providing a major portion of the funding for the Diamant scientific satellite launcher (AW June 17, p. 26), figures released last week by the defense ministry show.

Diamant is derived from an experimental military two-stage missile, the Saphir, which incorporates a liquid-fueled first stage and solid-fueled second stage.

Saphir launch weight is 38,080 lb., and its trajectory can either be programed before launch or controlled during flight, the ministry said.

First Saphir launching is scheduled for November.

Diamant research and development program is budgeted at about $100 million, with the military furnishing all but 10-15%, ministry figures show.

The balance of the funding is to be provided by CNES, the French government space agency.

Helicopter Competition

U. S. Army has scheduled a 20-day light helicopter competition at Ft. Rucker, Ala., beginning Sept. 20 to evaluate aircraft for a proposed procurement of 275 helicopters for pilot training.

Firms entering the competition include Bell Helicopter, Hiller Aircraft, Hughes Aircraft, Brantley and R. J. Enstrom Corp. of Menominee, Mich. Enstrom will enter a second prototype of its F-28 three-place helicopter (AW Feb. 12, 1962, p. 95); the first was destroyed in a crash last fall.

Army says it wants a light, inexpensive helicopter of simple construction so that heavier equipment now used for pilot training can be released for other duty.

Hiller to Design Jet Rotor Tips for Army

Army Transportation Research Command has awarded a $953,000 contract to Hiller Aircraft Co. to design a rotor system for a heavy-lift helicopter powered by turbojets at the rotor tips.

The contract will be the first of several phases leading to construction of a flying article if the study indicates the idea is feasible. A second phase would involve construction of a full-scale lift and propulsion system that would be tested in a whirl test facility.

Subcontractor with Hiller, Continental Aviation and Engineering Corp., will furnish its J69-T29 jet engine for the program. This is the engine that powers the Air Force T-37 trainer.

The rotor system will consist of four blades each with an engine at the tip. Hiller has been testing tip-powered systems, both with company funds and military funds, since 1949.

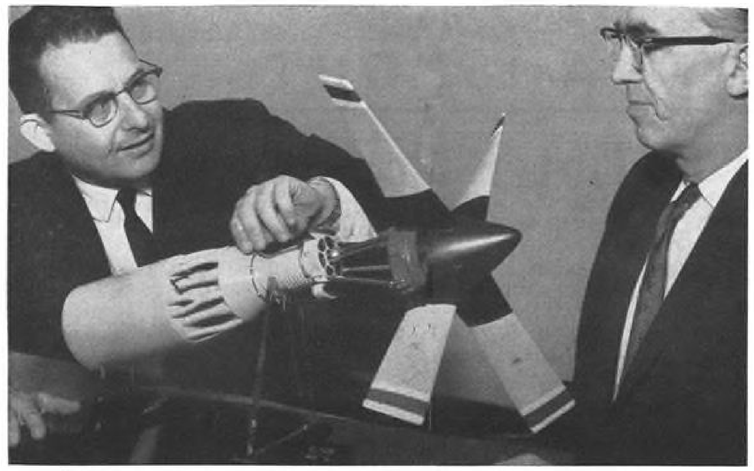
Other firms in the final competition were Goodyear Aerospace Corp. and General Electric.

Cosmonaut Confirms Parachute Landing

Moscow—Soviet Cosmonaut Valentina Tereshkova last week confirmed that she landed by parachute separately from her Vostok 6 spacecraft.

"I landed very smoothly by parachute and the spaceship landed very close to me—a mere 400 meters [about 1,300 ft.] away," she said at a press conference during the World Congress of Women here.

Previous Soviet reports had indicated that Miss Tereshkova landed separately from her spacecraft, but no specific description of the landing was given at the earlier Bykovsky-Tereshkova press conference (AW July 1, p. 28).



Allison Regenerative Engine Design Shown

Navy has chosen the Allison Div. of General Motors Corp. to develop a regenerative turboprop engine which may equal reciprocating engine fuel consumption rates—0.3 lb./hp./hr. Engine, designated 545-B2 is shown in model form above. If development is successful, Navy will install it in most of its propeller-driven anti-submarine aircraft. Air Force also is interested in the engine for a long endurance missile-launching aircraft (AW Feb. 18, p. 40). Regenerative engine uses heat from exhaust to heat air emerging from compressor section and improve burning efficiency. Allison competed with Pratt & Whitney, General Electric, Curtiss-Wright and the Lycoming Div. of Avco Corp. (AW Apr. 1, p. 29). AiResearch Div. of Garrett Corp. had offered its heat transfer data to all competitors.

News Digest

Martin Co. will build infrared horizon sensors for the Saturn 1 launch vehicle under a $827,000 contract announced last week by the National Aeronautics and Space Administration. Sensors will be built by Martin's Electronic Systems & Products Div. in Baltimore for long duration checkout flights of the Apollo spacecraft in earth orbit in 1965 and 1966.

Sud Aviation management and union leaders last week neared agreement on wage issues which had threatened to halt Caravelle production.

Northrop Corp. has received definitive Air Force contracts totaling $129,572,500 for production of F-5A and F-5B fighters and T-38 jet trainers.

Radio Corp. of America Service Co. is negotiating a $5-million, two-year contract with the National Aeronautics and Space Administration for operation of two new NASA tracking stations at Rosman, N. C., and Fairbanks, Alaska. The new stations, which are expected to be in operation by September, will be used to track NASA's new generation of orbiting scientific observatories and weather satellites.

Boeing Co. has received a $196,000 contract from the U.S. space agency for a four-month initial study of a lunar base concept (AW July 1, p. 71).

Maj. Robert A. Rushworth recently became the third pilot to reach an altitude of 50 mi. in the North American X-15 research aircraft. He attained an altitude of 286,000 ft. and a maximum speed of 3,545 mph. during a high-altitude familiarization flight in the No. 3 X-15.

Avco-Everett Research Laboratory is conducting studies on use of superconducting magnetic systems for shielding spacecraft against ionizing radiation generated by eruptions on the sun. Contracts total about $191,000 and were awarded by the National Aeronautics and Space Administration's Marshall Space Flight Center.

Lear Siegler, Inc., Santa Monica, Calif., is negotiating a contract with the National Aeronautics and Space Administration for research on a psychophysical information acquisition, processing and control system. The system will sense, record and report on the condition of the pilot and spacecraft, permitting control of the environmental system. First phase of the $1-million effort will be development of a sensor system as part of a space suit. Sensors are now attached to the body with tape.

Strike by 900 draftsmen at Bristol Siddeley appeared deadlocked last week in a walkout that came after two years of wage negotiations. Many of the draftsmen were assigned to the Olympus 593 engine program for the Anglo-French Concorde supersonic transport, and to the Olympus 22-R, military version of the 593, scheduled for use in the TSR.2 strike-reconnaissance fighter.

French government last week approved a 50-50 ownership agreement between Henry Potez of France and Avco Corp.'s Lycoming Division for establishment of a company to manufacture and sell Lycoming engines in Europe, Africa and the Middle East. France had balked at the plan (AW Oct. 22, p. 27), preferring a controlling French interest, but agreed to the 50-50 plan with agreement by the companies that, in addition to Henry Potez as president and board chairman, the number two official of the company would also be French.

Republic Aviation Corp., Farmingdale, N. Y., has been selected by NASA to receive a $5.5-million contract for first phase development of an advanced orbiting solar observatory. The first flight is scheduled for late 1967.

Pan American World Airways and National Airlines have agreed to exchange the stock that each airline holds in the other (AW Apr. 1, p. 41) in compliance with a Civil Aeronautics Board order issued two years ago.

Mohawk Airlines Martin 404 crashed last week seconds after taking off in a rain and hailstorm from the Rochester, N. Y. airport. Pilot, copilot and five passengers were killed. Total of 36 persons on board were injured, 21 critically. Flight originated in Rochester and was bound for White Plains, N. Y. and Newark.

S-64s for Army

U. S. Army has awarded Sikorsky Aircraft a $13.5-million contract for six S-64 Skycrane heavy-lift helicopters (AW June 11, 1962, p. 32) and related ground support equipment to be delivered in the last half of 1964.

The S-64s, designated CH-54As by the Army, will be used to develop the heavy-lift concept, with emphasis on increasing mobility in combat areas. Heavy-lift missions include retrieval of aircraft and missiles, towing of mired vehicles, transport of portable maintenance shops, vans and pods, command posts or hospital units, and transport and placement of bridge spans.

U.S. Shuns Bid to Enter Concorde Effort

Halaby cites loss of competition; Anglo-French use of USAF center for SST engine tests is discouraged.

By L. L. Doty

Washington—U.S. has rejected for the present a proposal that it join the French and British in a tripartite consortium to build a supersonic transport, and has apparently discouraged Bristol Siddeley from making any further moves toward using the USAF Arnold Test Center to test the Olympus Mark 593 engines that will power the Concorde supersonic transport.

The British-French drive to bring the U.S. into the Concorde project had gained momentum late last month (AW June 17, p. 40), and aroused congressional interest, but Federal Aviation Agency opposition has shelved the project, at least temporarily. In addition, chances that the U.S. might cooperate to a lesser degree with the British-French combine appeared to be dwindling last week as the U.S. chose to view its supersonic program as a competitive project.

FAA Administrator N. E. Halaby emphasized this point last week when he said that he was not interested in the tripartite proposal because it would "eliminate" the element of competition which, he added, tends to "produce better service." U.S. aircraft manufacturers, however, are prepared to offer stiff resistance to President Kennedy's recommendation to Congress that they underwrite one quarter of the estimated $1-billion cost of building a U.S. supersonic plane.

Meanwhile, an Air Force spokesman told AVIATION WEEK & SPACE TECHNOLOGY USAF and Bristol Siddeley had an "informal exchange of technical ideas" over the use of the Arnold Test Center at Tullahoma, Tenn. for the testing of the Olympus engines, but had received no answer to a letter sent to the British manufacturer last March. Correspondence over the use of the Arnold facilities began last September. USAF sent descriptive material on the center and suggested that Bristol Siddeley send a team to inspect the Arnold facilities.

The Air Force spokesman emphasized that the transactions were handled on an informal basis and, since there is "strong congressional interest in the U.S. program," there is now some question as to whether use of the center would be aiding a competitor. In any event, Air Force said it had advised Bristol that any formal request for use of the center must be made through the British Ministry of Aviation.

Last week, Sen. J. William Fulbright (D.-Ark.) raised strong objection to the proposed U.S. supersonic transport program. He referred to the need for cooperation among NATO allies, and added:

"I should think that we might begin to put this spirit into practice by not breaking into panic every time one of our allies builds a better mousetrap. If we are to subsidize a $1-billion commercial supersonic airliner simply because the French and British are building one, must we appropriate additional billions in order to defeat them in every field of their endeavor?"

At the same time, Karl G. Harr, Jr., president of Aerospace Industries Assn., said his organization supported the President's decision to build the plane, but added that the "answer is no" to the question "can it be done independently by private industry?"

Harr said that in addition to development costs, financing of production tooling and work in process is estimated at $800 million. He stated that "the magnitude of such a sum becomes apparent when compared with the total net working capital of five airframe companies identified by Mr. Halaby as being most interested in the program, presently approximately $700 million."

Thus, as of late last week, no headway had been made in the U.S. supersonic transport program despite a general determination to undertake the effort as a national project. Feeling is strong that the U.S. must build a supersonic plane to retain its position as a leading producer of transport aircraft.

In addition, there is a general belief that the project is necessary to the health of the manufacturing industry. On this point, however, Harr said, "we do not believe it either necessary or desirable to picture the aircraft industry as a sick or partially sick industry which needs succor by this kind of effort. The American aircraft industry, now blended into the broader designation aerospace, is not going to wither and die if the supersonic transport effort is abandoned."

But, in the same statement, Harr said, "we estimated that the supersonic transport program would mean the employment of an estimated forty to fifty thousand people over approximately a 10-year period."

Both the British and French have admitted that the Concorde program is an essential factor in preventing a deterioration of their aircraft industries during the next decade. The project will not be dropped despite the quality or quantity of U.S. competition.

British-French enthusiasm for the tripartite plan has not been dampened by the unwillingness of the U.S. to enter into discussions on the proposal with the European group. As of late last week, French aviation leaders were still openly expressing hope that the U.S. could be brought into a joint program.

At the same time, U.S. officials were denying that any formal offer had been made and were rejecting informal suggestions that the plan be discussed. As a result, there is now only slight hope that the U.S. will respond favorably to British-French overtures as long as some prospect remains that it will find satisfactory methods of producing its own supersonic airplane.

Court Delays Stall New Pilot Union

New York—Court delays brought on by the Air Line Pilots Assn. have stalled its rival Allied Pilots Assn. in efforts to gain National Mediation Board recognition as the bargaining agent for American Airlines' 1,650 pilots (AW Apr. 15, p. 41).

Latest block is a temporary restraining order obtained by ALPA in Washington that prevents the mediation board from conducting a representation election among the American crews.

Restraining order was effective through last Friday. However, Judge Luther Youngdahl of U.S. District Court in Washington was expected to grant a further 10-day extension before hearings on grounds of a crowded court calendar.

ALPA maintained in its complaint that the mediation board had not conducted a proper examination of the Allied Pilots Assn. before authorizing the election.

Judge Youngdahl, in granting the restraining order, also received an affidavit from the mediation board which insisted that it had made such an investigation and found no evidence of coercion or misconduct.

In another court action, Judge Inzer B. Wyatt of the Southern District Court of New York is expected to rule soon on an ALPA suit against the new union and the airline. ALPA maintains that the Allied Pilots negotiators were ALPA members when they negotiated a disputed contract with American.

More than 90% of American's pilots withdrew from ALPA when that union refused ratification of the contract.

No retroactive pay is provided in the proposed contract, and Allied Pilots is under pressure from its membership to obtain a signing as quickly as possible. However, the airline maintains it cannot sign while court actions are pending.

Special Lighted Traffic Pattern Planned to Reduce Idlewild Noise

New York—Home owners near Idlewild Airport were told by the Federal Aviation Agency last week that a new, specially lighted traffic pattern is being adopted at the field to route jet aircraft away from residential areas.

Oscar Bakke, assistant administrator for the FAA's eastern region, explained the new procedure at a meeting of the newly formed Aviation Development Council. Present were members of homeowners' anti-noise committees.

Bakke said that a right-hand traffic pattern had been established for aircraft approaching runways 13L and 13R at Idlewild. Such a pattern brings aircraft in over Jamaica Bay over an unpopulated area along the Belt Parkway.

Previously, aircraft landing from a left-hand approach pattern passed over densely populated areas of the Borough of Queens, resulting in a flood of noise complaints to the FAA.

After it enacted the new pattern, however, FAA began receiving complaints from Brooklyn residents.

"What was happening," Bakke said, "was that pilots having trouble making visual runway contact on murky days were swinging out over Brooklyn to prolong their final letdown."

Consequently, FAA has decided to spend $275,000 on a lighted airway that will lead pilots over the uncongested route. The flashing beacons, arranged in several segments of six in-line lights each, will extend approximately six miles along the Belt Parkway and bend at a 15 deg. angle toward the runway threshold. FAA hopes to have the lights installed by March, 1964, if the city grants it use of the land required.

Bakke also said that aircraft departing on Runway 31L, Idlewild's busiest, are being instructed to maintain overwater climbs for an additional two minutes, placing them at higher altitudes before turning over residential areas.

His presentation was part of the Aviation Development Council's campaign to improve relations between airports and the communities around them. In addition to 21 airlines and the FAA, the council's members include the Port of New York Authority, Air Line Pilots Assn. and the Aerospace Industries Assn. of America.

Malcolm A. MacIntyre, president of Eastern Air Lines, is president of the council. Main purpose of the organization, established last March, is to seek a solution to the growing civic and governmental pressures being brought against airline operations.

"We have had and continue to face, through litigation and proposed legislation, demands for restrictions on our operations which, if met, would seriously cripple air commerce," MacIntyre said.

Besides its anti-noise activities, the council expects to participate in determination of a site for a proposed fourth New York area airport, and also to work toward more appropriate zoning for areas bordering airports.

Bakke said he was particularly disturbed that despite the FAA's recommendations, construction of new homes was still under way within sight of Idlewild's runways.

Capt. Harry F. Clarke, an ALPA official and pilot for Trans World Airlines, said that pilots had gone as far as they could in reducing noise through low-altitude power reductions and other procedures they consider objectionable.

Clarke said that it compromises safety to reduce power, maintain a speed only 10 kt. over takeoff velocity and initiate turns, all below 600 ft. It doesn't leave a pilot sufficient margin for emergencies such as engine failures, he said. To initiate additional such restrictions cannot be considered, he said.

"Besides, as it is now, we're merely reducing noise in one area and increasing it in another where we increase power to continue our climb."

Monitoring of aircraft noise, which the Port Authority does with a sound measuring device beneath the aircraft's takeoff path, doesn't solve anything, Clarke maintained. Penalties are levied by the Port Authority against carriers whose planes consistently exceed noise limits over the monitoring point.

"As it is now, we're merely reducing power to fool a black box on the ground," Clarke said.

Pacific Merger Bids Blocked

Washington—Plans of West Coast and Pacific Airlines to merge hit a major legal block last week when Civil Aeronautics Board attorneys launched an investigation of West Coast's reported purchase of a 34% controlling interest in Pacific.

Meanwhile, Bonanza Air Lines was rebuffed temporarily in its own attempt to acquire Pacific, when Pacific replied last week that it could not discuss the proposal now, but would be willing to negotiate later.

Bonanza triggered the CAB investigation in a complaint charging that West Coast violated the Federal Aviation Act by not filing with CAB details of the transaction.

Specifically, Bonanza contends that West Coast ignored CAB's denial of its stock purchase application and paid two former Pacific officers more than $2.3 million for 296,240 shares of the airline's stock. Former Pacific President John H. Connelly and Board Chariman Leland Hayward were paid $8.24 for each share, even though Pacific's market bid price averaged only $3, Bonanza claims.

In the event of a merger between West Coast and Pacific, the remaining Pacific stockholders will probably get less than half of the price paid to Connelly and Hayward, Bonanza contended. As evidence, Bonanza pointed out that early last month West Coast voted a stock dividend of two shares for each share held. The action had the direct result of dropping the airline's book valuation per share from a previous $9.25 to only $3.08. The new price places West Coast stock on a relatively equal price level with that of Pacific, and would probably require a share-for-share exchange basis in the event of a merger.

In addition to the purchase, Bonanza stated "on belief and information" that West Coast placed the stock holdings in the hands of a trustee, without notifying CAB of this action or identifying the trustee or his voting authority. Terms of the trust agreement, Bonanza contended, could determine whether Pacific should be merged into West Coast or Bonanza.

Pending completion of the investigation, Bonanza urged the Board to order West Coast to either dispose of the Pacific stock or place it in a trust agreement.

Northeast Assured Planes Until Sept. 11

By James R. Ashlock

New York—Retention of jet and turboprop equipment by Northeast Airlines until Sept. 11 has been assured through an agreement on a revised leasing program backed by the carrier's principal stockholder, Hughes Tool Co. (AW July 1, p. 37).

Northeast agreed to turn back two of its Convair 880s, which were returned to General Dynamics Corp. at Ontario, Calif., early in the week. However, these were immediately replaced by two 880s owned by Hughes Tool, leaving Northeast with its previous complement of six 880s.

With the 880s went eight CJ-805-3 engines on lease from General Electric. Northeast was granted continued use of General Electric's engines on the remaining four leased 880s under conditions of the interim arrangement backed by Hughes Tool.

DC-6 Sales

Vickers-Armstrongs, Ltd., also agreed to withhold repossession of Northeast's nine Viscounts, at least until the September deadline. However, Northeast has agreed to seek immediate sale of some of its DC-6 aircraft to raise cash for partial settlement of the $7 million in overdue payments to Vickers for the Viscounts.

Temporary relief from repossession by the three engine and airframe manufacturers came in a meeting at Boston called by Gov. Endicott Peabody of Massachusetts. Among those present were several other New England governors and Sen. Edward M. Kennedy, the President's brother.

In an earlier meeting, Sen. Kennedy had personally requested that Northeast be allowed to keep its equipment in the interest of continued air service to New England.

However, he did not intervene in discussions at the second meeting when it became evident that agreement was being reached.

Specific details were not revealed, but Hughes Tool evidently provided a more acceptable proposal than it had earlier. It had first suggested that existing debt on the equipment be written off, and that Northeast be allowed to keep the planes temporarily for approximately half the normal lease or payment scale.

In its second offer, Hughes Tool consented to immediate return of the two 880s, and established the Sept. 11 deadline for release of the other four. In addition, it consented to rental payments more closely approximating the $55,000 average monthly lease rate on the 880 airframes, and to a comparable arrangement on the engine lease. Besides backing the revised lease, Hughes Tool also agreed to pay off a portion of the existing equipment debt. None of the creditors plans to write off any portion of the debt.

Besides the $7 million due on the Viscounts, Northeast owed about $4.8 million on the 880 airframes and $2.35 million on the engines.

Hughes 880s

Hughes Tool is expected to provide two other 880s it owns, currently in storage at Ontario, Calif., to Northeast. Consideration is being given to modifications of these aircraft, modifications that might include installation of General Electric CJ-805-23 aft-fan engines.

Although Gov. Peabody's calling of the meeting was instrumental in bringing the parties together, threatened loss of Northeast's service in New England now appears to be a less immediate possibility.

New England routes are almost entirely served with piston equipment, including Douglas DC-3s. Loss of the jet and turboprop aircraft would not necessarily mean immediate disruption of the local and regional service. Such a loss would effectively put Northeast out of its Florida route, which is a major income producer for the airline.

Alan S. Boyd, chairman of the Civil Aeronautics Board, has said that the CAB will decide shortly the question of renewal of Northeast's temporary Florida route certificate, or possibly the awarding of a permanent certificate. If Northeast is denied continued operation to Florida, and consequently relegated to the role of a regional carrier, it is considered certain that the airline would have to receive federal subsidy to remain operative.

Congressional opposition to rising subsidies provided to airlines is increasing, however.

Both Northeast and Hughes Tool now have more time to seek a merger partner for the airline, an effort that is practical only as long as Northeast retains its Florida route. Hughes Tool is expected to withdraw its financial support, making federal subsidy even more imperative for Northeast.

Three Carriers Indicate General Approval of Pan Am Fare Proposal

New York—General approval of Pan American World Airways' proposal for lower transatlantic fares (AW July 1, p. 37) was expressed by three of the American carrier's foreign competitors last week.

However, two of the three airlines questioned whether the Pan American proposal is actually a genuine fare-reduction move, or simply a promotion effort that would further complicate the current fare structure.

British Overseas Airways Corp., Alitalia and Scandinavian Airlines System agreed that fares should be lowered. BOAC said it "welcomed" the Pan American proposal, emphasizing that the proposed $160 one-way fare is equivalent to that already available on BOAC flights between England and the Crown colonies.

Officials of BOAC said that Pan American's suggestion would receive serious consideration at the next International Air Transport Assn. rate conference this September in Salzburg, and predicted that "lower fares of some kind will be recommended for the approval of all governments."

Fabrizio Serena, Alitalia's general manager for North America, said his carrier feels that the Pan American proposal does not go far enough toward simplifying the fare muddle. The Italian carrier is working on its own lower-fare proposal, he said.

"While we feel there is a pressing need for reduced fares, we do not think the best way to go about it is to introduce still another type of service adding another level of tariffs," Serena said.

Alitalia objects to Pan American's plan for continuing first-class and economy service over the same routes where it would introduce the lower "thrift" fares. This is merely "adding another patch to the old one," Serena said.

"The public, the travel agents and our own harassed employes could better be served by the adoption of two basic fares—first class and economy—with possibly seasonal variations," he added.

Serena also criticized Pan American's proposal for withdrawing meals and "other amenities" on the $160 flights.

"Amenities are the foundation upon which Alitalia has built its reputation and it is against the Italian nature to eliminate them," Serena said, adding that 7 hr. is too long for persons to travel without having some food and refreshment.

Airline Income and Expenses—April 1963

(In Thousands of Dollars)	OPERATING REVENUES						Total Operating Expense	Net Profit (or Loss)
	Passenger	Cargo	Other Non-Mail	U. S. & For. Mail	Federal Subsidy	Total		
DOMESTIC TRUNKS								
American	34,408	3,216	98	950	.....	38,672	35,880	1,055
Braniff	6,580	378	117	185	.....	7,260	6,804	162
Continental	5,564	322	86	140	.....	6,112	5,674	106
Delta	17,051	969	201	343	.....	18,564	15,126	1,621
Eastern	25,832	1,272	241	444	.....	27,789	26,888	343
National	8,995	595	38	157	.....	9,785	8,029	701
Northeast	4,698	162	52	48	.....	4,960	4,757	90
Northwest	7,789	630	58	239	.....	8,716	8,281	104
Trans World	24,064	1,678	357	658	.....	26,757	26,464	(850)
United	42,784	2,940	360	1,462	.....	47,546	46,877	613
Western	6,601	236	83	106	.....	7,026	5,799	513
Domestic Trunk Total	184,366	12,398	1,691	4,732	.....	203,187	190,579	4,458
INTERNATIONAL								
American	634	57	23	8	.....	722	518	103
Braniff	643	99	44	47	.....	833	1,072	(123)
Caribair	477	31	15	11	.....	534	483	24
Delta	212	25	.....	.....	.....	237	324	(42)
Eastern	2,989	151	1	67	.....	3,208	2,873	257
Mackey	154	7	13	.....	.....	174	197	(29)
Northwest	2,659	431	207	895	.....	4,192	3,243	395
Panagra	1,099	262	143	120	.....	1,624	1,685	(45)
Pan American	29,945	4,143	3,619	3,759	.....	41,466	39,897	38
South Pacific	84	1	.....	1	.....	86	111	(36)
Trans-Caribbean	Not Available							
Trans World	6,404	739	252	1,226	.....	8,621	8,731	(335)
United	2,128	78	35	130	.....	2,371	1,670	174
Western	614	14	6	8	.....	642	439	92
International Total	48,042	6,038	4,358	6,272	.....	64,710	61,243	473
LOCAL SERVICE								
Allegheny	1,523	94	28	28	517	2,190	1,999	74
Bonanza	751	21	4	5	235	1,016	855	55
Central	460	30	11	17	362	880	825	25
Frontier	780	50	16	17	672	1,535	1,404	62
Lake Central	561	32	11	13	331	948	916	19
Mohawk	1,694	69	36	27	388	2,214	2,023	73
North Central	1,385	96	24	38	657	2,200	2,162	2
Ozark	952	58	7	20	413	1,450	1,377	26
Pacific	621	21	8	21	309	980	936	8
Piedmont	1,272	54	18	25	457	1,826	1,670	64
Southern	756	38	20	27	513	1,354	1,249	42
Trans-Texas	572	37	14	19	386	1,028	1,005	15
West Coast	530	18	6	10	422	986	963	1
Local Service Total	11,857	618	203	267	5,662	18,607	17,384	466
ALASKA & HAWAIIAN								
Alaska Airlines	255	50	536	59	169	1,069	984	23
Alaska Coastal	105	20	4	15	109	253	266	(16)
Aloha	463	6	(1)	3	19	490	470	(2)
Cordova	16	9	14	7	50	96	117	(21)
Hawaiian	599	87	(9)	5	.....	682	698	(28)
Kodiak	12	2	4	1	6	25	38	(15)
No. Consolidated	64	40	3	83	131	321	282	9
Pacific Northern	618	128	15	112	97	970	1,130	(95)
Reeve Aleutian	99	34	71	62	.....	266	248	16
Western Alaska	5	1	2	2	16	26	26	(1)
Wien Alaska	79	41	152	97	205	574	528	17
Alaska & Hawaiian Total	2,315	418	791	446	802	4,772	4,787	(113)
HELICOPTERS								
Chicago	27	1	3	1	96	128	134	(2)
Los Angeles	90	15	1	14	148	268	259	(14)
New York	173	5	20	4	166	368	369	(15)
Helicopter Total	290	21	24	19	410	764	762	(31)
CARGO & OTHERS								
Aerovias	.....	36	75	.....	.....	111	135	(24)
Avalon	Not Available							
Flying Tiger	.....	892	2,760	.....	.....	3,652	3,371	40
Riddle	.....	816	284	.....	.....	1,100	1,200	(184)
Seaboard	.....	844	972	350	.....	2,166	2,027	2
Slick	.....	.....	1,709	.....	.....	1,709	1,594	1
Cargo & Other Total	.....	2,588	5,800	350	.....	8,738	8,327	(165)
Industry Total	246,870	22,081	12,867	12,086	6,874	300,778	283,082	5,088

Prepared By Ray & Ray



ONE OF THREE British-built Vickers Viscount 880s (right) purchased by LOT Polish Airlines is shown parked alongside a Soviet-built LOT Il-18 turboprop transport at Warsaw-Okecie Airport. One of LOT's Viscounts was lost in a crash last December.

Polish Carrier Plans Start of Jet Service

By Edith Walford

Warsaw—LOT, state-owned Polish airline, hopes to introduce its first turbojet services for both medium- and long-range operation in 1964 or 1965.

At the moment, Russia's 44-passenger Tupolev Tu-124 transport, powered by two Soloviev turbofan engines, and the newer 168-passenger Ilyushin Il-62, powered by four rear-mounted turbojet engines, appear to be favored among several contenders to fill LOT's requirements for approximately 10 medium-range and 3 or 4 long-range jets, respectively.

The airline also has a requirement for a fourth Ilyushin Il-18 or third Vickers Viscount turboprop aircraft to serve the carrier's longer medium-range routes as a replacement for the Viscount 800 which crashed during an approach at Warsaw soon after it had entered service with LOT last December (AW Dec. 24, p. 27).

It was the first of three of this type to be delivered by British Aircraft Corp. as a replacement for LOT's aging fleet of four Convair 240s operating over most of the carrier's medium-range services.

Under the airline's original planning schedule, LOT had hoped to inaugurate its first jet services with the East German Type 152 medium-range transport built by VEB Flugzeugwerke of Dresden.

This plan was voided when all East German aviation projects, including the 152 development program, were scrapped in the spring of 1961 as part of the government's re-orientation of industry (AW Aug. 14, 1961, p. 38).

LOT says the recent drag problems developed by Britain's Vickers VC.10 four-jet airliner, at first considered here as the best Western prospect for the airline's envisaged transatlantic services, has forced the carrier into a wait and see attitude before making any final decision on buying transatlantic aircraft.

"Our resources are too limited to take any risks," LOT Commercial Director Kasimierz Nowicki told Aviation Week & Space Technology: "We hope to benefit from the experience gained by other operators that can better afford such experiments before we decide on either the VC.10 or Il-62 for new services planned not only to North America but to certain points yet to be determined in Southwest Asia also."

Loss of the first of three Viscounts ordered to replace LOT's four 40-passenger Convair 240s made it necessary to reorganize the airline's entire 1963 flight schedule, according to Nowicki.

For example, it was planned to introduce a new twice-a-week Viscount round-trip service this spring between Warsaw and Stockholm via Gdansk, Poland's Baltic port, with one of these flights subsequently extending to Helsinki. Under present planning, the opening of the Scandinavian route will not be possible until about Apr. 1, 1964.

