

Aviation Week & Space Technology

75 Cents

A McGraw-Hill Publication

December 10, 1962

**727 Aimed At
All-Weather
Capability**

Boeing 727 Rollout



SPECIAL REPORT:

Army Program Tests Bell UH-1B at High Speeds

60 CPS REF. & EVENT

Honeywell test instrumentation records structural soundness of missiles

System records 112 test parameters simultaneously

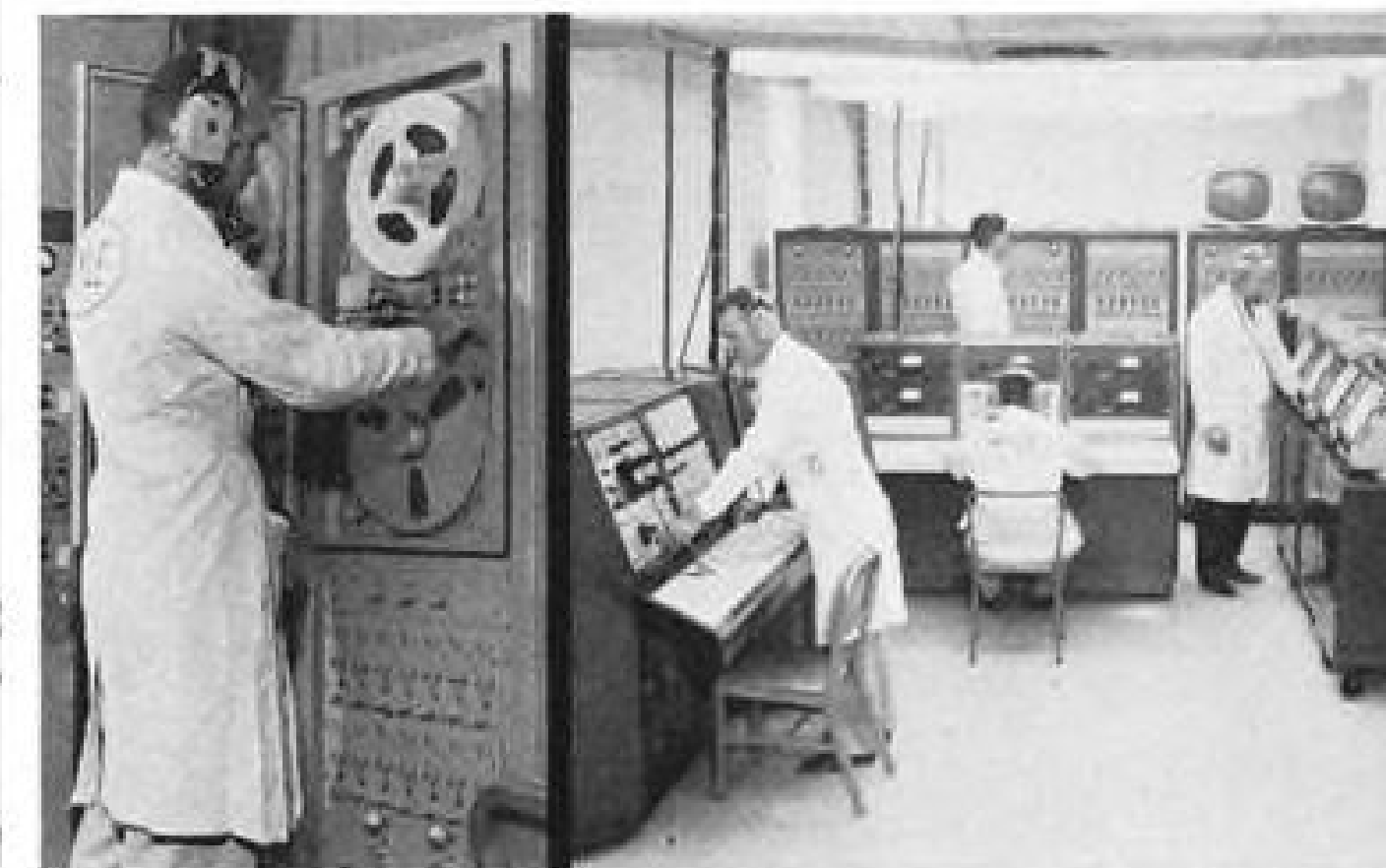
Wyle Laboratory, at its Norco, California, facility, tests the structural soundness of Minuteman, Polaris, and Skybolt missile stages under transportation conditions with a battery of four multiplexed Model 1012 Visicorder oscillographs. The total Wyle-Honeywell system at the three Wyle test sites includes eight 1012 Visicorders, 84 Accudata III amplifiers, and a 14 channel FM tape system.

The Wyle test site uses Wyle hydrashaker systems of about 100,000 force pounds, mounted on million pound concrete reaction blocks . . . the only installation of its magnitude in the country. The hydrashaker exciters introduce vibration into the missiles comparable to those encountered during transportation prior to launching.

The specimen record shows data recorded from accelerometers on the third stage of a missile at the locations marked on the record.

The fidelity, contrast, and easy readability of all Honeywell Visicorder records is vividly shown in this record. Where traces are numerous and of this complexity or greater, the trace-identifier interruptions, occurring at regular intervals along the time base of the record, make it easy to identify the individual traces.

For details about Honeywell Signal-Conditioning equipment, the Model 1012, and other Visicorder oscillographs, and the LAR 7400 FM Tape Sub-system write Minneapolis-Honeywell, Heiland Division, 4800 E. Dry Creek Road, P.O. Box 8776, Denver 10, Colorado. Telephone DDD Area Code 303-794-4311.



The Honeywell LAR 7400 FM tape system stores 14 channels of data

A battery of multiplexed Model 1012 Visicorders directly records 112 parameters of information

Honeywell
First in Control

20 CPS 20"/SEC



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For complete technical data on Silastic and sources for parts write Dow Corning Corporation, Midland, Michigan, Dept. 0912.



Dow Corning

AEROSPACE CALENDAR

- Dec. 17—First National Conference on the Utilization of Retired Military Personnel, Sheraton Park Hotel, Washington, D.C. Co-sponsors: Department of Labor; Air Force Assn.
- Dec. 17-20—International Arms Control Symposium, University of Michigan, Ann Arbor, Mich. Co-sponsors: University of Michigan; Bendix Systems Division.
- Dec. 26-31—Space Physics Meeting, American Rocket Society and American Assn. for Advancement of Science, Philadelphia, Pa.
- Dec. 27—American Astronautical Society Symposium on Scientific Satellites-Mission and Design, Franklin Hall, Philadelphia, Pa.
- Jan. 7-10—Millimeter and Submillimeter Conference, Institute of Radio Engineers, Cherry Plaza Hotel, Orlando, Fla.
- Jan. 13-16—15th Annual Convention, Helicopter Assn. of America, Cabana Motor Hotel, Palo Alto, Calif.
- Jan. 14-18—Automotive Engineering Congress and Exposition, Society of Automotive Engineers, Cobo Hall, Detroit, Mich.
- Jan. 15-17—Ninth Annual Meeting, American Astronautical Society, Statler Hilton Hotel, Los Angeles, Calif.
- Jan. 21-23—31st Annual Meeting (including Wright Brothers Lecture), Institute of the Aerospace Sciences, Hotel Astor, New York, N. Y.
- Jan. 21-24—43rd Annual Meeting, American Meteorological Society, New York, N. Y.
- Jan. 22-24—Ninth National Symposium on

(Continued on page 7)

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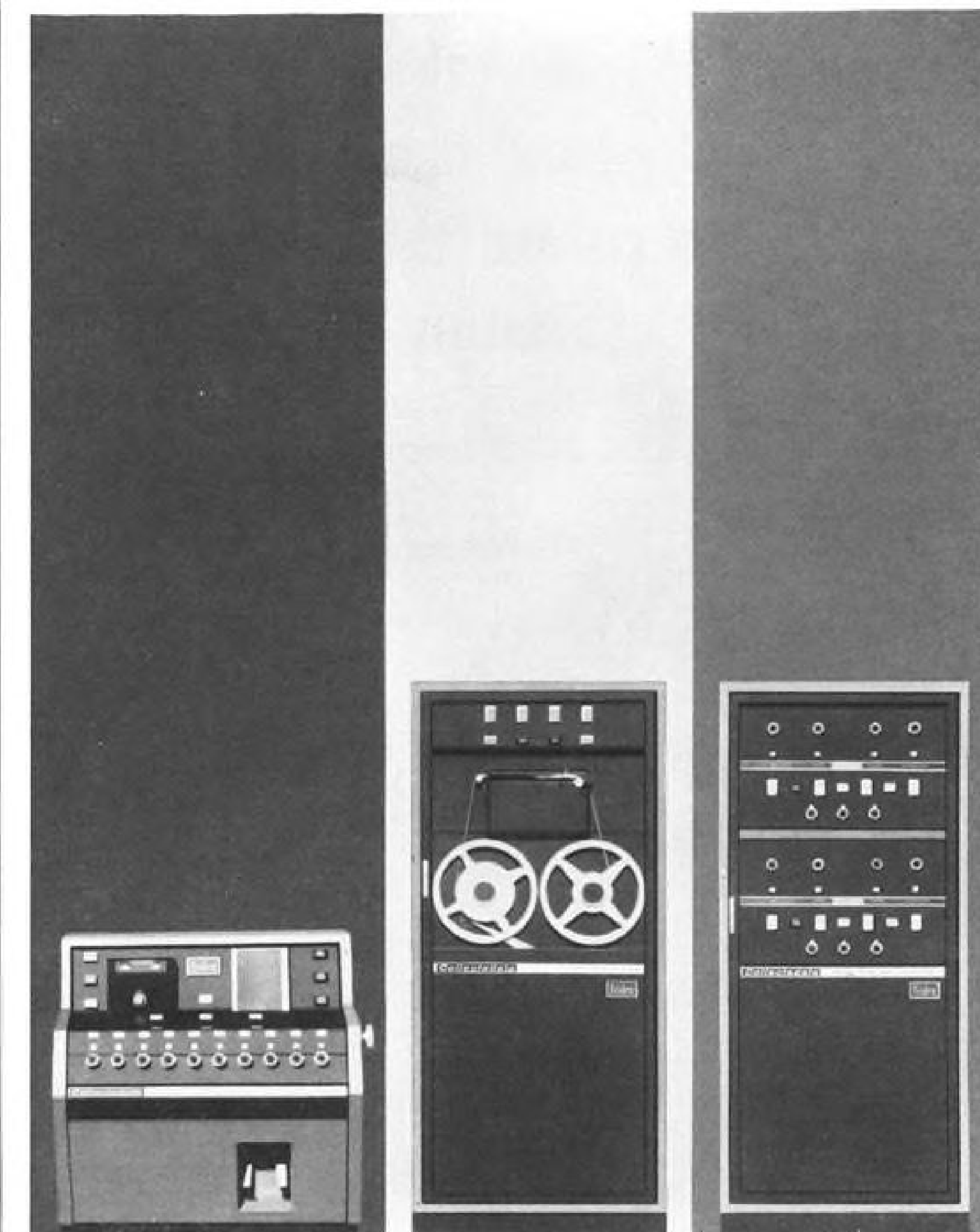
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Collectadata: how to collect data without collecting mistakes

Data collection, the laborious business of "keeping track," is vital to efficient plant operation. The ideal way to collect data is to use a system whereby the men recording data virtually cannot make mistakes. Add speed to accuracy and you have the perfect data collection system.

Such a system is now available from Friden. It's the new Model 30 Collectadata System: a series of transmitting units connected to a central receiver. Workers dial reports instead of writing them.

The Model 30 Collectadata has the most elaborate in-machine and operator checks of any data collection system you can name. Each dial is checked; the worker's identification is checked; and the input card itself is checked. Only if all three have been used properly, can the message go through.

The Collectadata Model 30 gives

totally accurate data—automatically. Another new feature: The system can be changed from collecting data to taking attendance. Men can check in or out on the new Friden Badge Reader almost as fast as they can walk by the machine. Further, the controls are tamper-proof.

By many standards, this is the most advanced, most reliable data collection system available. Get the full story by calling your local Friden Systems man. Or write: Friden, Inc., San Leandro, California.

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hydraulic muscle
to rotate this wing
through 90°



It takes
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safety

The tilting wing is one design approach to VTOL (vertical take-off and landing) capability. There are others, but one factor they all have in common is heavy reliance on hydraulic power for the transition from vertical to horizontal flight and back again.

Tilting engines, ducted fans, free fans, oversize flaps, thrust deflectors, separate lift engines, or various combinations of these elements all involve unprecedented extensions of the hydraulic system. Because they are so extensive, the systems often must operate close to "hot spots."

There's the environmental situation. On the one hand: more tubing, more actuators, more connections where leaks could develop. On the other: proximity to heat sources.

Given these operating conditions, the specification almost writes itself: Fire-resistant Skydrol for the hydraulic systems of V/STOL aircraft.



MONSANTO CHEMICAL COMPANY
Organic Chemicals Division, St. Louis 66, Mo.

AEROSPACE CALENDAR

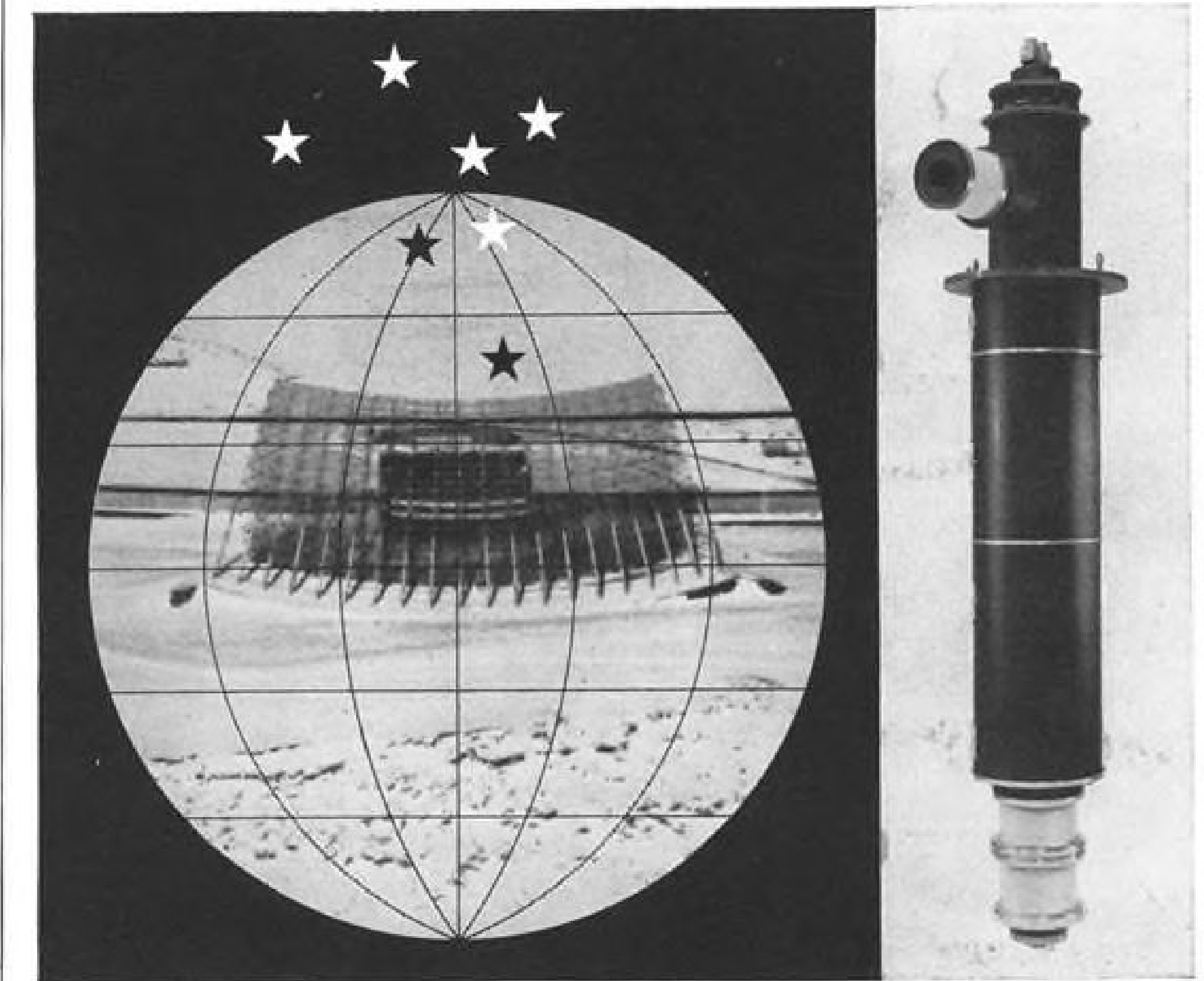
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- Reliability and Quality Control, Sheraton-Palace Hotel, San Francisco, Calif.
- Jan. 28—Fifth Annual Army Aviation Contract Services Symposium, International Inn, Washington, D. C. Sponsor: National Aeronautical Services Assn.
- Jan. 30-Feb. 1—Fourth Annual Solid Propellant Rocket Conference, American Rocket Society, Bellevue Stratford Hotel and The Franklin Institute, Philadelphia.
- Jan. 30-Feb. 1—National Winter Convention on Military Electronics, Institute of Radio Engineers, Ambassador Hotel, Los Angeles, Calif.
- Feb. 5-6—Symposium on Engineering for Major Scientific Programs, Georgia Institute of Technology, Atlanta, Ga.
- Feb. 5-7—Advances in Metalworking Seminar, American Society of Tool and Manufacturing Engineers, Park Sheraton Hotel, New York, N. Y.
- Feb. 6-7—59th Meeting, National Aerospace Standards Committee of the Aerospace Industries Assn., Ambassador Hotel, Los Angeles, Calif.
- Feb. 11-15—Third International Symposium on Quantum Electronics, UNESCO Building, Paris, France. Sponsors: International Scientific Radio Union; Office of Naval Research; La Federation Nationale Des Industries Electroniques.
- Feb. 12-13—Space Vehicle Thermal and Atmosphere Control Symposium, conducted by the Aeronautical Systems Division, Engineers Club, Dayton, Ohio. Sponsor: ASD's Flight Accessories Laboratory.
- Feb. 15-Apr. 14—International Aeronautics and Space Fair, Congresses and Competitions, Ibirapuera Park, Sao Paulo, Brazil. Sponsor: Santos Dumont Foundation.
- Feb. 20-22—1963 International Solid-State Circuits Conference, Philadelphia, Pa. Sponsors: Institute of Radio Engineers; American Institute of Electrical Engineers; University of Pennsylvania.
- Mar. 7-8—Propulsion Meeting, Institute of the Aerospace Sciences, Cleveland, Ohio.
- Mar. 11-13—Electric Propulsion Conference, American Rocket Society, Broadmoor Hotel, Colorado Springs, Colo.
- Mar. 18-20—Space Flight Testing Conference, American Rocket Society and Institute of the Aerospace Sciences, Cocoa Beach, Fla.
- Mar. 18-21—1963 Western Metal Exposition and Congress, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles.
- Mar. 19-21—Second Air Force-sponsored Symposium on Bionics, Biltmore Hotel, Dayton, Ohio.
- Mar. 25-28—International Convention, Institute of Radio Engineers, Waldorf-Astoria and Coliseum, New York, N. Y.
- Apr. 1-3—Fourth Annual Structures and Materials Conference, American Rocket Society and Institute of the Aerospace Sciences, El Mirado Hotel, Palm Springs.
- Apr. 2-3—Eighth Annual Business Aircraft Safety Seminar, Flight Safety Foundation, Barbizon Plaza, New York, N. Y.
- Apr. 2-5—Spring Conference, Airport Operators Council, Shoreham Hotel, Washington, D. C.