Although current negotiations for landing rights are expected to be successfully concluded within the near future, LOT also is deferring the extension to India of its new Il-18 once-a-week Warsaw - Burma - Athens - Cairo round-trip service (AW June 17, p. 50) pending delivery of a substitute for the lost Viscount.

According to one LOT spokesman, the findings of the investigating committee which examined the possible cause of the accident are inconclusive. Several possible factors were cited, however, including:

- **Malfunction** of the airspeed indicator and a consequent spurious reading. Landing approach was made at an unusually slow speed.
- **Entanglement** of the radio antenna in the Viscount's tail assembly, which may have prevented proper movement of the control surfaces at a critical moment.
- **Icing** while the aircraft flew a holding pattern for 20 min. after having aborted the initial landing attempt.

Other Warsaw sources attribute the crash to pilot error and claim that on the approach they saw the Viscount flare for landing when it was still several hundred feet above the ground. It then fell to the ground and burst into flames, according to these observers.

In addition to the two remaining Viscount 800s, three Il-18s and four Convair 240s, LOT operates a fleet of 12 Il-14s and 20 Li-2 piston-engine aircraft. The latter now are used exclusively on the carrier's domestic network.

Conversion of six of the Il-14s from 26 to 32-passenger configuration recently was completed, and the remaining Il-14s presently are being given the same additional seating capacity.

Despite its present frustrations in its struggle to re-establish itself, the carrier is making some progress.

Compared with a total of 201,632 passengers and 4,453 U. S. tons of cargo carried in 1961, 245,704 passengers and 5,402 U. S. tons of freight were transported in 1962. In 1961, aircraft movements at Warsaw-Okecie Airport totaled 12,750 as compared with 14,417 last year.

To meet modern transport aircraft requirements, the longest of Warsaw Airport's three concrete runways has been extended from 6,560 ft. to 9,900 ft.

A new hangar also has been added to the existing airport buildings. Measuring 260 x 145 x 40 ft. and enclosing 2,650,000 cu. ft., it can accommodate the airline's three Il-18s and seven Il-14s simultaneously. According to LOT, it is the largest of its type in East Europe.

Work began last fall on the reconstruction and modernization of Warsaw-Okecie Airport. Estimated cost of the project is about $8.3 million, and it is scheduled to be completed some time in 1965.

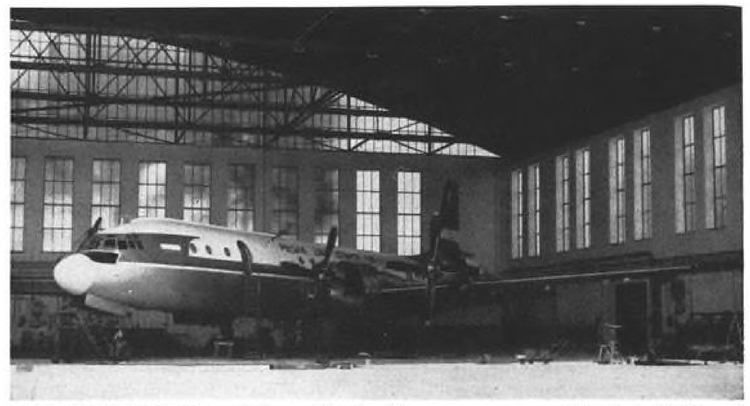
Situated between Warsaw-Okecie and Kracow and covering a total area of about 1,500 acres, it will in future serve both centers and enable the present separate Kracow airport to be closed as soon as the new one is completed.

The new one-story terminal building is being constructed in three stages—passenger terminal, administrative and technical facilities and the freight and mail station. At present, 12 aircraft can be accommodated on the apron in front of the existing terminal building, but, on completion of the project, a parking area for a maximum of 20 aircraft will be available.

LOT says it expects to be able to handle about 20 aircraft movements an hour and approximately one million passengers annually when the new airport comes into service in 1965.



LOT'S VISCOUNTS, one of which is shown above being serviced at night, are replacing the carrier's four Convair 240s over most of its longer medium-range routes.



LOT'S NEW HANGAR at Warsaw-Okecie Airport can accommodate three Il-18s and seven Il-14s at one time and is the largest maintenance hangar in Europe, according to LOT. Il-18 is shown in the hangar for engine servicing.



ONE OF LOT'S three Il-18s is shown on the ramp at the Warsaw-Okecie Airport. Il-18s carry crew of five and 84-111 passengers. Maximum speed is 446 mph. and maximum range is 2,920 mi. LOT is seeking a fourth Il-18 to complete its fleet.

LA Airways Reports 1962 Earnings Rise

Net earnings for Los Angeles Airways in 1962 totaled $89,887 after taxes and special credits, compared with $46,508 in 1961.

The helicopter carrier, whose fleet includes four Sikorsky S-61L turbine-powered aircraft, reported operating revenues of $2,611,870 and expenses of $2,380,702. These compare with an operating income of $1,651,204 and expenses of $1,560,354 in 1961.

Mail revenue, including subsidy, rose to $1,942,890 in 1962, up from $1,236,189 the previous year. The increase was attributed to Civil Aeronautics Board's establishment of mail rates effective July 1, 1962, and include $15,074 in retroactive mail payments back to Aug. 1, 1961.

Passenger revenues totaled $475,821 in 1962, compared with $248,488 in 1961. Long-term debt, consisting of 5½% chattel mortgages on the four S-61Ls, is $2,348,237, not including the $301,200 to be paid in 1963. The airline is paying off its debt in monthly installments of $25,100, with a maturity date of Nov. 21, 1971.

Retroactive mail payments, plus the carrier's shift to deferred income tax accounting which resulted in a recomputation of prepaid taxes, brought retained earnings as of Dec. 31, 1962, to $498,771, compared with $408,884 in 1961.

Elimination of unprofitable services in 1962 caused revenue passenger miles flown to drop 8.65% to 610,899. Total hours flown dropped to 7,822 compared with 9,608 in 1961. However, passenger volume rose 86.97% on 77,531 fares.

The carrier's S-61Ls operated an average of 2:58 hr. daily, while its piston S-55s flew 2:30 hr. daily.

C. M. Belinn, president of the airline, said the S-61Ls had helped attain a 214% increase in passenger volumes during the first four months of 1963, compared with the same period of 1961.

AIRLINE OBSERVER

► Civil Aeronautics Board staff is urging that the U. S. continue to stand firm on the restriction of sixth freedom traffic carried to and from the U. S. by foreign flag carriers, although CAB Chairman Alan S. Boyd recently reached an agreement in principle with the British Air Ministry that calls for more leniency in the transportation of such traffic. The agreement was expected to win the approval of KLM and SAS, chief opponents to U. S. demands for sixth freedom restrictions. Sixth freedom is defined as that traffic which is carried by a flag airline from its home country to a second country and then beyond to a third.

► **Russian press now places the seating capacity of Aeroflot's Ilyushin Il-62 four-turbojet transport at 168. When the aircraft was unveiled last September, Soviet reports said it would carry 182 passengers. Official Russian government newspaper Izvestia says the Il-62 has been tested "at great altitude and with one and two engines out." It adds that the Il-62 will make its first long trip "in the not-distant future." Izvestia puts the Il-62's wing span at 141 ft. Earlier reports placed the span at 168 ft.**

► Trans World Airlines has been conducting a survey of 10 major U. S. and European cities that will serve as primary cargo hubs for the airline's three Boeing 707-331C turbojet freighters by early next year. Survey forecast traffic volume and necessary schedules, plus information on terminal facilities and ground support equipment required.

► **Foreign visitors will have the opportunity to fly the entire U. S. and Alaska local service pattern for $100 in a 30-day period, beginning in September. The new package, stemming from the original "Bonanzaland" tours introduced two years ago by Bonanza Air Lines, offers unlimited travel on route systems of 13 local service airlines, plus Alaska and Cordova airlines.**

► CAB Chairman Boyd has assured New England senators that there will be no interruption in local air service in their area if Northeast Airlines loses its Florida-New York route (AW July 1, p. 37). Boyd said that if Northeast's service collapsed, it would be replaced within 48 hr.

► **Federal Aviation Agency has extended its positive separation control of aircraft above 24,000 ft. to cover the area above Missouri, Illinois, Oklahoma, Kansas, Nebraska, Iowa, South Dakota, Wyoming, Colorado and Utah. Traffic control centers at Kansas City and Denver will provide the control. Action brings approximately one third of the airspace above 24,000 ft. over the continental U. S. under positive control.**

► Indian Airlines plans to put the first of its three recently ordered Sud Caravelle jet transports into service Jan. 1 on its New Delhi-Bombay route. The airline hopes to operate three Caravelle flights daily on the route and eliminate flights by Boeing 707s leased from Air-India.

► **Surge of new orders for flight equipment by U. S. domestic trunklines can be expected shortly. Steady traffic growth indicates that the problem of over-capacity may have been temporary, and that on a long-range basis, airlines may have under-purchased aircraft rather than over-purchased as was originally believed. One weakness could mar a renewed re-equipment program: airline business is closely linked to the rising gross national product and an expanding general economy. Any break in the economy would deter traffic growth and could cause another airline depression. Failure of the industry to develop new travel markets would compound the difficulties and could revive the over-capacity issue.**

► Wall Street brokers are changing their low opinion of airline stocks and are now strongly recommending U. S. carrier issues for general portfolios.

► **FAA last week awarded a third contract for the development of a low-cost glide-slope and markers to International Telephone and Telegraph Federal Laboratories. Program calls for an ILS that will serve airports where air traffic is not sufficiently heavy to justify installation of conventional ILS. Previous contract awards for the project were let to Airborne Instrument Laboratories and Scanwell Laboratories.**

SHORTLINES

► **Bombay's Santa Cruz Airport** has introduced traffic control restrictions during the current monsoon season as an outgrowth of an Alitalia Douglas DC-8 crash there during the previous monsoon. Restrictions prohibit descents below 7,000 ft. without positive radar control.

► **Continental Air Lines** special Boeing 707 scenic 30 min. jet flights from Los Angeles on July 4, 5 and 6 were sold out in 10 days. Total of 2,200 seats on the special flights, planned for the light traffic period, were offered for sale and company officials have estimated that 5,000 seats would have been needed to handle the demand.

► **Civil Aeronautics Board** chairman Alan S. Boyd has told Mohawk Airlines that use of the BAC 111 jet transport would be viewed favorably by the Board if, as Mohawk contends, the operation would reduce rather than increase subsidy need. He added that the staff has not had an opportunity to analyze the Mohawk presentation on the jet operation but will be in a position to make "an informed judgment" when the staff study is completed.

► **North Central Airlines** has been authorized by the Civil Aeronautics Board to continue serving Manitowoc and Sheboygan, Wis. through the Manitowoc Municipal Airport, rather than provide additional service at the Sheboygan airport.

Pan American World Airways will inaugurate direct service from New York to the African republic of Guinea on July 28 with once-a-week flights on a route via Lisbon and Rabat, Morocco. Flights will continue on past Conakry, capital of Guinea, to Monrovia.

► **Pan American World Airways** is cooperating with the Federal Aviation Agency in testing an inertial navigation system on transatlantic flights. The 80-lb. test unit has been installed on a Pan American jet flying regular schedules. Program is being financed by a $22,500 contract awarded by FAA.

► **United Air Lines** has declared a regular quarterly cash dividend of $1.37 per share on preferred stock and 12½ cents a share on common stock, payable Sept. 3 to stockholders of record on August 15.

► **Western Air Lines** earned a record profit for the five-month period ending May 31 of $2.9 million, or $2.05 per share. This compares with $1.8 million in the same period of 1962.



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ENGLAND CANADA AUSTRALIA

Pacific Southwest Airlines—Part 2:

PSA Business Traffic Proportion Grows

By Harold D. Watkins

San Diego—Pacific Southwest Airlines, an intrastate operator, must contend with regulatory problems even though it operates outside the jurisdiction of the Civil Aeronautics Board (AW July 1, p. 48).

Earlier this month, the CAB ordered the airline to stop carrying passengers transferred to it by another airline when the PSA flight is a direct connection with an interstate itinerary. The Board's order resulting from a complaint filed by Western Airlines noted that PSA had voluntarily discontinued the infractions, which stemmed directly from interline arrangements with supplemental carriers. Participation in interstate operations immediately place the carrier under CAB regulatory authority.

Another problem is a bill pending before the California state legislature that would give the state's Public Utility Commission greater control over intrastate airlines. While PSA supports some aspects of the bill, it fears too much interference in its operations.

Management's Goal

Meanwhile, PSA's management is focusing on its principal aim: to keep the carrier a leader in the West Coast air travel market. To achieve this, the airline constantly adjusts its operations to meet changing demands.

A gradual shift in PSA's sales and advertising approach began with the advent of the Electras, and has intensified in the last year or so. "We've given up the hard sell," PSA President J. Floyd Andrews explained. Now, instead of hammering away at low prices on radio spots and billboards, PSA takes a somewhat softer approach, emphasizing frequency, convenience and "jet power," in addition to economy. "Our advertising now is aimed at markets that weren't so readily available to DC-3s and DC-4s," Andrews said.

Choice of advertising media mirrors PSA's penetration into the heavy business traffic on its route. About 40 to 45% of its passengers now are believed to be businessmen, compared with 20% in pre-Electra days.

The carrier draws heavily from the aerospace industry, particularly in San Diego and the San Fernando Valley region of Los Angeles (AW May 6, p. 42). In the latter area, PSA has little competition from the Burbank airport on direct flights to San Francisco or San Diego.

In an attempt to siphon off a greater share of economy-minded travelers on the prime San Francisco-Los Angeles run, Western Airlines in June of last year initiated a "Thriftair" all-coach service with piston-powered Douglas DC-6Bs (AW June 10, p. 45). One-way fare of $12.95 plus tax undercut PSA's $13.50 by a shade, and the difference was increased slightly when Western lowered its tariff to $11.43 this February. The original schedule called for 84 Thriftair flights weekly. This has gradually been increased to 126. Western claims the load factor has risen to 7%. DC-6B flight time is 1 hr. 35 min. between the two cities, as contrasted with PSA's 1 hr. for the Electra.

One more low-fare challenge is offered by Trans California Airlines, another intrastate carrier, which last July began serving Oakland, Los Angeles International Airport, Burbank and San Diego with piston-powered Lockheed Constellation 749s.

PSA's establishment of reservation control in one place under the direct supervision of top management at San Diego was another move in the carrier's general policy of attempting to make air travel as uncomplicated as it can, not only for passengers, but for the company. Fairly consistent loads, for instance, have resulted in simplified weight and balance forms, and familiarity with route conditions has reduced flight planning to a minimum of effort.

The new reservation center is expected to eliminate inaccuracies and minor errors that were inevitable in the previous system where reservation control was duplicated in San Diego, Los Angeles and San Francisco.

Ticket Offices

In line with low overhead policy, the company maintains no ticket offices outside the airport either in Los Angeles or San Diego, and has only two downtown offices in San Francisco. To keep "no-shows" to a minimum, callers usually are referred to travel agents to pick up their tickets unless the request is made on the day of the flight, in which case passengers are asked to get to the check-in counter 30 min. before flight time. PSA pays agents 8% commission, compared with the usual 5%.

An "instant ticket" plan is offered to the company's 7,000 credit card holders. Tickets are sent via teletype from reservation control to special printers at each check-in counter where they are held for card-holding passengers, who are billed at month-end.

A refinancing program was initiated to cover the heavy expense of modernization and expansion. One important step was a February public stock offering, which resulted in the sale of 313,000 shares, 100,000 of which were issued by the company. Remainder were sold by original shareholders. Proceeds to the company were approximately $1.7 million which, together with other funds and a new 5½% bank loan of $4.32 million, was used in late February to re-finance three separate, long-term installment notes totaling about $7.6 million.

Approximately $4.5 million of this amount was in a 5% note which was given in January, 1961, when the company purchased the three Electras it was leasing. An $830,000 discount was realized by prepaying this note. The remainder of the installment notes which were replaced bore 6% interest.

Purchase of the sixth Electra at a cost of $1.9 million was financed primarily with another 5½% bank loan of $1.7 million.

The new bank loans are secured by mortgages on the aircraft, engines and related equipment.

Financial Report

As of the Mar. 31 financial report to shareholders, PSA also had $425,000 in 6½% convertible notes outstanding with a $10 a share conversion price. On that date, PSA had 550,500 shares of common stock outstanding, with another 42,500 reserved for issuance upon conversion of the 6½% notes.

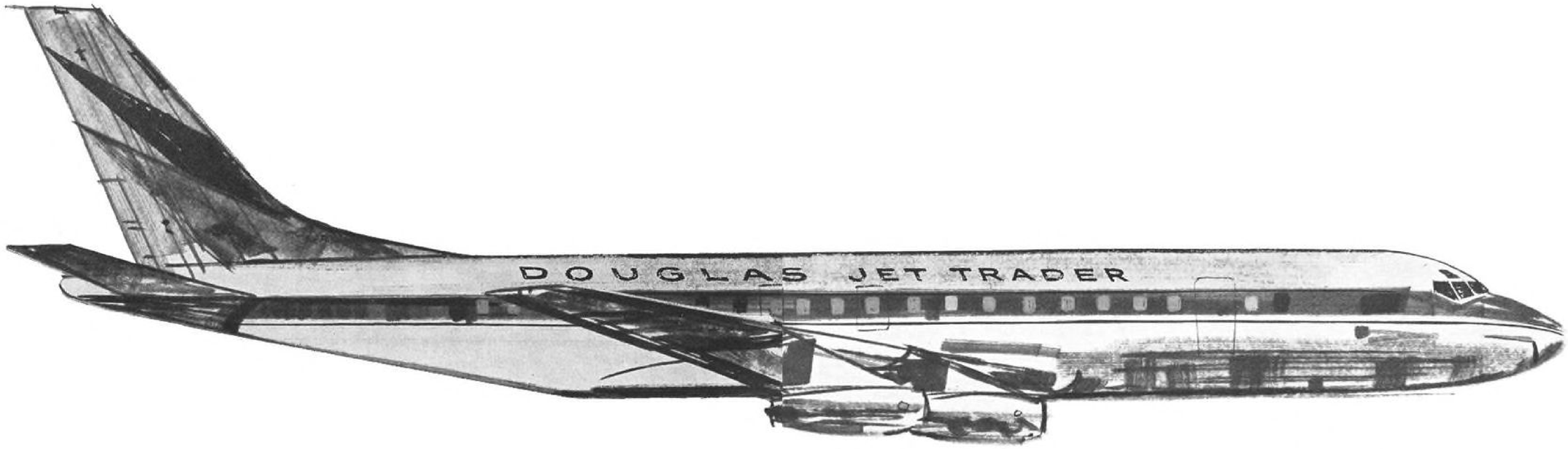
Depreciation on equipment is expected to more than cover repayments of the long-term debt as they come due.

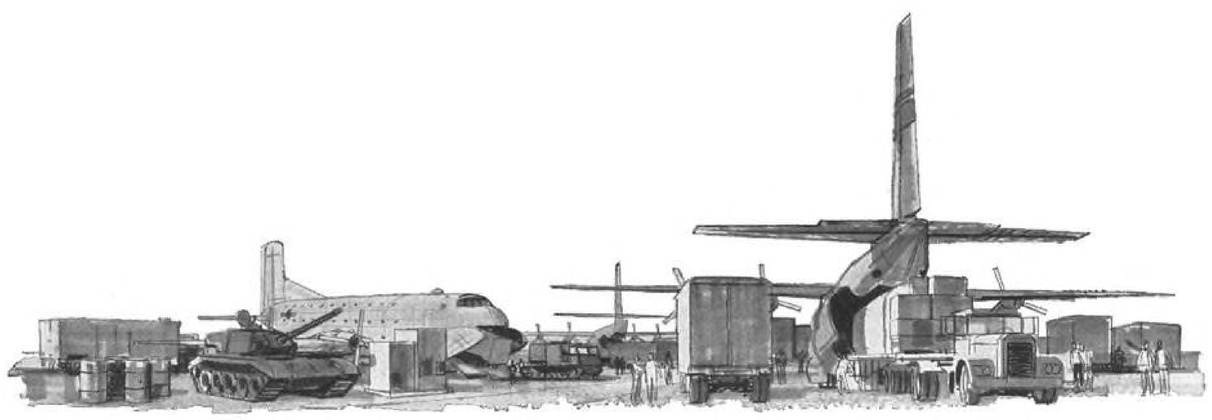
Heavy reliance on cash flow from depreciation is indicated by the 1963 first-quarter report, which showed current assets of $3,637,000 and current liabilities of $3,576,000.

First-quarter operating results seem to justify the buoyant spirits of the PSA staff. Revenues, aided by the fifth Electra, were up 42% to $3,900,000, and earnings rose by 158% from $170,000 to $440,000, or 80 cents a share.

Andrews said that PSA is "projecting a 35% growth rate in revenues over the next couple of years." Rising population in California, coupled with greater use of air travel on PSA routes, are among basic factors behind the anticipated growth. Planned expansion will not involve any changes in fares, additions to routes, mergers or other significant changes in the company other than acquiring additional aircraft.

(This is the second of two articles covering Pacific Southwest Airlines.)





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Major U.S. Airports—Part 4:

Los Angeles 'Satellites' Offer Convenience

By Robert H. Cook

Los Angeles—Los Angeles International Airport's unique "satellite" construction design may well offer the only practical compromise between airline operational needs and passenger convenience in the handling of high volume traffic among the nation's major hub airports.

Rejecting the customary "finger" concept, still used by most airports, the Los Angeles Dept. of Airports built a decentralized terminal around a half mile long mall. The mall contains a 172-ft. high administration building and tower at the entrance, public parking, heating and electrical plants and a "Theme Building" restaurant suspended from four parabolic arches 70 ft. above the ground.

Around the perimeter of this mall are six ticketing buildings, each about 600 ft. long and connected to oval shaped satellite buildings by 400-ft. tunnels. In addition, there is a seventh satellite of conventional, rectangular design used by United Air Lines.

To provide adequate 360-deg. clear areas for aircraft around the island satellites, the mall area was excavated 14 ft. below the level of the ramp and apron areas. This eliminates the need for any connecting, above-ground fingers, reduces ramp delays, and provides space for airline operations facilities in the second, ramp level story of the ticketing buildings.

Baggage Handling

Baggage may either be checked at a curbside stand or within the building, depending on the airline. It is moved to and from the satellite area by concealed parallel conveyor belts which flank the passenger tunnel. Free of baggage, the passenger may walk a few more feet to telephone, send a wire or purchase insurance before entering the tunnel. Escalators at the end of the tunnel run up to the satellite lobby area.

Bisecting the lobby area are separate restaurant, gift shop and cocktail lounge facilities. All of these accommodations are duplicated in each satellite.

Distinct advantage of this lobby design for departing passengers is that they are only seconds away from the departure gates. In the vast majority of large hub terminals employing the sprawling finger concept, 15 to 20 min. is barely adequate between lobby facilities and the aircraft.

The system works as well for arriving passengers. As they arrive in the satellite lounge area, their baggage is unloaded below and placed on the conveyor belts for delivery to the baggage claim area at the terminal end of the tunnel. Bags usually are delivered to the claim area in an average of 10 min. Temporary parking space is available at the curbside, and despite heavy peak loads of traffic, the airport's one level, one way public traffic is smooth.

Interline connections and international transfers obviously pose more of a problem for the passenger, but they are insignificant when compared with the situations at other more decentralized airports or those using the finger system. Los Angeles International handles only a small volume of interline connecting traffic and although its international trade amounted to 289,463 passengers last year, this total is only a small percentage of the total passenger volume of more than 7.6 million.

Time permitting, many interline connecting passengers could easily walk the required distance if they were transferring to American, Western, Continental, Delta, Pacific, Pacific Southwest or United Airlines, which occupy satellites 4 through 8 on the south side of the mall. Trans World and Bonanza Airlines are on the north side, next to the international satellite which serves eight foreign carriers, Pan American and National. International flight arrivals of domestic carriers are also served here.

With the exception of international arrival transfers, total walking distance to most of the domestic carriers would usually be far less than that required in the full-length fingers of O'Hare, Atlanta or Miami airports.

Perimeter transportation also is provided by a fleet of three "satellite" busses for 25 cents. Specially designed for ease of entry, these vehicles make a complete swing around the area about every 10 min. Although the terminal to satellite tunnels require a relatively short walk, there have been public complaints about the distance, mostly by elderly or infirmed passengers.

Western has moved to solve this problem by providing a free shuttle service using 10-passenger electric carts. Two carts have been in use about 10 months and a third is on order. Operating on a continuous schedule the vehicles have been making about 280 trips per day. The airport is also considering installation of a wall mounted "mobile bench" for tunnel use.

Financially, the airport has exceeded expectations of the taxpayers who voted a $59.7-million general obligation bond issue for its construction in 1956. Total operating revenues topped $7.9 million last year, with 7.6 million passengers. Revenues are expected to reach $16 million a year by 1970, when the airport will be handling a projected 23.7 million passengers. Under the terms of the 1956 bond issue, the Dept. of Airports was prevented from using any surplus revenues from operation of the Los Angeles International Airport for anything other than payment of principal and interest on the issue through 1969.

To offset the possibility of financial stalemate through the next six years of anticipated growth, the department's charter recently was amended to permit issuance of revenue bonds when needed and after certain provisions, to protect the taxpayers, have been met. Those provisions include the advance payment of about $3.5 million principal and interest on the 1956 issue, establishment of a one-year reserve of payments on the 20-year bonds and creation of a maintenance and operation reserve fund.

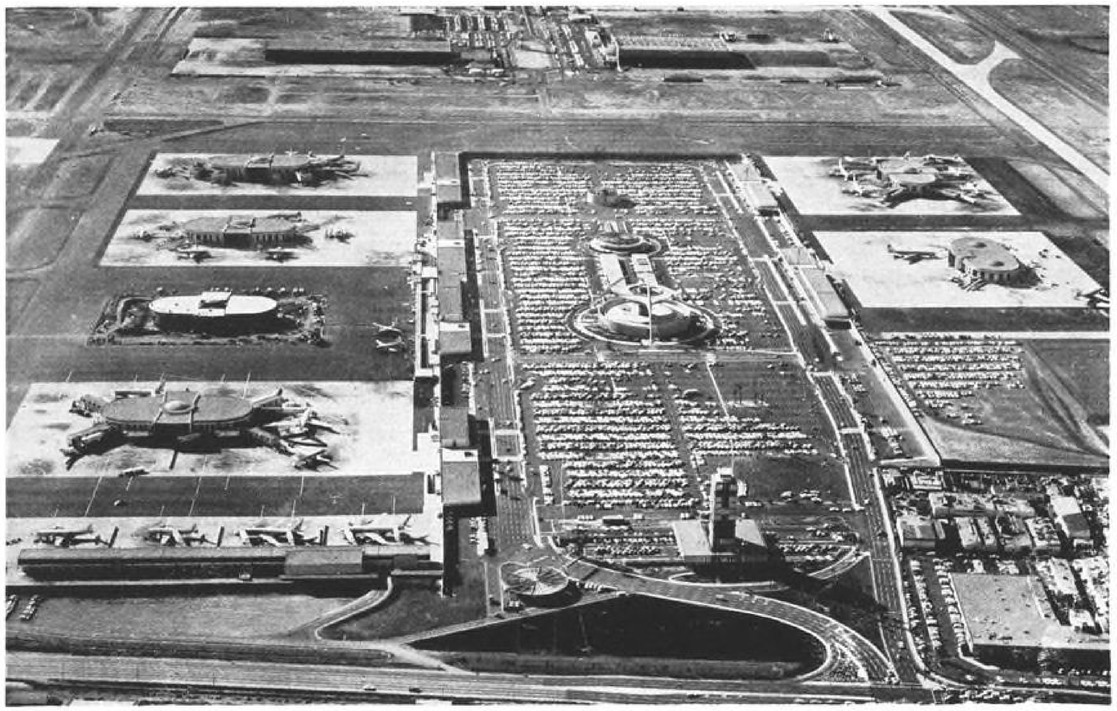
Amendment Vote

Some idea of community acceptance of the airport can be gained by the amendment vote. Five heavily populated communities which surround the airport gave a unanimous approval from all precincts. A sixth precinct, Playa del Rey, which is situated almost directly beneath most of the airport's takeoff pattern, voted 12 to 1 against the amendment. The area has been the major source of most of the community complaints against aircraft noise.

To date, the airport has about $10 million in gross revenues accrued through this fiscal year. After provision for operating expenses and bond retirement, a surplus of $1 million will be realized to boost the airport total reserve fund accrual to $6.1 million.

Construction is now nearing completion on No. 6 satellite which will serve Continental, Delta, Pacific and Pacific Southwest airlines. These carriers occupy No. 6 terminal building. Cost of a terminal and satellite is approximately $5 million and each building is designed to take another floor for future expansion. Each facility also is planned to accommodate a maximum of 3 million passengers a year.

Los Angeles International has reserved space for a ninth satellite and ticket building next to the present international facility. The space is now used for extra auto parking and taxi service during peak periods.



Aerial view of terminal complex shows sunken mall, which eliminates passenger ramp fingers out to satellite terminals. Parking lot (lower right) is reserved for additional ticketing and satellite buildings. Satellite under construction (center left) will be completed by September for use by Continental, Delta, National, Pacific, Pacific Southwest and Transports Aeriens Intercontinentaux (TIA).

Although the airport has design room for 5,000 cars on the mall, it is getting pinched for room and may make its first major construction a double parking deck opposite satellite No. 6. As at most major hubs, parking is the greatest revenue producer and last year earned $2.1 million compared with $1.2 million for landing fees.

The airport now has three ILS-equipped runways and plans a fourth for the future. Two of the runways bridge busy Sepulveda Blvd. which fronts on the airport entrance. They are used primarily for jet operations because of their lengths of 12,000 and 10,115 ft. The most immediate project scheduled is a $1.2-million construction of a new taxiway, plus high speed turn offs and apron areas to serve runway 25-R. Completion of a fourth runway would give the airport simultaneous takeoff and landing capability, making it the equivalent of two international airports, according to Manager Francis Fox.

Location of the runways is affected by the community noise problem, primarily with Playa del Rey. This area contains homes ranging in value from $30,000 to $80,000. The site also is perched about 150 ft. higher than the end of runways 25-R and 25-L. The north runway is in a more direct line with the community and is used primarily for piston engine flights because of the noise problem.

Real estate assessments in part of the Playa del Rey area were reduced from 5 to 20%, and may be further reduced for other residents of this and other surrounding communities in an effort to placate the complainers. This has not stopped Playa residents from filing damage suits totaling almost $1.2 million.

Future assessment reductions would be based upon an approach and departure zone 6 mi. long and ½ mi. wide. Reductions of 5% would be granted home owners at the outer extremities, 10% for those closer to the zones.

Takeoff rules now require a fast climbout with no power reduction until the aircraft has achieved a 2,000 ft. altitude over the Playa area. Departure turn then may be made over the Pacific.

Fox believes that LAIA, with its expansion plans, is a supersonic transport airport, despite a California study now being made to determine the necessity for yet another airport in the future. Nine counties, stretching from Santa Barbara to San Diego, are being considered as a megalopolis in a study by the Stanford Research Institute.

"We must keep humanity in mind," Fox said, "and not put the airport too far out. Let's make the machine fit the environment, instead of vice versa."