(Continued on page 9)

Giant klystrons, which are providing megawatts of peak power for space radar systems, are part of the extensive line of Litton microwave tubes and display devices. San Carlos, California. In Europe, Box 110, Zurich 50, Switzerland.

LITTON INDUSTRIES
ELECTRON TUBE DIVISION



PROBLEMATICAL RECREATIONS 148



Arrange the digits 0 through 9 in fractional form so that:

$$\frac{xx.xxx}{xx.xxx} = 9.$$

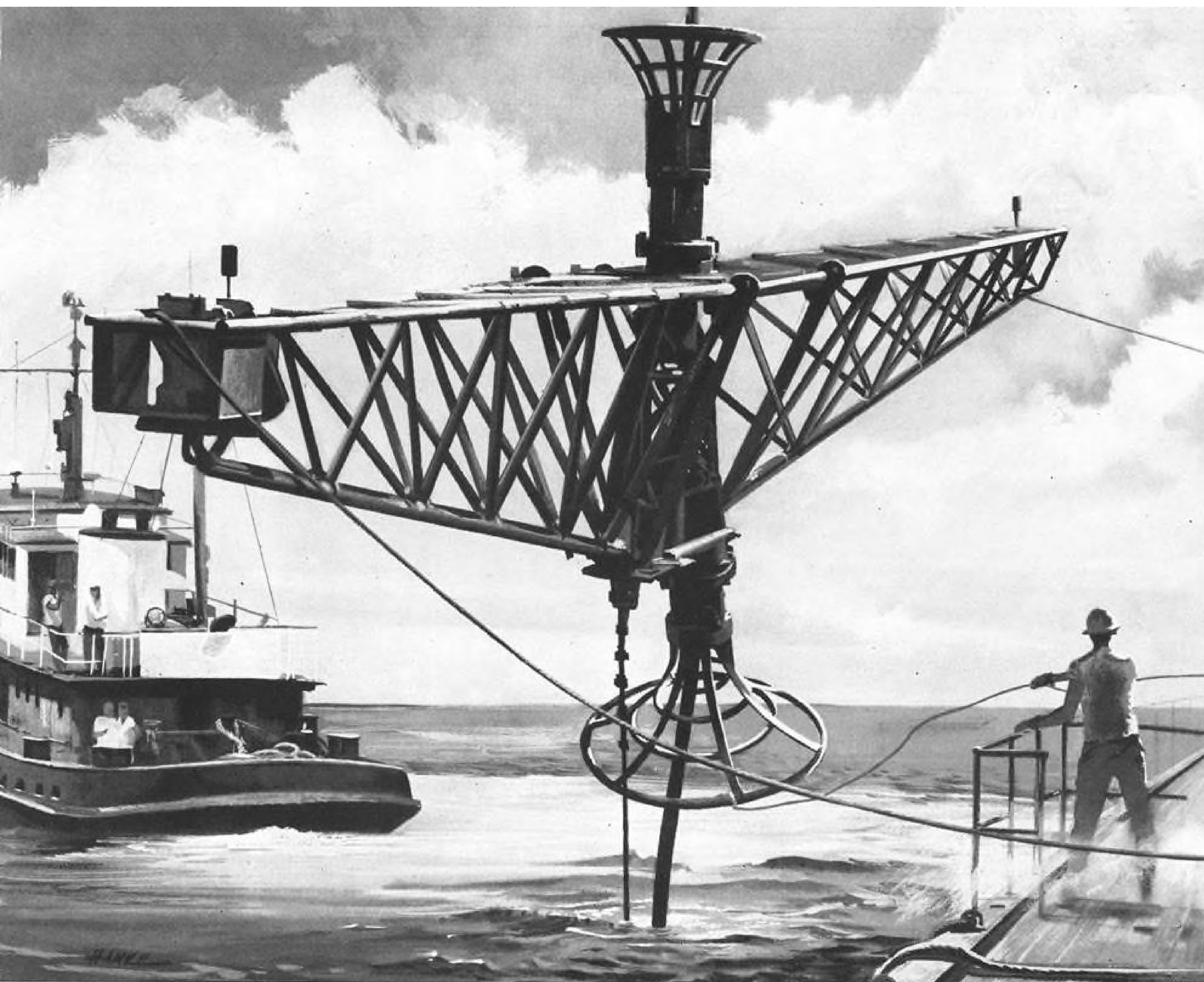
—Contributed

Arrange an interview at our Data Systems Division by directing your résumé to Mr. William T. Short. Systems Engineers are being sought to determine and study systems integration problems. Requires 5 years' experience in digital data processing systems. You could contribute to these specific areas: tactical data systems, active tracking, radar/computer interface, digital communications, and mixed mode navigation systems.

ANSWER TO LAST WEEK'S PROBLEM: $\$17.00$. $1122 = N_1 \cdot C$, $2210 = N_2 \cdot C$ so that C divides 1122 and 1105, and hence C divides the greatest common divisor of these numbers. The g.c.d. is 17, a prime, so that $C = 17$ with $N_1 = 66$, $N_2 = 130$.

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Putting ears in the ocean

Unique underseas sound laboratory built by Lockheed helps U.S. Navy measure submarine noise.

The sea is saturated with sounds—the motion of the waves, the rumble of ships and the babel of marine life. Sifting out single sounds—such as the noise of a distant submarine—may be as difficult as hearing a pebble tossed into a puddle during a thunderstorm.

The U. S. Navy has embarked upon a high-priority underwater test facility known as the Atlantic Underwater Test and Evaluation Center (AUTECE). This undertaking may well achieve importance tantamount to the nation's achievements in space.

Lockheed Electronics Company was chosen by the Navy as team manager to direct the design and installation of the first operational range of this vast program.

Inventive Designers of Lockheed engineered and developed a bottom-moored acoustic array, involving a sensitive hydrophone system for the surveillance, detection and measurement of undersea sounds.

Practical Packagers of Lockheed housed the system to operate efficiently under the enormous pressure and other adverse conditions encountered underseas.

Engineering Follow-through teams

of Lockheed directed the installation of the hydrophone array in deep water—and completed test and check-out of the system to assure optimum operation in that environment.

Lockheed offers these *inventive designers, practical packagers and engineering follow-through* capabilities to the defense and civilian electronic industries alike. LEC is the electronics gateway to several thousand scientists, engineers and technologists who work for Lockheed.

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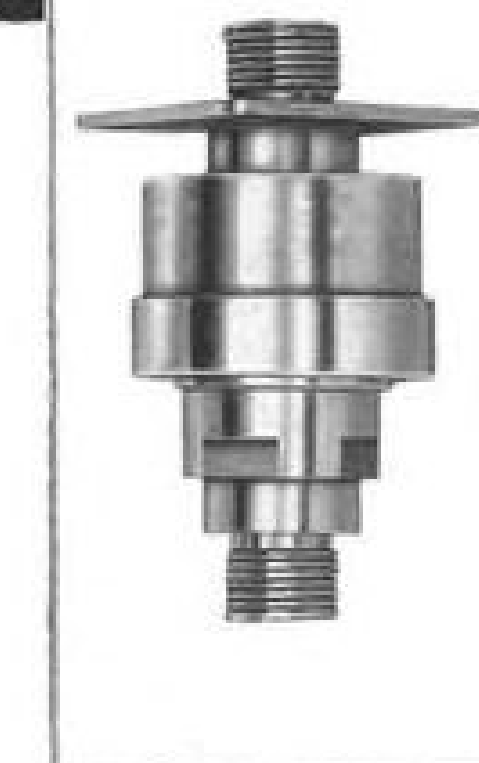
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- Apr. 10-11—Fourth Symposium on Engineering Aspects of Magnetohydrodynamics, University of California, Berkeley.
- Apr. 15-17—Hypersonic Ramjets Conference, American Rocket Society and American Society of Mechanical Engineers, Naval Ordnance Laboratory, White Oak, Md.
- Apr. 17-19—International Nonlinear Magnetism Conference, Shoreham Hotel, Washington, D.C. Sponsors: American Institute of Electrical Engineers; IRE.
- Apr. 17-19—Southwestern Conference and Electronic Show, Institute of Radio Engineers, Dallas Memorial Auditorium, Dallas, Tex.
- Apr. 17-19—Technical Meeting: Nuclear Materials for Space Applications, American Nuclear Society, Netherland Hilton Hotel, Cincinnati, Ohio.
- Apr. 22-23—Annual Meeting, National Aeronautical Services Assn., Washington, D. C.
- Apr. 22-24—Second Manned Space Flight Symposium, Institute of the Aerospace Sciences in cooperation with NASA and AFSC, Dallas, Tex.
- Apr. 22-24—Third Annual San Diego Symposium for Biomedical Engineering, Del Webb's Oceanhouse, San Diego, Calif.
- Apr. 24-26—Seventh Region Technical Conference, Institute of Radio Engineers, San Diego, Calif.
- Apr. 29-May 3—Annual Conference, Society of Photographic Scientists and Engineers, Ambassador Hotel, Atlantic City, N. J. Co-sponsor: Army Research Office.
- May 1-3—19th Annual National Forum, American Helicopter Society, Sheraton Park Hotel, Washington, D. C.
- May 2—Bioastronautics Conference, American Rocket Society and Aerospace Medical Assn., Los Angeles, Calif.
- May 2-3—Fourth National Symposium on Human Factors in Electronics, Institute of Radio Engineers, Marriott Twin Bridges Motel, Washington, D. C.
- May 6-8—Aerospace Reliability and Maintainability Meeting, Institute of the Aerospace Sciences, Washington, D. C.
- May 7-9—Electronic Components Conference, Institute of Radio Engineers, Marriott Twin Bridges Motel, Washington, D. C.
- May 13-15—National Aerospace Electronics Conference, Institute of Radio Engineers, Dayton, Ohio.
- May 15-17—Connecticut General Flight Forum's Second National Symposium on Air Transportation, Hartford, Conn.
- May 20-22—National Symposium on Microwave Theory and Techniques, Institute of Radio Engineers, Miramar Hotel, Santa Monica, Calif.
- May 20-22—National Telemetry Conference, Hilton Hotel, Albuquerque, N. M.
- May 21-23—Spring Joint Computer Conference, American Federation of Information Processing Societies, Cobo Hall, Detroit, Mich.
- May 27-28—Seventh National Conference on Product Engineering & Production, Institute of Radio Engineers, Continental Hotel, Cambridge, Mass.
- June 7-16—25th French International Air Show, Le Bourget, Paris, France.

Trigger-fast disconnects at 3000 psi with



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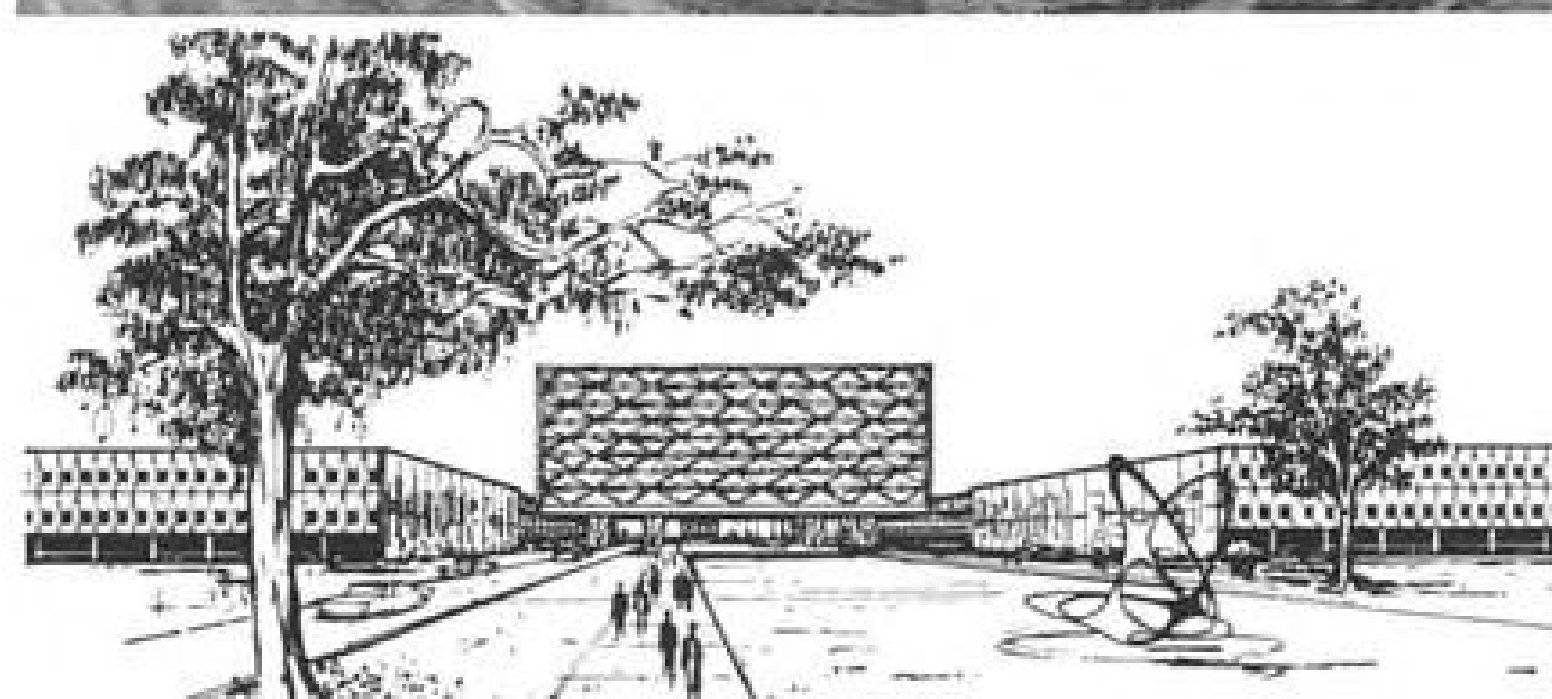
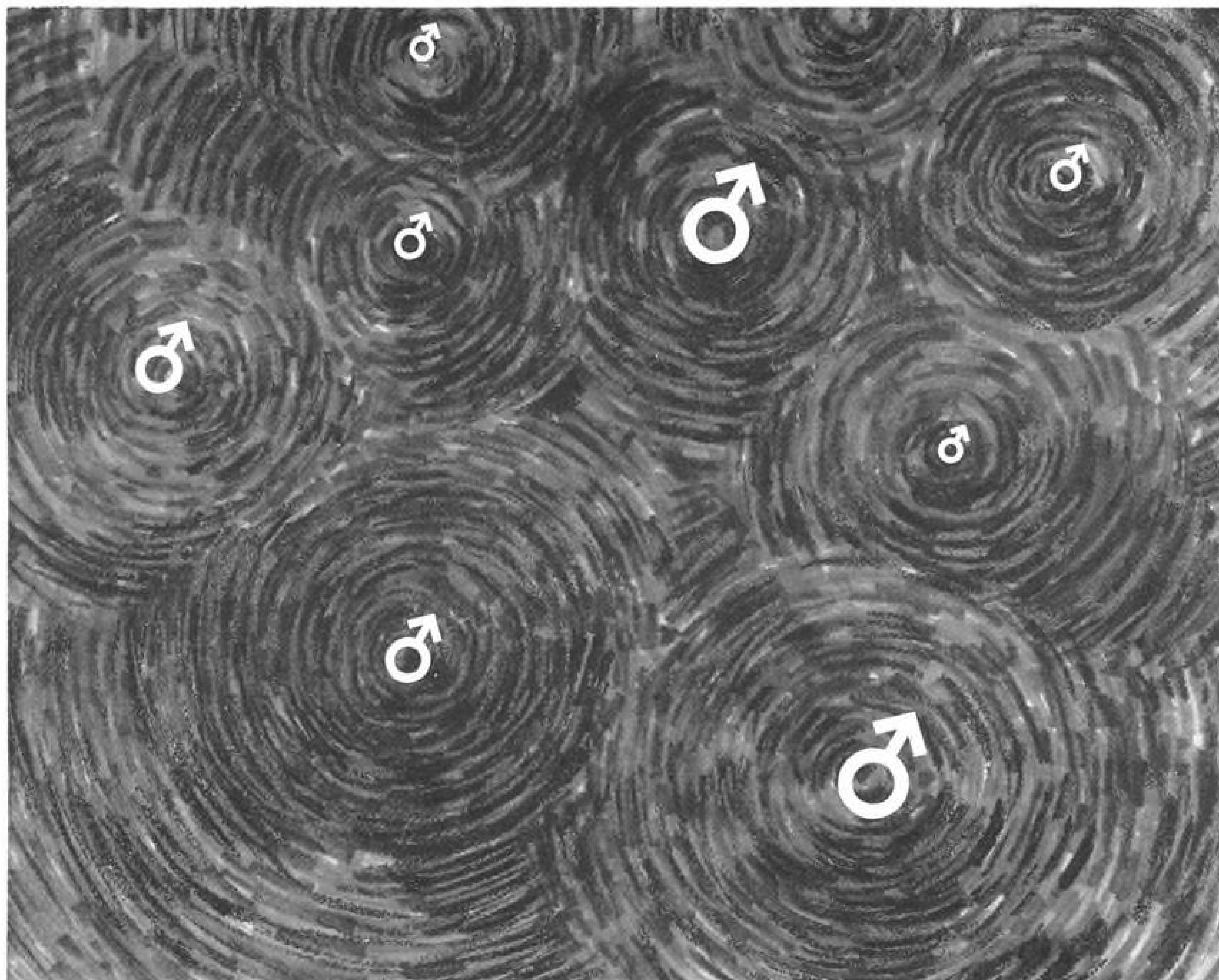
10919-LS

Exploration of the universe by spacecraft capable of safely transporting men takes vast down-to-earth preparation. That's why Douglas is now building the nation's most modern research and development facility on a 245 acre site in Huntington Beach, California. □ The Douglas Space Systems Center will include a space simulation chamber 39 feet in diameter, capable of housing a complete manned spacecraft. Supplementing this will be a complex of specialized research laboratories.

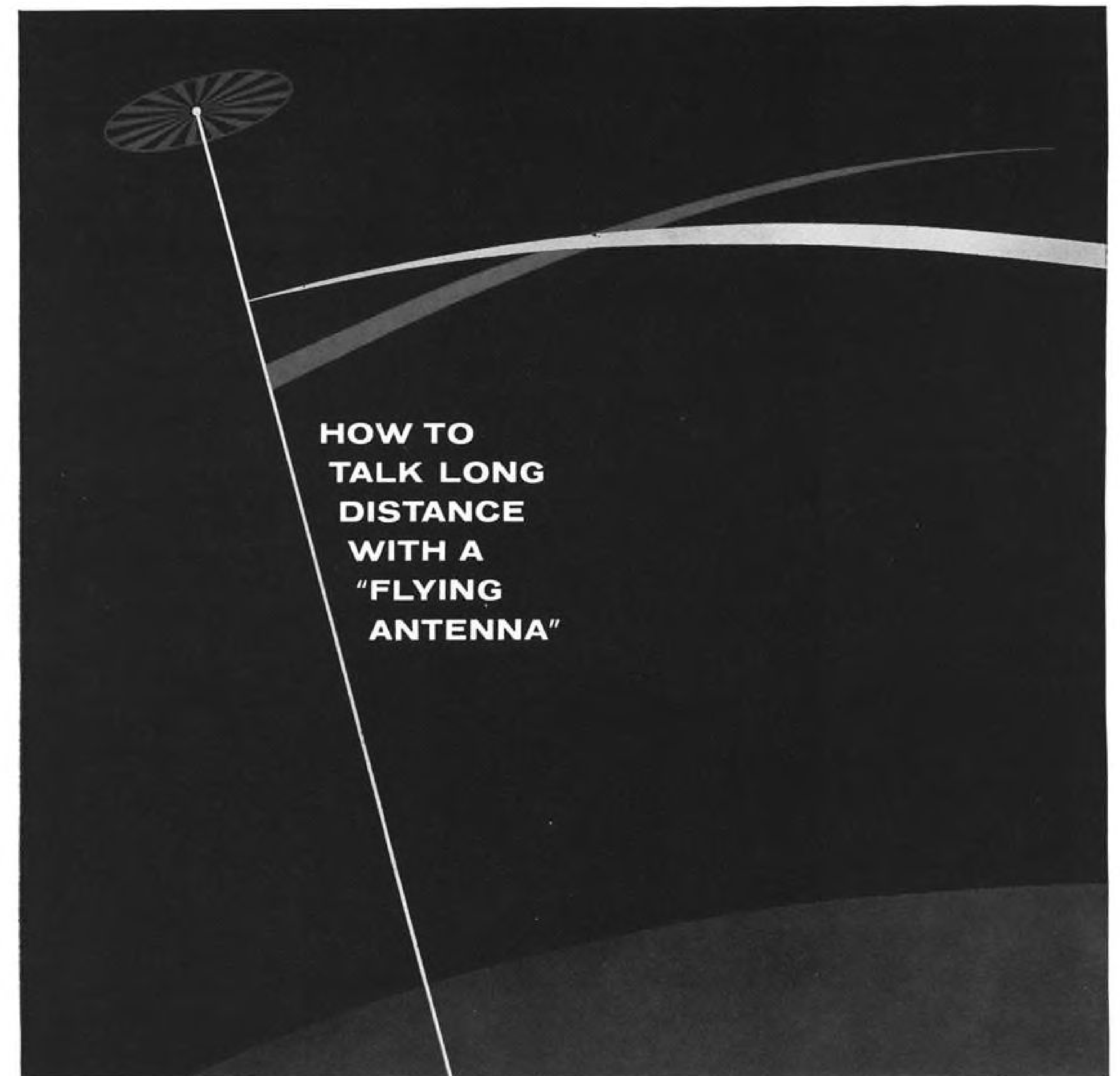
MAN-RATED SPACECRAFT

...AND WHAT DOUGLAS IS DOING ABOUT THEM

Here, manned space systems will be proved in environments similar to those which will exist on orbital, lunar and interplanetary missions. □ Douglas understanding of space problems is a direct result of booster experience and manned vehicle experience with high performance military aircraft.



The new Douglas Space Center will further many of the more than 500 research programs now under way in company laboratories. And it will incorporate the sophisticated technological equipment required to solve the new problems man will meet as he begins to explore outer space.



HOW TO TALK LONG DISTANCE WITH A "FLYING ANTENNA"

For special-purpose, long-range communications, Fairchild Stratos-ESD has created and developed Helevator. An electric-powered rotary wing tethered drone, it can hover as high as 9,000 feet, stay aloft 1,000 hours without maintenance. The tether itself serves as the antenna for VLF and LF transmissions. Helevator* can act as a sensor platform for difficult

short-range surveillance and a relay for UHF/VHF communication. The "Flying Antenna" is a compact, mobile, economical system; ready for immediate deployment and equally fast concealment. Operating from land or sea, it can withstand the foulest weather. Interested? Let our Helevator brochure tell you more. Contact our Director of Customer Relations.

*A TRADEMARK OF FAIRCHILD STRATOS PATENTS APPLIED FOR

When there's a need to know: Fairchild Stratos-Electronic Systems Division capabilities are best reflected in an integrated approach to data requirements. Extensive experience in acquisition, processing, transmission and display has given FS-ESD engineers a particularly sensitive awareness of both final information needs and the many subsystems required to answer them. • For knowledgeable engineers interested in career opportunities in advanced data techniques, may we

suggest a note to our Director of Industrial Relations for the brochure "Grow Your Own Future". FS-ESD, an equal opportunity employer.

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EARTHBORNE INSTRUMENTATION

Precision telemetering and tracking need precision instrumentation. Sperry has the capability and experience in instrumentation to meet the need.

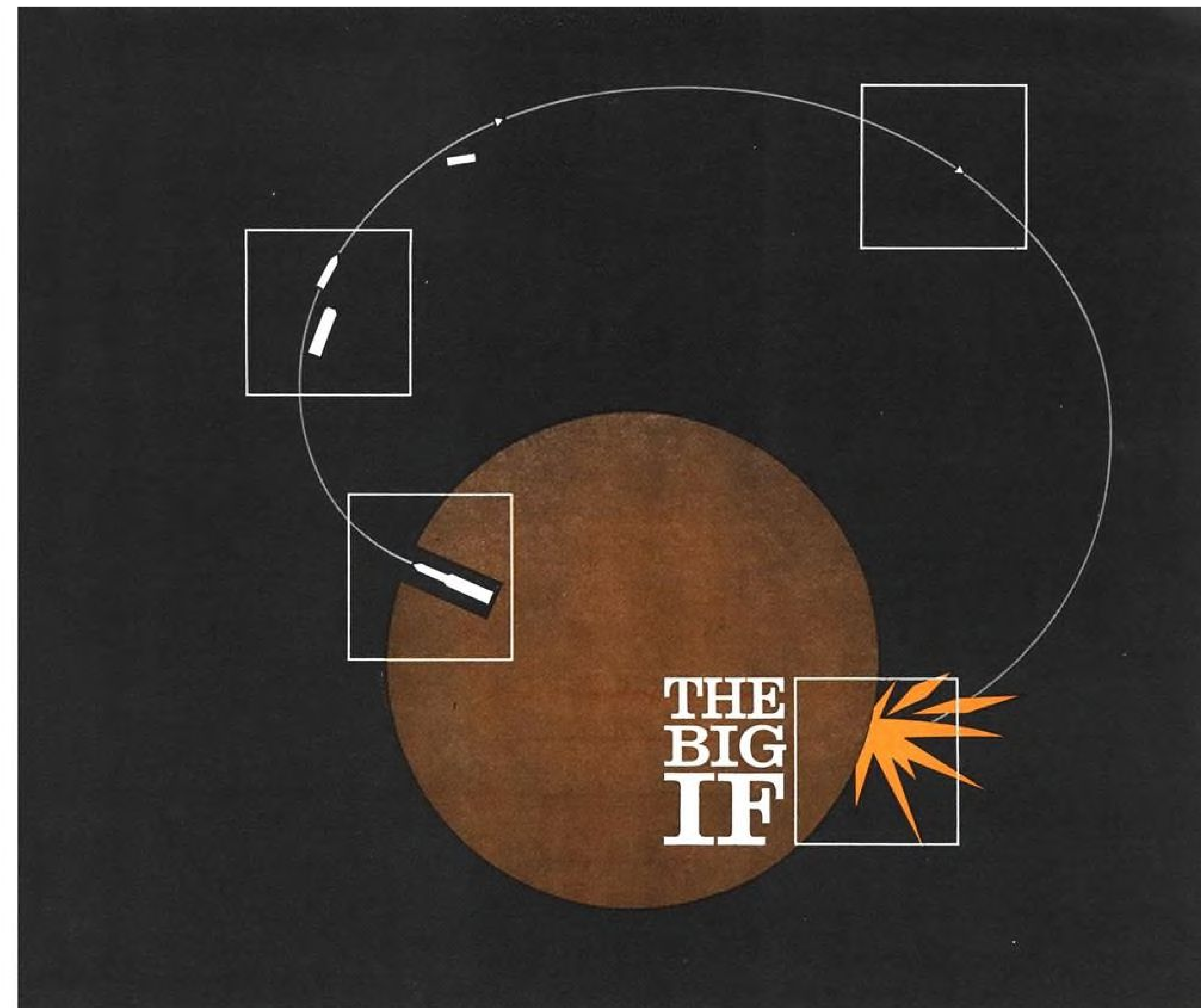
Sperry has system responsibility for the ARIS (Advanced Range Instrumentation Ships) program — seagoing tracking stations to collect accurate terminal trajectory and re-entry data — a project incorporating every advanced technique in data handling, radar, telemetry, navigation and associated technologies. In space vehicle tracking, Sperry has the best background going — with radar and associated interface experience from the minuscule (PPS-4) to the mighty (FPS-35) — plus creative capability in data control, both analog and digital, weapon direction equipment (Talos WDE) and other areas.

Most important, Sperry offers the ability successfully to *tie together* many diverse technological efforts into a reliable system — one that does the job consistently and does it well.



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ORDNANCE A long range hit can depend on dozens of "if's" on the way to target... a series of interrelated sequences, each depending on those preceding... each with its own set of conditions requiring fulfillment. They all add up to a big "if", and that is whether the weapon will be fully effective yet safely controlled through all stages. □ Kollsman ordnance capabilities include advanced concepts in aerospace instrumentation, electronic circuitry and electromechanical devices. In addition to complete systems, tailored to requirements for missiles, space vehicles and aircraft, Kollsman also produces missile safety and arming devices, sensing components of various types, target detecting devices, barometric devices, percussion primers and fuzes.