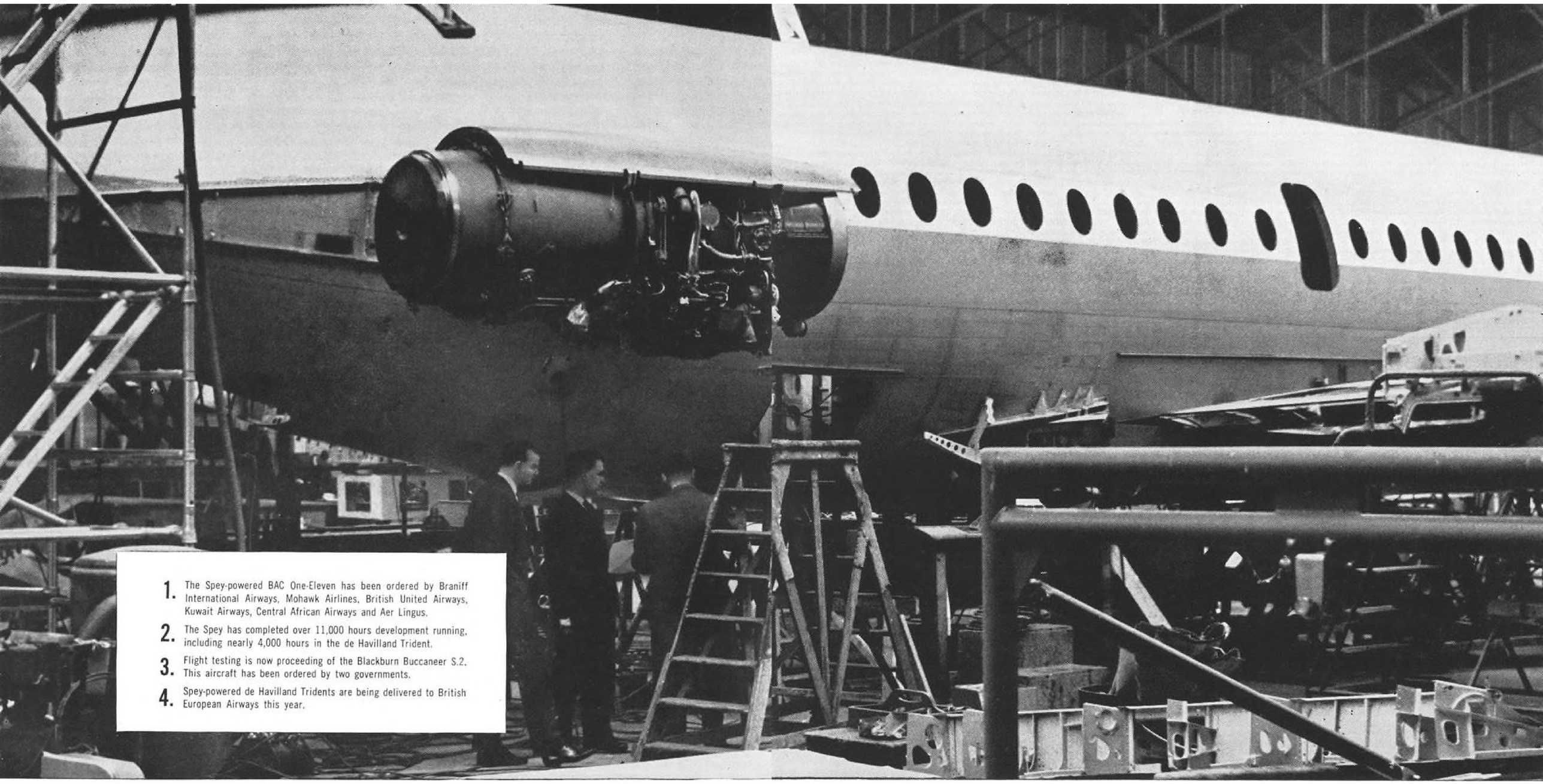
Much of the existing apron concrete has been stressed to SST landing weight specifications and all further runway and taxi construction will have the higher weight stress, he said.

The airport originally planned to have its own hotel within the terminal area, but decided to delay this phase because of objections from local motel and hotel operators. Today a new hotel is nearing completion on the northeast corner directly across from the airport entrance and another private hotel is planned for the opposite corner. Eventually, the airport hopes to build its own 400-room hotel above the parking area, Fox said.

Some of the greatest future expansion will take place at the old 640-acre terminal area which adjoins Los Angeles International. Detailed studies of the idea are being examined and the U.S. Post Office Dept. is expected to announce construction bids for a $10.5-million postal building in the area within three months.

Los Angeles Dept. of Airports also owns and operates Van Nuys Airport, which is first in the country in terms of general aviation operations and third in total aircraft operations. Future plans call for the building of a new passenger terminal, a tower and a second runway parallel to the existing runway.

(The fifth article in this series on major U. S. air terminals—concerning Chicago's O'Hare International Airport —will appear in a subsequent issue of Aviation Week & Space Technology.)



1. The Spey-powered BAC One-Eleven has been ordered by Braniff International Airways, Mohawk Airlines, British United Airways, Kuwait Airways, Central African Airways and Aer Lingus.
2. The Spey has completed over 11,000 hours development running, including nearly 4,000 hours in the de Havilland Trident.
3. Flight testing is now proceeding of the Blackburn Buccaneer S.2. This aircraft has been ordered by two governments.
4. Spey-powered de Havilland Tridents are being delivered to British European Airways this year.

The Spey is winning world acceptance

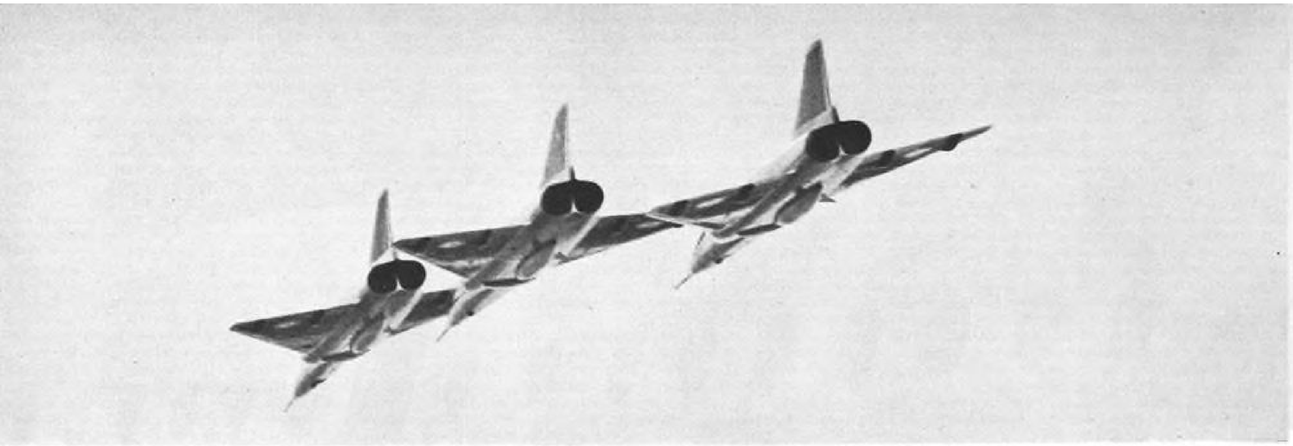
Production engine deliveries of the Spey are building up fast. And more and more airlines are showing firm interest in the engine for their re-equipment programmes.

In its design and rating the Spey is based on Rolls-Royce's unique experience of commerical turbine operation. This is your assurance of the operational economy vital for profitable use of the short-haul jet.

The Spey will bring to jet travel all the inherent qualities of the Dart, which powers the Vickers Viscount, the Grumman Gulfstream, the Fairchild F-27 and the Whitworth-Gloster Argosy—all in service in North America.

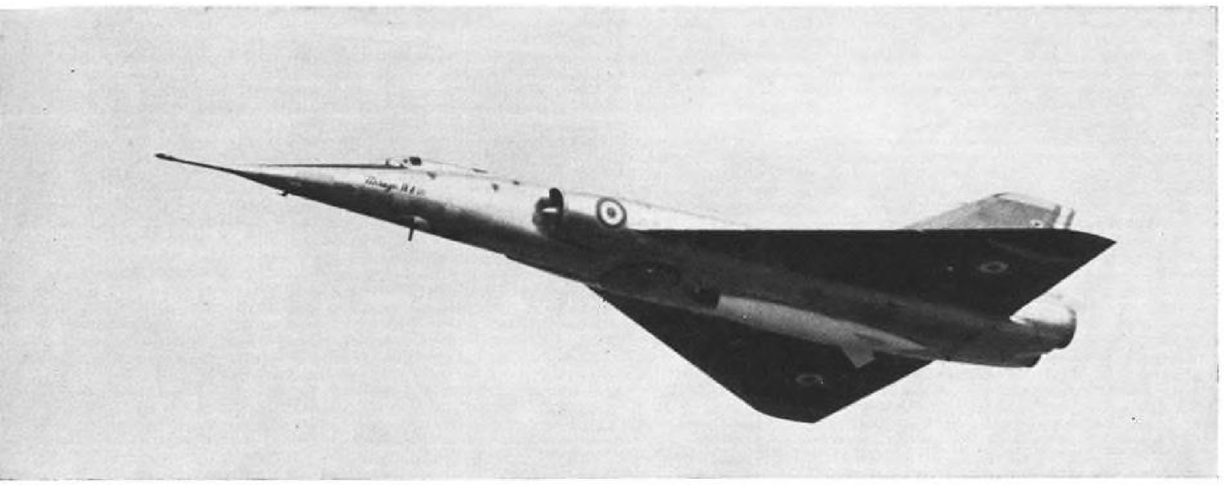
A NEW PHASE BEGINS WITH ROLLS-ROYCE POWER

ROLLS-ROYCE OF CANADA LIMITED, 6265 COTE DE LIESSE ROAD, MONTREAL, P.Q.



Second, third and fourth preproduction Dassault Mirage 4A bombers, all carrying a weapon shape in a belly mounting, fly past reviewing stand at the Paris Air Show. These prototypes are slightly larger and closer to the production version than the first prototype that was lost in a crash earlier this year. Gross weight of the Mirage 4A, which has Mach 2 capability, is 66,000 lb. Dimensions of the later prototypes are: length, 77 ft., span, 38.9 ft., and height, 18.5 ft. The airplane carries a three-man crew.

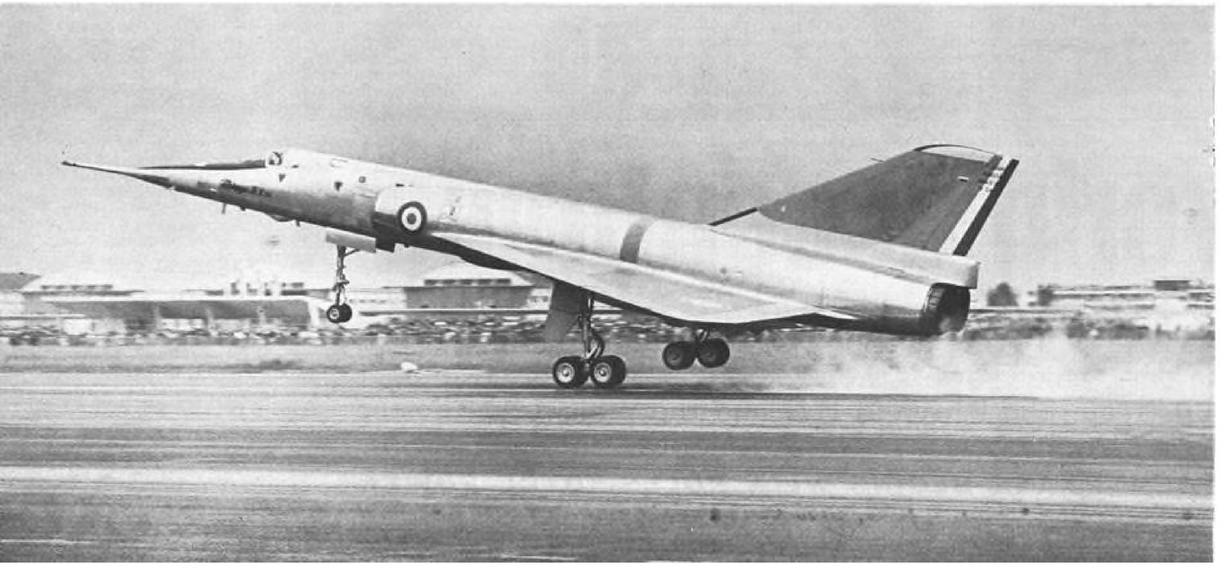
Three Mirage 4A Prototypes Fly Formation, Demonstrate Landing, Takeoff Performance

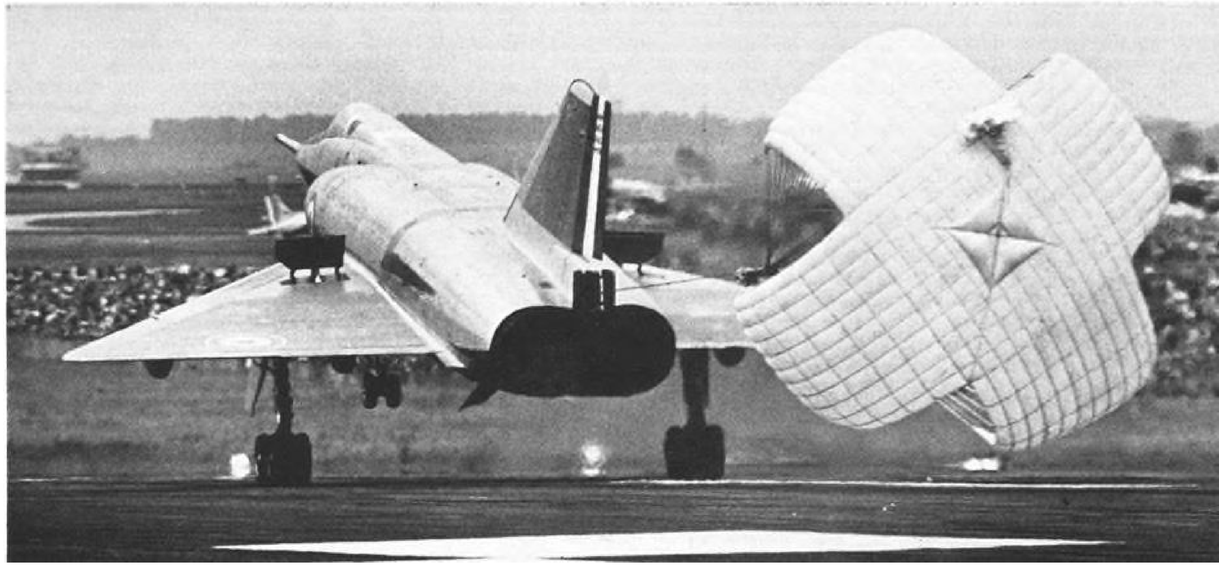


Large belly radome is visible ahead of weapon on the third prototype (above). Smoke puff trails from main landing gear of the fourth prototype (below) just after initial touchdown in a 90 deg. crosswind on the runway at Le Bourget Airport.



Afterburners lit on its two 15,000 lb. thrust Snecma Atar 9K turbojet engines, the Mirage 4 begins its takeoff roll (above). Drag parachute and wing mounted speed brakes aid deceleration after landing (below).



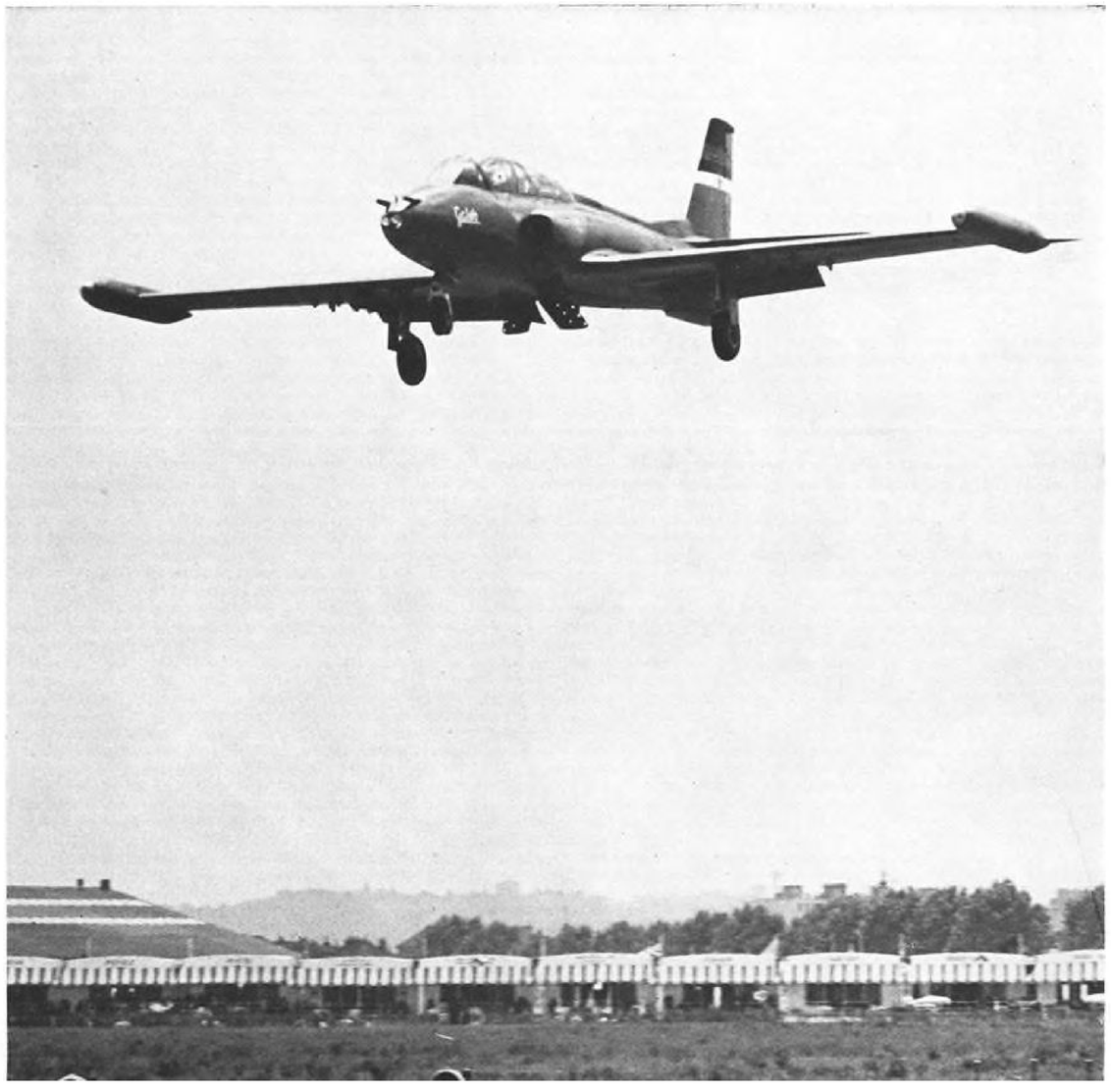




Yugoslav Soko Mostar Galeb two-seat tandem trainer is fitted with wing mounts for stores (above), and also mounts two guns in the nose.

Yugoslav Trainer Makes Flight Debut in West

Speed brakes extend from the belly (below) in landing configuration. The trainer, shown for the first time in the West at the Paris Air Show, is powered by a single Bristol Siddeley Viper 11 engine rated at 2,500 lb. thrust. Maximum rate of climb at sea level is 4,500 fpm. and gross weight of the two-seat trainer is 7,438 lb.



Kodak reports on:

real gone absorption bands . . . a flare-up in europium . . . microfilming computer printout . . . a nice way to look down . . . the brew for masks

Announcement to the trade

Eastman Kodak Company, Special Products Division, Rochester 4, N. Y., announces with pleasure and anticipation its success in pushing up to 7 inches the maximum diameter for disks of hard, clean, heat-resistant, shock-resistant, non-cold-flowing, moderate index (2.4), 1μ-to-20μ-transmitting, polycrystalline zinc selenide KODAK IRTRAN 4 Optical Material. Buy some. Absorption bands now eliminated!

Name your rare-earth chelate

The division mentioned above also offers KODAK Neodymium Glass Laser Rods (non-silicate). These are getting bigger and bigger while reports of low beam-divergence, low threshold, and high output grow more startling. Inquiries invited.

We think we are also getting involved with organic lasers but are not ready to boast of general expertise about them. All we say is: 1) business in europium chelates that customers could conceivably be dissolving in various plastics has suddenly flared up at Eastman Organic Chemicals Department, Distillation Products Industries, Rochester 3, N. Y. (Division of Eastman Kodak Company); 2) at the latter division further inquiries for any organic compound of europium or any other rare earth that a clever customer can think of will receive prompt and courteous attention.

The 29-minute mile

The new RECORDAK ROTOMATIC Microfilmer we believe to be the world's fastest off-the-shelf microfilmer. To keep the shelf stocked we find it necessary to scramble. The customers are in desperate need. Their computers keep pouring out computations. They signed up for the computer when impressed with how fast a mile of computation could be pushed out. When the mile shoots out as promised, the question arises of what to do with it. To feed the printout through a chute directly to the paper shredder and baler in the basement would represent ingenuity masking a pathetic failure to understand ultimate purposes.

Between generation and shredding, the computations should be microfilmed for possible future reference. An interposed RECORDAK ROTOMATIC Microfilmer photographs the mile in 29 minutes on 220 feet of 16mm film. Acreage from paper to film shrinks by a 500 factor, which is desirable in the high-rent district. The paper can then safely move to the shredder, which usually returns a small but steady cash income.

You ask: why, with the electronic art in its present sophisticated state, bother with the paper at all instead of impressing the output signal from the computer directly on microfilm? We have been over *that* route before. We know exactly how to do it. The only trouble is that we also know how to build this little microfilmer for a tiny fraction of the price that a decently sophisticated device to accomplish the same end-result has to cost!

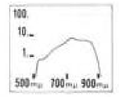
In case interested, address is Recordak Corporation (Subsidiary of Eastman Kodak Corporation), 770 Broadway, New York 3.

Under false colors

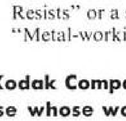
Ecologists have more important things to think about than the technicalities of color film, and we have other things to think about than ecology.* Let us, nevertheless, make beautiful music together. To any geologists or others who wish to join in, welcome.

A little while ago we announced a new color film for aerial photography and set up a howl about how much more informative is photography to which have been added the dimensions of color. We now go the next step and suggest that man's color vision can be exploited for scientific purposes in a way quite unrelated to the color sensation that nature presents to the naked eye.

The brain's response to the spectral distribution of energy falling directly on the cones of the retina is measurable but not truly describable and certainly immutable. Color film lacks such mystical character. If we want to make it see well at 850mμ, we do so without waiting for eons of evolution. We can then use it to adapt the mystical processes of the central nervous system to man's needs in 1963 A.D., as distinguished from his needs in 200,000 B.C. We have freedom. We can arbitrarily decide that it might be useful to see



as red (when it's mostly infrared),



as green (when it's actually red), and



as blue (when it's actually green). This might give the world a crazy aspect but heighten sensitivity to the way various carotenoids and xanthophylls mark the members of the association of a rain forest.

We can't go on, for fear of betraying our ignorance. Far better merely to say that the above-indicated spectral sensitivities are indeed available in the three layers of a new film called KODAK EKTACHROME *Infrared Aero Film, when exposed through a* KODAK WRATTEN *No. 12 Filter. We supply it only in aerial-film widths and lengths. Ask Eastman Kodak Company, Professional Photographic Division, Rochester 4, N. Y.*

We can hardly believe it ourselves



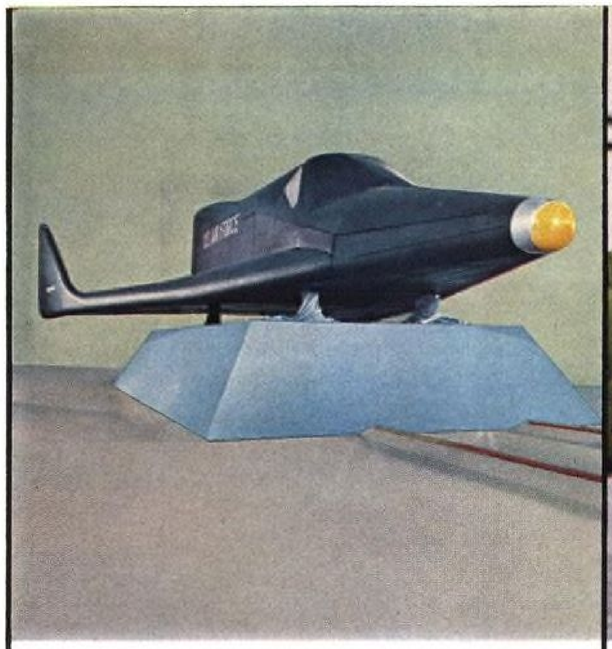
The business of photographically converting a drawing into the thing drawn has attained some volume. Look at how we are now putting up the liquids that are hardened by light into etchant resists in making masks. KODAK Photo Resist (KPR) can be ordered from graphic arts dealers in 425-lb. drums, KODAK Metal-Etch Resist (KMER) in 400-lb. drums, and KODAK Ortho Resist (KOR) in 450-lb. drums. Also available on a less ambitious scale. As to which does what, consult Graphic Arts Division, Eastman Kodak Company, Rochester 4, N. Y., which can even arrange to loan you a 26-minute sound movie entitled "Chemical Milling with Kodak Photo Resists" or a script with slides for a 35-minute lecture entitled "Metal-working with Photo Resists."

*But none more important.

This is another advertisement where Eastman Kodak Company probes at random for mutual interests and occasionally a little revenue from those whose work has something to do with science

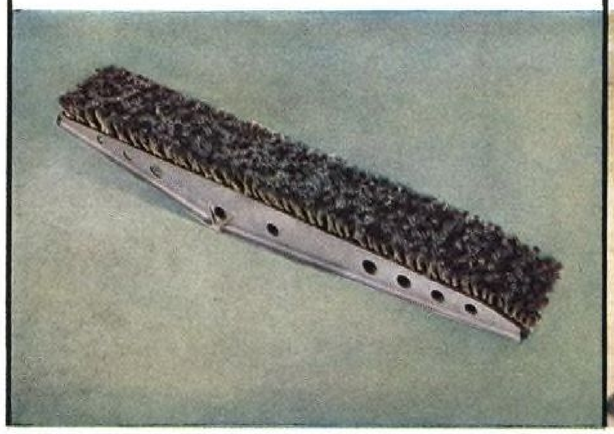
How Goodyear "Engineered Value" solves today's flight problems

FOR THE AIR FORCE



PROBLEM: Re-entry heat of wheels, brakes and tires.
SOLUTION: Goodyear wire tires and skids.

ADVANTAGES: Withstands prolonged exposure at re-entry temperatures. Highest coefficient of friction of any skid system. Shorter landing runs. Gives "hottest" aircraft landing capability.

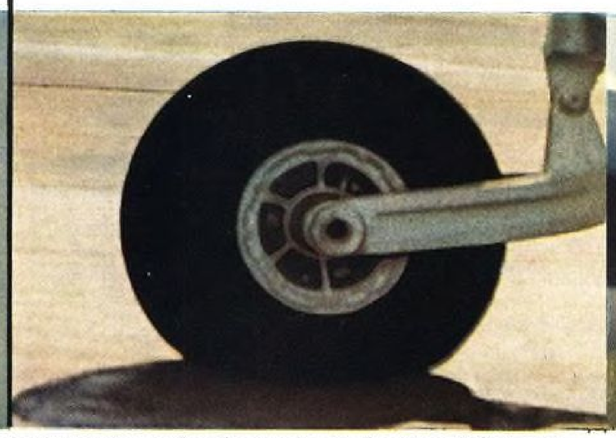


FOR THE NAVY



PROBLEM: Wheel corrosion in naval aircraft.
SOLUTION: Goodyear plastic wheels.

ADVANTAGES: Unaffected by marine environment. Requires no painting. Competitive with metal wheels in areas of weight and cost. Standard inspection techniques. Helps protect tires from brake heat.



FOR PRIVATE FLYING



PROBLEM: Icing conditions.
SOLUTION: Goodyear Iceguard.

ADVANTAGES: Reliable—no moving parts. No maintenance. Patented electrical heating element prevents cold spots or hot spots. Conforms to wing, tail and propeller surfaces. Heats instantly.

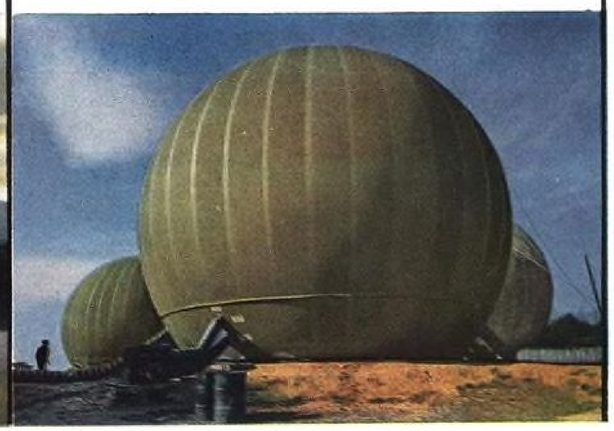


FOR THE MARINES



PROBLEM: Protect remote radar antennas.
SOLUTION: Air-dropped inflatable radomes.

ADVANTAGES: Protect radar antenna from wind and weather. Can be erected by six-man crews in half hour. Can be air-dropped in sections. Inflatable, already proved in other radar applications.



"Engineered Value" is a Goodyear exclusive. It means extra value in products developed through the unmatched capabilities of one of the world's largest, most experienced manufacturers of aircraft components—Goodyear. Since Kitty Hawk, Goodyear scientists, engineers and researchers have been solving flight problems with "engineered value" products. They stand ready to solve your problems, too. For full information write Goodyear, Aviation Products, Dept. G-1715, Akron 16, Ohio.

Iceguard—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

GOODYEAR
AVIATION PRODUCTS



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Boeing-Vertol 107



Kaman UH-2A


Sikorsky S-62


Sikorsky S-61L


Boeing-Vertol CH-46A


Sikorsky CH-3B


Sikorsky HH-52A

T58

PICKED TO POWER ANOTHER

U.S. Air Force selects Bell helicopter powered by General Electric T58 engine for missile site support missions. Engine produces 1250 horsepower, weighs 300 pounds, has 800 hour TBO record in Air Force service.

235-04

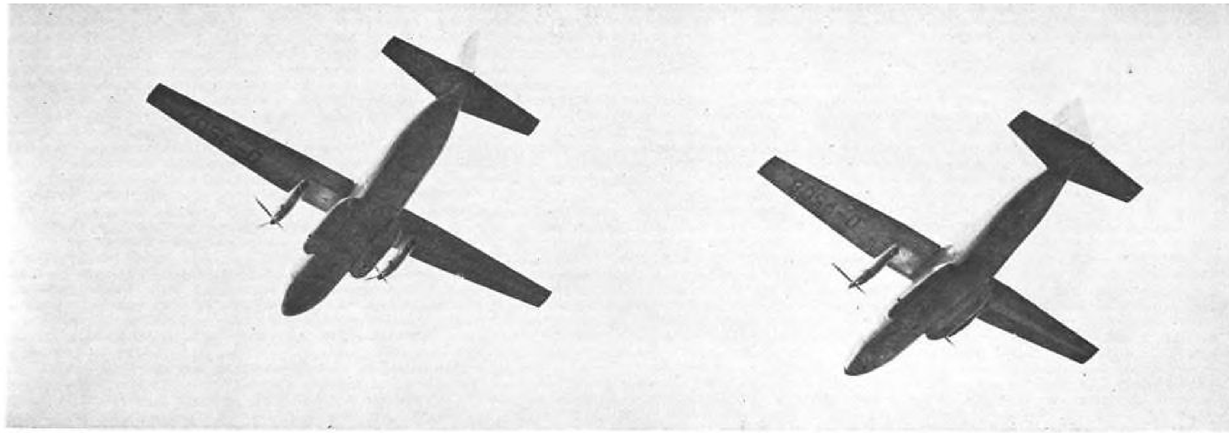


General Electric T58 Powers Them All

FLIGHT PROPULSION DIVISION / LYNN, MASSACHUSETTS

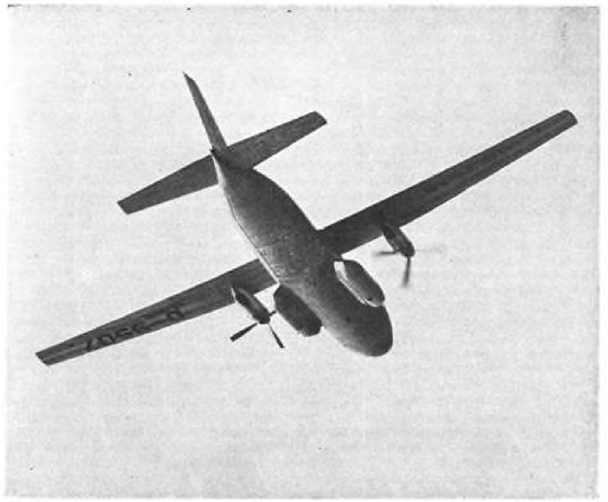
GENERAL ELECTRIC

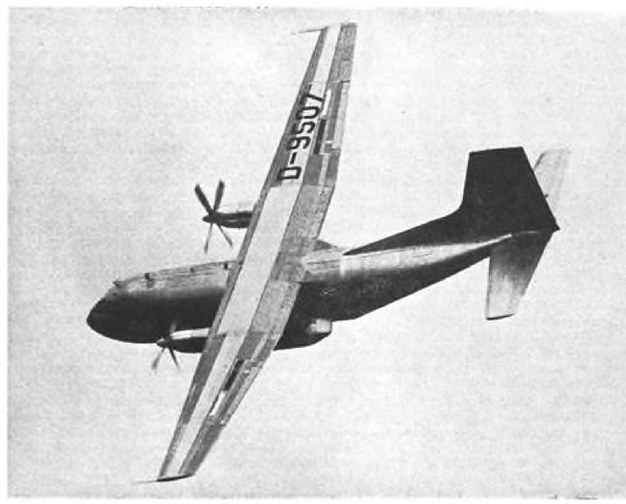
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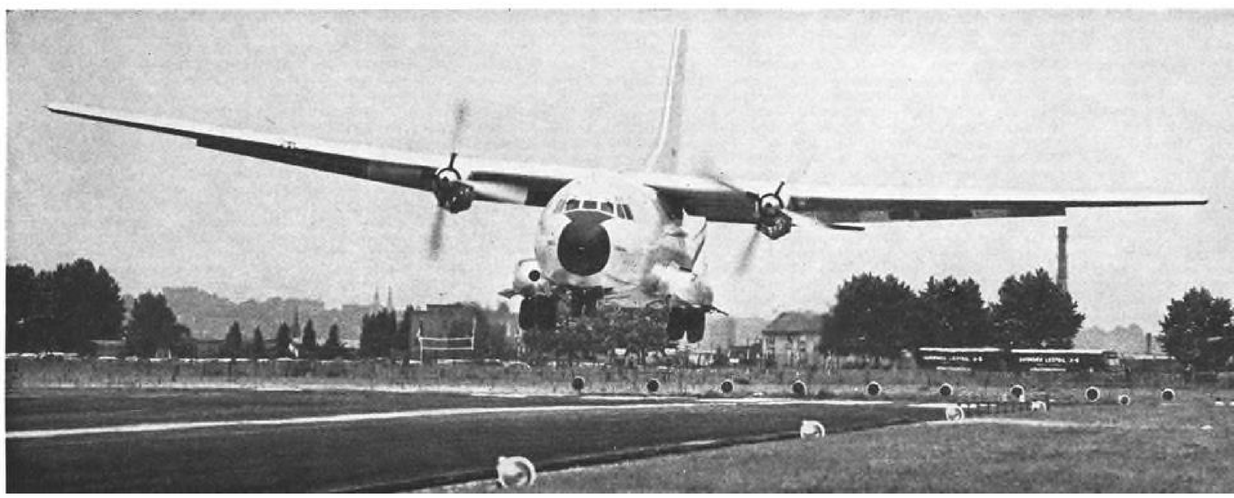
First prototype of the Franco German C-160 Transall cargo transport (left) is flown at the Paris Air Show with the recently rolled out second prototype (right). Powerplants are two Rolls-Royce Tyne Ty. 20 turboprop engines rated at 5,665 shp. at takeoff. France's Nord Aviation built the first prototype, Germany's Weser Flugzeugbau built the second (AW June 10, p. 78).

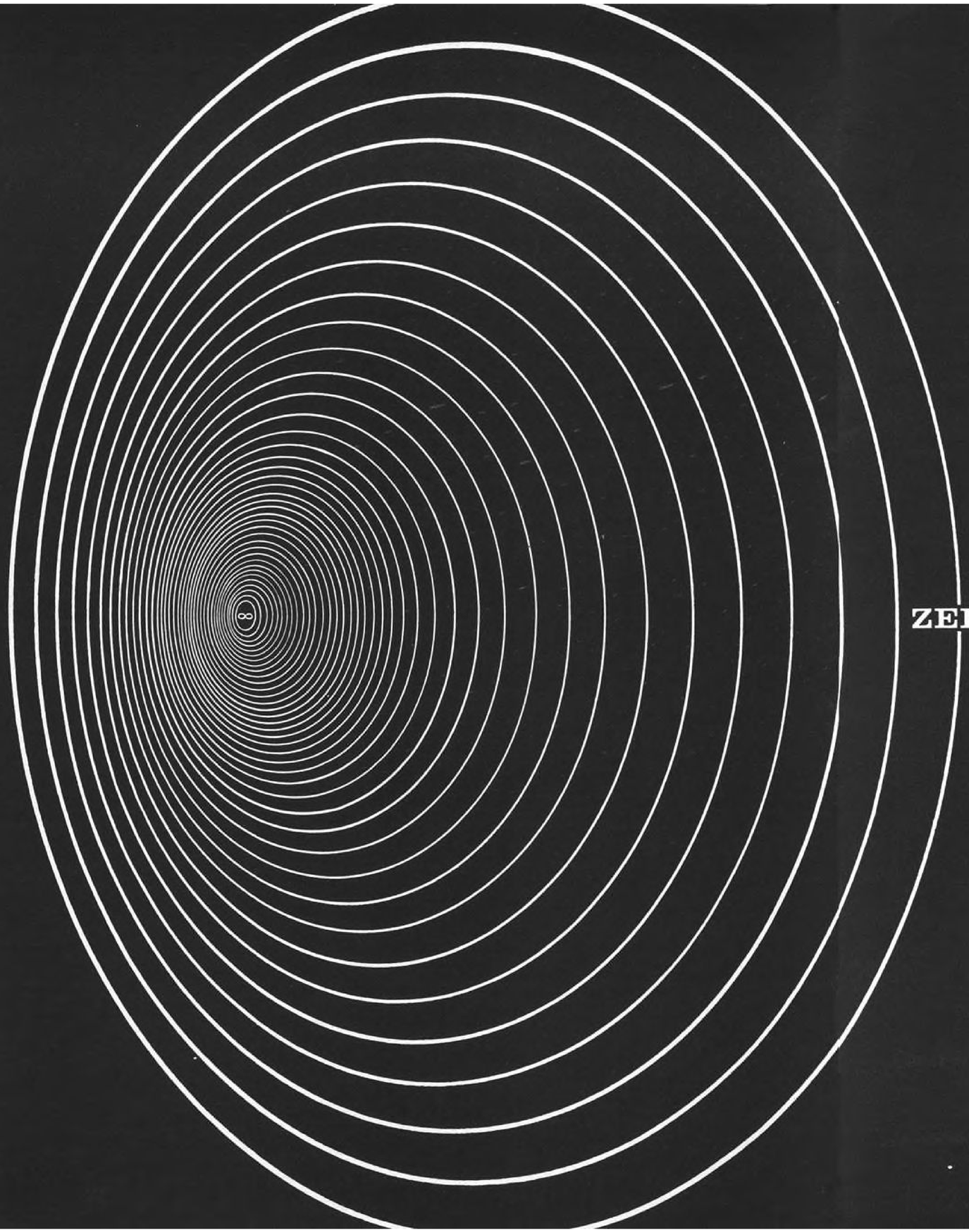
First, Second Transall Flown in Paris Demonstration





Top and bottom views of the first prototype (above) show wing planform details, and (left) design of rear loading cargo door tail structure and twin, tandem bogey main landing gear for unprepared field operation. Note feathered left engine (above, left). Landing configuration with gear extended is shown in photograph below.





SCIENTISTS AND ENGINEERS:

From undersea navigation equipment for test on the research vessel Trieste to the development of non-inertial systems for deep space rendezvous, Motorola performance spans the broad spectrum of environments in advanced systems.

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ZERO TO INFINITY

Systems Design • operational and functional mission analysis, optimum time-bandwidth utilization, redundant system organization for reliability, phased arrays, digital and voice communications, and A-J secure communications.

Equipment Design • solid state receivers, transmitters and transponders, distributed parameter microwave equipment, digital Modems, controls and displays, low-level switching circuits, and digital data processing circuitry.

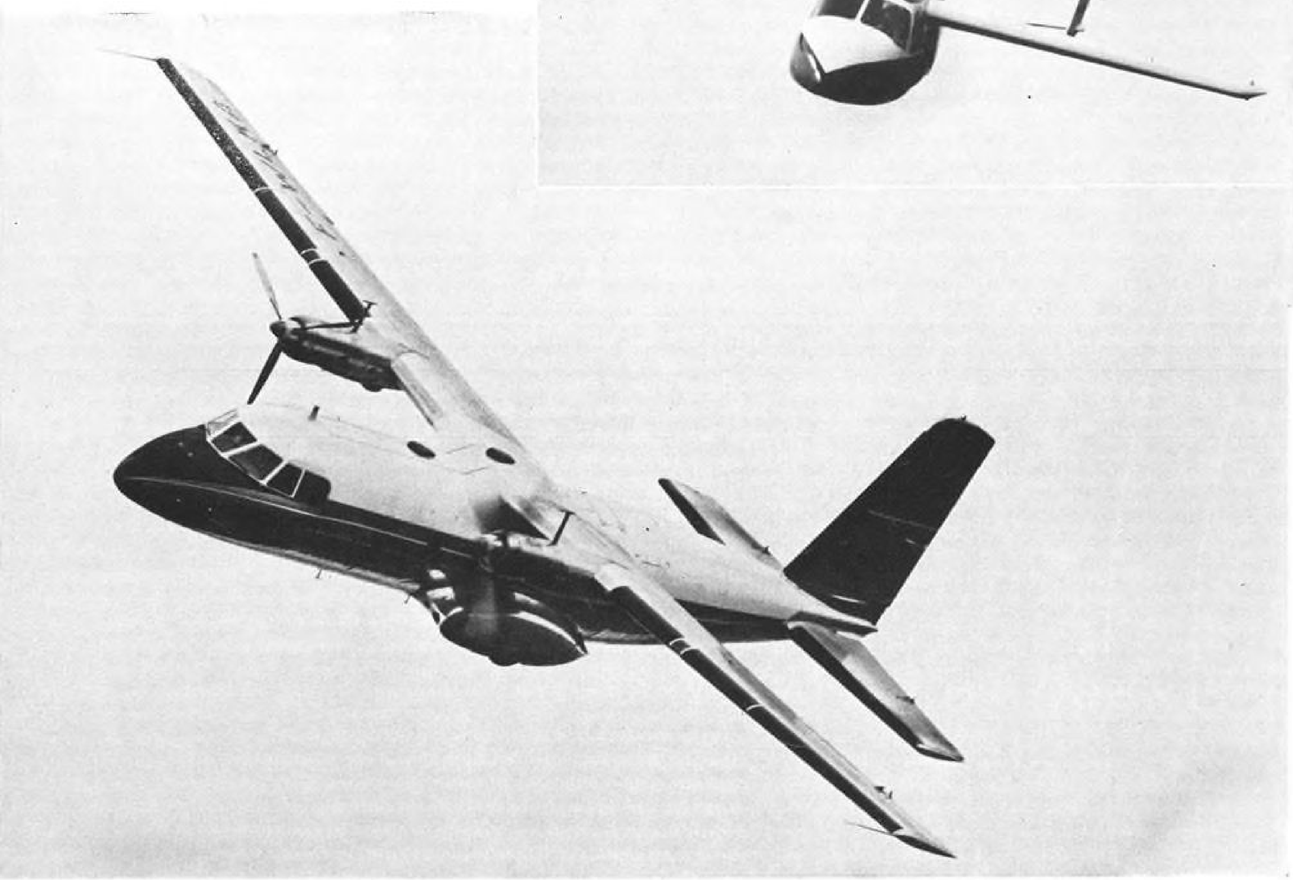
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NORD M.H. 262 SUPER BROUSSARD, pressurized light twin-transport, makes a single engine, low-level flyby. Aircraft powered by two Turbomeca Bastan 6 turboprops, carries 26 passengers. Miles Student (top photo) is a side-by-side, two-seat turbojet trainer, and is powered by Turbomeca Marbore 2A.



SFERMA-Beech PD.146 Marquis, turboprop version of the Beech Baron, is shown during approach at the Paris air show.

Jets Top Business Plane Display at Paris

By Herbert J. Coleman

Paris—Two new executive jet transports—the Dassault Mystere 20 and the de Havilland DH-125—captured most of the business flying interest at the Paris Air Show, topping a display that featured few new designs with a chance of reaching the hardware stage.

On the whole, the business flying section was dominated by designs now well established in various national markets, although the French company of S.A. Engins Matra unveiled a new airplane that has been built under conditions of extreme security and will fly for the first time next month.

The aircraft is the twin-engine "pusher-puller" Moynet 360, the first of what Engins Matra hopes will be a family of planes capped by the Moynet 2000, an executive and liaison plane powered by a turboprop and a turbojet engine.

Another new French design is, in effect, a Potez 840 turboprop scaled down to a twin-engine executive plane which the firm, Etablissements Henry Potez, is proposing to the French air force for an initial production order.

The Moynet 360 prototype was built at Engins Matra's main aircraft division plant at Boulogne-Billancourt (Seine) and unveiled on opening day of the 25th Paris air show at Le Bourget.

The company has designed a military version but has little hope of interesting French or foreign air forces until the prototype has gained considerable flight test time. The initial aim is to press for worldwide sales in the civil market.

All-metal Moynet 360 is a low-wing monoplane which can be fitted with five or six seats. Two Lycoming IO-360 200-hp. fuel-injection engines are mounted fore and aft along the airplane's centerline. The tailplane, mounted on top of fuselage, has outboard rudders.

Clean wing is slightly swept back and is a trapezoidal platform containing two spars. Span is 36 ft. 1 in. and the wing includes integral tanks which hold a total of slightly more than 97 U.S. gal. Landing gear, built by Messier, is a tricycle type with main wheels folding and retracting into the wings and the nose gear retracting rearward into the fuselage. Propellers, built by Hartzell, are constant-speed, full-feathering.

Engins Matra said design aims call for a maximum speed at sea level of 212





PIAGGIO-DOUGLAS PD-808 Vespa-Jet, shown in model form (left), is powered by two Bristol Siddeley Viper 525 turbojet engines. Civil version of SIPA 251 Antilope (AW June 24, p. 96) shows lengthened nose and wider cabin to allow for single entry door.



MODEL OF POTEZ 89 (above right), shows derivation from the four-engine Potez 840, which is marketed in the U.S. by Turbo Flight, Inc. French government has ordered two Potez 89s.



LOCKHEED ELECTRA. Lockheed's popular turbo-prop is equipped with BFG brakes which deliver higher torque without fade, and slower, more even lining wear. Other BFG products on the Electra include tires, seals, erosion shoes, propeller heating elements.



BOEING 707-320. The big Intercontinental passenger models of the 707 are all equipped with BFG brakes, selected for their higher capacity for fast, chatter-free stops. A major advantage of BFG brakes is their thermally balanced design.



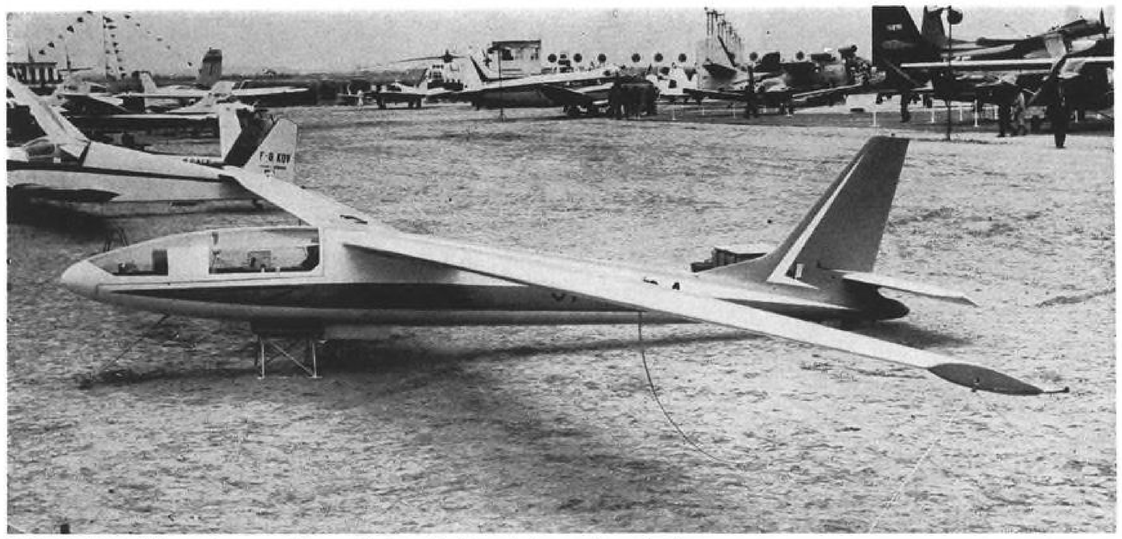
BOEING 720. This medium range jet is equipped with BFG disk brakes, as well as wheels and fabric tread tires. One of the reasons BFG brakes are preferred on more commercial jets is the special sintered metal linings, developed by B.F.Goodrich.



BOEING 727. The newest Boeing jet has special BFG brakes on both main and nose wheels, designed to meet requirements for operation from short runways. New design permits a series of short flights without delays for brake cooling.

■ More U. S. made jets and turbo-props in airline service are equipped with B.F.Goodrich wheels and brakes than with any other make. For the reasons behind this performance record, contact *B.F.Goodrich Aerospace and Defense Products, a division of The B.F. Goodrich Company, Department AW-7A, Troy, Ohio.*

aerospace and defense products **B.F.Goodrich**



POLISH ZEFIR, high performance glider on display at LeBourget, is now in production.

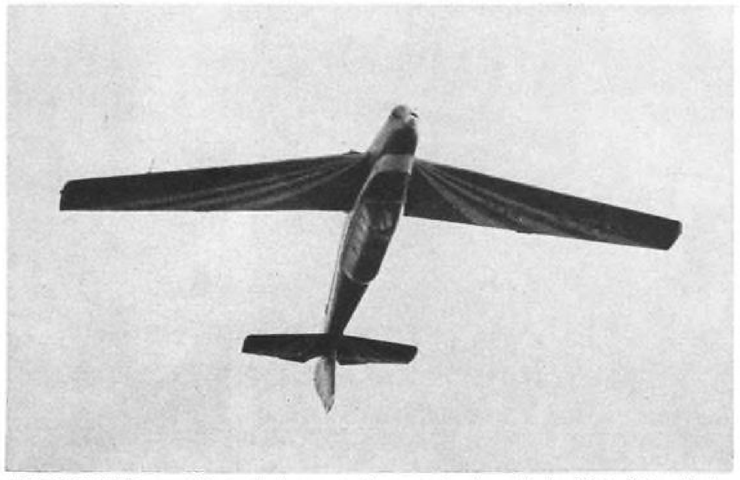
mph. and cruise speed, using 75% power, of 204 mph. at 7,540 ft. Maximum speed with one engine out at 3,280 ft. will be 158 mph.

Future member of the Moynet family, still in the design stage, is the Moynet 700, a slightly larger version of the 360 fitted with two 290-hp. engines turning three-bladed propellers. It would carry six passengers.

Most sophisticated airplane in the Engins Matra group will eventually be the Moynet 2000, a low-wing, combined turboprop-turbojet powered executive transport which will carry eight passengers at speeds up to 455 mph.

Moynet 360 Specifications

Dimensions	
Span	36 ft. 1 in.
Length	25 ft. 9 in.
Wing area	173.2 sq. ft.
Engines	Two Lycoming IO-360, 200 hp. each
Power loading	9.48 lb./hp.
Wing loading	22 lb./sq. ft.
Weights	
Empty, equipped	2,215 lb.
Payload	1,600 lb.
Gross weight	3,815 lb.
Performance	
Maximum speed, sea level	212 mph.
Cruise speed, 75% power	204 mph. at 7,540 ft.
Cruise speed, 65% power	199 mph. at 10,660 ft.
Rate of climb	1,460 ft./min.
Rate of climb, one engine out	512 ft./min.
Service ceiling	22,470 ft.
Service ceiling, one engine out	9,676 ft.
Minimum takeoff distance over 50-ft. obstacle	1,391 ft.



CZECH ZLIN Trener Master is shown at the top of a loop during Paris flying display.



CZECH MORAVA 200D is used for taxi and hospital service by CSA and Aeroflot.



ALL METAL Moynet 360 (above) is a low wing monoplane with five to six seating capacity. Two Lycoming IO-360, 200-hp. fuel-injection engines power it; one mounted in the nose and one in the tail along the airplane's centerline.



SIMMERING-GRAZ-PAUKER M.222 Flamingo, shown approaching a landing (above) is fourth version of an Austrian four-passenger light twin. Powerplants offered are 180-hp. Lycoming IO-360-BIA or 200-hp. Lycoming IO-360-AIA fuel injection engines.

Nose-mounted turboprop engine will be a Turbomeca Astazou 2 furnishing 560 eshp. The aft turbojet powerplant, mounted in the tail cone with a single intake faired out the upper fuselage on either side of the vertical stabilizer, will be a single Pratt & Whitney JT12-A6 producing 3,000 lb. thrust. The airplane will be 46 ft. long, 13.5 ft. high. Wingspan is 42 ft. Gross weight will be 10,400 lb.

Engins Matra has not yet revealed price ranges, pending production schedules and future orders, but the company estimates that the entire line will be flying within the next two years.

Establissements Henry Potez, still pushing the Potez 840 four-engine turboprop in the world market, this year unveiled the Potez 89, a twin-Astazou powered airplane which bears a close resemblance to its larger predecessor.

The company has not yet made the decision to go ahead with the construction of a prototype, pending completion of surveys, but the airplane has been designed to carry eight persons. Cabin will be pressurized. Dimensions are: length, 36 ft., height, 16 ft., and wingspan, 46 ft.

Newest entry in the turbojet-powered executive transport field is the Messerschmitt ME.P-308 Jet Taifun, a five- to six-seat airplane shown in model form. Powerplants are two Turbomeca Marbore 2s of 860 lb. thrust each.

Jet Taifun, which will be submitted to air forces throughout the world as a liaison and training aircraft, is a low-wing, all-metal monoplane with a T-tail. The wing is built as a single section and runs through the fuselage without a break. Takeoff weight is 5,630 lb. Dimensions are: length, 25 ft. 6 in., height, 9 ft. 1 in., and wingspan, including tip tanks, 28 ft. 1 in. Wing area is 118 sq. ft.

Two other new jets, well advanced in construction, are the Piaggio-Douglas PD-808 and the Saab 105. Both were shown in model and mockup form. The Saab 105 prototype, designed to Swedish air force specifications as a twin-jet multi-purpose airplane, is scheduled to make its maiden flight this month (AW June 3, p. 29).

The Saab 105 was originally designed to take the Turbomeca Marbore 4 engine, but the powerplant requirement later was changed to the Turbomeca Aubisque, a turbofan engine. This necessitated a redesign of the air intakes because of the greater volume of air required, a task completed after testbed and wind tunnel testing.

Saab is building two prototypes of the high wing, T-tail airplane. This configuration was selected because of air force specifications calling for a capability to carry external weapons and photo stores at six attachment points under the wings.

Newest U.S. business planes shown were the Cessna Skymaster twin pusher-puller and the Aero Commander.





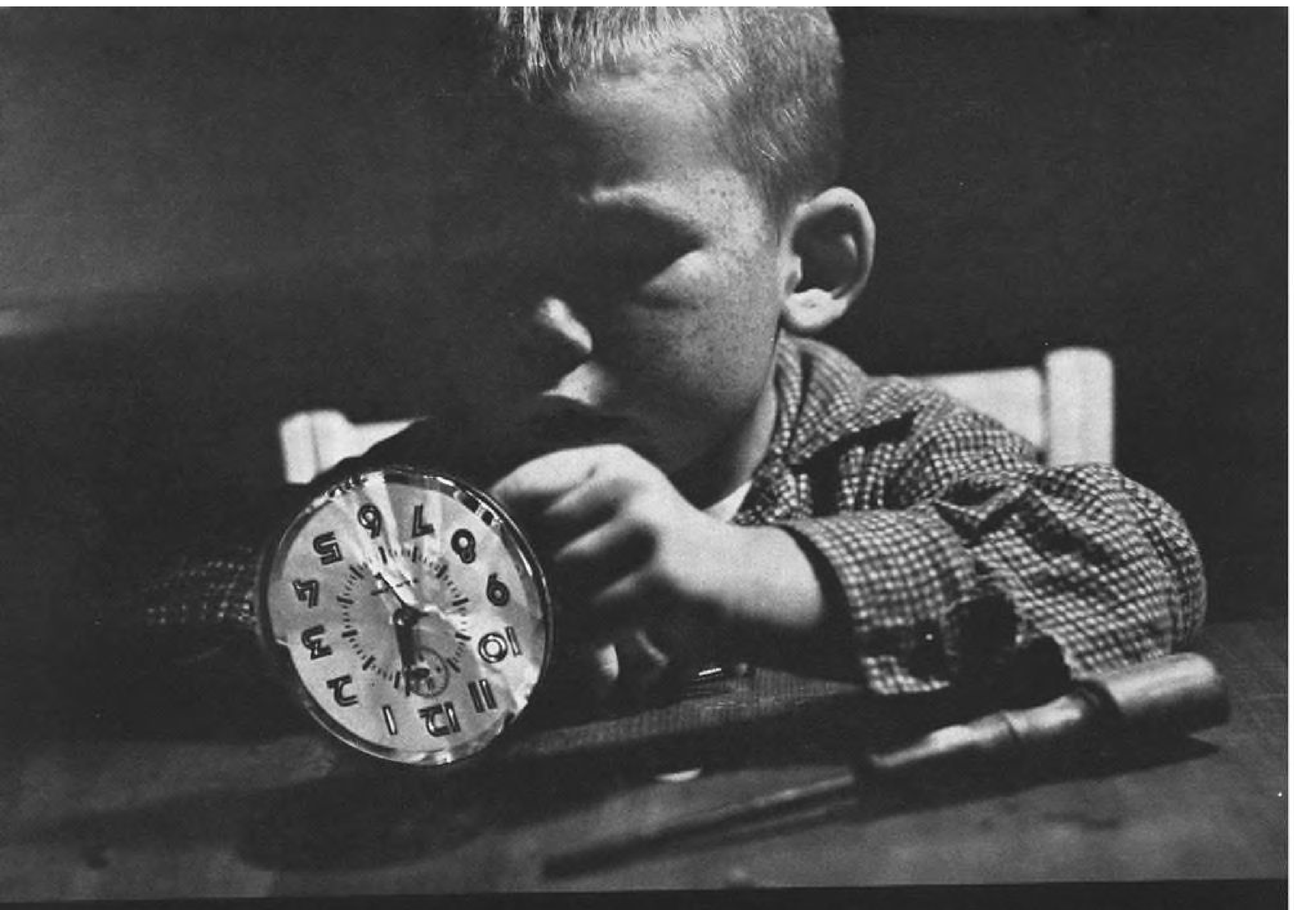
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AEROSPACE CORPORATION

PRODUCTION BRIEFING

Wyman-Gordon Co., Worcester, Mass., has received initial orders from de Havilland of Canada, Ltd., for 25 sets of wing spars for the Douglas DC-9 short-haul jet transport. Each set will consist of four forgings each approximately 120 in. long and weighing as much as 300 lb. Deliveries will begin in August.

Crane Carrier Industries, Inc., of Tulsa, Okla., has formed an Aero-Space Div., to be situated in Irving, Tex., between Dallas and Ft. Worth. The division will be housed in a 120,-000-sq.-ft. building now under construction. Initial employment will total about 500 people, primarily machinists. Crane Carrier is a manufacturer of heavy duty construction machinery.

Republic Aviation Corp., Farmingdale, N. Y., has a $100,000 study contract from National Aeronautics and Space Administration to determine the biomedical and human performance requirements for a manned-earth-orbiting space station.

International Telephone and Telegraph Corp. has merged two of its Defense/Space Group units—International Electric Corp. and ITT Information Systems Div. The new unit is called ITT Information and Data Systems Div. and is headed by Martin H. Dubilier, former president of IEC.

Federal Aviation Agency has awarded the firm of Bolt, Beranek and Newman, Inc., Cambridge, Mass., a $261,511 research contract to develop zoning guidelines to aid airport planners in keeping noise to acceptable levels. Part of the study will include reactions of people to aircraft noise, and their community actions to stop it.

Aerojet-General Corp., El Monte, Calif., has been awarded a $2-million Air Force contract for studies in advanced liquid propellant rocket engine design. Work will be performed in Sacramento, Calif.

Air Force Logistics Command reports savings of $19.7 million realized through extension of the projected life of General Electric J-85-GE5 turbojet engines used in the Northrop T-38A trainer. Savings resulted from modifications which extended engine life and reduced need for spare engines.

Honeywell, Ordnance Div., West Covina, Calif., has a $2-million cost-plus-incentive fee contract from U.S. Naval Training Device Center, Port Washington, N. Y. for one sonar room tactical team trainer for use at the fleet ballistic missile training facility at Charleston, S. C.