Advanced Research
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Kollsman Instrument Corporation

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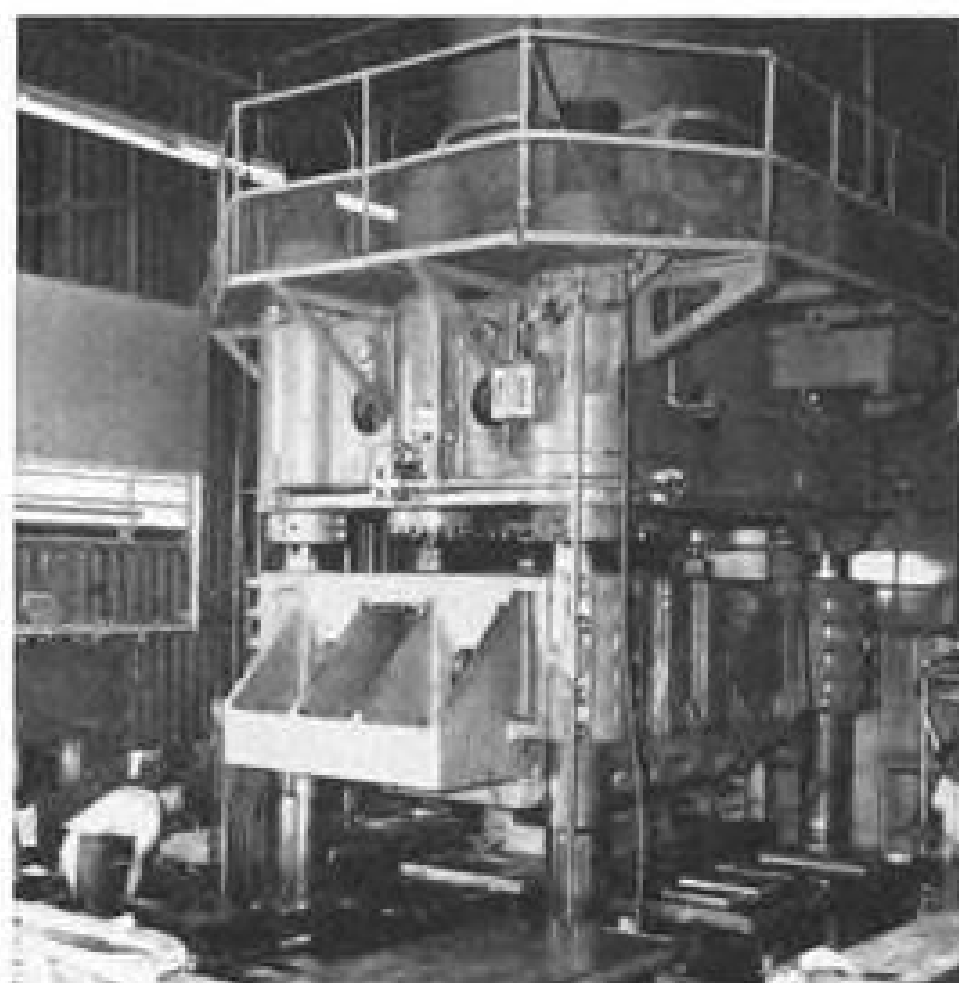
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New CINCINNATI ACRAMATIC THOUSAND combines contouring and positioning in a single package. Modular, solid state, absolute measuring, easier to program and operate—a practical man's control. Write for Bulletin M-2395. Cimtrol Division, The Cincinnati Milling Machine Company, Cincinnati 9, Ohio.

CINCINNATI
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Clearway through the weather



The SMITHS Para-Visual Director (P.V.D.) combines and presents to the pilot, in an entirely new way, information previously available only on his instrument panel. It consists of small 'barber's poles' which revolve when the aircraft pitches, banks or yaws: these are readily visible even out of the corner of the eye. The pilot thus receives constant information which enables him to maintain continuous correction of the aircraft's attitude without deflecting his attention from the runway. The P.V.D. currently being evaluated by K.L.M. and other airlines and operators, forms part of the complete SMITHS Flight Control System installed in the B.E.A. de Havilland Trident—the first commercial aircraft to be specifically designed for all-weather flying.

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J-M Microbestos and J-M Micro-Quartz Fiber used to reinforce high-temperature plastics

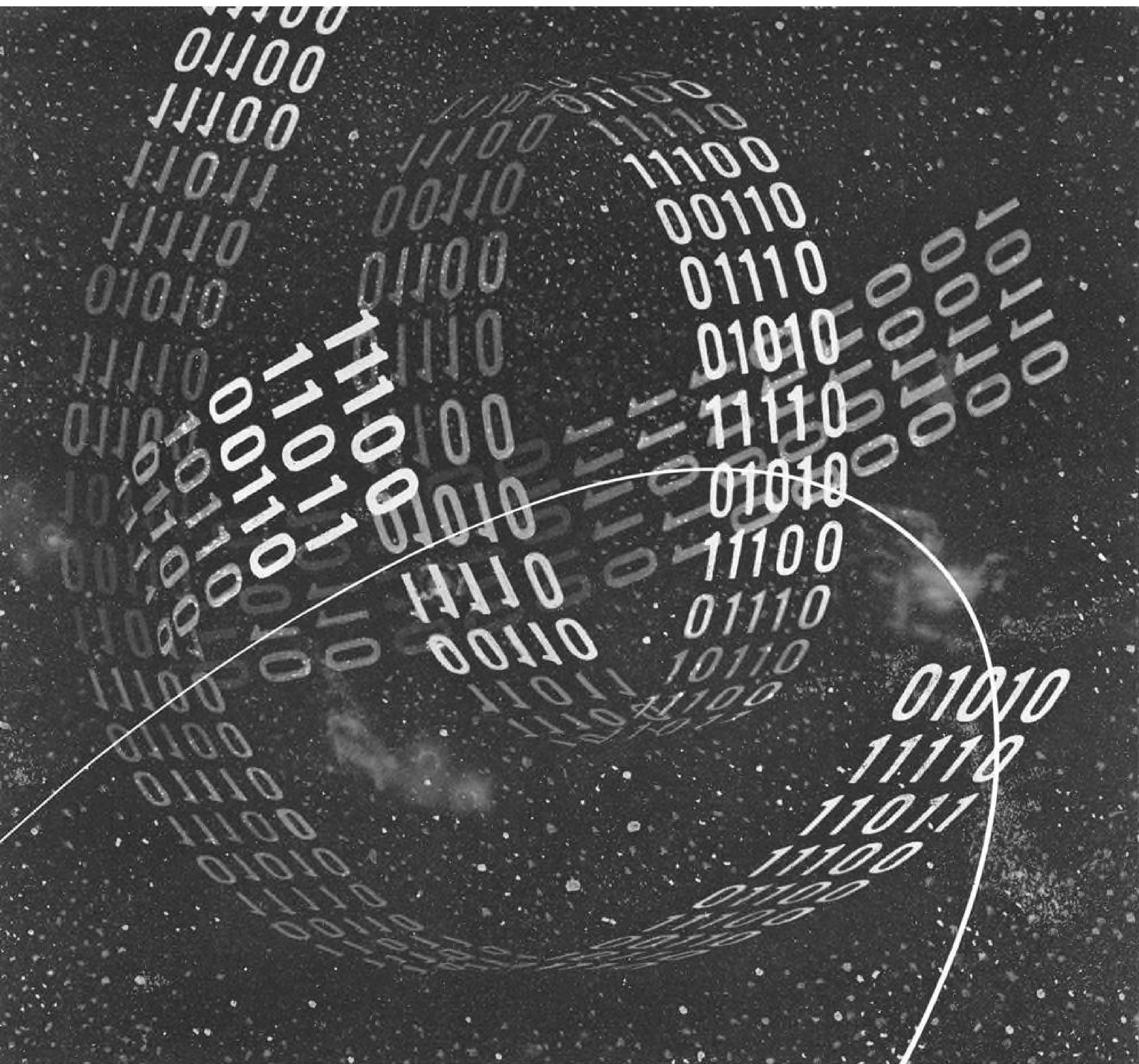
From Johns-Manville, manufacturer of Min-K and Thermoflex (the only thermal insulations used aboard the Mercury Spacecraft), come two equally important products . . . J-M Microbestos Paper and J-M Micro-Quartz Fiber. They are designed to provide reinforcement for high-temperature plastics such as exhaust nozzles, nose cones and aero-dynamically heated surfaces.

Microbestos Paper is a high-purity, high-bulk, uniform paper made of asbestos or asbestos in combination with other organic and inorganic fibers and fillers. It is capable of accepting up to 50% resin saturation. Microbestos-reinforced products saturated with various resin systems are available from leading manufacturers of laminating sheets, tapes, and molding compounds.

Micro-Quartz is made of the highest purity silica fiber with thermo-physical properties similar to those of pure silica. It is available in bulk form in various fiber diameters for use as a reinforcement for high-temperature and ablative plastics.

For full details on these and other J-M aerospace insulations, write to J. B. Jobe, Vice President, Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable: Johnmanvil.

JOHNS-MANVILLE 



Ford Instrument Does It With Digits:

Symbolized above is Ford Instrument's proven configuration of the "strap-down" inertial guidance or navigation system. The "strap down" concept replaces the stable platform . . . gyros are mounted directly to the vehicle frame and the platform functions are performed by a digital computer.

Developed by Ford Instrument, this system offers unprecedented space and weight savings together with flexibility as to placement of components and adaptability to sensor design changes.

The "strap-down" program was initiated as an ASD study at Wright-Patterson Air Force Base. The concept has been proven sound through an extensive flight test program

Innovations such as this are evidence of Ford Instrument's well-balanced capability for rapid and successful accomplishment of research and development assignments: creativity tempered by practical experience; technical talents effectively directed by a dynamic management team.

FORD INSTRUMENT CO.

DIVISION OF SPERRY RAND CORPORATION
31-10 Thomson Avenue, Long Island City 1, New York

Aviation Week & Space Technology

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COVER: First Boeing 727 transport rolls out at company's Renton, Wash. facility. Aircraft is powered by Pratt & Whitney JT8D-1 engines producing 14,000-lb. thrust each (AW Dec. 3, p. 38). Aircraft will carry 70-114 passengers depending on interior configuration. For other details on the 727 transport see p. 60.

PICTURE CREDITS

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At a deserted airport in Florida, this odd looking vehicle helps B.F. Goodrich engineers design better tires for jet service.

The single tire at the rear of the vehicle carries a load of 38,500 pounds — equal to load per tire on a big jet. The vehicle speeds down a runway through an area of controlled debris consisting of nuts, bolts and broken concrete which can cause damage. Objective of this test program is to test wear, cut resistance and other dynamic conditions, and evaluate new designs.

This is the first vehicle ever made to test aircraft tires under actual airport conditions. Thorough research of this type is one of the reasons B.F. Goodrich is the leader in aircraft tires — and has pioneered with fabric-tread tires, new designs, and new materials. Specify BFG for tires you can depend upon. *The B.F. Goodrich Company, Aerospace and Defense Products Division, Dept. AW-12, Akron, Ohio.*



Examination of heavily-loaded test tire yields data on cutting, slipping, wear and rolling resistance, different types of surfaces.

EDITORIAL

Supersonic Transport Stakes

Formal approval of the Anglo-French supersonic transport program (AW Dec. 3, p. 41) came as a surprise to many people in this country who regarded this much-publicized effort as a paper program that would never develop into a flying machine. We changed our mind about the solidity of this program earlier in the fall after talking to many of the technical people involved on the British side of the program. It was obvious then (AW Sept. 17, p. 34) that a great deal of substantial wind tunnel and engine development work had already been completed on both sides of the Channel and the technical managements involved in both countries were engaged much more heavily than any paper parameter studies would warrant.

Thus the formal signing of the Anglo-French agreement last month to jointly finance building two prototypes and two preproduction models of the Mach 2.2 Concorde transport serves as ample warning that this effort represents serious competition in the race to sell this type of transport in the international airline market. They are tackling a goal well within the technical capability of the times since the Convair B-58 has demonstrated Mach 2 cruise performance as a standard operating procedure. Aerodynamics and engine development will require no broad state-of-the-art advances to bring the Concorde into airline service, although this will represent a design and production achievement requiring the top talent of both countries. Despite all of the anguished wails of airline presidents in Dublin, and the stern admonitions of IATA's Director General Sir William Hildred, there is no doubt that a supersonic transport will be readily available in the international airline market. Every major technical advance in the world has had its Sir Williams wringing their hands during its gestation period. The history of technology has shown that despite these wailers progress continues its inexorable march forward.

Definite Market Value

We think that a transport that can cut present traveling time between major stage lengths around the world in half will have a definite market value. Once its performance has been demonstrated during initial flight testing, passengers will be eager to buy a ticket to utilize its speed. The prize that awaits success in the supersonic transport race is a large enough slice of the international airline market to make this a profitable venture.

The fact that the Anglo-French Concorde is off to a solid start with a technically feasible plan, however, does not yet insure this success. Experience has shown what a vast difference there can be between being first into

the market with a new technical development and arriving later with a much sounder product. The British courageously pioneered postwar jet transport development with the Comet 1. They were the first to put a jet transport into airline service with BOAC's London-Johannesburg route in 1952. The Soviet Union was the second nation to put jet transports into airline service with its Tu-104 inaugurals on Aeroflot in 1956.

The first Boeing 707 jet transports were not delivered to customers until late in 1958 and were not really seen on the airways in any significant numbers until the next year. Yet today the Boeing 707 is the most widely used jet transport in airline service around the world. Boeing has cut the largest slice of the subsonic jet transport pie selling more than 474 planes of this basic design. In contrast, the Comet fleet operating today numbers less than 100 and the Soviets have failed to sell the Tu-104 in any competitive market despite strenuous efforts to do so.

So it is not just sour grapes when U. S. manufacturers avow their purpose is not to be just first in the supersonic transport race but to be "first with the best." This is a policy that has paid ample dividends in the past.

Soviet Competition

The Anglo-French Concorde has a chance to be both first and best in the supersonic field. Its initial competition to be the first will probably come from the USSR where a supersonic transport is in the works, although little is known about its design goals or development progress. The lack of Soviet success in selling its transports in the non-satellite airline market has been due to basic defects in the Soviet policies on production and competitive economy, rather than any lack of technical talent in its aircraft industry. We doubt that their supersonic transport will be any more successful than their turbojets and turboprops since the system that produces them has not corrected its flaws.

Real competition for the Concorde to be the best will come from this country if and when a firm decision is made to begin supersonic transport development. The government has been supporting a modest research and development program in this area and at least four major airframe manufacturers have been devoting considerable technical resources to exploring this area. But as yet there has been no firm decision on either the direction the U. S. supersonic transport program should take or the pace at which it should move. Hopefully both of these decisions will be made as part of the Fiscal 1964 federal budgeting process that should come to fruition next January.

—Robert Hotz



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WHO'S WHERE

In the Front Office

Pratt & Whitney Aircraft Division of United Aircraft Corp., East Hartford, Conn., has announced the following appointments: Arthur E. Smith, executive vice president; Bernard A. Schmickrath, vice president-engineering; James S. Lee, vice president-marketing; Bert J. McNamara, vice president-product support; Richard T. Baseler, engineering manager; Richard J. Coar, engineering manager-Florida Research and Development Center; Walter Doll, general manager-CANEL (Connecticut Advanced Nuclear Engineering Laboratory); Levon Parmakian, general manager-airport and overhaul department. UAC's Hamilton Standard Division, Windsor Locks, Conn., has appointed: Charles T. Roelke, executive vice president; Ermano Garaventa, assistant to the division president; John F. Burridge, vice president-marketing; Donald G. Richards, vice president-engineering; Robert C. Treadwell, controller; Anthony F. Dernbach, general manager-ground support equipment department and general manager-industrial products department; Walter R. Bush, general manager-electronics department; John P. Sullivan, general manager-overhaul and repair department. UAC's Norden Division, Norwalk, Conn., has appointed: Ernest J. Greenwood, vice president-operations; Will M. Quinn, Jr., vice president-engineering; Francis P. Halas, vice president-sales and service; Milo L. Voight, controller.

Lawrence M. Limbach, vice president-manufacturing, Ryan Aeronautical Co., San Diego, Calif.

George W. Dick, executive vice president, C-E-I-R, Inc., Washington, D. C.

Adm. Walter Fredrick Boone (USN, ret.) has been named Deputy Associate Administrator for Defense Affairs, a newly established position in the National Aeronautics and Space Administration.

Major J. Ronald McCrindle of London, England, has been appointed to the new post of permanent Commissioner of the International Air Transport Assn. to judge breaches of the resolutions of the international airlines' traffic conferences.

Honors and Elections

William M. Allen, president of The Boeing Co., has been elected chairman of the Board of Governors of the Aerospace Industries Assn. for 1963. Donald W. Douglas, Jr., president of Douglas Aircraft Co., was elected vice chairman. Elected to the Board of Governors' Executive Committee: Messrs. Allen and Douglas; J. L. Atwood, chairman of North American Aviation; Malcolm P. Ferguson, president of The Bendix Corp.; Carl G. Holschuh, executive vice president of Sperry Rand Corp.; Dan A. Kimball, president of Aerojet-General Corp.; E. Clinton Towl, president of Grumman Aircraft Engineering Corp.; and the president of AIA when he is named.

Dr. Hugh L. Dryden, Deputy Administrator of the National Aeronautics and Space Administration, has received a 1962 Rockefeller Public Service Award in the field of science, technology and engineering.