Continental Aviation and Engineering Corp., Detroit, Mich., has been awarded a $1.6-million Air Force contract for production of J69 engines for the T-37C jet trainer.

Giannini Controls Corp. will develop a propellant gaging system for operation in a zero-gravity environment for the Apollo spacecraft, under a $1.5-million contract from North American Aviation's Space and Information Systems Div. The system will use radioactive rays from a radioisotope to detect diminishing fuel and the rate of use. The information will be signaled by computer to the display panel.

Vitro Services Div., of Vitro Services Corp., New York, N. Y., will manage and operate Air Force's Air Proving Ground Center land range test areas and Eglin Gulf Test Range in Florida under a $7-million Air Force contract.

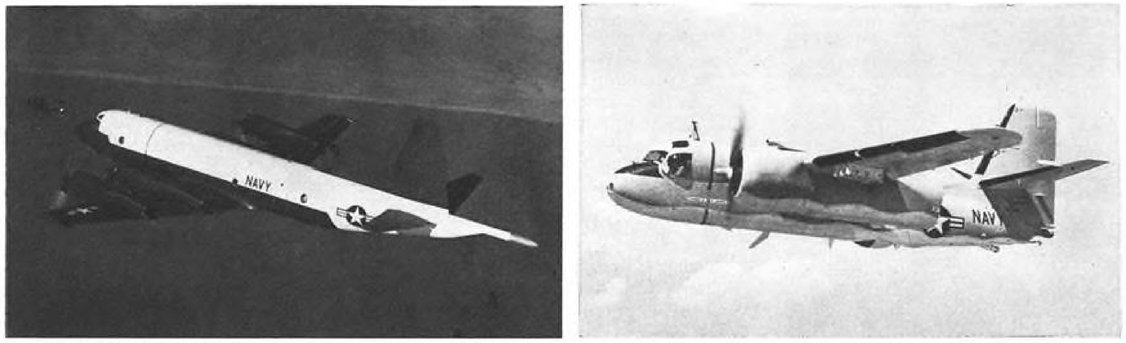
Murray J. Shiff Construction Co., Tucson, Ariz., has been awarded a $2-million NASA contract to build a test stand and other support structures for testing the Apollo spacecraft's propulsion system, at White Sands Missile Range, N. M.

General Motors Corp., Detroit, Mich., has a $1-million Air Force contract to provide engineering services for the Army Light Observation Helicopter program.

North American Aviation, Inc., Columbus, O., will build additional A-5C Vigilante aircraft under a $20-million contract from Bureau of Naval Weapons..

NASA is building an instrument laboratory building at Marshall Space Flight Center, Huntsville, Ala. The laboratory will be used to design and develop instrumentation for Saturn booster test stands. Building and equipment will cost $1.9 million.

Aeronutronic Div. of Ford Motor Co. at Newport Beach, Calif., has been transferred to Philco Corp., a wholly owned subsidiary of Ford. Aeronutronic is operating as a division of Philco.



PROJECT A-NEW, RECENTLY LAUNCHED Navy program, seeks to integrate variety of anti-submarine warfare sensors on carrier- and land-based ASW aircraft into more effective system for coping with high-speed nuclear submarines. Previously, Navy first bought suitable aircraft, such as the P-3A (left) and S-2D (right), then stuffed them full of avionic black boxes.

Navy Adopts New ASW Avionics Approach

By Philip J. Klass

Washington—Fundamentally different approach to the design of airborne anti-submarine warfare weapons, expected to improve significantly Navy's ability to cope with high-speed nuclear submarines, has been adopted by the Bureau of Naval Weapons.

Instead of buying a long-endurance patrol plane and equipping it with miscellaneous avionic black boxes and sensors, Navy has set out first to design an integrated airborne avionics system specifically suited to the ASW task. Only after the system's design parameters have been established will a new ASW aircraft be procured, according to present plans.

Project A-New

The program, launched earlier this year, is known as Project A-New, not an acronym. Current funding is about $4 million with an estimated $8 million projected for Fiscal 1964.

The program's implications are far more important than these modest figures would indicate since the A-New concepts will shape future large-scale procurements of airborne ASW avionics equipment.

Project A-New is primarily a systems engineering program, intended to integrate existing ASW sensors and subsystems and improved models already under development to achieve greater effectiveness and ease the workload of aircraft crews. But the system integration effort involves some new hardware, including a central airborne digital computer and new tactical situation displays.

First experimental version of the A-New system, referred to as XN-1, is being assembled at the Naval Air Development Center, Johnsville, Pa., for initial evaluation using an ASW simulator. Later this fall the system will be shifted to a Lockheed YP-3A, a converted turboprop Electra, for flight tests which are slated to begin early next year. The XN-1 hardware is intended to serve as a flying testbed and not to reflect the ultimate size or weight of the system.

By late 1964, it is expected that an engineering prototype (XN-2) of the integrated ASW avionics system will have been procured for simulator and flight evaluation. Meanwhile, preliminary performance specifications will have been prepared and sent out to airframe manufacturers for use in preparing future proposals for new Navy ASW land- and carrier-based aircraft competitions.

Bureau of Naval Weapons is managing the A-New program, with technical direction assigned to the Naval Air Development Center (NADC), according to Lt. Cdr. Guy Buck, advanced systems project officer in BuWeps ASW Detection and Classification Div. Principal contractors in the program include Dunlap & Associates, General Dynamics/Electronics, Grumman Aircraft, Lockheed-California, Loral Electronics and the Univac Div. of Sperry Rand Corp.

The ASW problem of target detection and classification (threat or non-threat) is one of the most difficult and complex in the spectrum of modern warfare, particularly with the advent of deep diving, high-speed nuclear submarines which don't have to surface very often.

It requires surveillance of vast volumes of a medium which is not homogeneous as seen by submarine detection sensors and which is filled with many non-threat objects.

Because there is no single type of sensor which has the range and effectiveness in water that radar has against airborne and spaceborne targets, a variety of sensors must be used, each operating on a different principle. These range from radar to sonar, from magnetic anomaly detectors (MAD) to infrared sensors and ferret receivers.

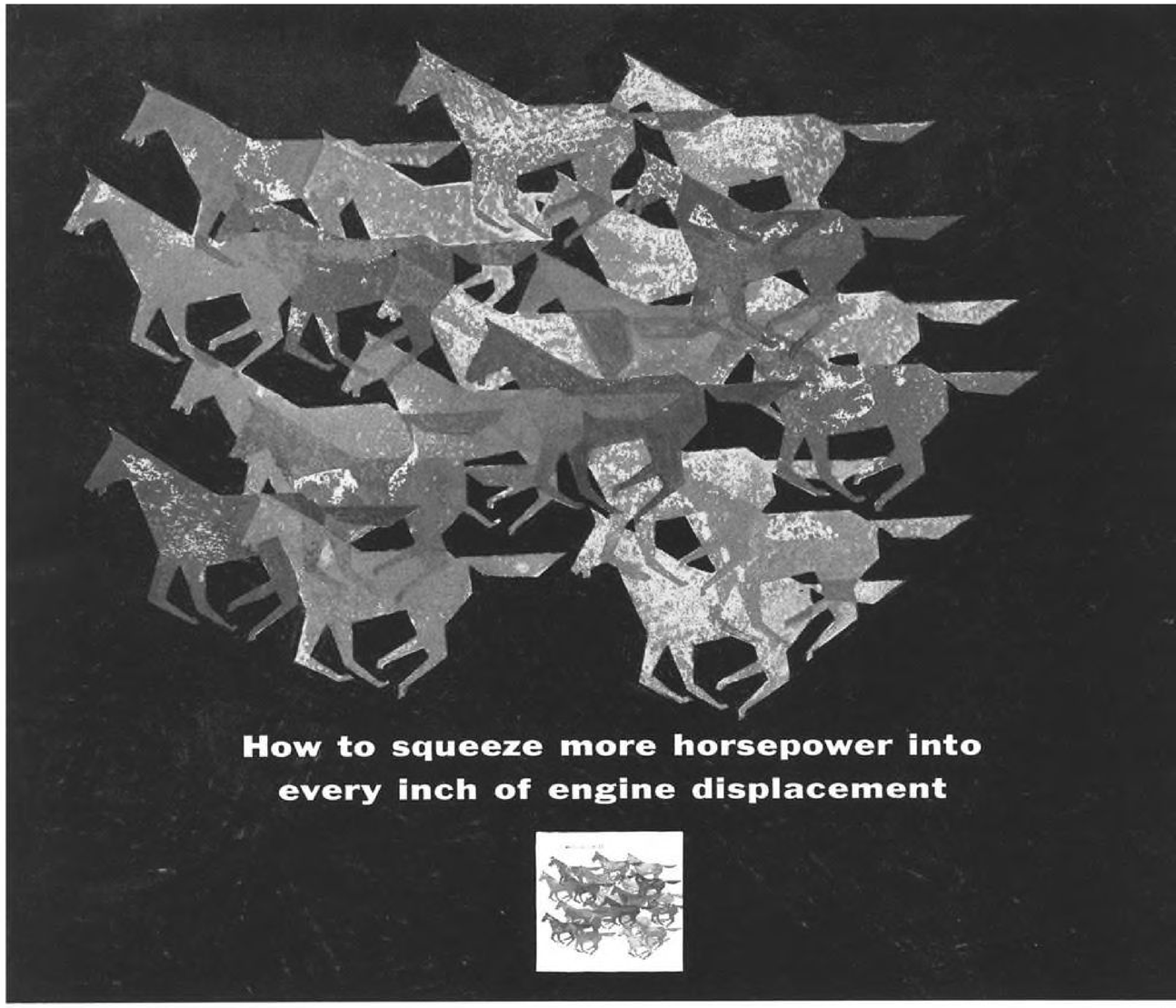
Sensor Variety

Some of the sensors are fixed in their location, while others such as sonobuoys drift.

Still others on board ASW aircraft, surface ships and submarines are in continuous motion over or in waters which have few convenient landmarks. For maximum effectiveness it is necessary that each ASW vehicle not only correlate the data obtained from its own variety of sensors but that it also attempt to correlate this data with sightings made by other ASW vehicles in the area.

With the present state of the ASW sensor art, the most pressing problem is one of data correlation, a task which is relatively easy for a digital computer but which now heavily taxes the airborne ASW crew, particularly when it has been on station for many hours, Buck said.

Frequently there may be conflicting data from different airborne sensors, making it difficult for the crew to determine its best next move, according to Donald F. Smith, technical director for A-New at NADC's Anti-Submarine Warfare Laboratory. Today the ASW crew must manually calculate the optimum positions in which to drop sonobuoys and the number that must be used to achieve the desired range, a factor which depends upon temperature levels in the ocean. The crew also



...another example of Caterpillar capabilities at work

When Caterpillar Research Engineers talk about this project, they call it VHO.

Officially, it's a research project to design a family of four Very High Output engines for the U. S. Army Tank Automotive Command. The family goal: delivery of more working horsepower per inch of displacement than any compression-ignition engine now available. Horsepower-to-weight ratios will be in the gas turbine range.

Current design indicates a realistic initial target of 80 HP from each cylinder at 2800 RPM. This is without revolutionizing engine structure or creating highly sophisticated aspiration methods.

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The VHO research program demonstrates another of Caterpillar's capabilities in the area of military vehicles and engines to power them.

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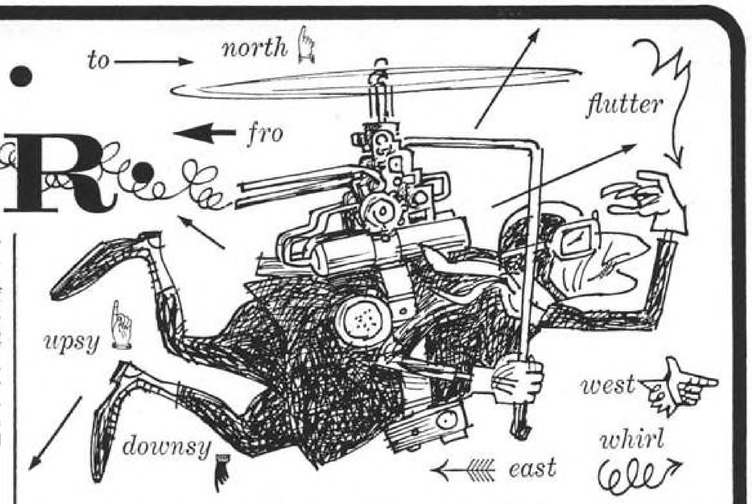
(pō'poo-rē', pot-poor'i), **n.** [Fr.; a pot + *pourri*, pp. *pourrir;* transl. of Sp. *olla podrida*]. Published monthly by Giannini Controls Corporation: 1. In self-recognition of unusual Measurement & Control capabilities for Aerospace & Industry. 2. For painless, incremental reading. 3. To advance the theory that truth need not be dull.

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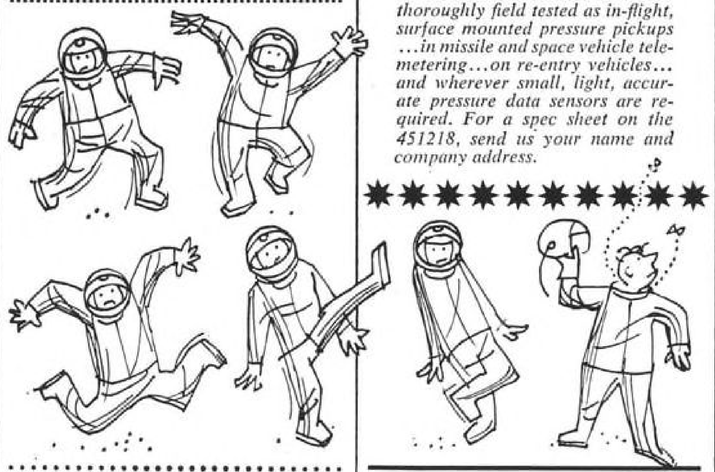
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Our friends at Ham.-Standard tell us each LEM "moonsuit" will be equipped with two GCC Model 451218 miniature pressure transducers. One of these 1" by 1" by 1" by 1-ounce sensors will be used for telemetering suit pressure data. The other, a switch output device, automatically warns the moon man to bug out when his suit pressure approaches the danger level. These "cubic inch" transducers have been thoroughly field tested as in-flight, surface mounted pressure pickups ...in missile and space vehicle telemetering...on re-entry vehicles... and wherever small, light, accurate pressure data sensors are required. For a spec sheet on the 451218, send us your name and company address.



(DON'T SAY YOU READ IT HERE)

Talk about secrets! We've been working on a project so secret, even the editors of Aviation Week don't know about it. And you should see the stuff we've come up with... it's a real technical tour de force. Too bad we can't share it with you; it's the sort of data you can really get involved with. Especially if you're interested in missile arming and fuzing techniques (OOPS).

BIG GCC DENVER SCORE PROMISED BY MARTINEZ

This is our year in Denver. According to our local Manager, Dick Martinez, last year's loss in the semi-finals will not be repeated. We think this is a swell idea for both GCC and Dick since we're traditionally an outfit that hates to lose. So, if you're a betting man, put your bucks on the GCC sponsored Denver Little Leaguers and hope that two-thirds of the team doesn't leave for camp *en masse* in a repeat of last year's performance.

True Air *Zig Zag Tack Twirl Skitter Crab & Skew* Speed

Nice thing about aircraft, from a TAS designer's point of view, is that they're generally unidirectional and relatively unconcerned with speeds below 100 MPH. Helicopters are birds of a different feather.

Our New Jersey Division has recently put a pile of effort into developing operational true air speed hardware to tell helicopter pilots how fast they're going. And since how fast they're going can be in any direction of the compass, irrespective of fuselage attitude, the design problem is a compound one.

The GCC answer to this dilemma gives readings for forward, reverse, port and starboard speeds (or any combination thereof). It's accurate right down to a few miles per hour. Modesty forbids further hyperbole. And budget forbids complete description here. But the following may whet your appetite: The GCC system is based on mounting pressure sensors in the rotor tips (where else on a helicopter can you get an accurate reading on free air stream conditions?) As you can no doubt appreciate, having the sensing end of a TAS system scribing full 360° circles several thousand times per minute on the end of a thin, hinged, pitch-controlled blade that gets wet-spaghettiish under flight loadings, can create some rather exotic compensation problems for an air data computer. It's the sort of problem you automatically send to GCC.

For complete details on our typically practical working hardware-type solution to helicopter true air speed measurement, send us your name, company and address.

Giannini Controls Corporation

1600 South Mountain Avenue, Duarte, California

must select radio transmitting frequencies for each sonobuoy which will avoid interference. And it must do this quickly before the submarine is able to escape into the ocean's depths.

Submarine skippers are trained to employ unpredictable and unconventional tactics to avoid any pattern of behavior which will make their detection and destruction easier. But the long memory of a digital computer may be able to spot even faint patterns of behavior that might be overlooked by an ASW crew which has been on duty for many hours.

In the A-New integrated system, the airborne digital computer will perform many functions. It will continuously compute the aircraft's latitude and longitude, calculate optimum deployment configurations for sonobuoys, keep tab on their location with respect to the moving aircraft and determine estimated target position from data supplied by all aircraft sensors.

It is expected that the computer will use statistical techniques to derive several possible courses of action, displaying these and the computed probability of success, for final selection by the aircraft commander.

Because the computer acts a a central clearing house for all sensor data as well as keeping track of the aircraft movement, it should greatly simplify the problem of briefing the crew of a new aircraft coming on station. At present this must be done by voice radio and is necessarily sketchy, which can result in needless duplication of areas already patrolled. By means of a two-way data link, Navy expects to be able to automatically transfer the complete history of the departing aircraft's operations to the oncoming ASW aircraft's digital computer.

Data Transferral

Similarly, information on potential ASW targets available at shore or shipboard combat information centers can be quickly transmitted to the airborne digital computer, via data link. Radio Corp. of America currently is under contract to adapt Navy's standard AN/ASW-21 data link system, originally designed for airborne intercept use, to the ASW information transfer requirements.

Because of the key role planned for the airborne digital computer, Sperry Rand's Univac Div. is playing a major role in the A-New program. It is responsible for modifying an existing computer, originally developed by Univac under Air Force sponsorship for missile guidance, to suit the ASW mission.

Univac also is developing the complex programs, "software," needed for this new ASW mission. Modification of the original computer design includes addition of increased memory capacity and instruction repertory.



UNIVAC DIGITAL COMPUTER will play key role in Project A-New integrated ASW avionics system which Naval Air Development Center is assembling for installation on YP-3A. Flight evaluation of the experimental system is scheduled to begin early next year.

The machine is a stored-program type rather than a wired-program computer which Navy currently is using on its Grumman E-2A (W2F) and A-6A (A2F). The choice of a stored program machine will not only provide greater flexibility for evaluating different tactics and procedures during the early flight test phase, but also will make it easier to adapt an operational system to new ASW sensors or tactics, according to M. R. Clement, Jr., Univac's A-New program manager.

The digital computer also will be used to generate tactical situation displays in the aircraft, combining information now displayed on a multitude of devices. The aircraft commander and ASW system operators will be able to select and display only the information needed at any moment. There will be an alpha-numeric display which will enable the crew to interrogate the computer for stored information and read the response on the face of a Charactron cathode ray tube. General Dynamics/Electronic has developed a short-neck Charactron for this use and is responsible for design of the tactical situation display equipment for A-New.

Dunlap & Associates is responsible for human engineering aspects of the system design, including what usually is called the man-machine interface involving communications between computer and human operators.

Grumman and Lockheed are under contract to develop system configuration requirements with the former considering carrier-based vehicles and the latter working on land-based aircraft. Loral Electronics is developing the black-boxes and controls required to provide an interface between existing sensors, the digital computer and displays.

Increased Commonality

At present there is considerable difference between the ASW avionic systems used in carrier- and land-based aircraft. NADC officials express the hope that increased commonality will come out of the A-New program and that ultimately the two types of airborne systems will differ primarily only in the number of crew stations required.

System integration and display techniques being considered for A-New have been undergoing simulated ASW wargame evaluations at NADC for several months.

These are conducted using a modified version of an analog simulator originally built by ACF Electronics for training P-2H (P2V-7) ASW crews.

This will be replaced with a more versatile digital simulator next summer. It will be able to simulate a larger variety of sensors and will be designed to reproduce the high speed and maneuverability of nuclear submarines expected to be operating during the next decade. The new machine will enable Navy scientists to "fly" a complete

SNAP-10A Reactor



RADIATION RESISTANT VOLTAGE REGULATOR

SNAP-10A (Systems for Nuclear Auxiliary Power) is being developed for the U.S. Atomic Energy Commission to answer the demand for more reliable, higher output space power sources capable of operating for at least a year. Its potential applications range from world-wide communication and weather observation satellites to space navigational aids.

An integral part of the SNAP-10A system is an ITT-built radiation-resistant voltage regulator. Designed for long-life operation in the radiation environment near the nuclear reactor, the ITT package regulates the DC output of a bank of nuclear reactor-heated, thermoelectric elements by reflecting a constant load back into the element bank.



ITT for radiation-resistant power conversion equipment. For further information write to Power and Space Dept. for Data File #AW-2065-1.

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ASW mission in a 500 x 500 mi. area of ocean.

Because of the difficulty of conducting well-instrumented airborne ASW tests in the ocean and the problem of obtaining the use of late-model nuclear submarines for extended periods of time, the new ASW simulator is expected to play a vital role in quantitatively assessing new techniques. Choice of the contractor to build the new simulator is expected to be announced soon.

The A-New program is an outgrowth of problems that have plagued newly procured ASW aircraft in the past. Only partial integration of the multiple sensors has been obtained and this usually at the expense of a costly retrofit program, according to Cdr. E. O. Skidmore, superintendent Systems Div. of NADC's ASW Laboratory. Too frequently in the past, the over-all effectiveness of the aircraft and its airborne avionics equipment did not undergo meaningful tests under actual operating conditions until dozens of aircraft had been produced and dozens more were in production, Skidmore said.

Two years ago, in an effort to correct this situation, Navy awarded contracts to four teams of avionics companies to study the feasibility of using a central digital computer for ASW data processing. The teams were headed by North American's Autonetics Div., Hughes Aircraft Co., Librascope Div. of General Precision and Loral Electronics. Under the study, the companies were to consider not only existing ASW sensors but new types under development. The study reports indicated that the concept had much to offer in improving the effectiveness of airborne ASW operations.

Last December, after Navy approval for A-New had been granted, the present team of contractors was selected and the program was officially launched. Recognizing that system integration is both a state of affairs and a state of mind, Navy A-New project managers lay great stress on bringing Navy and industry team members together at frequent intervals for mutual progress reports and to work out interface problems.

To familiarize industry with the objectives of the A-New program and Navy's anticipated future requirements for airborne ASW avionics, NADC gives a classified briefing every Wednesday morning at Johnsville. Program personnel also are available on Wednesday to answer questions on the project.

FILTER CENTER

► **Laser Gyro Sensitivity Gains**—Angular rates as low as ½ deg. per minute have been detected by Sperry Gyroscope Co. using a simplified version of its laser gyro. This is a four-fold improvement over the figure achieved earlier this year (AW Feb. 11, p. 93). Improved model uses only a single gas laser tube, operating at 1.15 microns, instead of four lasers, with mirrors employed to deflect the beam into a square optical path. Company says it has achieved rates of 1 deg./min. using a triangular configuration gyro with lasers emitting at 3.39 microns and 0.632 microns. Sperry has just received a $100,386 contract from Air Force's Aeronautical Systems Div. to continue to work on increasing sensitivity and trying different optical path configurations and wavelengths.

► **Defense Share Grows**—Electronics industry's share of the defense budget is expected to total $8.3 billion in Fiscal 1964, roughly 16% of the total, compared with an estimated $7.7 billion for current year, according to Electronic Industries Assn.'s prediction. Estimated share of the DOD research, development, test and evaluation category for the coming year is $2.1 billion, or 30% of the total, compared with $1.7 billion, or 26%, for Fiscal 1963. EIA estimates that roughly one-fourth of NASA's Fiscal 1964 budget of $1.6 billion will go for electronics, with an additional $160 million coming from Federal Aviation Agency. Total government figure will be about $10 billion.

► **Microcircuit Interest Grows** – Although airborne and spaceborne applications gave microcircuit technology its initial impetus, there is growing interest in its use for large surface- and ship-based electronic equipments. Improved reliability is a major objective for surface applications but the lower weight, power consumption and smaller size are not unimportant considerations. Navy's Bureau of Ships soon will receive its first operational microcircuit hardware, a shipboard tape control unit built by Sylvania Electric using thin-film techniques.

► **High Thin-Film Capacitance**—Thin-film capacitor dielectric material composed of a blend of silicon monoxide and a rare earth compound which has yielded capacitance values consistently in the 10 microfarads/sq. in. range has been developed by North American's Autonetics Div. as part of its extensive microcircuitry activity (AW May 14, p. 95). The high dielectric is formed by evaporating silicon monoxide, then both silicon monoxide and the rare earth compound and finally silicon monoxide again. Working voltages up to 400 volts have been achieved at low values of capacitance, although these voltages are well above levels of interest in microcircuits.

► **Signed on the Dotted Line**—Major contracts that have recently been awarded to avionics companies include the following:

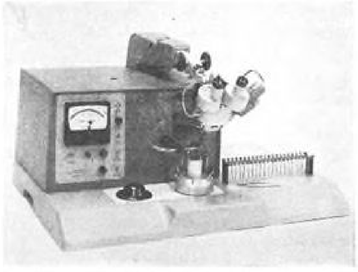
• **Electro-Mechanical Research, Inc.,** Sarasota, Fla., will develop and build rocketborne ultraviolet radiometers to measure radiation spectra at 2,400 to 2,800 Angstrom wavelengths from ICBM rocket boosters, under a contract from Air Force's Air Proving Ground Center. Radiometers will be used as part of Air Force's Project Trump, intended to obtain booster measurements for use in the Midas early warning satellite program (AW Dec. 24, p. 19).

• **National Cash Register Co.,** Dayton, will develop techniques for improving efficiency of cadmium-sulfide solar cells made by thin-film deposition process. The company was awarded a $178,489 contract from Air Force's Aeronautical Systems Div. for the work.

• **Laboratory For Electronics,** Boston, will build 13 lightweight, portable AN/TPN-12 GCA radar sets under a $1.6-million contract received from Royal Swedish Air Board. Company earlier had sold five TPM-12 sets for use by Royal Swedish Air Force.

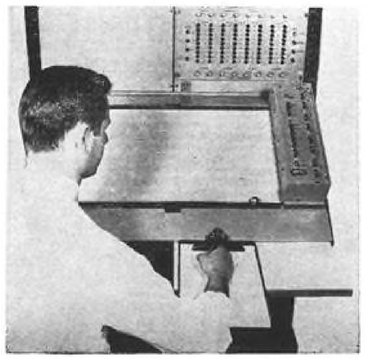
NEW AVIONIC PRODUCTS

• **Thermocompression bonding machine,** high-speed nailhead type designed to handle gold wire in diameters of ½ to 10 mils, uses tungsten carbide



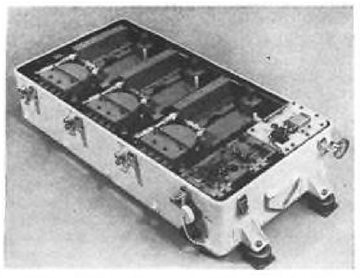
capillary which fits into heated shank. Devices are preheated in a six-position rotary heat column. Bonding time and pressure are adjustable over wide range. Manufacturer says machine can make up to 750 bonds per hour. Manufacturer: Micro Tech Manufacturing Co., 1246A Birchwood Dr., Sunnyvale, Calif.

• **Eight-channel recorder,** direct-writing type, provides a 30-in. continuous display of analog data for quick analysis. Device, developed to record biomedical data from manned space flights, provides direct view of up to 25 min. of past data. Pushbutton controls enable operator to adjust attenuation, gain and pen position. Maximum sensitivity is 50 mv./chart division. Manufacturer: Brush Instrument, division of Clevite Corp., 37th & Perkins, Cleveland 14.



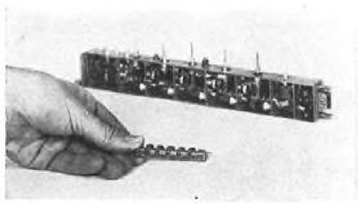
• **Sensitive digital voltmeter,** Model 2660, measures d.c. voltages from 1 microvolt to 1,000 v. in six overlapping ranges. With 100 megohm input impedance, accuracy in the 0-30 microvolt range is quoted at 3 microvolts. Instrument provides automatic polarity reversing, decade switchable sensitivity control and panel mounted meter for observing deviations of less than one digit. Manufacturer: Houston Instrument Corp. Auto Data Sales Div., 4950 Terminal Ave., Bellaire 101, Texas.

• **Low-noise parametric amplifier,** for 400 mc. operation, has noise figure quoted at 1.0 db. including circulator but excluding second-stage noise. Gain is quoted at 15 db. and bandwidth at 8 mc., with gain stability better than



1.0 db. for 24 hours. Fail-safe operation is provided by two independent stages of amplification in which failure of either automatically bypasses faulty stage. Added technical information is available from manufacturer: Micromega Corporation, 4134 Del Rey Ave., Venice, Calif.

• **Microminiature I-F amplifier,** with 100 mc. center frequency and 20 mc. bandwidth, weighs only ¼ oz. and occupies ½ cu. in., 1/46th the weight and 1/30th the size of conventional transistorized intermediate amplifier with comparable performance. Noise figure is quoted at 5 db. nominal with over-all gain of 55 db. for five-stage amplifier. Operating temperature range is −55C



to 100C and input power required is 6 ma. at 15 v. The amplifier also is available in models having center frequency at 30 mc. and 60 mc., supplying 12-15 db. gain per stage. Manufacturer of the amplifier: Loral Electronics Corporation, 825 Bronx River Ave., Bronx 72, N. Y.

• **Digital frequency synthesizer,** Model HMPD-171, using all solid-state construction, can generate radio signals between 1.4 mc. and 35 mc. in increments as small as 10 cycles up to 7 mc. and 50 cycles from 7-35 mc. Any decade can be tuned independently of others.



Stability of output signal is quoted at one part in 100 million per day. Output is 100 mw. across entire range but can be increased to 250 mw. with minor circuit change. Synthesizer design is novel in that there is no RF signal applied to any moving part in decade tuner. Device measures 3½ x 17½ x 23 in. Manufacturer: Hoffman Electronics Corp., 3761 S. Hill St., Los Angeles 7, Calif.

• **Static thermal switch,** thermistor with positive instead of usual negative temperature coefficient, experiences abrupt increase in resistance in predetermined temperature band. New positive temperature coefficient (PTC) thermistors experience negligible change of resistance at zero, increasing to 10%/degree centigrade at transition band temperature. Units are available with transition temperatures of 60, 85, 105, 115, 135 and 155C. Manufacturer: Westinghouse Electric Corp., Special Products Dept., Semiconductor Div., Youngwood, Pa.

New Department of Defense Standard Rocket, Missile, Probe Designations

Missile Prefix Symbols Detailed

Following missile symbols are used in the new Defense Dept. missile designation system (AW July 1, p. 31):

Letter	Title	Description
J	Special Test, Temporary	Vehicles on special test programs by authorized organizations and vehicles on bailment contract having a special configuration to accommodate the test. At completion of the test the vehicles will be either returned to their original configuration or returned to standard operational configuration.
N	Special Test, Permanent	Vehicles on special test programs by authorized activities and vehicles on bailment contract, whose configurations are so drastically changed that return of the vehicles to their original configurations or conversion to standard operational configurations is beyond practicable or economical limits.
X	Experimental	Vehicles in a developmental or experimental stage, but not established as standard vehicles for service use.
Y	Prototype	Production vehicles procured for evaluation and test of a specific design.
Z	Planning	Vehicles in the planning or predevelopment stage.

LAUNCH ENVIRONMENT SYMBOLS

A	Air	Air launched
B	Multiple	Capable of being launched from more than one environment.
C	Coffin	Horizontally stored in a protective enclosure and launched from the ground.
H	Silo Stored	Vertically stored below ground level and launched from the ground.
L	Silo Launched	Vertically stored and launched from below ground level.
M	Mobile	Launched from a ground vehicle or movable platform.
P	Soft Pad	Partially or nonprotected in storage and launched from the ground.
R	Ship	Launched from a surface vessel such as ship, barge, etc.
U	Underwater	Launched from a submarine or other underwater device.

MISSION SYMBOLS

Letter	Title	Description
D	Decoy	Vehicles designed or modified to confuse, deceive, or divert enemy defenses by simulating an attack vehicle.
E	Special Electronic	Vehicles designed or modified with electronic equipment for communications, countermeasures, electronic radiation sounding, or other electronic recording or relay missions.
G	Surface Attack	Vehicles designed to destroy enemy land or sea targets.
I	Intercept-Aerial	Vehicles designed to intercept aerial targets in defensive or offensive roles.
Q	Drone	Vehicles designed for target reconnaissance, or surveillance purposes.
T	Training	Vehicles designed or permanently modified for training purposes.
U	Underwater Attack	Vehicles designed to destroy enemy submarines or other underwater targets or to detonate underwater.
W	Weather	Vehicles designed to observe, record, or relay data pertaining to meteorological phenomena.

VEHICLE TYPE SYMBOLS

Letter	Title	Description
M	Guided Missile	Unmanned, self-propelled vehicles designed to move in a trajectory or flight path all or partially above the earth's surface and whose trajectory or course, while the vehicle is in motion, is capable of being controlled remotely or by homing systems, or by inertial and/or programmed guidance from within. This term does not include space vehicles, space boosters or naval torpedoes, but does include target and reconnaissance drones.
N	Probe	Non-orbital instrumented vehicles not involved in space missions that are used to penetrate the aerospace environment and transmit or report back information.
R	Rocket	Self-propelled vehicles without installed or remote control guidance mechanisms, whose trajectory or flight path cannot be altered after launch. Rocket systems designed for line-of-sight ground fire against ground targets are not included.

Manufacturer's Code Letters

Symbol	Manufacturer	Address
HU	Hughes Tool Co.	Culver City, Calif.
HA	Hughes Aircraft Co.	Culver City, Calif.
KA	Kaman Aircraft Corp.	Bloomfield, Conn.
LD	Lockheed Missiles & Space Co.	Sunnyvale, Calif.
MA	Martin Co.	Baltimore, Md.
MD	Martin Co.	Denver, Col.
MF	Martin Co.	Orlando, Fla.
MG	Martin Co.	Marietta, Ga.
MX	Maxson Electronics Corp.	Great River, L. I., N. Y.
MC	McDonnell Aircraft Co.	St Louis, Mo.
MP	Honeywell	Hopkins, Minn.
MS	Motorola	Scottsdale, Ariz.
NA	North American Aviation, Inc.	Inglewood, Calif.
NH	North American Aviation, Inc.	Columbus, Ohio
NL	Norris Thremador	Los Angeles, Calif.
NV	Northrop Ventura	Van Nuys, Calif.
PP	Philco	Philadelphia, Penn.
RL	Raytheon	Lexington, Mass.
RW	Raytheon	Waltham, Mass.
RY	Ryan Aeronautical Co.	San Diego, Calif.
SU	Sperry Utah Engineering Laboratories	Salt Lake City, Utah
AJ	Aerojet	Sacramento, Calif.
AL	Atlantic Research Corp.	Alexandria, Va.
AB	Army Ballistic Missile Agency	Redstone Arsenal, Ala.
BH	Beech Aircraft Corp.	Wichita, Kans.
BC	Bell Aerosystems Co.	Buffalo, N. Y.
BX	Bendix Corp.	Detroit, Mich.
BY	Bendix Corp.	Michawaha, Ind.
BO	Boeing Co.	Seattle, Wash.
BD	Bridgeport Brass	Riverside, Calif.
BP	Bureau of Naval Weapons	Washington, D. C.
CM	Chrysler Missile Div.	Detroit, Mich.
CN	Chrysler Space Div.	New Orleans, La.
CV	Chance Vought Corp.	Dallas, Tex.
DO	Douglas Aircraft Co., Inc.	Santa Monica, Calif.
FA	Fairchild Stratos Corp.	Hagerstown, Md.
FN	Ford Motor Co. Aeronutronic Div.	Newport Beach, Calif.
FS	Firestone Tire & Rubber Co.	Los Angeles, Calif.
CO	General Dynamics/Convair	San Diego, Calif.
CP	General Dynamics/Pomona	Pomona, Calif.
GP	General Electric	Philadelphia, Penn.
GO	Goodyear Aircraft	Akron, Ohio
GT	Grand Central Aircraft Co.	Tucson, Ariz.
ST	Space Technology Lab	Redondo Beach, Calif.
TH	Thiokol Chemical Corp.	Bristol, Penn.
TX	Texas Instruments, Inc.	Dallas, Tex.
WE	Western Electric Co.	New York, N. Y.

MISSILE SERIES

Current Designation	Former Designation	Popular Name	Service
MGM-1C	TM-61C	Matador	AF
RIM-2A	SAM-N-7	Terrier BW-0	USN
RIM-2B	SAM-N-7	Terrier BW-1	USN
RIM-2C	SAM-N-7	Terrier BT-3	USN
RIM-2D	SAM-N-7	Terrier BT-3A	USN
RIM-2E	SAM-N-7	Terrier HT-3	USN
MIM-3A	M-1	Nike Ajax	USA
AIM-4A	GAR-1D	Falcon	AF
AIM-4B	GAR-2	Falcon	AF
AIM-4C	GAR-2A	Falcon	AF
AIM-4D	GAR-2B	Falcon	AF
AIM-4E	GAR-3A	Falcon	AF
AIM-4F	GAR-4A	Falcon	AF
MGM-5A	M-2	Corporal	USA
RGM-6A	SSM-N-8	Regulus 1	USN
RGM-6B	SSM-N-8A	Regulus 1	USN
BQM-6C	KDU-1	Regulus 1	USN
AIM-7A	AAM-N-2	Sparrow 1	USN
AIM-7B	AAM-N-3	Sparrow 2	USN
AIM-7C	AAM-N-6	Sparrow 3	USN
AIM-7D	AAM-N-6A	Sparrow 3	USN
AIM-7D	AIM-101	Sparrow 3	AF
AIM-7E	AAM-N-6B	Sparrow 3	USN
RIM-8A	SAM-N-6B	Talos (6B)	USN
RIM-8B	SAM-N-6BW	Talos (6BW)	USN
RIM-8C	SAM-N-6B1	Talos (6B1)	USN
RIM-8D	SAM-N-6BW1	Talos (6BW1)	USN
RIM-8E	SAM-N-6C1	Talos (6BC1)	USN
AIM-9A	AAM-N-7	Sidewinder 1	USN
AIM-9B	AAM-N-7	Sidewinder 1A	USN
AIM-9B	GAR-8	Sidewinder 1A	AF
AIM-9C	AAM-N-7	Sidewinder 1C-SAR	USN
AIM-9D	AAM-N-7	Sidewinder 1C-1R	USN
MIM-10A	IM-99A	Bomarc	AF
MIM-10B	IM-99B	Bomarc	AF
PGM-11A	M-8	Redstone	USA
PTM-11B	XM-9	Redstone	USA
AGM-12A	ASM-N-7	Bullpup	USN
AGM-12A	GAM-83	Bullpup	AF
AGM-12B	ASM-N-7A	Bullpup	USN
AGM-12B	GAM-83A	Bullpup	AF
AGM-12C	ASM-N-7B	Bullpup	USN
XAGM-12D	XGAM-83B	Bullpup	AF
AGM-12D	GAM-83B	Bullpup	AF
ATM-12A	ASM-N-7 (Martin-Marietta)	Bullpup Trainer	USN
ATM-12B	ASM-N-7A (Maxson)	Bullpup Trainer	USN
ATM-12D	TGAM-83B	Bullpup Trainer	AF
ATM-12A	TGAM-83	Bullpup Trainer	AF
MGM-13A	TM-76	Mace	AF
YMGM-13B	YTM-76A	Mace	AF
MGM-13B	TM-76A	Mace	AF
YMGM-13C	YTM-76B	Mace	AF
MGM-13C	TM-76B	Mace	AF
MIM-14A	M-6	Nike Hercules	USA
RGM-15A	SSM-N-9	Regulus 2	USN
GQM-15A	KD2U-1	Regulus 2	USN
PGM-16D	SM-65D	Atlas	USAF
PTM-16D	USM-65D	Atlas Trainer	AF
PGM-16E	SM-65E	Atlas	AF
PTM-16E	USM-65E	Atlas Trainer	AF
HGM-16F	SM-65F	Atlas	AF
XPGM-17A	XSM-75	Thor	AF
PGM-17A	SM-75	Thor	AF
PTM-17A	USM-75	Thor Trainer	AF
MGM-18A	M-4	Lacrosse	USA
PGM-19A	SM-78	Jupiter	AF
ADM-20A	GAM-72	Quail	AF
ADM-20B	GAM-72A	Quail	AF
ADM-20C	GAM-72B	Quail	AF
MGM-21A	SS-10	———	USA
AGM-22A	SS-11	———	USA
XMIM-23A	XM-3	Hawk	USA
MIM-23A	M-3	Hawk	USN (MC)
XMTM-23B	XM-16	Hawk	USA
XMTM-23C	XM-18	Hawk	USA
RIM-24A	SAM-N-7	Tartar Basic	USN
RIM-24B	SAM-N-7	Tartar Improved	USN
HGM-25A	SM-68	Titan 1	AF
HTM-25B	USM-68A	Titan 1	AF
XLGM-25C	XSM-68B	Titan 2	AF
LGM-25C	SM-68B	Titan 2	AF
AIM-26A	GAR-11	Falcon	AF
XAIM-26A	XGAR-11	Falcon	AF
AIM-26B	GAR-11A	Falcon	AF
UGM-27A	———	Polaris A1	USN
UGM-27B	———	Polaris A2	USN
UGM-27C	———	Polaris A3	USN
AGM-28A	GAM-77	Hound Dog	AF
AGM-28B	GAM-77A	Hound Dog	AF
XMGM-29A	XM-15	Sergeant	USA
XLGM-30A	XSM-80	Minuteman	AF
LGM-30A	SM-80	Minuteman	AF
LGM-30B	HSM-80A	Minuteman	AF
LGM-30C	HSM-80B	Minuteman	AF
XMGM-31A	XM-14	Pershing	USA
XMTM-31B	XM-19	Pershing	USA
MGM-32A	———	Entac	USA
MQM-33A	OQ-19B	———	USA
MQM-33B	OQ-19D	———	USA
BQM-34A	Q2C	Firebee	AF
BQM-34A	Q2C	Firebee	USN
AQM-34B	KDA-1	Firebee	USN
AQM-34C	KDA-4	Firebee	USN
AQM-35A	Q4A	———	AF
AQM-35B	Q4B	———	AF
MQM-36A	KD2R-5	———	USN
AQM-37A	KD2B-1	———	USN
AQM-38A	RP-76	———	USA
AQM-38B	RP-78	———	USN
MQM-39A	KDB-1	———	AF
MQM-39A	KDB-1	———	USN
XQM-40A	KD6G-2	———	USN
AQM-41A	AUM-N-2	Petrel	USN
MQM-42A	———	Red Head Road Runner	USA
XMIM-43A	———	Redeye	USN (MC)
XMIM-43A	———	Redeye	USA
UUM-44A	———	SUBROC	USN
AGM-45A	ASM-N-10	Shrike	USN
XMIM-46A	———	Mauler	USA
RIM-46A	———	Sea Mauler	USN
XAIM-47A	XGAR-9	Falcon	AF
AIM-47A	GAR-9	Falcon	AF
XAGM-48A	XGAM-87	Skybolt	AF
XLIM-49A	———	Nike Zeus	USA
RIM-50A	SAM-N-8	Typhon (LR)	USN
XMGM-51A	XM-13	Shillelagh	USA
XMGM-52A	———	Lance	USA
AGM-53A	ASM-N-11	Condor	USN
AIM-54A	AAMN-11	Phoenix	USN
RIM-55A	SAM-N-9	Typhon (MR)	USN
PQM-56A	CT-41	———	USN
MQM-57A	VSD-1A	———	USA
MQM-58A	VSD-2	———	USA

ROCKET SERIES

Current Designation	Former Designation	Popular Name	Service
MGR-1A	M-31	Honest John	USA
MGR-1B	M-50	Honest John	USA
MGR-1B	M-50	Honest John	USN (MC)
AIR-2A	MB-1	Genie	AF
AIR-2B	MMB-1	Super Genie	AF
MGR-3A	M-51	Little John	USA
RUR-4A	———	Weapon Alpha	USN
RUR-5A	———	ASROC	USN

PROBE SERIES

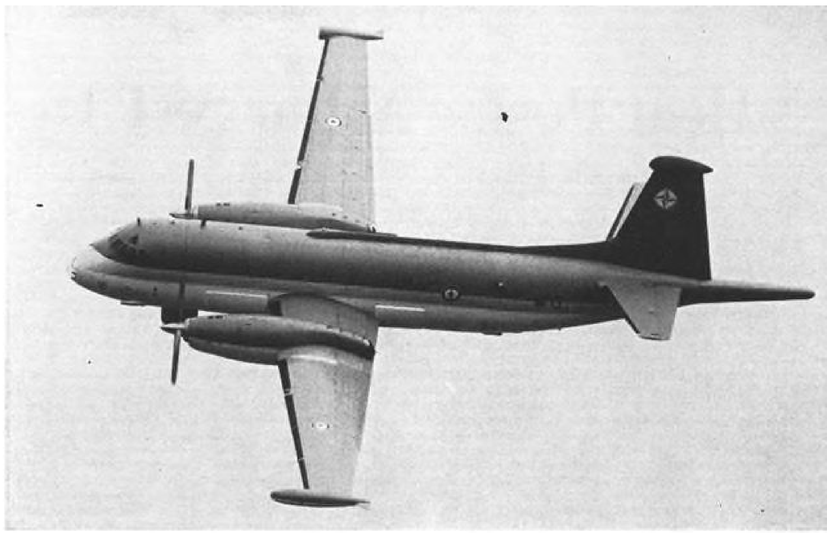
Current Designation	Former Designation	Popular Name	Service
PWN-1A	XRM-82	———	AF
PWN-2A	XRM-84	———	AF
PWN-3A	XRM-85	———	AF
PWN-4A	XRM-86	———	AF
PWN-5A	XRM-88	———	AF



Hughes OH-6A lifts helicopter technology to a new high. Faster, lighter, smaller, easier to maintain, lower cost—this is the modern answer to U.S. Army LOH needs.

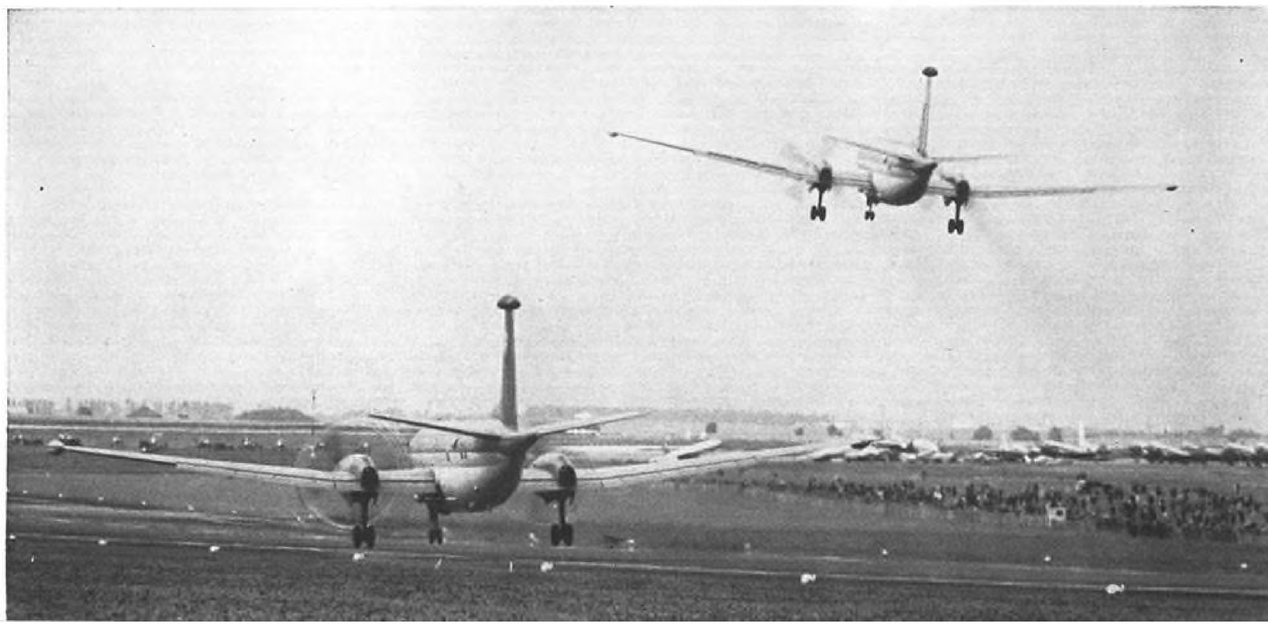
HUGHES TOOL COMPANY, Aircraft Division, Culver City, California

Atlantic's Performance, Avionic Gear Displayed





Both flying prototypes of the Breguet 1150 Atlantic ASW aircraft were flown at the Paris Air Show, demonstrating landing and takeoff, and the operation of various gear, including the retractable belly radome under the cockpit. The aircraft, built under a cooperative North Atlantic Treaty Organization program financed by five nations (AW June 10, p. 72), is powered by two Rolls-Royce Tyne 20 turboprop engines rated at 6,105 eshp. Rolls has supplied engines for the prototype, but later production engines are also to be supplied by France's Hispano Suiza. The third prototype (above) has a clear plastic nose section. Nose on the first prototype (left) resembles a radome, but actually is a tinted plastic bombardier-type window. Both are fitted with MAD detection gear in the tail stinger, and the fairing on top of the fin also houses avionic gear. Both aircraft are shown at Le Bourget Airport (below). Second prototype was lost in a crash last April.



Heat Posing Major SST Design Problems

By James R. Ashlock

Atlantic City—Research now under way toward development of a Mach 3 aircraft is revealing major problems in the areas of fuel, lubricants and nonmetallic components.

Extent of such problems was explained in reports presented here recently to the annual meeting of the American Society for Testing and Materials. In almost every instance, heat was cited as the factor that is causing researchers to seek new designs and materials not yet incorporated in a commercial winged vehicle.

Robert C. Sheard of Wright-Patterson AFB said that wing tank fuel in a Mach 3 transport may heat up to 500F at times, matching the anticipated temperature of the wing skin. This could cause fractions of the fuel, resulting in solid deposits in the tank.

"This viscous residue will accumulate in the tank in successive cycles and be diluted with fresh fuel added to the tank, contributing to fuel degradation and tank and downstream deposits," Sheard said. "Varnish may form in the tank in localized areas which may or may not be a problem."

Large scale fuel system test rig, constructed for North American Aviation by Thompson-Ramo-Wooldridge, Inc., currently is being used to evaluate the reaction of various fuels under simulated supersonic conditions. Initial tests are under the most critical heat conditions, with no fuel tank insulation. This is to determine how well existing fuels will stand up to supersonic conditions.

"We are not asking for the development of a fuel having advanced performance characteristics as is the case with most military advanced development programs," Sheard said. "We are instead looking for the ability to use fuels that are not costly in order that operation of the supersonic transport is economically feasible."

Stressing the importance of holding the price line on fuel, Sheard said the Mach 3 transport may use 25,000 gal. of fuel in a 2½ hr. flight. An increase of one cent in the cost of the fuel represents an additional $100 in hourly operating cost, or $1 million per 10,000 hr., he said.

First tests with the North American Aviation rig will be on one of the better quality fuels currently used on subsonic jets. The fuel has a thermal stability threshold value of 375-475F. Later tests will use more sophisticated fuels with stability values as high as 450-550F.

"This improved quality fuel probably will not be required or tested if the initial fuel is completely satisfactory," he said.

Seeking to adapt existing fuel as much as possible toward supersonic application, future tests will evaluate tank insulation, extensive fuel circulation to lower temperature, and the purging of oxygen from the fuel to discourage fractioning.

Sheard also explained that consideration is being given to using the fuel as a coolant for the engine oil. The oil, he said, it expected to reach 500F and to be in contact with localized areas at 800F.

While fuel in the wing tanks also may reach 500F toward the end of the cruise phase, this fuel is mainly that remaining following the climb segment. Fuel in the main reservoir, within the wing root, should not exceed 225F and would be an effective coolant for the oil.

Attention will be given to circulating the fuel through a heat exchanger to cool the oil, then routing it back to the tank. Heat exchanger temperature should not exceed 325F, Sheard said, and when the fuel is returned to the tank it would be approximately 20 deg. hotter than when the cooling cycle began.

"Whether or not such a technique can be employed in an actual system without undue complications or penalties would have to be established," Sheard said, "and the net result on fuel system deposits would likewise have to be determined."

Sheard said that to purge the fuel of oxygen to discourage degradation, blanketing the fuel with an inert gas such as nitrogen may prove helpful.

"Oxygen has a pronounced effect on the thermal stability," Sheard said. "This suggests fuel treatment to control the available oxygen, although the treatment and handling costs for such an operation may well prove to be prohibitive."

He added that purging the fuel of oxygen, accompanied by blanketing with a gas like nitrogen, has the advantage of protection against explosion due to auto-ignition.

Lubricants pose one of the most frustrating problems in Mach 3 operation, Sheard said, simply because at present there are no suitable lubricants from the technical standpoint.

He acknowledged that the polyphenyl class lubricant (5P4E) has exceptionally good qualities in the 500-600F range, but said that its viscosity was unsatisfactory at low temperatures.

"On the other hand, current high temperature lubricants possessing good low temperature properties, such as MIL-L-9236 fluids, are considered inadequate with respect to their high temperature performance," Sheard said.

The Mach 3 transport's oil, he said, is expected to operate in a range from —30F to 500F bulk temperatures.

Cost of the oil, like that of fuel, also is a concern. In view of the need for development, researchers are assuming that oil for the Mach 3 aircraft will cost $50 a gallon, compared with $3.50 a gallon for oil used on subsonic jets.

Assuming a five gallon oil capacity for each of four engines, and more frequent oil changes due to the severe requirements, the Mach 3 transport's over-all consumption would average approximately 4½ gal. during a 2½ hr. mission—costing $225 per flight.

"When one considers that a one cent per gallon fuel cost increase accounts for $250 in a 2½ hr. mission, it can be seen that oil cost likewise could exert nearly as great an incremental cost increase," Sheard said.

Although hydraulic fluid is subject to the same heat problems as fuel and oil, Sheard said, some fluids exist that show promise for Mach 3 application. These are the highly refined, deep dewaxed paraffinic hydrocarbons and synthetic hydrocarbons, polyphenyl ethers, chlorinated phenyl methyl silicones. While certain of these have shortcomings such as poor lubricity and unsatisfactory low temperature characteristics, they might be improved with additives and better pump designs, he said.

In another area of current research, that of non-metallics, attention is being focused on windows, seals, cabin insulation and tires. Harry E. Hightchew of the Boeing Co. said that materials which provide long service on today's aircraft would fail in days, hours or even minutes at supersonic temperatures.

Hightchew said that the pilot's window, at Mach 3, is expected to heat up to 550F, while passenger window temperature will rise to 450F. The light, cheap acrylic material currently used for most window and canopy applications is suitable to 200F, he said, but tends to shrink above this level. Other plastics able to withstand 300F become too brittle under extended load pressure at temperature.

Hightchew said that the present glass candidates for Mach 3 use are those containing soda lime, borosilicate and aluminosilicate. But the glass itself does not end the problem. Its coatings to provide non-shattering and electrical conduction for deicing also will have to be of improved quality.

"The present day interlayer is polyvinyl butyral, but this material is not usable at temperatures over 160F," he said. "Silicone interlayer materials and proprietary cast-in-place materials show promise of utilization at 350F."

Heat shields, such as those made from monolithic single-unit glass, perhaps will be included in the window structure to absorb and reflect heat. Vacuum deposited metal coatings also can be applied for further reflectivity, Hightchew said, and stannic oxide tested at Mach 2.5 conditions shows promise as a coating of this type.

Seals and sealants are particularly vital for cabin and fuel tank security, and in other areas such as the hydraulic system and pumps. Organic elastomers have been used, but Hightchew says research on such units for Mach 3 has produced discouraging results.

"The chemical makeup of many of the fluids on the Mach 3 transport have not been selected as yet," he said. "This would indicate a program of materials evaluation and design testing as the aircraft approaches the final design stage and some of these decisions are made."

Hightchew said that in subsonic jets, a primary concern so far as passenger welfare is concerned has been heating the interior. But with the Mach 3 aircraft, the reverse is encountered. The Mach 3 transport will require a much greater circulation of interior air to offset the skin temperatures.

"The excess air will have to be dumped overboard, but at supersonic cruise this is a waste of valuable heat sink capacity," he said.

Consequently, consideration is being given to circulating the cabin air through a layer of insulation, possibly glass fiber, between the cabin and the exterior skin.

"By passing the air through the porous wall insulation, the air is heated to a temperature approaching that of the outer skin before it is discharged," Hightchew said. "In this manner a large percentage of the aerodynamic heat is intercepted and carried back overboard.

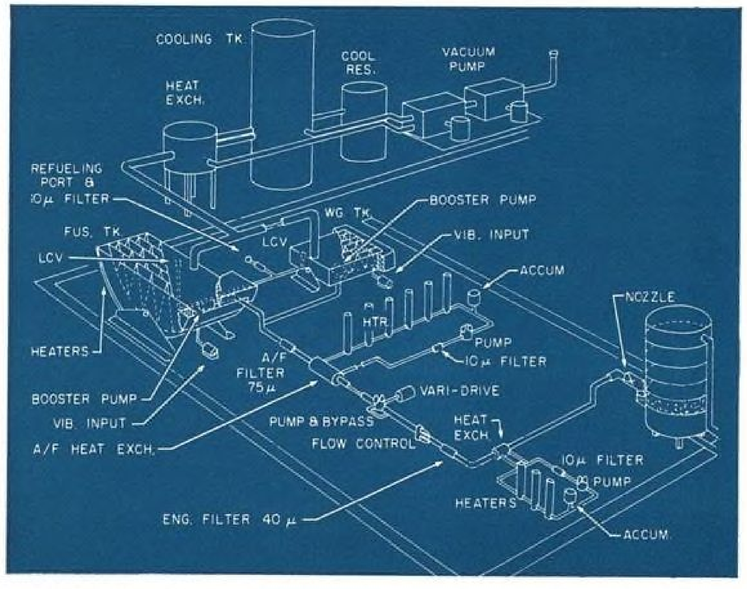
"Testing his shown that the discharge of the waste air can reduce the aerodynamic heat flow to the passenger compartment by as much as 80% at Mach 3," he added.

Aerodynamic heat also is a threat to the Mach 3 transport's tires, which must be protected to prevent expansion and explosion while in retracted position.

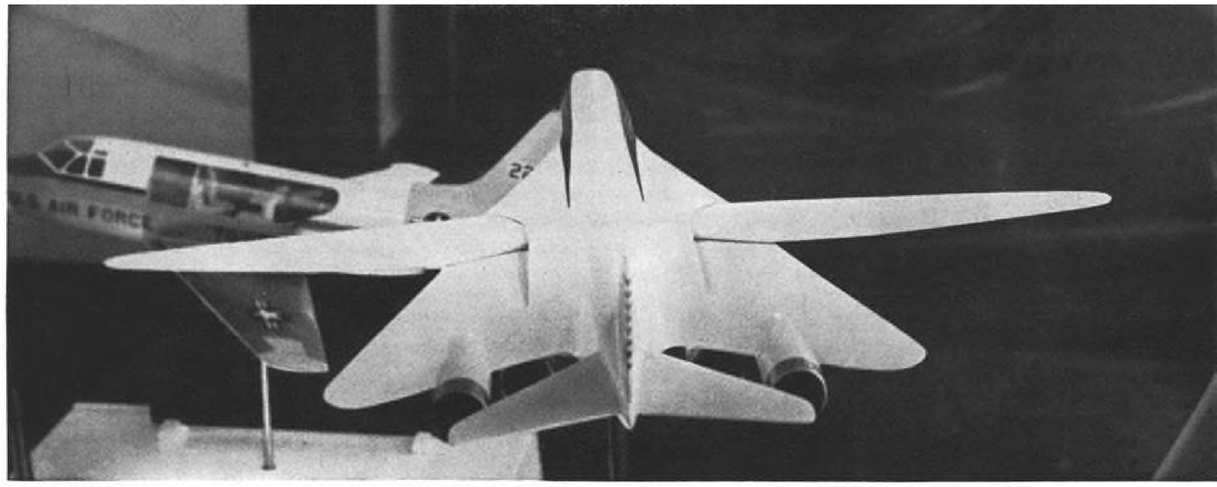
Present aircraft tires are of natural rubber and nylon fabric construction, materials which suffer a lowering of strength when exposed to high temperature and prolonged heat soaking.

"The maximum temperature limit for present day tires is generally considered to be 230F," Hightchew said. "New reinforcing fibers will be able to improve this picture somewhat. However, any prolonged exposure of the tires to elevated temperatures will diminish the life expectancy of the tire."

Ozone, a traditional enemy of elastomers, also could pose threats since the Mach 3 transport will cruise at altitudes approaching the theoretical maximum ozone region, an area of substantial unknowns, Hightchew said.



LARGE-SCALE TEST RIG on which fuels are being tested at North American under conditions representative of supersonic flight environment is shown in schematic.



North American Displays Variable-Geometry SST Design

North American Aviation model of a variable-geometry delta-wing supersonic transport was displayed at the Paris Air Show. In this photo the wing is in the fully extended position. North American also displayed another supersonic transport design at the show with a modified delta wing, canard configuration (AW June 10, p. 55).



JULY 22, 1963

MANNED SPACE FLIGHT ISSUE

• The most important development of this decade, MANNED SPACE FLIGHT, will be the subject of the July 22, 1963 issue of AVIATION WEEK & SPACE TECHNOLOGY. MANNED SPACE FLIGHT, the major segment of the national space program, is planned at $20 billion for a manned lunar landing. The total space budget requested for fiscal 1964 alone is a record $7.3 billion.