(Continued on page 121)

INDUSTRY OBSERVER

► Ping-Pong is the name for a small, potentially inexpensive reconnaissance and interdiction rocket being designed by Lockheed Missiles & Space Co. in anticipation of Army Signal Corps procurement of an effective low-altitude combat-surveillance system. Ping-Pong would replace the more expensive and recently terminated USD-5 surveillance drone program (AW Nov. 26, p. 35). Ping-Pong vehicle would have motors at both ends enabling it to refire for a return to friendly territory.

► Watch for British Parliamentary probe into reasons for heavy influx of top Ministry of Aviation civil servants into private industry. In past 10 years, more than 60 employees of department-head rank or above have left the Ministry. Opposition Labor Party wants legislation aimed at restricting top-ranking civil servants from entering private industry for two years after leaving government posts.

► Difficulty in solving the problem of the sonic boom in supersonic transport operations has directed serious attention to the low supersonic speed range as a possible alternative. Several manufacturers are studying the characteristics of a transport designed to operate at about Mach 1.2 as one way of avoiding the sonic boom intensities expected at higher speeds. One problem area will be in wind-tunnel testing; the cruise Mach number lies within the transonic region where flow characteristics make acquisition of test data difficult.

► Air Force Space Systems Division is seeking sources with proven ability to design and build pulsed plasma engines to be tested on ballistic rocket flights.

► Avionics companies are expected to submit bids by Jan. 7 for Air Force's space communications and tracking subsystem and flight test program (AW Sept. 10, p. 35), expected to lead ultimately to a complex for commanding and controlling all types of Air Force earth-orbital satellites. Bidders probably will include General Dynamics/Astronautics, General Electric, Hughes Aircraft, Philco, Radio Corp. of America and Space Technology Laboratories.

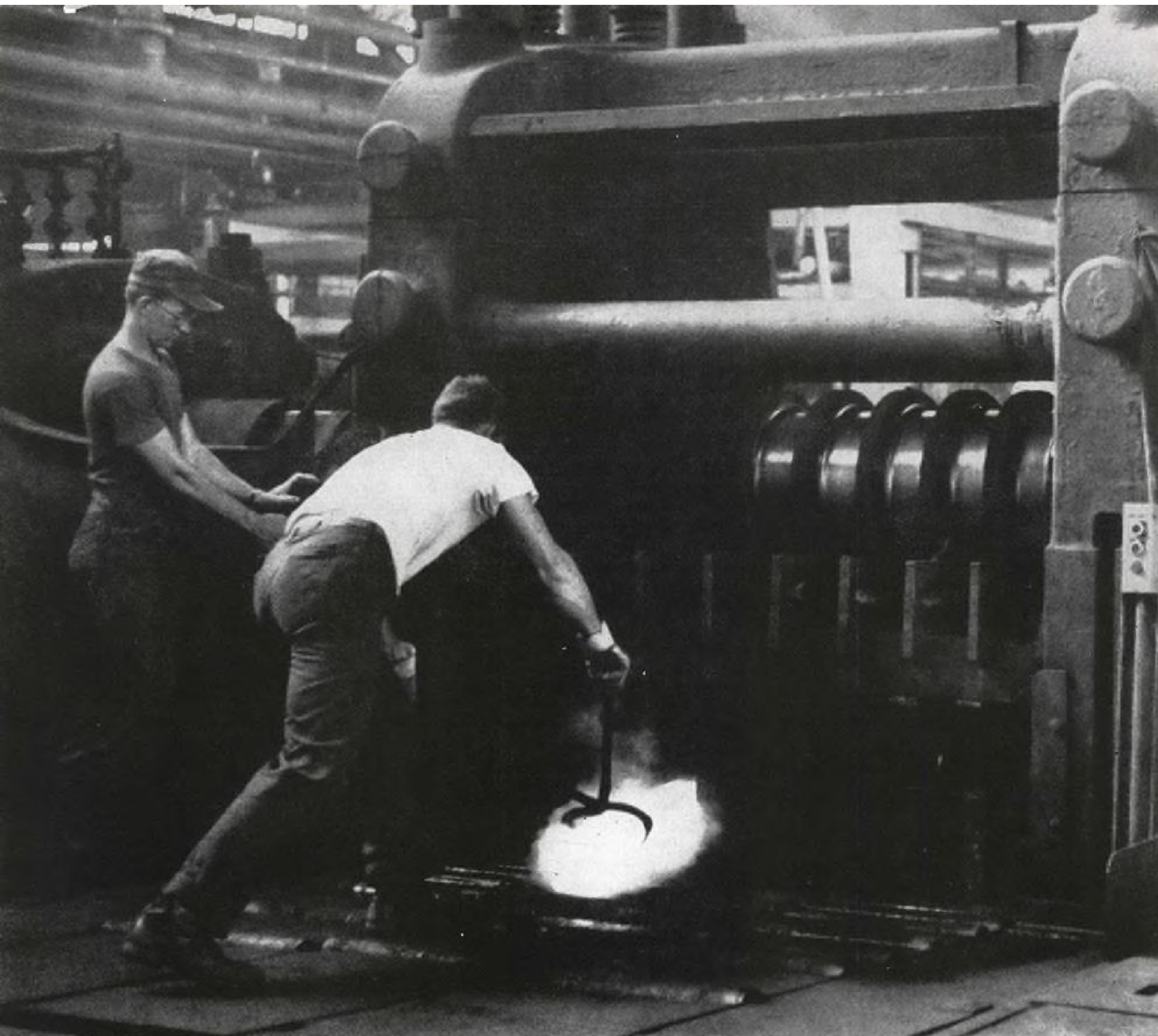
► Snap-10A, nuclear reactor and thermoelectric power conversion system designed to produce 500 watts, is scheduled to be flight-tested late next year. Vehicle will be an Air Force Agena B; tests will be conducted under a program previously known as Snapshot. North American Aviation's Atomic International Division is supplying Snap-10A under contract with the Atomic Energy Commission. Lockheed Missiles & Space Co., which will integrate the system with Agena B, is assigning the greatest emphasis to requirements for radiation resistance of avionic equipment in the experiment (AW Oct. 8, p. 23).

► Grumman Aircraft Engineering Corp. is proposing its W2F Hawkeye to the Air Force as an airborne warning and command and control aircraft. Grumman earlier proposed a carrier-on-board version of the W2F to the Navy, to carry 28 passengers or 39 troops over a 1,400-naut.-mi. range.

► Strategic Air Command KC-135 tankers will be delivered without the vivid conspicuity paint markings on vertical tail and fuselage nose. Studies have concluded that the paint does not contribute significantly to the safety of in-flight refueling operations.

► Boeing Co.'s Wichita, Kan., facility is modifying a B-52 to be mother-plane and launcher for initial free-flight tests of the Dyna-Soar. Air Force glide vehicle will be used for aerodynamic stability tests and pilot checkout in launches from the B-52 before being boosted into space with the Titan 3 (System 624A) launcher. Modification of the B-52 may be completed by April, 1963.

► Arms Control and Disarmament Agency plans two new research study programs, one dealing with responses to violations of agreements and the other covering the role of ground-inspection teams in detecting unauthorized armament production activities. Industry proposals on the first are due Jan. 3; on the second, by Jan. 15.



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Washington Roundup

Ranger Review Ends

Report on the findings of NASA's in-house review of the Ranger lunar spacecraft program (AW Oct. 29, p. 38) was completed Dec. 7, and although it is somewhat critical of Jet Propulsion Laboratory's management of the project, it concludes essentially that Ranger should continue, and under JPL's direction. JPL probably will have a chance for rebuttals before details of the report are given to Congress or made public. NASA's nine-man board visited subcontractors and spent a week at JPL during its five-week study.

JPL hopes one result of all this will be a clear, written definition of the division of responsibilities between itself and NASA headquarters, which it feels has been lacking.

Federal Aviation Agency is debating whether to propose legislation spelling out its authority in helping to reduce aircraft noise. Some FAA officials argue this would be better than letting Congress define this authority for the agency. Several bills aimed at giving FAA anti-noise responsibility failed to pass in the last Congress.

A2F-1 Cost Under Fire

Cost vs. effectiveness argument is threatening to cut short the Navy's Grumman A2F-1 attack aircraft program as Fiscal 1964 budget-making enters its final stages. Navy is authorized by Congress to buy a total of 65 with Fiscal 1962 and Fiscal 1963 money. It considers the A2F-1, which combines radar, television and superimposed grids on a display to permit all-weather attack, a highly sophisticated aircraft. Initial unit price was \$6.26 million in Fiscal 1962. This has now dropped to \$4.54 million, but analysts in the Defense Dept. comptroller's shop consider this too high.

Air Force's Skybolt air-launched ballistic missile system is being attacked both on cost-effectiveness (AW Nov. 26, p. 27) and on the argument that the first retaliatory strike capability will soon pass to intercontinental ballistic missiles. This argument runs that ICBMs could clear away anti-aircraft opposition—which is one of the missions of the Skybolt—and allow B-52 aircraft to fly to their targets with nuclear bomb loads. Air Force maintains that Skybolt provides a much more flexible response than a ground-based ballistic missile.

Lower echelons in the Air Force are reviving a proposal to strap two Thiokol Sergeants to a Douglas Thor to provide a relatively cheap booster for such payloads as the Samos reconnaissance satellite. The booster would be called Thorad.

Federal Labor Policy

Important policy question has been posed on whether the special labor commission appointed by President Kennedy to reduce work stoppages during construction of operational military missile launching sites should extend its jurisdiction to several military and National Aeronautics and Space Administration installations of other types.

Julius E. Kuczma, executive secretary of the President's Missile Sites Labor Commission, said Defense Dept. has asked the commission to help assure labor-management harmony at command and control sites and NASA had asked similar help at space centers in Huntsville, Ala., and Michoud, La. The commission, chaired by Labor Secretary W. Willard Wirtz, may decide on the requests at its Jan. 17 meeting.

Basic issue is whether expansion of the commission's role would lead the government deeper into labor-management relations before a need is demonstrated. Wirtz is more deliberate than his predecessor, Arthur Goldberg, and may resist enlarging the commission's jurisdiction at this time.

Max Golden, Air Force general counsel, will leave the Pentagon around the end of the year after 14 years as USAF's associate general counsel, deputy to the assistant secretary for materiel and chief legal officer. Golden told AVIATION WEEK & SPACE TECHNOLOGY that he is leaving for financial reasons, and has not yet decided whether he will practice law or take an aerospace industry post.

Canaveral Helicopters

Use of helicopters to cut travel time in the Cape Canaveral area is under study by NASA. Saturn C-5 and Nova assembly and launch sites are 20 to 35 mi. from offices at Patrick AFB, Fla., and Cocoa Beach. Helicopters also could be used to haul personnel from air arrival points at Orlando and Melbourne. NASA would not buy the helicopters. Service would be provided under contract, if NASA decides the saving in man-hours warrants the cost.

Latest anti-statement on anti-missile missiles comes from Paul H. Nitze, assistant secretary of defense for international security affairs, in testimony released recently by the Senate Preparedness Investigating Subcommittee. He said "an effective anti-missile deterrent" was not "in the cards for them [Russia] nor for us within presently foreseeable technology." Delivery systems and related electronics, rather than further development of nuclear explosives, will pace development of anti-ICBMs, he said.

—Washington Staff

Urgent COIN Aircraft Program Planned

Bids will be asked by Jan. 1; \$100,000 glass-fiber counter-insurgency vehicle would have turboprops.

By Larry Booda

Washington—Industry will be asked before the end of the year for proposals to develop and produce on a "crash" basis a relatively small, glass-fiber counter-insurgency (COIN) aircraft. It would be used by the U.S. but would be intended primarily for small nations faced with communist attacks.

Target cost of the aircraft in quantity production has been set at \$100,000 each. No final decision has been made on which service will be given management responsibility, but it appears that it will be given to the Navy.

Specifications will require that the aircraft be powered by two turboprop engines of about 1,150 shp. each, be able to operate from a 500 ft. airstrip over a 50 ft. obstacle, and be adaptable for operations from the water. It will have a crew of two. Target weight is 3,500 lb. empty and wing span is 20 ft.

Target minimum speed is 40 kt. with power on and 60 kt. with power off. Maximum speed desired is between 250 kt. and 300 kt.

Reason for the sense of urgency is the need to replace the relatively low-performance aircraft now being used in guerrilla actions as they wear out over the next two years. No aircraft now in production is considered capable of fulfilling the counter-insurgency role.

The specifications will call for already-developed components. The only innovation will be a statement that it is desired that the basic construction of the airframe exterior be glass fiber to produce a minimum radar return.

Another requirement limits the navigation and target location equipment to radio-grid and low-light-level television.

Night Actions

It is estimated that 90% of all guerrilla activities take place at night. During daylight the forces that are vulnerable to air attack take cover and wait for darkness to operate.

In this kind of environment ordinary radio navigation devices do not provide enough accuracy. The standard mission would involve going to the front line area, landing on a strip to pick up an observer acquainted with the area, proceeding to the action site and making an attack at low level. Since the average terrain in Southeast Asia, where the aircraft probably would be used first, is hilly or mountainous, VHF or UHF navigation systems cannot be used because they are limited to line-of-sight.

The specifications will call for a low frequency system which will be reflected from the ionosphere, covering any kind of terrain. In some respects it would resemble the British-developed Decca

system. This would enable the pilot to navigate to the general area of a target.

To pinpoint target, low-light-level television would be used. It is at this point that the observer from the front lines would be helpful. Low-light-level TV systems have been developed by several companies and demonstrated to the Defense Dept. Only adaptation of such a system to the counter-insurgency aircraft application would be necessary.

Aerodynamically, the aircraft would not include any highly sophisticated system, such as boundary layer control through blowing or sucking on the wings, because it is difficult for relatively unskilled military forces of smaller nations to maintain. The wing would include slotted flaps and leading edge slots. The lowest speed would be obtained by having the aircraft "hang" on contra-rotating propellers. When lightly loaded, the aircraft would have almost vertical takeoff and landing capabilities.

In one suggested configuration, the aircraft would resemble superficially the Lockheed P-38 fighter of World War 2. It would have twin booms with a fuselage between. The water operation adaptation would come from having pontoon pods fitted to the underside of the booms, to be lowered for landing on water. Previous attempt to develop a short takeoff and landing fighter using these ideas was undertaken by the Navy during World War 2. By 1946, the Chance Vought XF5U-1 had been built and was flown. The concept was considered good but the aircraft lacked sufficient power from its two Pratt & Whitney R-2000 reciprocating engines for successful operation.

The armament for the new counter-insurgency aircraft would include conventional high explosive bombs, small rockets and napalm. Machine guns would use the standard NATO 7.62 mm. size ammunition. Armament stores would be carried both on wing stations and internally.

On a typical mission, the aircraft would have to take off carrying 1,500

lb. of arms, proceed 50 mi. to the combat area, pick up an observer, then remain in the area 3½ hr. before returning. Other missions would be variations of this, carrying larger loads for shorter times or extending the combat radius.

A Defense Dept. official emphasized that no technical breakthroughs will be necessary to develop the aircraft. Primary consideration in writing the specifications was given to ease of maintenance. Glass fiber is easier to repair than metal. Electronics equipment could be replaced easily in the field and later repaired at central locations.

There are about 3,000 of the "T" and "L"—for trainer and liaison—light aircraft in use outside the U.S. today. Most are 15 to 20 years old.

A very few are in South America and Africa. Those light aircraft in use in countries which are now engaged in military action against enemy guerrillas are not used for training or commercial purposes but for actual operations. These have been augmented in Southeast Asia by an estimated 500 modified North American T-28 aircraft from the storage inventories of the Air Force and Navy. There already are many NAA T-6 (SNJ) trainers in use in that theater.

When the situation in South Vietnam grew to such proportions that the supply of relatively low-performance aircraft was consumed, the services sought to replenish them. A survey of industry revealed that all assembly lines for aircraft that would even partially fulfill the requirements had been closed down long ago. The urgent requirement was generated 10 months ago.

Marine Corps Studies

Basically, the specifications that will appear in the requests for proposals will be an outgrowth of studies conducted by the Marine Corps over a number of years. The Marines wanted an aircraft that resembles the one now proposed. They also wanted one which could land on an aircraft carrier in an emergency.

The specifications for the counter-insurgency aircraft do not call for the capability of making catapult takeoffs or arrested landings. Nevertheless, it will be able to operate from carriers because of its minimum speed capability and high power-to-weight ratio.