AVIATION WEEK & SPACE TECHNOLOGY has established an unmatched reputation for detailed coverage of technical and industry developments on the plans, operations, facilities, budgets, organization and procurement policies of the national space program. Now, a task force of editors will concentrate on both civilian and military manned space projects in an issue devoted entirely to the subject.

Theme of the issue will stress future programs from Project Apollo to manned permanent moon bases, manned orbiting space stations and interplanetary Mars and Venus flights. Editorial highlights will include:

• Major progress report on Project Apollo, its hardware and technical developments.

• Status Report on Project Gemini two-man spacecraft including joint NASA-USAF operations.

• What we learned from Project Mercury and how it built a technical foundation for future manned space flight programs.

• Technical needs of military in manned space flight, including Dyna-Soar, Aerospace Plane, maneuverable re-entry vehicles, inspector and surveillance satellites.

• Russian manned space flight programs and technical progress.

• New types of support operations required for large-scale manned flight including simulators, control centers, transport and assembly facilities, tracking and data transmission equipment, medical and life support.

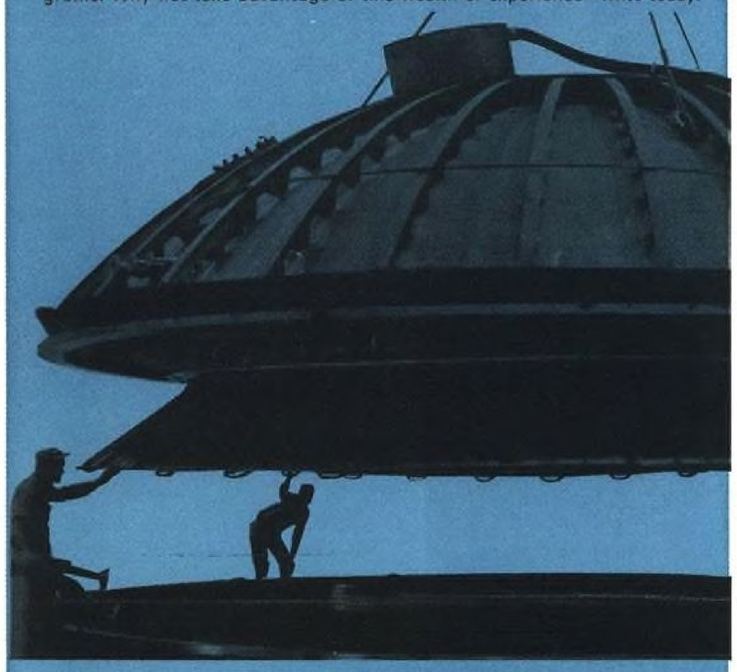
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Putting the lid on a big one

This top head is shown being lowered onto one of the three 39-foot spherical simulation chambers at the recently completed Space Simulation Test Facilities at the General Electric Space Technology Center, Valley Forge, Pennsylvania. CryoVac, a sub-contractor to the F. J. Stokes Corporation, Philadelphia, designed and installed the thermal shrouds, heat sinks—like the one suspended under the lid—cryopumps and associated cryogenic equipment including controls for the facilities. ■ This isn't the first lid we've helped put on a space simulation chamber and it certainly won't be the last. We helped place quite a few. In fact, the cryogenic equipment in many of the simulators now in existence or under construction has been designed and built by CryoVac. ■ CryoVac's experience goes even beyond cryogenic systems however, it includes responsibility for the design, fabrication and erection on many programs. Why not take advantage of this wealth of experience—write today.



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Cost of Air-Delivered Truck Changes Cited

Washington—Army spent ten years in developing an air transportable truck—the M151—but failed to include the key device for air mobility in letting a production contract to Ford Motor Co., according to a report to Congress by the General Accounting Office.

GAO said this resulted in unnecessary modification costs that amounted to $405,000.

The device consisted of a threaded lifting eye mounted at the center of each wheel hub to facilitate air delivery of the truck by parachute and external transport by helicopter.

It was omitted from the original production contract for 4,050 M151 trucks let to Ford in June, 1959, GAO said. It was also omitted from a follow-on contract for 13,124 trucks let in 1961, according to GAO.

This occurred, the agency said, despite these facts:

- **"During the 10-year period** that the M151 vehicle has been under development, the principal military characteristic established with respect to transportability was that it could be air-dropped by parachute and externally transported by helicopter . . ."
- **"The Army had a similar experience** with another vehicle about a year prior to the award of the initial M151 production contract."

GAO said that in February, 1959, four months before the original production contract, Ford had recommended the wheel-lifting device.

Garrett Officers

Board of directors of Garrett Corp. has elected E. A. Bellande as chairman of the board and chief executive officer; Harry H. Wetzel as president, and Walter R. Ramsaur as executive vice president, following the death of J. C. Garrett, founder, chairman and president of the company, late last month (AW July 1, p. 36).

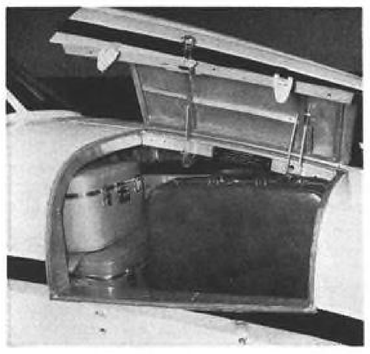
Bellande, former vice chairman of the board, joined Garrett Corp. as assistant to the president in 1943. Prior to joining the company, he spent 15 years as an airline pilot for Transcontinental and Western Air.

Wetzel, former executive vice president, joined Garrett's AiResearch Manufacturing Div. in 1946 as an engineer. He became assistant to the president in 1956, director in 1958 and executive vice president in 1962.

Ramsaur joined Garrett in 1939 and helped form the AiResearch Manufacturing Div. He has served as director and corporate vice president in charge of engineering since 1941.

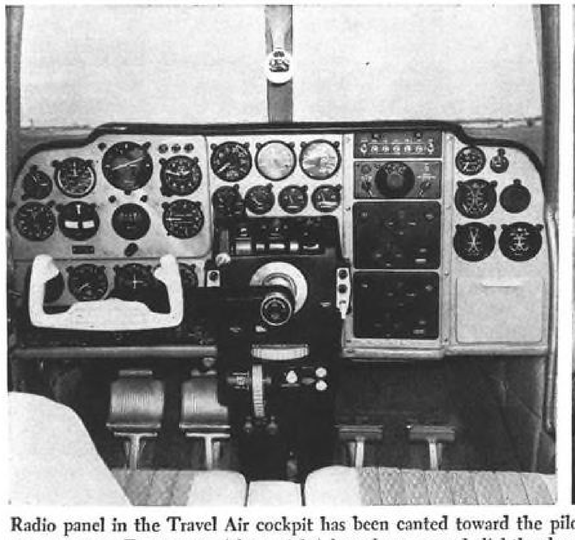


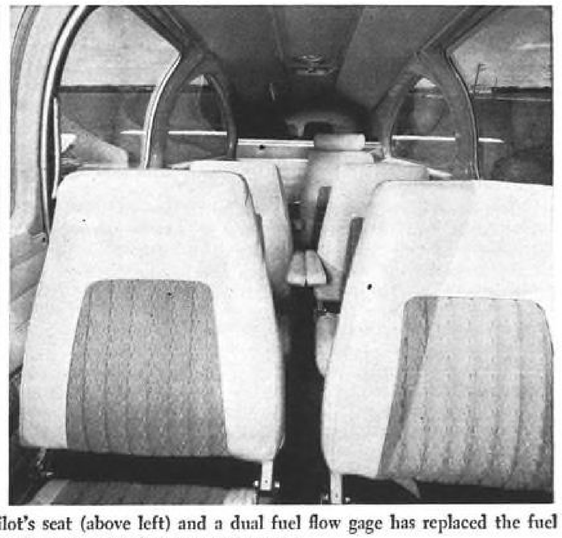
Beech Increases Travel Air Fuel, Baggage Capacity



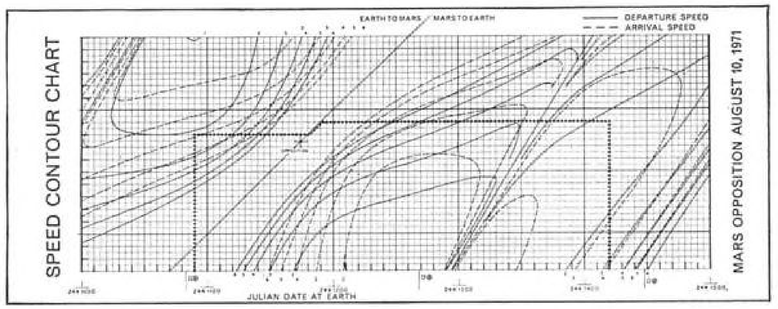
Beech D95A Travel Air light twin has extended nose (right) which moves radio equipment forward and increases baggage area in nose compartment (left) to 19 cu. ft. from 12 cu. ft. Rear baggage area has been increased from 270-lb. capacity to 400 lb. Bendix fuel injection system eliminates need for fuel return lines by lowering fuel pressure to engine. Fuel capacity has been increased from 78 to 80 gal. Optional tanks will increase this to 112 gal. Goodyear 7.00 x 6 ring disc brakes have been added also, as have more powerful 25-amp. generators. Control column has been moved forward 1 in. to increase leg room.







Radio panel in the Travel Air cockpit has been canted toward the pilot's seat (above left) and a dual fuel flow gage has replaced the fuel pressure gage. Front seats, (above right) have been moved slightly closer by narrowing between seat armrest.



At Lockheed Missiles & Space Company, a dedicated team of scientists devotes its entire attention to problems in interplanetary navigation. Of particular interest are problems attendant to the guidance of a manned vehicle to another planet. With many successful accomplishments to their credit (such as the Polaris and various Agena missions), this group faces every new challenge with confidence.

A promising means for manned spacecraft guidance includes taking celestial and planetary optical sightings, feeding that information into an onboard computer, and computing the spacecraft's position and velocity to predict its future course. The computer will then calculate the predicted destination planet error, decide if a correction is necessary, and compute its value. These procedures would be repeated continually until the planet is reached. The optimum timing and magnitude of correction, in view of the information obtained from the observations, is the subject of continuing study.

Even before work on hardware for an interplanetary mission is begun, orbit characteristics must be determined to set the requirements to be built into the spacecraft. An optimum trajectory must be shaped for the specific mission, in order to realize ultimate effectiveness. An outstanding accomplishment by Lockheed scientists is the computation of some 250,000 different orbits to Mars and a similar number to Venus. Each orbit varies as to speed, fuel, departure, arrival, and elapsed time.

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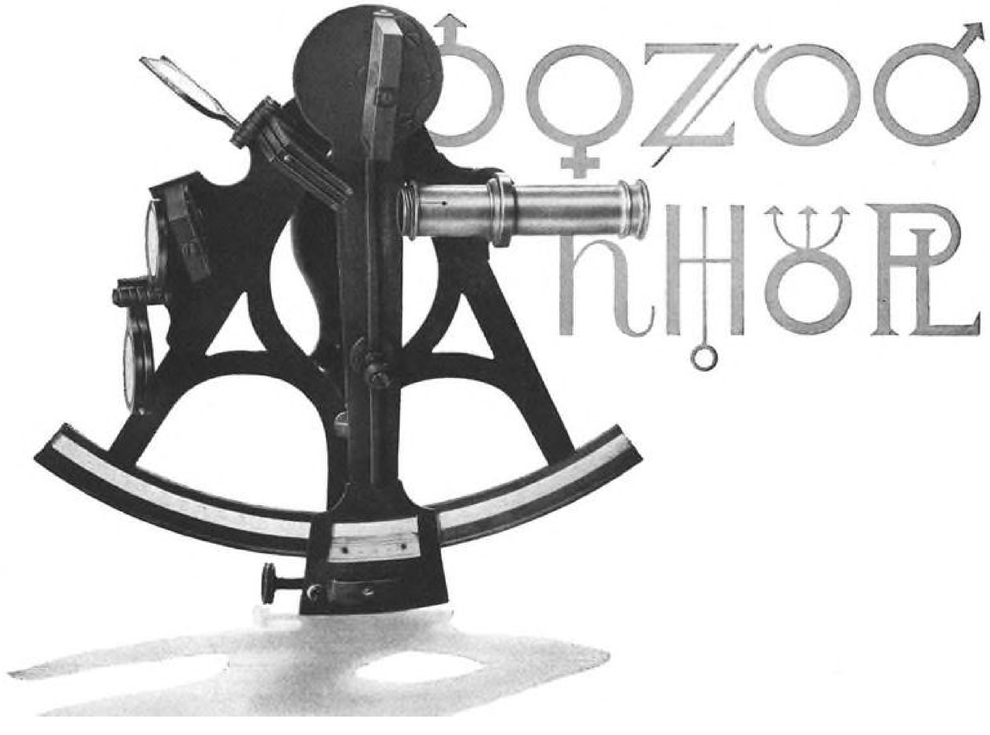
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Post-Apollo Passenger, Cargo Types Seen

Los Angeles—Current trends in National Aeronautics and Space Administration concepts for post-Apollo space vehicles point to two distinct types of configurations—one for transporting passengers, not yet given a program name, and Nova, the more widely publicized study for a freight-carrying vehicle.

H. Herman Koelle, director of future projects, Marshall Space Flight Center, said that the need for such special-purpose vehicles is foreseen for the mid-1970s. Present indications are that large outlays by NASA for development of the vehicles will be made in 1967, based on the assumption that NASA's 1% share of the nation's gross national product will remain at that level.

"We shall have to wait until the Apollo project is over the hump before we have the money to go ahead with these programs," Koelle said. He estimated that development of the smaller passenger-carrying vehicles will cost $2.5 billion and take from six to seven years from go-ahead to production of the first operational model. The much larger Nova-type vehicle probably would require at least seven years and $7 billion for development.

A preliminary target date for delivery of the two types of vehicles is 1975, he said. These two projects represent the major launch vehicle programs likely to be undertaken by NASA in the next decade, he added.

Present design studies indicate that the takeoff weight of the passenger vehicle would be around 1 million lb., while the Nova type would weigh approximately 20 million lb.

One consideration for definitely planning on two distinct vehicles is the desire to distribute future space work among more companies, the NASA official said.

At present NASA is spending about $5 million annually on Nova studies. About $2.5 million per year now is going toward investigation of the passenger concept. NASA is contributing $1 million, and the Air Force the remainder.

Koelle expects spending on these programs to increase slowly in the next few years.

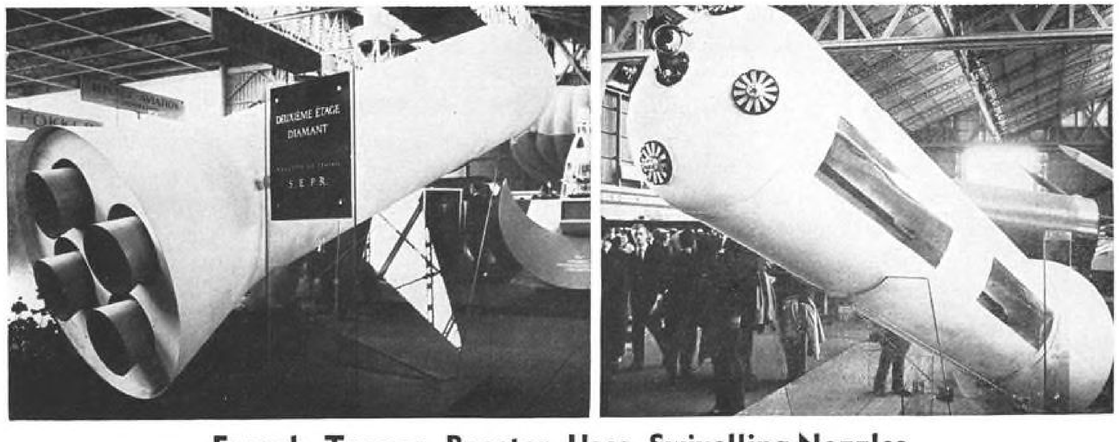
Present thinking is that the passenger vehicle definitely will be a two-stage configuration because of weight considerations, while the Nova vehicle "could be a single stage," Koelle said. He anticipates that the general outline of design direction to be taken on Nova's configuration should be arrived at within one year, while preliminary decisions on the passenger vehicle may take as much as a year longer than that.

Reusability will be an important consideration in determination of the vehicles' design. Adoption of a recoverable concept, Koelle said, will depend on the following three primary considerations:

- **Development of a feasible** recovery scheme for the vehicles, including incorporation of a sufficient low-risk factor.
- **An economic justification** to government officials and Congress for the extra development and construction expense that would be necessary to build a recoverable model.
- **Demand for a sufficient number** of flights to enable realization of the economics that recoverability offers.

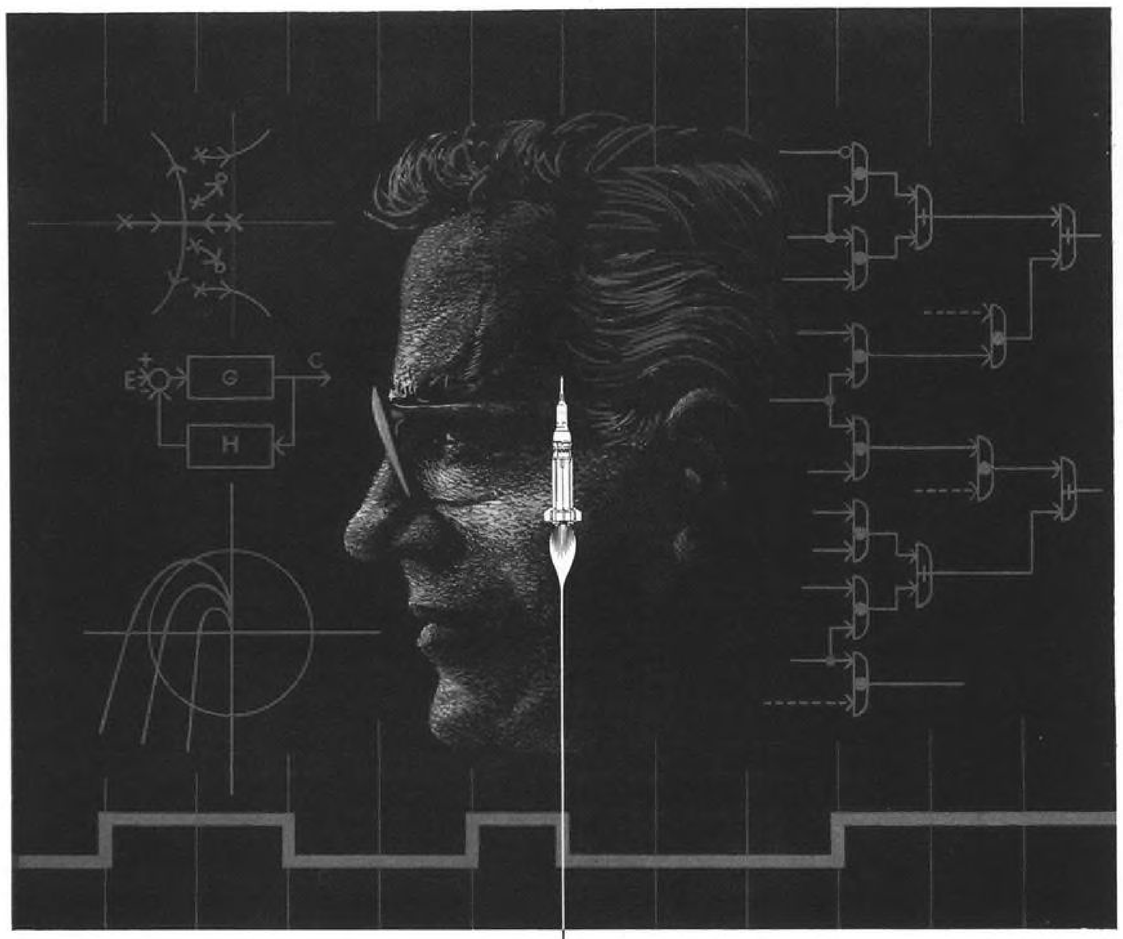
Looking beyond the next decade, Koelle forecasts that by 1980 the U.S. might have an earth-to-moon transport system working, making use of recoverable passenger and freight vehicles. This three-step system would involve a chemically propelled earth surface-to-earth orbit vehicle, a nuclear-powered earth orbit-to-lunar orbit rocket ferry, and another chemically powered lunar orbit-to-lunar surface transport. He estimates that such a system could reduce to $3 million the cost of transporting one man to the moon and back, compared with the $30 million per round trip with the Apollo.

Concerning modes of recovery, Koelle is leaning towards fixed wings and retrorockets for passenger vehicles, and braking rockets and parachutes for Nova-type trucks. He estimates that a 5-10% weight penalty would have to be paid for heavier construction demanded by a vehicle designed for reusability.



French Topaze Booster Uses Swivelling Nozzles

Topaze solid-propellant second-stage for France's Diamant satellite launcher (AW June 17, p. 26) has been developed by SEPR to fit a basic design established by SEREB, the French industry consortium. Rear view of Topaze, left, shows four swivelling nozzles which will be employed for thrust direction and control. The second stage will remain essentially the same for the planned second-generation Diamant, which will have a substantially greater over-all thrust rating. Present first stage, using a liquid fuel mixture, will be replaced by a solid-propellant unit. Solid-propelled third stage also will be redesigned.



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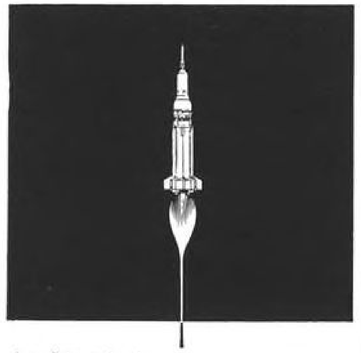
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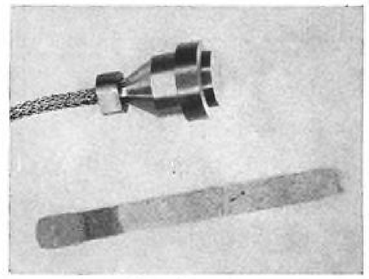
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Transducer, type PT 3C-B1, converts pressure-induced strains to an electrical output through a bridge circuit connected to solid state elements bonded to a pressure sensing diaphragm.

Unit is designed to aid in wind tunnel research and hydraulic instrumentation. Transducer operates over ambient temperatures from −65 to +300F and withstands overpressures of 150% without recalibration and minimum burst pressures of 300% manufacturer says. Device is supplied with a transducer driver which can be located up to 500 ft. from transducer.

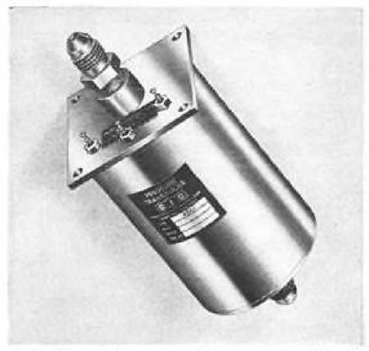


Driver is run from any unregulated 28 v.d.c. source and provides compensation for temperature, static and transient fluctuations present. Transducer weighs less than .3 oz. and is available in ranges from 0−50 to 0−5000 psia. or sealed gage.

Micro Systems, Inc., 170 N. Daisy Ave., Pasadena, Calif.

Pressure Transducer

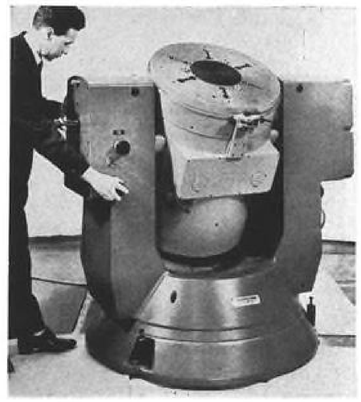
Transducer transmits fluid pressures of 0−2 to 0−200 lb. directly to an oil-filled diaphragm. The Model 4500 is designed for use with corrosive fluids such as jet fuel and liquid petroleum. Unit operates in temperatures from −55C to +85C, withstands shocks of 50gs and is linear to 0.3%.



Computer Instruments Corp., 92 Madison Ave., Hempstead, L. I., N. Y.

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The table can be equipped to test one or two degrees of freedom-floated integrating gyros of the four and eight pole magnetic suspension type.

Accelerometers are tested by tilting the table so they sense part of the earth's gravity. Guidance platforms are tested by using the table as a positioning fixture and an earth's rate isolation device.

J. W. Fecker Div. of American Optical, 4709 Baum Blvd., Pittsburgh 13, Pa.

High-Temperature Vibration Transducer

Linear vibration transducer monitors vibration of aircraft turbine engines.



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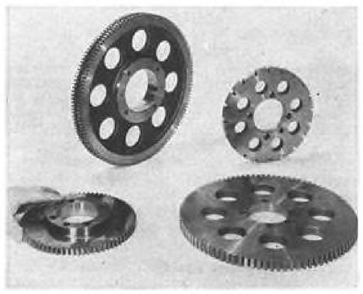
−65F to +700F. Unit is a permanent magnet voltage generator which uses a seismic mass moving inside a cylinder wound with a coil as its sensing mechanism. Transducer weighs 6 oz.

Consolidated Electrodynamics Corp., 360 Sierra Madre Villa, Pasadena, Calif.

Precision Index Plates

Red Ring precision index plates will space accurately 0.0001 in. tooth-to-tooth and 0.0003 in. cumulatively.

Index plates are made in split tooth, single-tooth plain and hub types with



20 or 30 deg. angular teeth, straight teeth or a combination of both. The split-tooth type uses one row of teeth as means for movement from one index position to the next by a pawl arrangement. The other row of teeth serves as the position lock for the index pin.

Plates are steel forged, heat treated to 62-64 Rockwell C scale hardness.

National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich.

Cryogenic Thermometer

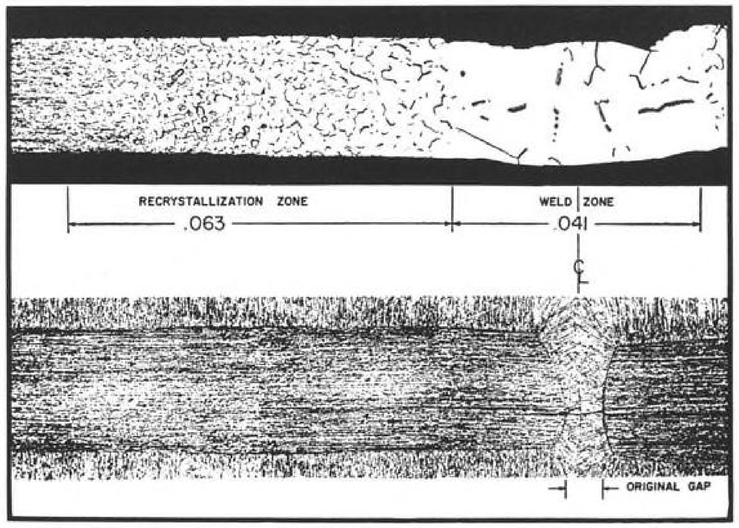
Cryogenic thermistor thermometer with ½ x 8 in. sensing probe measures temperatures from 76-91K, ±0.05K with ±0.01K meter sensitivity.



Probe is inserted in material to be measured and meter is adjusted to zero by a potentiometer.

Temperatures are read directly in digital form on the potentiometer face. Thermometer case size is 6 x 9 x 5 in.

Numec Instruments and Controls Corporation, Apollo, Pa.



MICROPHOTOGRAPH SHOWS DIFFERENCE between electron beam welded tungsten joint (top) and Martin-Orlando's thermal-chemical reduction joint (bottom). Note recrystallization in top weld where tungsten was melted and resolidified after cooling. Thermo-chemical weld avoids this.

Refractory Metal Weld Developed

Orlando, Fla.—Bonding technique developed by Martin-Orlando for refractory metals such as tungsten and titanium holds promise for easier joining of these materials and possibly their greater use in aerospace structures.

Refractory metals have certain properties which make their use in space structures desirable—their strength-to-weight ratios are good, even under elevated temperatures; their wear resistance is high and they generally are radiation resistant. However, the advantage of strength is a disadvantage during the manufacturing sequence. Refractory metals do not readily lend themselves to forming and it is difficult to weld pieces without weakening the base metal.

Four Criteria

Martin-Orlando's Material Laboratories Dept., under Saul R. Locke, has done some extensive work on a metal vapor-type of bonding, called thermo-chemical reduction, which is said to fill the four criteria of an "ideal" joint:

- **Base metal** remains unaffected by the process, which operates at temperatures well below its melting point.
- **Bond of the filler material** is metallurgically sound; there is no sharp interface between base metal and filler.
- **Strength** tends to be uniform in the joint area.
- **Filler material** possesses the same grain structure as the base metal.

Basically, thermo-chemical reduction involves the vapor-deposit of a filler material identical to the type of metal to be joined. Upon cooling, the bond formed is ionic, not mechanical.

Working stock used by Martin-Orlando in experiments was 6 x 36-in. wide sheets of .02-in. thin tungsten, from which .5 x .5-in. sample specimens were cut by hot-shearing. Surfaces to be welded, preparatory to butt and lap welds, were ground and polished.

Specimens were mounted on a solid molybdenum-tungsten alloy heater block and pre-heated by conduction through an electric arc applied to the opposite end of the block from the mounting. Pre-heat temperature was about 1,200F, well below tungsten's normal melting point of 6,100F.

Filler material was a gaseous mixture of tungsten hexafluoride and hydrogen in a ratio of 1 to 5. Gas was applied to the heated specimens through a double nozzle—resembling a wishbone—with the flow directed at an angle across the joint of the specimens.

Cooling Period

In the heated environment, the tungsten hexafluoride and hydrogen combined to form hydrogen fluoride. Pure tungsten was deposited on the joint. Inert atmosphere was maintained by argon in the reduction chamber during the approximate 5-min. process. Cooling period lasted about 30 min.

Advantages of the process, Locke says, are that the grain structure of the deposited tungsten filler is almost identical with that of the specimens and that the specimens experience no degradation, through localized heating, in the area of the joint.



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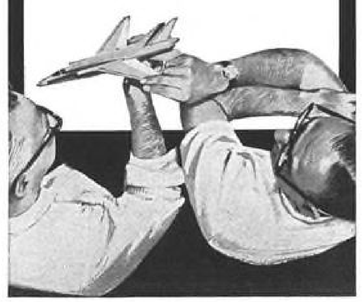
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CAB Accident Investigation Report

Elevator Trim Suspected in Lodestar Crash

On Sept. 4, 1962, at 2100 EDT, a Lockheed Lodestar, N 1000F, owned and operated by Ashland Oil & Refining Co., Ashland, Ky., lost its right wing in flight, crashed and burned in a field near Lake Milton, Ohio, seven-tenths of a mile south of Ohio State Highway Route 18.

The pilot and copilot of the aircraft and 11 passengers perished. The aircraft was destroyed by fire after impact.

The Board determines that the probable cause of this accident was a malfunction of the electric elevator trim tab unit which resulted in aircraft uncontrollability and subsequent structural failure of the wing.

Investigation

At approximately 1822 EDT[1], the pilot of N 1000F, a Lockheed Lodestar, owned and operated by Ashland Oil & Refining Co., called Buffalo Flight Service Station and filed a flight plan in accordance with Instrument Flight Rules (IFR) from Buffalo to Ashland, Ky. The proposed route of flight was from Buffalo via airways to York, Ohio, then direct to Ashland. The cruising altitude was 8,000 ft. The flight plan listed a crew of 2 and 11 passengers. The pilot requested and received the current weather for Buffalo, Erie, Cleveland, Parkersburg, Knoxville, Louisville, Lexington, and Huntington, and the winds aloft for Buffalo and Pittsburgh.

The gross weight of the aircraft was computed to be 19,300 lb., which was below the maximum allowable takeoff weight for the aircraft. Its center of gravity was within allowable limits.

The aircraft's crew consisted of Capt. Arthur Blaine Berkstresser and Copilot Ronald D. Roberts.

At approximately 1951, N 1000F contacted the Buffalo Tower for taxi instructions and was cleared to runway 13, and shortly thereafter the flight was cleared for takeoff. N 1000F departed Buffalo at 1959.

The flight operated routinely to the vicinity of Youngstown, Ohio. It reported over Youngstown at 2051 at 8,000 ft., estimating arrival over the Briggs Very High Frequency Omnidirectional Range (VOR) at 2109. When the aircraft failed to report over Briggs, numerous attempts were made to establish communications with negative results.

N 1000F had crashed and burned at 2100. The time of the accident was established by an electrical power interruption which was caused by the aircraft's flying debris. The pilot, copilot, and 11 passengers were killed.

The components of the aircraft that were shed in flight fell nearly in a straight line on a magnetic heading of 260 deg. to the main impact site. The portion of wreckage located farthest from the main wreckage site was the outboard 20 ft. of the right wing, which was recovered from Lake Milton, 200 ft. from the west shore and ¾ of a mile from the main wreckage site. An examination of the wing panel revealed that the failure and separation resulted from a negative airload—the separation being downward and rearward.

Two flap roller supports and a small piece of flap rib were found 500 ft. from the location of the right wing toward the main wreckage site. It was established that these parts were from the right wing. No evidence of in-flight shedding from other areas of the aircraft was found. The aircraft, minus the right outer wing panel, struck the ground at a high velocity in an inverted, 85-deg. nosedown attitude, penetrating the hard soil to a depth of approximately 8 ft.

Impact damage and the fire that followed resulted in almost complete disintegration of the aircraft. Fragments were found as far as 300 ft. from the crater with a concentration of pieces to the southwest.

Inverted Attitude

The engines and accessories were found with the main wreckage. The relative position of the landing gear and engines with respect to the left wing indicated that the aircraft struck the ground in an inverted attitude. The high velocity of the aircraft at impact was indicated by the high degree of engine disintegration. The engine nose accessory and supercharger casings were fragmented at impact.

The right and left propellers were separated from their engines and their hubs were broken open. Shim plate markings showed that the right propeller blade setting was approximately 30 deg. at impact. The left propeller shim plates could not be used to determine the blade setting because of extensive impact damage. The right propeller dome index ring was found at a position which indicated a pitch setting of 18 deg. The left propeller dome index ring was found at a pitch setting of 22 deg., 4 deg. off low pitch setting.

Although a considerable amount of the control system assemblies were heavily damaged by impact and subsequent fire, examination of those parts of the systems remaining, with the exception of the elevator system, did not reveal any indication of faulty operation prior to impact. The elevator trim drive and both manual elevator trim cable drums were found in a position that corresponds to an aircraft full nosedown setting. Rudder and aileron trim systems were found in the neutral trim position.

A review of the weather reports indicates that the Youngstown, Ohio, weather, 20 naut. mi. northeast of the crash site, at the time of the accident was: measured 2,000-ft. ceiling, broken clouds with higher broken clouds. The visibility was five miles in haze, the temperature 70 deg., with a dewpoint of 65 deg., and the surface wind was calm. The Akron, Ohio, weather, 23 naut. mi. west of the crash site, at the time of the accident was: high scattered cloud cover, visibility five miles, ground fog, temperature 69 deg., with a dewpoint of 67 deg. The surface wind was from the west at 3 kt.

The weather radar at Akron, Ohio, displayed no significant weather echoes in the vicinity of the accident site for a period of 15 min. before and after the crash of N 1000F. The pilot of an aircraft who traversed the area approximately two hours before the accident indicated the weather was clear. Witnesses reported the sighting of aircraft passing through the area and the observation of stars in the sky.

The separated right wing panel was examined and found to be free of corrosion and fatigue in the break area extending approximately 4 ft. spanwise and the area adjacent thereto. All breaks were the result of loading beyond the ultimate strength of the material. The separation of the wing in a negative direction was revealed by the tensile failure of the upper chord member of the main spar, the top skin, the corrugated top skin stiffener panel, and the local compressive buckling of the lower wing surface stringers.

Unwanted Trim

An examination of the record of a sister ship, N 1000W, indicated that unwanted elevator trim in a positive G direction had occurred on one occasion. This aircraft had a Spartan electric longitudinal trim system identical to that of N 1000F. In examining the installation in N 1000W and from data secured in the operation of the trim system, it was established that neutral to full nosedown trim required 5¼ sec., while neutral to full noseup trim required 7¼ sec. The trim tab travel was found to be 25 deg. in each direction. It was possible to stop the rotation of the trim wheel with the right hand and also roll it gradually against the clutch and motor direction by a manipulation of the fingers. The deactivation switch for the electric trim is located on the instrument panel to the right of the pilot's control wheel. The switch is of a toggle lever type. Power to the electric trim actuator is turned off by a "down" position of this switch allowing manual control of the trim system.

It was found from Lockheed data that the positive design limit load factor was 3.125, while the negative design limit load factor was −0.95 at a designed gross weight of 18,500 lb. N 1000F, however, was recertificated to a new gross weight of 19,605 lb. and a landing weight of 18,500 lb. The increase in gross weight lowers these design limit load factors by 5.5% at maximum gross weight. While the actual gross

[1]All times herein are Eastern Daylight based on the 24-hour clock.

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weight of N 1000F at the time of the accident is not known, it was computed to be 18,783 lb.

N 1000F was southwest bound on Victor Airway 43 (NE-SW). This airway intersects with Victor Airway 30 (E-W) near the accident site. Because of the proximity of the accident site to the intersection of these airways, and certain witness statements, the possibility of a collision avoidance maneuver resulting in a pilot induced negative loading of the wing was investigated. An extensive search produced some evidence of air traffic in the area at the time of the accident; but none, however, which might have conflicted with N 1000F.

Analysis and Conclusion

It is determined from the investigation that the aircraft was loaded within allowable weight limits; that the crew and the aircraft were properly certificated; that the aircraft was properly maintained; that there was no in-flight fire; that there was no evidence of an in-flight strike with a foreign object; that the weather was not a factor; and that the presence of conflicting air traffic is not supported by available evidence.

The negative failure of the right wing panel and the full nosedown trim indication appear to be interrelated. The electric longitudinal trim system installed in N 1000F would require large control column forces to override unwanted elevator trim. The amount of force would be approximately 30 lb. per degree of aircraft nosedown trim with the aircraft near maximum gross weight, with an aft center of gravity position and a true airspeed of 170 kt. At an airspeed of 220 kt. the override force would be approximately 50 lb. for each degree of aircraft nosedown trim. The rate at which this elevator tab moves, if unchecked, is approximately 5 deg. per second, requiring about 5.5 sec. from the neutral position to its full aircraft nosedown setting of 25 deg.

Relating control column force to time, a pilot would be required to exert a force of approximately 150 lb. to override the first second of unwanted nosedown trim when the aircraft is cruising at a true airspeed of 170 kt. At the end of two seconds the override force would approximately double.

If, prior to the subject accident, longitudinal trim was applied to N 1000F in a nosedown direction, either intentionally or inadvertently, and at this time a runaway trim condition developed, the pilot's reaction would probably have been to resist the nose heaviness of the aircraft with the control column or by reversing trim or both. The time involved in any corrective action would have to be within slightly over one second, since in this interval of time the control forces would have reached the limit of human capabilities. If it is assumed that this occurred before the trim could be deactivated there would follow an abrupt downward pitching of the aircraft. At cruising or higher speeds this could induce loads beyond the design limits of the surface involved.

For N 1000F, the time from unwanted nosedown trim initiation to catastrophic failure of the right wing panel was probably a matter of a very few seconds; therefore, the aircraft would be near its cruise altitude of 8,000 ft. at the time of wing failure. The initial downward pitch acceleration might have incapacitated the crew but the gyrations which followed immediately after the loss of this wing would be more likely to do so. The latter gyration would probably be a roll to the right while in a steeply descending nosedown attitude and would produce a general deviation to the right of the proposed flightpath as indicated by the wreckage distribution.

The Board determines that the probable cause of this accident was a malfunction of the electric elevator trim tab unit which resulted in aircraft uncontrollability and subsequent structural failure of the wing.

Recommendations

As a result of a recommendation made by the Board to the Federal Aviation Agency, an order for immediate deactivation of Spartan electric longitudinal trim systems in L-18 aircraft was issued by that Agency. This order was followed by a modification of S.T.C. SA2-183 which now requires a driving motor rated at 0.12 hp. at 4,000 rpm. as opposed to the original motor which produced 0.167 hp. and operated at 8,500 rpm. In addition, this modification limits the travel limits of the elevator trim tab to 5 deg. nosedown trim and 10 deg. noseup. All L-18 aircraft, in order to utilize the Spartan electric longitudinal trim system, must now comply with the provisions of this modification.

By the Civil Aeronautics Board:

Alan S. Boyd, Chairman; Robert T. Murphy, Vice Chairman; Chan Gurney, Member; G. Joseph Minetti, Member; Whitney Gillilland, Member.

Investigation

The Civil Aeronautics Board was notified of this accident at approximately 0827 EDT, Sept. 5, 1962, and an investigation was initiated in accordance with the provisions of Title VII of the Federal Aviation Act of 1958, as amended.

Aircraft Owner

Lockheed Lodestar N 1000F was owned by Ashland Oil & Refining Co., Ashland, Ky.

Air Crew

Arthur B. Berkstresser, age 49, was employed by Ashland Oil & Refining Co. on Jan. 16, 1949, as Chief Pilot and had accumulated a total of approximately 13,250 hr. of flight time. He held currently effective multiengine land airline transport certificate No. 222186 which was issued to him on Feb. 23, 1951, with an appropriate rating for the type of aircraft involved. Records indicate that he was issued a first-class medical certificate on Aug. 7, 1962, with a "correcting glasses" limitation.

Ronald D. Roberts, age 31, was employed by Ashland Oil & Refining Co. on June 1, 1960, and had accumulated approximately 1,000 hr. of flight time. He held currently effective commercial pilot certificate No. 1386274 issued Oct. 8, 1958, with airplane single-engine land and instrument rating.

Records indicate that he was issued a first-class medical certificate on Feb. 1, 1962, which contained no waivers or limitations.

The Aircraft

Lockheed Lodestar N 1000F Model 18, manufacturer's serial number 2463 was owned and operated by Ashland Oil & Refining Co., 1409 Winchester Ave., Ashland, Ky. Total time on the aircraft was 6557:44 hr. The last periodic inspection was accomplished on Apr. 26, 1962, by the Spartan Aircraft Co., Tulsa, Okla. The aircraft had accumulated 401:10 hr. in service for the twelve-month period prior to the last periodic check.

The aircraft was equipped with two Wright Model 1820-87 engines and the propellers were Hamilton Standard model 23E50-473 with DWG 6339-A-12 blades.



New Soviet Turbine Helicopter Shown

Russian twin-turbine powered helicopter, the Mi-2, shown above in hover flight, is a development of the Mil Mi-1 piston engined helicopter. V-2 carries eight passengers and one-man crew. Dimensions are similar to the Mi-1: length about 39 ft. and rotor diameter about 48.5 ft. Soviets recently claimed a speed record of 164.1 mph. (264 km. per hr.) over a 62.14 mi. (100 km) course with the V-2.

WHO'S WHERE

(Continued from page 15)

Honors and Elections

C. Towner French, manager of government relations for P. R. Mallory Co., has been elected president of the Institute of Navigation.

Dr. James Hillier, vice president of RCA Laboratories, has been installed as president of Industrial Research Institute, Inc.

Dr. Robert E. Marshak, chairman of the University of Rochester Department of Physics and Astronomy, has been named chairman of the National Academy of Sciences' Advisory Committee for Eastern Europe.

Changes

Wayne T. Wilcox, Jr., assistant to the vice president, Arinc Research Corp., Washington, D. C., a subsidiary of Aeronautical Radio, Inc.

Dr. Martin H. Bloom, technical assistant to the president, General Applied Science Laboratories, Inc., Westbury, N. Y.

B. J. Smith, assistant to the vice president for advanced technology programs, Rocketdyne's Solid Rocket Div., McGregor, Tex. Rocketdyne is a division of North American Aviation, Inc.

Vincent F. Acri, director of marketing, Sperry Phoenix Co., Phoenix, Ariz., division of Sperry Rand Corp. Also: **Thomas W. Cooley,** head of commercial marketing programs; **William W. Mapes,** manager of sales-military and government agencies.

John J. McKenna, manager of service engineering, Aero-Space Div., Walter Kidde & Company, Inc., Belleville, N. J.

Nicholas M. Voorhies, general manager-Washington, D. C., for The Martin Co.

Charles G. Leonhardt, general manager, Powertron Corp., Plainview, N. Y., a subsidiary of Giannini Controls Corp.

L. M. Miller, program manager-LEM (Lunar Excursion Module), Rocketdyne, a division of North American Aviation, Inc., Canoga Park, Calif. Also: **Harold Oquist,** assistant program manager; **F. A. Jennings,** project engineer.

Soren C. Ibsen, radar marketing manager, United Aircraft Corp.'s Norden Div., Norwalk, Conn., and **W. Robert Knapp,** guidance and control marketing manager.

Dr. Iwao Adachi, technical director, Pacific Optical Corp., a division of Chicago Aerial Industries, Inc., Barrington, Ill.

Alexander F. Brewer, director-product line management, Marketing Organization, Space Technology Laboratories, Inc., Redondo Beach, Calif.

Thomas J. Curtis, sales manager, Bomac Div. of Varian Associates, Beverly, Mass.

Daniel J. Rice, manager-underseas electronics marketing, Motorola's Chicago (Ill.) Military Electronics Center.

F. X. Marshall, Centaur program coordination and scheduling, General Dynamics/Astronautics, San Diego, Calif.

Gerard W. Elverum, Jr., associate director of the Propulsion Laboratory of Space Technology Laboratories, Redondo Beach, Calif., a subsidiary of Thompson Ramo Wooldridge.

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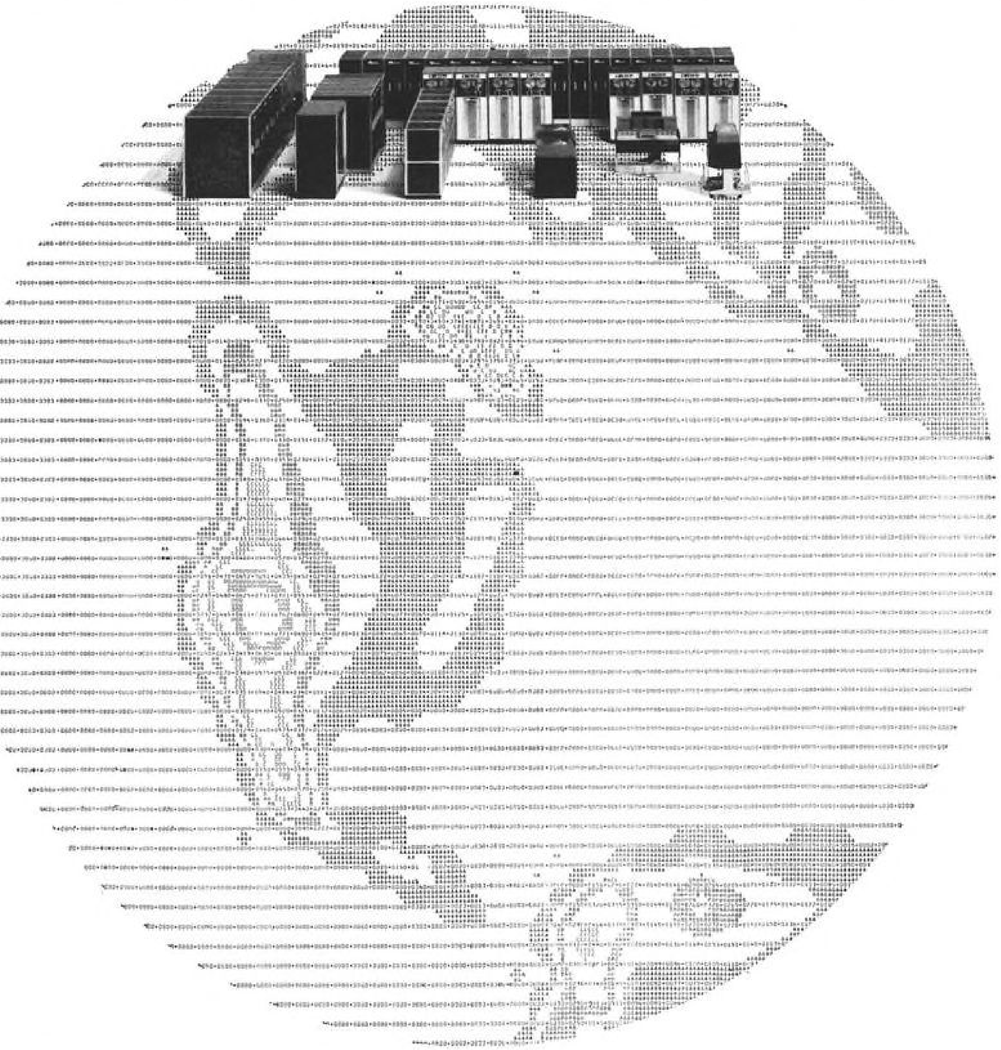
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SPACE AND INFORMATION SYSTEMS DIVISION
North American Aviation

LETTERS

Rand Report

In regard to the Rand Corp. report published in the Management Section of June 10 issue of AVIATION WEEK AND SPACE TECHNOLOGY (p. 135), I can find no fault with the conclusions of Rand, but I do find that certain of the data from which these conclusions are drawn appear to be in gross error.

The report states, "Development of large ramjet engines, too, was regarded as well within the state of the art, although difficulty with the Navaho program later showed otherwise." I have recently had occasion to review some of the Navaho ramjet reports and I have unearthed the following data:

1. At the time of the Navaho weapon system cancellation, the ramjet program was considered to be successful and was on schedule.
2. The XRJ47-W-5 engine successfully completed PFRT in August, 1956, demonstrating its readiness for flight test.
3. During all flights of the missile in which the rocket first stage achieved sufficient boost Mach number and altitude (four out of nine attempts), the ramjet ignited successfully, in spite of light-up outside the specification ignition envelope, and provided satisfactory thrust.
4. In no case was flight test termination attributed to ramjet failure. The longest flight lasted more than 42 min., covered more than 1,000 mi. and was terminated due to autonavigation and autopilot malfunctioning while attempting a 180-deg. turn.

The Rand report later states, ". . . it was fortunate indeed that the Navaho had a rocket booster associated with it." This is certainly true, as the Navaho added immeasurably to the development of large rockets and their guidance systems.

DONALD SCHILDKRAUT
Missile and Space Propulsion Dept.
Wright Aeronautical Div.
Curtiss-Wright Corp.
Wood-Ridge, N. J.

NASA Spending

The message contained in Robert Hotz's June 3 editorial "More Space Debate," which favored "highly selective pruning" of the National Aeronautics and Space Administration's Fiscal 1964 budget, literally struck home this week.

Our local newspaper on June 10 carried a long article stating that NASA has approved a $117,562 grant "for an intensive, two-year study of the impact of space and space-related activities on the economy of Boulder." Formal title of this project is apparently what makes it worth $117,562 instead of ten cents: "A socio-economic analysis of the effects of the expansion of space and space-related technological activities on selected communities."

Professors at Colorado University and Colorado State University, together with an appropriate number of "consultants" and graduate students struggling to learn the intricacies of Keynesian economics, will do the paper shuffling.

It strikes me that any connection between a strong American space program and this $117,562 boondoggle must be extremely tenuous. On the other hand, it does illustrate the strength of the tie that binds the flock of New Frontier professors now woolgathering in government agencies with their colleagues who still man the Ivory Towers.

Main "impact" of this project upon the city of Boulder (population 40-50,000) should be obvious to anyone. It will noticeably fatten the wallets of the economics professors and flatten those of the taxpayers.

As Mr. Hotz says in his editorial, "Congress must cut the NASA Fiscal 1964 budget to convince its constituents that it is exercising prudent control over their tax dollars, as well as to discourage any government agency from anticipating a blank check for all of its desires or whims."

When Congress gets around to separating government agencies' needs from their whims, it ought to begin by relieving NASA of such Sisyphean labors as Project Boulder.

BOULDER TAXPAYER

Seaboard Pilots

The pilots of Seaboard World Airlines, Inc., thank you for publishing our series of letters opposing airline capacity restrictions culminating in the printing of our latest in the May 13 issue (p. 134) under the caption "Capacity Rejoinder."

I note, however, in this latter case, the omission of the word "pilots" from the asterisked note that has followed each letter: "Financed and directed solely by Seaboard pilots for the purpose of developing and expanding the airline industry." This typographical omission scrambles the meaning of the second paragraph of the main text, which Mr. Olsen seemed to view (AW Jan. 21, p. 136) as an issue.

Lest any confusion arise, may I quote the sponsors' charge to this committee: "To monitor and act upon legislative and regulatory affairs bearing upon the interests of all airline pilots *impartially and without regard to company affiliation.*"*

We stand squarely opposed to any kind of restrictionism against anyone because it's inevitably a two-way street that winds up road-blocked altogether in both directions. It's small comfort to stand immobilized on one side of the barrier in the certainty that your share is now equal to that of the other.

Thank you again for your presentation of our views.

*Emphasis supplied.

FLOYD S. BENJAMIN, Chairman
Committee on Legislation
Seaboard World Pilots

Payload Loss

The Letters in your April 29 issue (p. 110) had a letter from Wallace L. Brown asking why no one has developed a crash locator beacon. I can tell him why!

In 1945 I made up a working model of exactly such a device and ran tests on it. Since this was BT (before transistors) the weight was seven pounds.

The government agency expressed no interest at all. One airline sent a representative to discuss the device with me. He admitted that it could be useful. However, he stated that his company had no interest in installing such a device unless forced to do so by the government. The reason: such an addition would represent the loss of seven pounds of payload. I threw the package away in disgust. To date I have seen no indication of any change in the thinking of the airlines!

I remember seeing, a few years later, a newspaper item that such a device was being installed in the CAP planes of some western state.

F. H. AMES, JR.
Rawlings, Md.

F-4B Icing

Your pictures of the heavy ice accretions on the Navy's F-4B aircraft (AW June 10, p. 159) may leave the impression that ice created by the Aeronautical Systems Div. is much heavier than that provided by Mother Nature. In this case, it is true, since Navy requested that ASD "over-ice" the fin section to severely test the heaters designed to overcome a known icing problem. The heaters performed well.

For normal icing work, a much smaller drop size and lower accretion rate are used, giving a more realistic formation than that shown in your pictures. In fact, conditions can actually be controlled to give the coverage and rate of build-up desired.

This type of flight testing conducted by ASD is typical of inter-service testing with the Army and FAA, as well as Navy. Icing work has been conducted at high speeds using a KC-135 tanker and at low speeds for helicopters, using a C-123 carrying tankage equipment.

E. T. BINCKLEY
Flight Test Engineering
Aeronautical Systems Div.
Air Force Systems Command
Wright-Patterson AFB, Ohio

Wrong Plane

Being one of the largest custodians of A4 type aircraft on the West Coast, I was shocked and surprised to open your latest publication (AW June 17) only to find a gross error on p. 39.

The gross error referred to is that the "Shrike" installation as shown in the photo marked "Shrike Mounting on Skyhawk Shown" is not on a Skyhawk as advertised but on a North American FJ-4B (old designation) which is easily read under the starboard horizontal stabilizer.

Although this capability may be in the mill for our little sky chariots, a revision in this case might be appropriate.

J. P. FLICK
Lt., USN
Attack Squadron 125
NAS Lemoore, Calif.

(Lt. Flick is correct. The aircraft with the Shrike installed under the wing is the AF-1E [new designation].—Ed.)

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Cascaded Resolver Systems

SIZE 8 FEEDBACK WINDING RESOLVERS

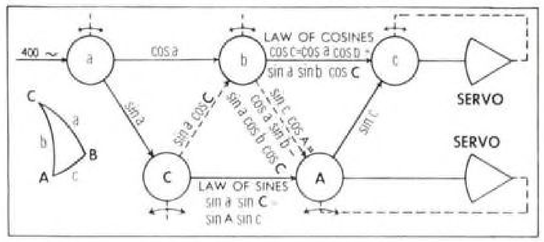


These resolvers are designed for use with transistorized "booster" amplifiers in cascaded chains.

Chains of precision size 8 winding compensated resolvers accurately solve the trigonometry of coordinate translation, rotation and conversion.

A chain of five resolvers is typically employed to solve for an unknown side and angle of oblique spherical triangles.

Individual resolvers exhibit functional errors of less than 0.1% and axis perpendicularity errors of ±5′ max. In combination with the proper amplifier, the closed loop phase shift is 0.00° ±0.01° and the transformation ratio is 1.0000 ±.0005. The residual null voltage is 1 mv/v max. over a range of 10V, 400~.



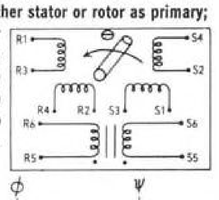
SIZE 11 "BOOSTERLESS" RESOLVERS FOR SERVICE IN REVERSIBLE CHAINS

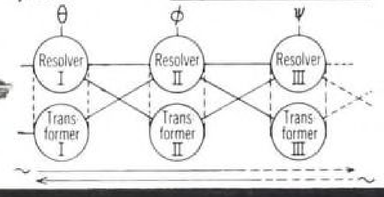




The frame of these size 11 computing resolvers also houses a matching transformer which simulates a pair of resolver windings at maximum coupling. In a reversible chain of alternately interconnected resolvers (only partially diagrammed), the excitation may be applied to either end of the chain and the outputs taken from the other end.

Quick disconnect allows ease in harnessing. Accuracy: ±5′ of arc or less; winding perp. ±5′. Electrical characteristics: Input to EITHER rotor or stator. Input voltage 115v 1600 ~; output voltage 110v with either stator or rotor as primary; phase shift (stator primary) 1.1°; phase shift (rotor primary) 1.9°; Zso (nom.) 990 + j13500; Zro (nom.) 1150 + j13500.





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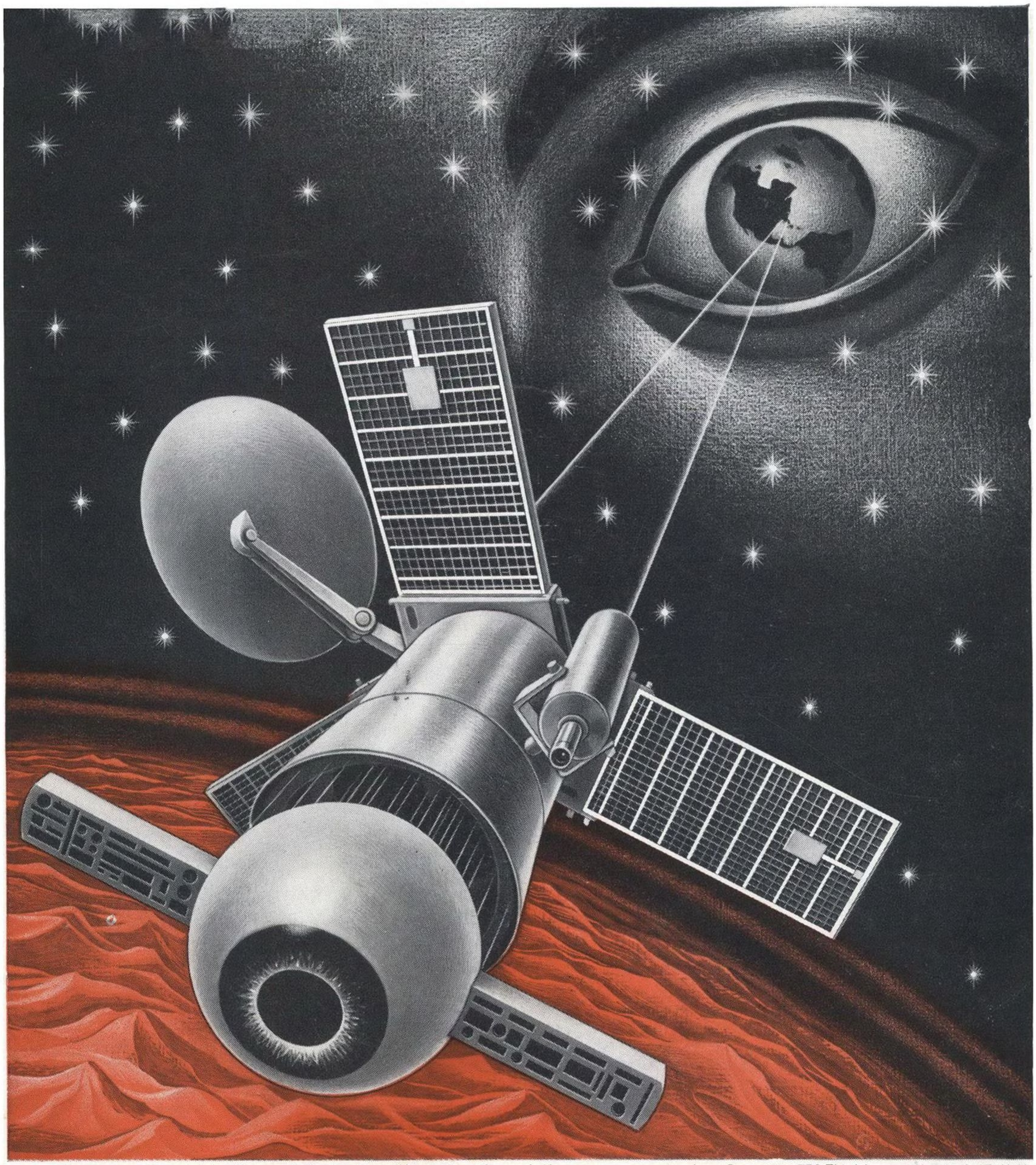
These units have been trimmed to provide zero phase shift and compensated for transformation ratio stability, under temperature, when working into their iterative impedance.

Accuracy: Functional error .1% or less; winding perp. ±5′. Electrical characteristics: Input voltage (stator) 40v900 ~; output voltage (rotor) 33.2v; phase shift 0; max. null voltage 1 mv/v.

Also ready for delivery is an equivalent, compatible pancake resolver. By its use, differential information from an inertial platform may be obtained and introduced into the system.

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