Reduction of Military Specification Standards has been recommended in order to speed the program. In a high-cost, highly-sophisticated aircraft, strict application of these standards is considered necessary. With mass production of lower-performance aircraft, it has been decided that the requirements can be eased without resulting in an unsafe or inoperable aircraft.

Advanced Missile Re-entry Flight Tests Planned

Cape Canaveral—All phases of advanced ballistic missile nose cone re-entry—from new materials to terminal guidance techniques—will be flight tested from Cape Canaveral, Fla., and Vandenberg AFB, Calif., aboard standardized Atlas F missiles over the next three years. The Air Force program is designed to increase penetration effectiveness of U.S. strategic missiles and the knowledge in re-entry physics.

Total of 23 contractors, including Aeronutronic, Avco, Bendix, Chrysler, General Dynamics, General Electric and Hughes, will participate in program, called ABRES (for advanced ballistic re-entry systems). Project code name has been changed from Reindeer to Sleighride. Contractors' efforts will cover:

- New materials with higher performance and lower cost characteristics. Ablative materials, including some of the newer phenolic and foamed metals and re-radiant compositions, probably will receive major emphasis.
- Maneuverable cones with the ability to change targets during descent or to increase terminal velocity through ignition of a "kicker" rocket in order to elude an anti-missile missile. Terminal guidance system, including a map-matcher, could be an essential part of a maneuverable cone.
- Decoys and other penetration aids, such as an ejective jammer to interfere with tracking of the cone by an anti-missile radar.

Although the primary purpose of the ABRES program is the development of more effective offensive re-entry vehicles, the flights are expected to produce considerable data on each cone's radar cross-section, emitted radiation pattern, shock wave characteristics, etc., that will be useful in designing U.S. anti-missile systems.

Cones to be flown in this program will be of completely new design rather than modifications of presently operational Mark 3, 4, 5 or 6 vehicles, although there may be some external resemblance between the two groups. Some ABRES vehicles are expected to be lighter than the minimum payload weight required by Atlas for dynamic flight stability and consequently will be ballasted. Re-entry vehicles with varying lift/drag ratios, as well as finned vehicles, are understood to be under consideration.

In addition to the ABRES cones, each launch vehicle will carry at least one and possibly several piggy-back pods on the side of its airframe. Scientific experiments for these pods will be provided by USAF centers and other government agencies such as the National Aeronautics and Space Administration or the Atomic Energy Commission.

Between 20 and 30 General Dynamics/Astronautics-built Atlas F missiles will be used to fly ABRES cones. Most will be flown over Atlantic Missile Range. First flight is expected late next January. Although the Atlas was scheduled to finish its five-year research and development flight test program late last week (see p. 37), the first several ABRES boosters will carry the normal amount of missile instrumentation, since they were on the production line before the decision to end the flight test program. All-Air Force crews will launch these vehicles.

ABRES is a more intensive continuation of re-entry research that began several years ago with the Lockheed-built X-17 rocket (AW Feb. 4, 1957, p. 27). Advanced re-entry materials and techniques have been explored in earlier ICBM flights but always on a secondary basis.

Administration to Ask \$6 Billion for NASA

By Edward H. Kolcum

Washington—Kennedy Administration plans to submit a \$6-billion Fiscal 1964 budget for the National Aeronautics and Space Administration, with 73% of the money earmarked for manned space flight. The Fiscal 1963 NASA appropriation was \$3.7 billion.

Congress is expected to cut more of the coming NASA budget request than it has in past years, but Administration leaders are banking heavily on congressional support for a "core" program which is designed to assure a manned lunar landing by February, 1968.

This core will cost \$3.4 billion in Fiscal 1964. It consists of development programs considered essential for the 1968 manned lunar landing target date. These are Apollo, Gemini, Saturn, Titan 2, and their associated flight and ground systems.

Last week, President Kennedy still had under consideration a \$425-million supplemental budget request for the space agency, despite NASA Administrator James E. Webb's public statement that a supplemental request will not be made (AW Nov. 19, p. 26). Chances are considered slim, however, that such a request will go through because both Administration and congressional strategists agree that the

agency needs the funds now, and not next March or April when Congress would probably approve them. As a result, the Fiscal 1964 budget request has grown from \$5.5 billion to \$6 billion in order to alleviate further delays in the manned space flight program.

The 1968 target date for a lunar landing is firm if approval is given for the core program. NASA recently conducted a schedule review and calculated that with an additional \$300 million for Apollo, the date could be advanced by five months, to October, 1967. But this time gain will dissipate with each month that passes before the money is received, and would be lost by the end of the 1963 spending year in June.

Budget Bureau and NASA are currently negotiating the Fiscal 1964 space budget, and are in what is called the reclaimer phase. This means that NASA is preparing its arguments to retain \$200 million which has been cut from the initial NASA request of \$6.2 billion. Whatever programs are cut, however, it is generally conceded that manned space flight will not be among them.

During a discussion on the budget involving the President, Webb and Brainerd Holmes, manned space flight chief, President Kennedy agreed with Holmes that his program has the highest priority in NASA.

Vice President Johnson, Webb, Holmes, Associate NASA Administrator Robert C. Seamans, Jr., and Dr. Edward C. Welsh, executive secretary of the Space Council, have been in fairly continuous discussions on policy-level questions regarding the coming budget request and its effect on future programs.

Questions under discussion by this group and the Budget Bureau concern programs other than manned lunar landing. Among them are nuclear rocketry and auxiliary space nuclear power. A fundamental issue which late last week remained unresolved is whether U.S. will proceed concurrently with nuclear hardware and technology, or await development of technology before going into an active hardware program.

Other unsettled questions which could affect the Fiscal 1964 program are the amount of duplication of NASA and Defense Dept. development effort in communication satellites and which of the large construction programs can be delayed without affecting the end-date schedule for Apollo.

Because such projects as Ranger and Surveyor are expected to contribute directly to Apollo, the Administration considers that funding for a part of their development and flight is a portion of the 73% of the manned space flight budget. Projects like these represent

the difference between the \$3.4 billion core program and \$4.38 billion, which is 73% of the budget request. The core program will permit NASA contractors to use maximum overtime, complete buildup of manpower and tooling for the Apollo system, and shift into a pace considered just short of a "crash" program.

The funding problems NASA has experienced since the manned program was defined in late summer forced the agency to initiate what amounts to a slowdown among its prime spacecraft and vehicle contractors (AW Nov. 26, p. 26). The major effect of the slowdown has been on Apollo, which is short by \$300 million, but the most immediate effect is on the two-man Gemini mission schedule and concept.

Dr. Joseph F. Shea, deputy manned space flight director for systems, told AVIATION WEEK that a few months can be regained in the Gemini program by eliminating the Agena D launch, but the major benefit in doing this will be a "much higher success probability."

He said NASA hopes to make a decision this week on whether to stick with the original concept—rendezvous of Gemini with an Agena D stage (AW July 2, p. 94)—or to have the manned spacecraft rendezvous with a piggyback satellite carried along on the same launch. Another alternative is to launch a light, inflatable sphere with the Thor-Delta vehicle, which has put 13 successive satellites into precise orbits after a single failure on the first attempt.

Dr. Shea said there is a 50-50 chance that the program will be changed.

Air Force, meanwhile, has reached a stalemate in developing its plan for Blue Gemini until NASA settles the question of the concept. Air Force wants to buy into the program (AW Oct. 15, p. 32), and both USAF and NASA are in fairly close agreement that Gemini-Blue Gemini should be a cooperative program to run this way:

- Development costs funded by NASA.
- First flights by NASA pilots, with USAF flying copilot on one or more of the early flights. USAF would participate in launch operations and mission control centers.
- USAF to buy the final four or five of NASA's original order of 12 Gemini spacecraft, with NASA flying copilot on some of them.
- USAF to buy additional Gemini spacecraft. One of the missions for Gemini which is gaining support in the Air Force is an unmanned testbed in the satellite interceptor (Saint) program (see p. 36). Late last week, Air Force had not received top-level DOD approval to include these Gemini spacecraft in its Fiscal 1964 budget.
- NASA to order more spacecraft if Gemini is selected as a space station ferry vehicle.

Money for early space station development work is included in the Fiscal 1964 request, but configuration for the station might well be much more modest than the 18-, 21- and 38-man stations previously described by NASA (AW Sept. 10, p. 33; Sept. 17, p. 26; Nov. 12, p. 56). Agency is now thinking in terms of a 3-to-4 man station which could be developed and launched before the culmination of the Apollo project.

Logistics System

The core program also provides money to start work on a lunar logistics system. Decision on whether the supply system should be made a part of Project Apollo is expected next month. Present 1964 program provides only modest funding for the system, but this could be changed if the agency feels it is necessary for the success of Apollo.

With direct and indirect manned space flight support totaling 73% of the budget, the other four NASA program offices would share about \$1.6 billion, including contracted and in-house work and construction.

Fiscal 1963 budget was split this way: manned flight, 62%; space sciences, 16%; advanced research and technology, 14%; tracking, 5%, and applications, 3%. All Ranger and Surveyor systems costs in the 1963 breakdown are included in space sciences.

Mariner 2 Expected To Complete Mission

Pasadena—Mariner 2, the Venus-bound spacecraft launched from Cape Canaveral Aug. 27, is expected to complete its mission—fly-by of the planet on Dec. 14—despite heating of the spacecraft's earth sensor.

Project engineers at the Jet Propulsion Laboratory in Pasadena said the temperature of the earth sensor reached 143°F on Dec. 4, 13 deg. above the design maximum. However, correlation of the drop in the sensitivity of the earth sensor with the increase in the instrument's temperature indicates that it will be possible to maintain lock on the earth until after the fly-by.

Mariner carries radiometers to measure temperatures of the atmosphere and surface of Venus, and four scientific instruments to report on magnetic fields, energetic particles and cosmic dust in space and near the planet.

Venus will be about 36 million mi. from earth when Mariner passes within about 21,000 mi. of the planet (AW Dec. 3, p. 29). At fly-by, Mariner will have been in flight 109 days and will have traveled about 182 million mi.

If Mariner's instruments make measurements near Venus, it will be the first successful planetary mission completed by either the U.S. or Russia.

DOD Plans Common Missile Designations

Washington—Directive ordering common designations and names for all military rockets and guided missiles is expected to be approved this week by the Defense Dept.

The directive would serve the same purpose for military rockets and missiles that the Defense Dept. directive of July 6, 1962, does for military aircraft (AW June 11, p. 26; Aug. 13, p. 27).

Space vehicles and their boosters will not be included, since their designations are classified under a separate order.

Completion of a combined designation list by the Air Force, Navy and Army is expected to take two to three months after issuance of the directive. The list will be more complex than the one issued for aircraft because missiles and rockets have appeared in more designs and series.

As proposed, the directive defines the different types of missiles, such as air-to-air, air-to-surface, surface-to-air, surface-to-surface, surface-to-underwater, and underwater-to-surface.

Designations for specific missiles and rockets will follow a letter-number-letter sequence similar to aircraft.

They will reveal the exact nature of the rocket or missile. First in the sequence, if applicable, will come the status prefix symbol. These designations are exactly as they appear in aircraft directive. Next is launch environment symbol to indicate how it is launched.

Mission symbols include decoy, special electronics, surface attack, aerial intercept, drone, training, underwater attack, weather. General vehicle type symbols are guided missile, probe, rocket.

The designations will end with a design number and a letter series symbol.

Judge Orders Umbaugh Reorganization Plan

Federal judge has appointed a trustee for Umbaugh Aircraft Corp. and ordered him to submit a list of creditors by Feb. 10 and a plan of reorganization for the company by Feb. 25.

Action by the Federal District Court for the Middle District of Florida, in Tampa, removes control of the company from its founder and president, Raymond E. Umbaugh.

Peace River Manufacturing Corp., formed to produce Umbaugh U-18 gyroplanes on order from Umbaugh Aircraft (AW May 28, p. 34), also has been placed under voluntary trusteeship.

Production of aircraft at the companies' Ocala, Fla., factory was halted in the fall, after four creditors received a \$481,556 judgment against the corporation from a Baltimore, Md., court.

U.S. Still Pressing for Settlement Of Long Lockheed-IAM Dispute

By Katherine Johnsen

Washington—Government continued to press for settlement of the protracted contract dispute between Lockheed Aircraft Corp. and the International Assn. of Machinists last week. Invocation of the Taft-Hartley Law will force a vote by workers on Lockheed's final package proposal between Feb. 1 and Feb. 15 if a deadlock over the union shop issue is not resolved before then.

Support of the company's proposals by a simple majority of workers would make them effective. Putting the package to a vote would represent a victory for Lockheed, which has favored this at various points during the several months of talks. The union wants a vote on whether Lockheed should have a union shop and company does not.

Meanwhile, Federal Mediation and Conciliation Service is continuing its negotiation efforts with Lockheed management and labor as the 80-day no-strike "cooling off" period provided for by the Taft-Hartley Law runs its course.

The cooling off period began on Dec. 3 when a temporary 10-day injunction against a strike, requested by the U.S. attorney general on behalf of the President, was issued by Federal District Judge Jesse Curtis. An injunction for the remaining 70 days is expected to be issued this week. During the 15-year life of the Taft-Hartley Law, no presidential request for the 80-day cooling off period has been denied.

Under Taft-Hartley, if no agreement is reached within 60 days—or by Feb. 1 in the Lockheed case—an election must be held on a final proposal by management within the next 15 days.

Rejection of the proposal amounts to a notice by the workers that they will resume the strike at the end of the 80-day period. Meanwhile, Administration pressure is being applied to Lockheed management to bow to the union's proposal that the union shop issue be decided by a vote of workers, and reach an early agreement. Defense Dept. is refusing to sign any further procurement commitments with the company (AW Dec. 3, p. 27).

The worker referendum was recommended by a special board, appointed by the President to advise on aerospace disputes. It was headed by Dr. George W. Taylor. Other aerospace firms have gone along with the Taylor board's recommendation, under which a two-thirds majority is required to establish a union shop (AW Nov. 26, p. 36).

Lockheed's steadfast rejection of a worker vote, which the company con-

tends does not protect minority rights, was climaxed by a short-lived strike of 40 hours, starting Nov. 28, against the plants and missile site installations of two divisions—Lockheed California Co. and Lockheed Missiles and Space Co.

Strikers voluntarily returned to their jobs at the personal request of William Simkin, director of the Federal Mediation and Conciliation Service. The President resorted to the Taft-Hartley Law as assurance against any stoppage in vital defense production.

Other labor developments:

- **Boeing Co.** Results of elections on the union shop issue at the Boeing plant in Seattle and at the Vertol Division in Philadelphia, held last week, are expected momentarily. The company reluctantly agreed to the election under White House pressure. The machinists union agreed to postpone possible strike action until at least Jan. 15.

- **McDonnell Aircraft Corp.** IAM and management continued to be optimistic last week that a peaceful labor settlement could be reached, despite an overwhelming vote to strike—approximately 7,500 to 1,370—by IAM members. The strike vote followed rejection of a three-year contract proposed by the company. The contract had previously been unanimously accepted by the union bargaining committee. McDonnell management said it felt there was confusion among workers as to what was included in its proposal. National IAM headquarters withheld sanctioning the strike.

NASA Fills Last Post In Biotechnology Unit

Washington—Robert F. Trapp, nuclear physicist and engineer, has been appointed chief of the man-system integration division in the National Aeronautics and Space Administration's Office of Advanced Research and Technology (OART).

Appointment of Trapp completes organization of OART's Office of Biotechnology and Human Research which includes a human research division headed by Capt. Frank B. Voris, on detail to NASA from the Navy Medical Corps., and a biotechnology division under Dr. M. G. Del Duca.

Trapp came to NASA from the Douglas Aircraft Co., where he directed radiation hazard studies, and later, research for manned nuclear spacecraft. Dr. Del Duca, also a recent appointment, directed research in environmental controls for space vehicles at the Thompson Ramo Wooldridge Corp.

AIAA Formed

New York—American Rocket Society and the Institute of the Aerospace Sciences formally merged last week into the 36,000-member American Institute of Aeronautics and Astronautics (AW Nov. 19, p. 27).

Dr. William H. Pickering was announced as the first president of the AIAA. Pickering is director of the Jet Propulsion Laboratory of the California Institute of Technology and was president of the ARS in 1962.

The AIAA, which will begin operation February, will have headquarters in New York and facilities in Los Angeles.

Other AIAA officers include three vice presidents, Dr. Martin Summerfield, professor at Princeton University; Harold T. Lusk of Lockheed Missiles and Space Co., Sunnyvale, Calif. and Charles Tilgner, Jr., of Grumman Aircraft Engineering Corp., Bethpage, N. Y. C.

Treasurer of the AIAA will be R. Dixon Speas of New York and executive secretary will be S. Paul Johnston, presently director of the IAS.

James J. Harford, now executive secretary of the ARS, will be deputy executive secretary.

Over-all responsibility of the Biotechnology and Human Research Office is development of advanced control and life support systems and better understanding of man and machines and their integration.

Trapp and his staff will be responsible for research into integration and utilization of spacecraft control systems. Dr. Del Duca has charge of research and design of systems to protect, support and provide for survival of crews on aeronautical and space missions.

Japan Permits U.S. Tracking Site Survey

Washington—Japan has agreed to permit U.S. space officials to survey its islands for possible satellite tracking stations.

National Aeronautics and Space Administration officials favor sites on Shikoku and the southernmost island of Kyushu. However, Japanese news agencies report local opposition to such proposals.

Japanese government has attached these conditions to U.S. tracking site proposals:

- Stations must be for purely peaceful purposes and not interfere with regular radio communications.
- Operators of the stations must be Japanese nationals.
- Tracking stations must be able to receive radio signals from other radio stations as well as satellites.

U.S., USSR Approve Joint Space Tasks

By Ward Wright

New York—U.S. and Soviet governments have formally approved three joint programs for the peaceful uses of outer space. Programs grew out of bilateral talks between Dr. Hugh L. Dryden, deputy administrator, National Aeronautics and Space Administration and A. A. Blagonravov, academician of the USSR Academy of Sciences, held in Geneva, Switzerland last June.

Joint programs, which grew out of a March, 1961, exchange of letters between President Kennedy and Chairman Khrushchev, were revealed last week by Adlai E. Stevenson, U.S. ambassador to the UN, in a General Assembly committee meeting convened to consider adoption of the report of the Committee on the Peaceful Uses of Outer Space.

UN observers consider the resumption and approval of U.S.-Soviet cooperative space programs as an indication of easing East-West tension. President Kennedy and Premier Khrushchev approved the programs outlined by Dryden and Blagonravov Dec. 4, after the timetable for approval had been interrupted by the Cuban crisis.

The three programs are:

- **Meteorological research** to be conducted in two phases.
- **World Geomagnetic Survey** to take place during the period of the International Year of the Quiet Sun (IYQS).
- **Satellite telecommunications** experiments.

First or experimental stage of the cooperative meteorological research program, will extend from approximately the present time through 1963-64. During this period, U.S. and Soviets will continue development of experimental weather satellites.

Joint Working Group of experts will meet in the near future to arrange communication links for the transfer of data gathered from the experimental satellites. These links would connect the World Weather Centers established during the IGY in Moscow and Washington. Working group also will consider cost sharing and the interests of other nations in the program.

Group will establish criteria for the transfer of satellite data which will include selected cloud-cover photos, especially those related to storms, vortices, fronts and their origins. Geographical coordinates and cloud analysis also will be included in the transferred data.

Date will be agreed upon by the group for initiating weather data transfer when the two countries are prepared to exchange data of equivalent interest. The same data links will be used to exchange weather charts, diagrams, vertical cross-sections and other material needed for solving world weather problems.

Second, or operational stage of the program is scheduled to begin in 1964-65 with the coordinated launchings by the two nations of a system of operational weather satellites. Weather data transmission will be on a real-time

basis. Joint working group is scheduled to meet next spring to agree on launching schedules for the operational satellites, their numbers, orbits and compatibility of their sensors.

These discussions will give due consideration to World Meteorological Organization (WMO) weather data acquisition goals for operational and research satellites.

Preliminary work for a world geomagnetic survey will be handled by another joint working group of specialists which would consider technical aspects of mapping the world's magnetic fields with artificial satellites. This group will formulate recommendations on the shape of orbits, angle of inclination to the equator, periods of satellite operation, accuracy of measurements, type of instruments to be used in the satellites, methods of processing and analyzing data and other details. This group is scheduled for appointment as soon as technically possible.

Program will involve a coordinated launching of two satellites equipped with magnetometers during the period of the IYQS. Satellites will be launched on different mutually agreed orbits. Period before IYQS will be used by both countries to conduct their own magnetic measurements in space with a mutual exchange of processed data.

Data gained from satellite measurement will be exchanged through the World Data Centers in Moscow and Washington, established during the IGY. Both nations have agreed to use

Navy Asks TV-Guided Missile Appropriation

Los Angeles—Navy is seeking appropriation of funds in Fiscal 1964 budget for development of a television-guided, air-to-surface missile, the Condor (AW Apr. 9, p. 31), possibly intended for use as armament on the McDonnell F4A and F4B, the North American A3J and possibly the F-111B.

Some aerospace companies are already investigating various elements of the system. North American Aviation's Columbus Division has been running simulation studies under contract from the Navy's Bureau of Weapons and Naval Air Division of Northrop Corp. is conducting intensive studies of the data system which is intended to link the missile with its launching platform over a range of up to 100 mi. Other companies which have expressed interest in the weapon to BuWeps include Martin Co., Douglas Aircraft, Grumman, General Dynamics/Pomona and Ling Temco Vought.

Condor missile is to be guided to its target by the pilot of a launching aircraft from a TV cockpit monitor displaying pictures secured by a camera in the missile while the aircraft is escaping from the target area. The missile would be dropped from about 40,000 ft. After falling about 200 ft., its propulsion would ignite. Its projected range is considerably longer than that of the sight guided air-to-surface Bullpup missile. Technical responsibility for the project rests with the Naval Air Development Center, Johnsville, Pa.

Should the Navy be successful in getting the desired funds in Fiscal 1964, industry may be invited to participate earlier, perhaps by this spring. The exact development format—whether Navy will select a single prime or a series of associates—has not been finally determined.

Naval agencies have been evaluating various elements of the missile, for some time particularly the automatic tracking and guidance systems. One of these, called Walleye (AW Apr. 9, p. 31, Oct. 15, p. 26), locks onto a target selected by the pilot from his display of image contrasts secured by a camera in the air-launched missile. This system was developed at the Naval Ordnance Test Station, China Lake, Calif. A somewhat similar one has been under investigation at the Naval Test Facility, Pt. Mugu, Calif.

Condor most recently has been under development at NOTS, China Lake, although much of the original work on it began at the Naval Ordnance Laboratory, Corona, Calif.

their influence to expedite the flow of magnetic field measurement information from non-government organizations such as International Committee on Geophysics and Committee on Space Research (Cospar) to the data centers.

In the field of satellite telecommunications, U.S. and Soviets agreed to cooperate during the remainder of 1962 and in 1963 in communications experiments utilizing the Echo A-12 passive satellite. Groundwork for future joint satellite telecommunications programs, including development with other nations of a global system of space communications, was reserved for discussion at future meetings between the two countries.

In spite of the promising start given cooperative programs for peaceful uses of space by the U.S.-Soviet agreement, the General Assembly's First Committee debating adoption of the UN Space Committee report remains bogged down over the legal issues involved.

Space committee report, completed last September, was to have been derived from recommendations from its two subcommittees—the technical subcommittee and the legal subcommittee. However, the legal subcommittee was unable to reach agreement due to conflict over cold war issues such as the role of reconnaissance satellites and

whether general disarmament is necessary before principles for peaceful space exploration can be laid down.

Report of the technical committee, urging wider exchange of scientific data among nations from non-governmental agencies such as Cospar, United Nations Educational, Scientific and Cultural Organization, World Meteorological Organization (WMO) and others, and creation of sounding rocket facilities, especially in equatorial and southern hemisphere areas, is expected to be adopted with little or no opposition.

At present, U.S., USSR, United Kingdom, United Arab Republic, and Canada (in conjunction with the U.S.) have various draft resolutions pending consideration before the Space Committee.

Sentiment at the UN is that the problem of working out legal recommendations for peaceful development of outer space will be returned to the legal subcommittee early next year.

Sen. Albert Gore (D-Tenn.) told the UN that there was no workable dividing line between military and non-military uses of space. To banish military activities in space, Gore said, nations must work for general and complete disarmament.

Gore said the U.S. had no intention of placing weapons of mass destruction

in orbit unless compelled to do so by the Soviets. He endorsed the UN space committee recommendation for improvement in distribution of weather information gathered by satellites, and mentioned the U.S. Nimbus weather satellite program. Nimbus, he said, could furnish weather information around the world to an inexpensive ground system such as NASA's Automatic Picture Transmission subsystem (APT).

This system, Gore said, would cost about \$30,000 and enable interested nations to receive direct transmission of local cloud cover.

Atlantic Research Management Changed

Top management of Atlantic Research Corp. has been reorganized, and Dr. Arthur W. Sloan, former board chairman, has been elected to the new post of chief executive officer.

Atlantic's board, following a five-week suspension in the trading of Atlantic Research Corp. stock (AW Nov. 26, p. 97), realigned the company organization so that:

- **Dr. Arch C. Scurlock**, who was president, becomes chairman of the board and will devote primary attention to the technical programs of the company.
- **Dr. Sloan** becomes vice chairman of the board and chairman of the executive committee as well as chief executive officer. He will be responsible for overall policy matters and for financial direction of the company.
- **M. Lee Rice**, becomes president and a board member, with responsibility for general management of the company's day-to-day operations. Rice was vice president and has directed company programs in solid propellant rocket development and also in vehicle system engineering.

Soviet Circumlunar Plan

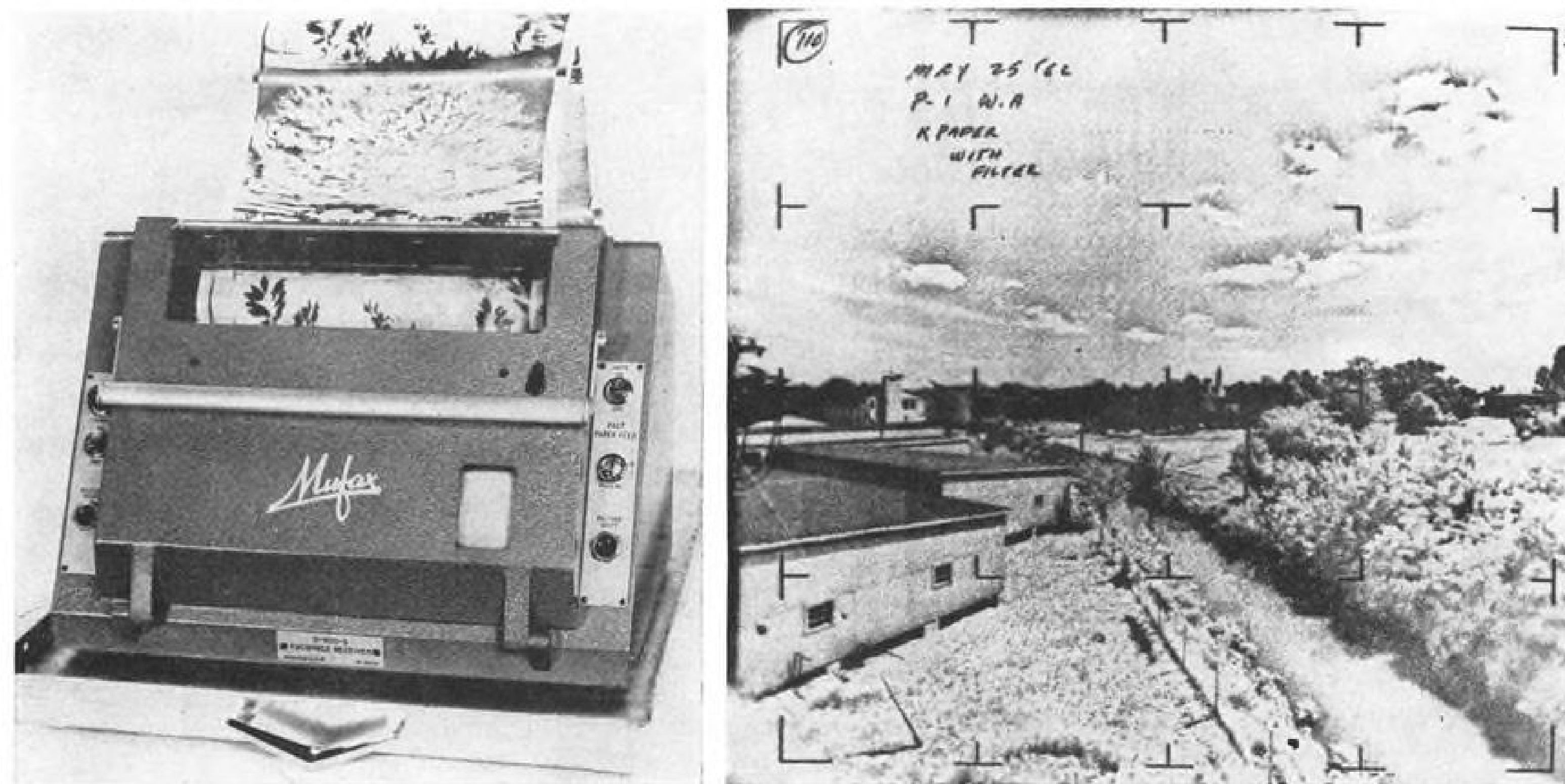
Washington—Swedish Scientist Bjoern Malmgren said last week that Soviet Russia plans to send two cosmonauts on a circumlunar flight late next year.

Malmgren made his report after visiting Russia to inspect a Swedish-built 15g centrifuge on which Soviet pilots are training, and to attend a USSR Academy of Sciences meeting.

Swedish Embassy here told Aviation Week & Space Technology the device was built by the Asea Co., the largest electrical components manufacturer in the country.

Asea is located in Vasteras, about 100 mi. west of Stockholm.

Asea said it delivered the centrifuge secretly to the cosmonaut training center in Russia a year ago.



AUTOMATIC PICTURE TRANSMISSION (APT) system is expected to have wide application in weather analysis and international forecasting. The system is planned for use in Nimbus meteorological satellite, although preliminary flight test may be conducted in 1963 with Tiros. Cloud pattern photos can be taken when satellite is within 1,700-mi. range of receiving station. Photos will be received and reproduced immediately from satellite transmission on special electro-sensitive paper.

CANEL Aims for Snap-50 Test in 1965

By David A. Anderton

Middletown, Conn.—Fabrication of core elements and the containment pressure vessel for a lightweight experimental reactor leading to the Snap-50 system has begun here at the Connecticut Advanced Nuclear Engineering Laboratory (CANEL).

Other components of the reactor have entered production, and about 40% of the detailed engineering fabrication drawings have been issued to the shop. Design of the reactor is essentially complete.

Current schedule calls for assembly of the reactor to be performed in 1964 at the Atomic Energy Commission's Idaho Falls station. Criticality experiments and testing of the liquid-metals systems will be done that year and in 1965, according to the same schedule.

Pratt & Whitney Aircraft Division of

United Aircraft Corp. is responsible for the design and development of the lightweight prototype reactor for the Snap-50 reactor system, which draws heavily on P&WA's background in the now-cancelled aircraft nuclear propulsion program. P&WA also operates the government-owned CANEL facility for the AEC, under a contract for research and development work approximating \$22 million in Fiscal 1963.

Snap-50 is a lithium-cooled reactor system for space electric power aimed at design power levels between 300 and 1,000 kw., and specific weights between 20 (for the 300-kw. level) and 10 lb./kw. (for the megawatt level). This weight goal would include the radiator, still one of the unknown factors in this and any other space power program. P&WA's responsibility does not now include the design, development or production of the radiator.

Snap-50 and its prototype system start with the fission process of highly enriched uranium fuel mounted in elements in a lightweight reactor. The reactor is cooled with liquid lithium, a low-melting-point metal with about one-quarter the specific weight of aluminum. The liquid lithium leaves the reactor at approximately 2,000F, at which temperature its viscosity is approximately that of water.

This characteristic of lithium makes it possible to cold-flow components on test with water, which is cheaper, neater, and considerably easier to handle than molten lithium at 2,000F.

Lithium is contained in a primary loop which leads from the reactor to a boiler, where the heat from the lithium is used by a heat exchanger to boil potassium metal in a secondary loop. The lithium leaves the boiler, passes an accumulator, and through a pump and back into the reactor again.

Vaporized potassium leaves the boiler and enters an expansion turbine which takes energy from the hot vapor. The turbine drives a generator and the generator provides the electrical power which is the main purpose of Snap-50.

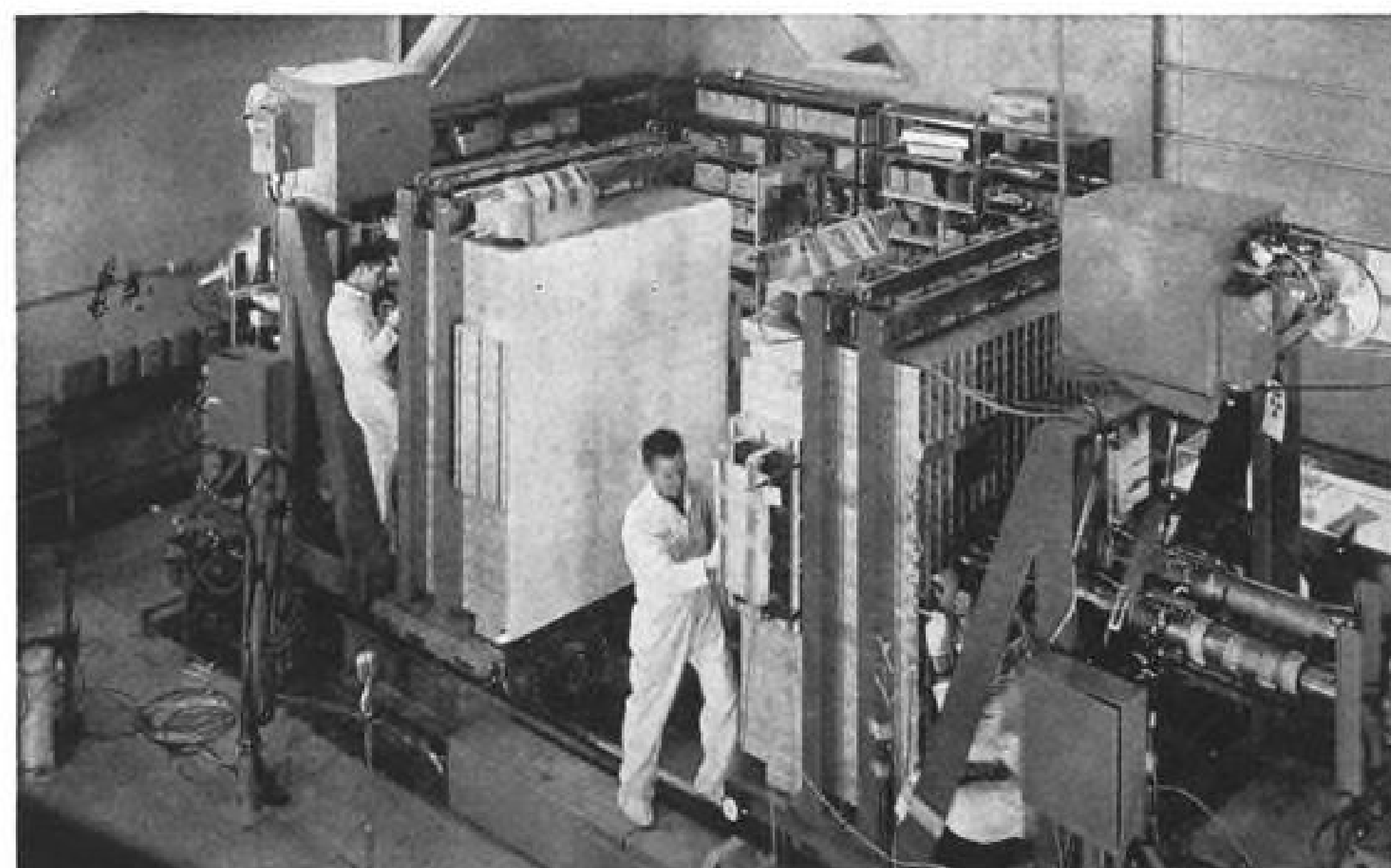
Immediately downstream of the turbogenerator is the potassium pump. Like the sodium pump, it is electrically driven by power tapped from the generator output.

Potassium in the vapor phase exits from the turbine and passes through a heat exchanger which cools it to the liquid phase. Its heat of condensation, emitted during the cool-down, is discharged through the radiator system. The liquid potassium passes through a secondary radiator for further temperature reduction, and is then used as a coolant for the generator and other system units. It is returned to the upstream side of the boiler unit to repeat the secondary loop cycle.

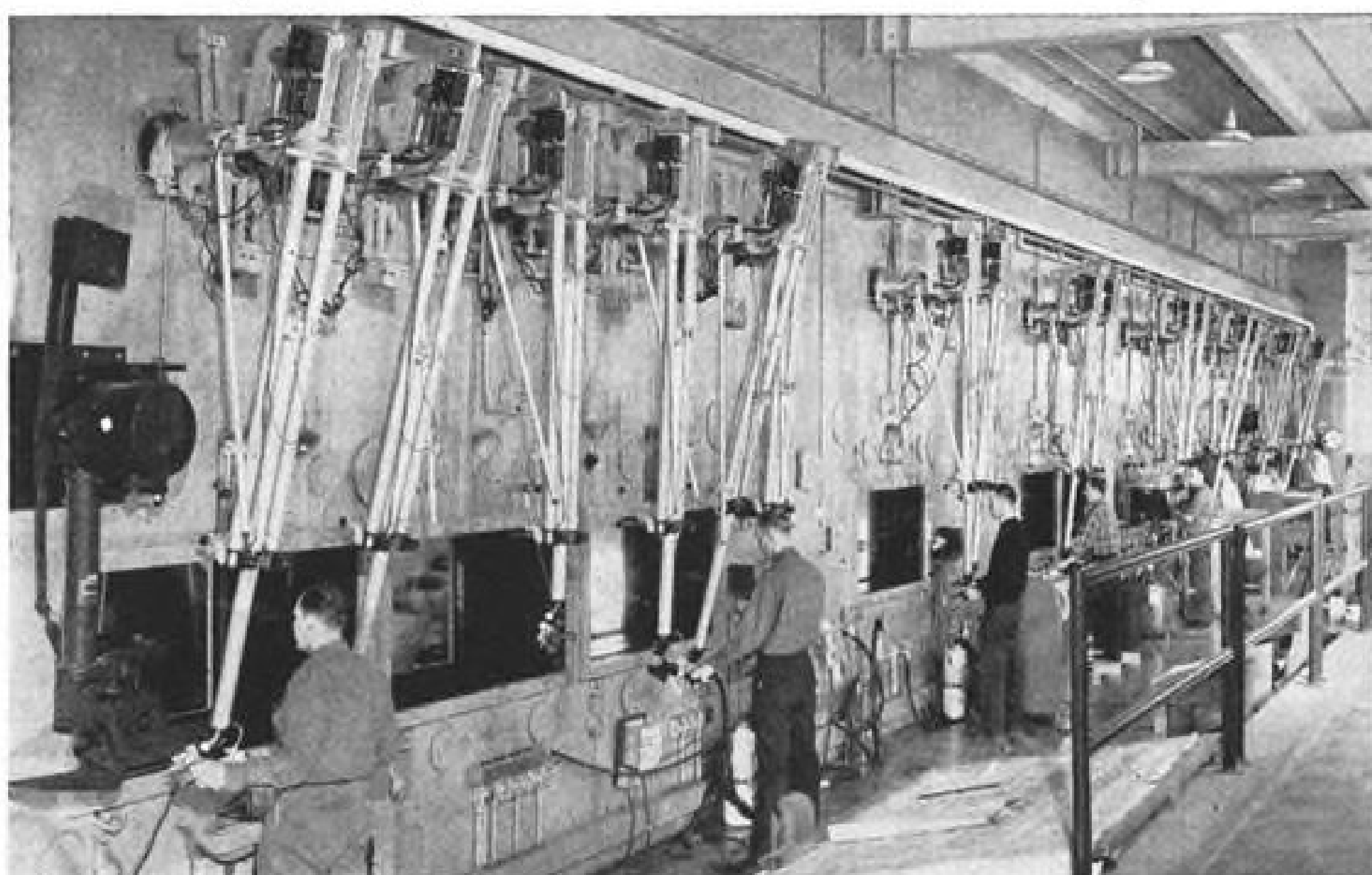
Lithium containment throughout the system is performed with an alloy of zirconium and columbium; pipes, valves, pumps and other components are fabricated from this alloy. Typical parts have been operated for "thousands of hours" at temperatures up to 2,000F, says the AEC.

Current reactor design will be followed by an advanced reactor for the Snap-50 system itself, specifically engineered to last for 10,000 hr. of operation in a space environment.

With total system weights between 6,000 and 10,000 lb., the Snap-50 system is scheduled for flight tests in vehicles of either the Titan 3 or the Saturn class. If present schedules are met, flight tests should be made before 1970.



MOCKUP REACTORS (above) are used in controlled-fission experiments at CANEL. In "hot" laboratory (below) operators work with radioactive materials remotely.



General Dynamics F-111 Organization

Fort Worth, Tex.—Important organization changes have been made by General Dynamics/Ft. Worth to emphasize and expedite development of the recently won development competition for the F-111 tactical fighter (AW Dec. 3, p. 26).

Project-type organization is being set up to handle the new program here, Ft. Worth President Frank W. Davis stated. Headed by J. T. (Bing) Cosby, formerly program director for the supersonic B-58 Hustler bomber, the organization includes: William C. Dietz, F-111 deputy program director and chief engineer; Bill C. Wills, manager-contract administration; Norman H. Simpson, quality assurance director; Roy Gallagher, planning and controls manager; E. S. Brown, F-111 configuration control manager; Robert Kahn, material manager; Warren H. Tidwell, manufacturing manager; Robert W. McGuffee, logistic support manager; Robert W. Moller, F-111 test base manager; E. E. Hatchett, Grumman activities manager; George I. Davis, executive assistant and value control coordinator, and A. S. Mitchell, Jr., assistant for tactical requirements.

Initial contract with the General Dynamics/Ft. Worth-Grumman team calls for 22 of the two-man tactical fighters to be built here for development testing, with initial deliveries scheduled within two-and-a-half-years.

USAF C-130As Accelerate Airlift Of Arms, Troops to Assam Valley

By Cecil Brownlow

New Delhi—Twelve U.S. Air Force Lockheed C-130A turboprop transports on loan to the Indian government are pushing infantrymen and arms into the threatened Assam Valley on an accelerated basis, with each aircraft and crew flying an average of one sortie per day.

By late last week, the aircraft were scheduled to have ferried a total of approximately 6,000 troops and well over a million pounds of equipment into Assam from New Delhi's Palam Airport from the time the C-130 airlift began in earnest on Nov. 26.

Sorties, with USAF crews aboard, are being conducted under the direction of Indian air force headquarters here and continuing despite the unilateral cease fire and partial withdrawal of Communist Chinese troops within the Himalayan border areas of Ladakh and the North East Frontier Agency (NEFA).

Government Proviso

The aircraft, from the 322nd Air Division based at Evreux-Fauville, France, have not yet begun to operate into the high-altitude fields of Ladakh and NEFA, although they are expected to begin flights into these regions within the near future. Only U.S. government proviso attached to the emergency loan of the aircraft to India is that they avoid any areas where they might become exposed to direct Chinese fire, possibly creating an international incident of major proportion.

Thus far, there has been no indication that the Indian government plans to slacken its troop and material reinforcement into the threatened areas by the C-130s and regular Indian air force

aircraft. Logistics support for the 322nd Division aircraft is being established from Evreux on the supposition that the planes probably will be called upon to remain here over a prolonged period.

Individual aircraft have lifted up to 100 troops on the five-hour flight from New Delhi to Assam, although officially 92 men is the maximum design load for the C-130A. Cargo carried has been primarily in the form of individual weapons, mortars, mines and ammunition plus support equipment.

Biggest push came during the first four days of the lift when over 4,000 troops were carried into the two asphalt-runway Assam fields assigned to the C-130s. The Evreux aircraft were alerted for the mission on Nov. 21 and by 4 p.m. on Nov. 23 all 12 plus a support C-130 had completed the 5,000 mi. trip to New Delhi, bringing with them a full 30-day supply of spares, maintenance vehicles, medical stores and food. Including the 12 aircraft crews, a total of 205 men are now stationed at Palam for the operation.

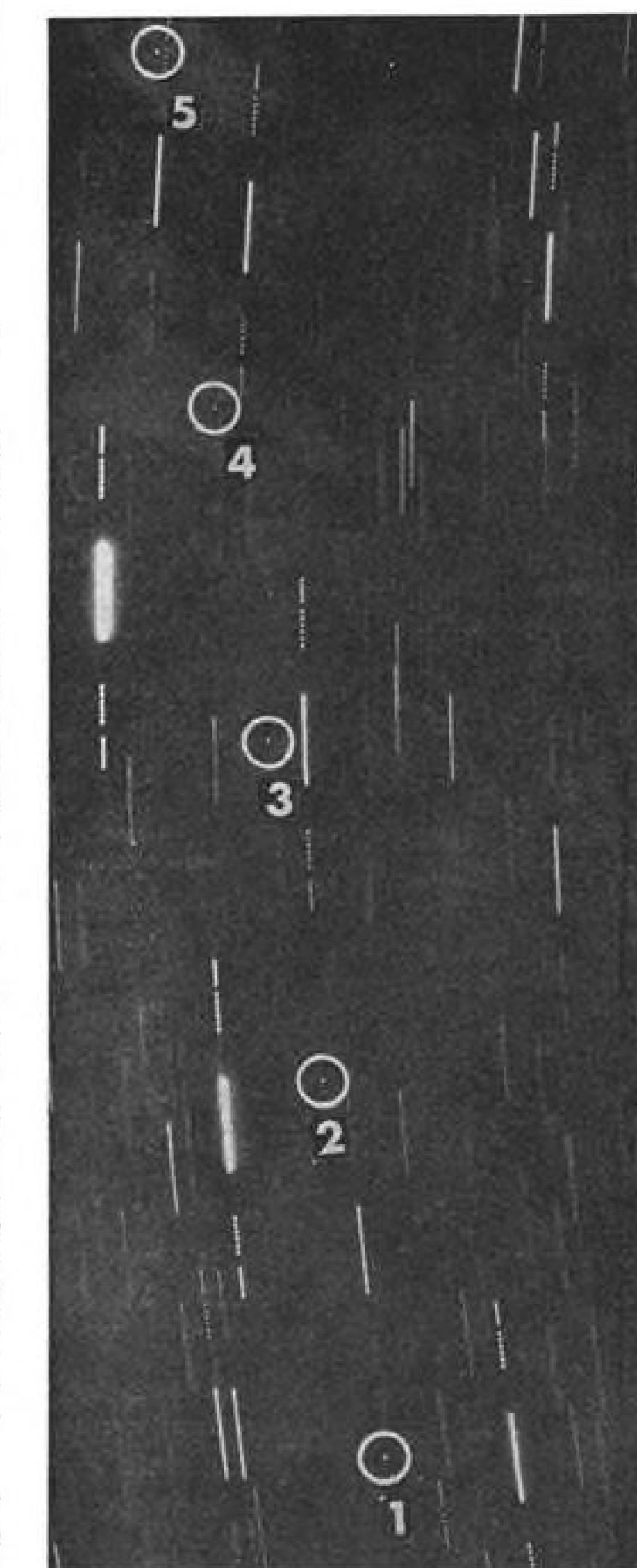
Fuel for the operation, JP-4, is being supplied from Indian air force stocks. Supply at the moment is said to be plentiful, although this could change if the combined C-130/Indian air force airlift operation continues at its present pace. There are no facilities for refining JP-4 within India, and this fuel must be sealifted here from stocks in the Near and Middle East. There also is a shortage of tank cars needed to transport the fuel from dock areas to air force pipelines.

There was a slight slowdown in tempo last week as the C-130s piled up flight hours and 322nd Commander Col. Charles Howe directed that one

aircraft be grounded each day for a full maintenance check. In anticipation of a prolonged operation in India, Howe also ordered that a rotational system for aircraft and crews be put into effect last week.

Under the plan, one aircraft and its crew will return to Evreux each week with its successor flying to New Delhi with additional spares and other stocks to augment the flyaway kits brought in on the original lift.

The C-130s made the flight from Evreux to Palam in a total elapsed time of approximately 29 hr., including a crew rest in Teheran.



ANNA Tracking

Flashing light on ANNA geodetic satellite was successfully photographed during recent operational test of the satellite which is administered by Army, Navy, Air Force and NASA. Flashes were manually triggered at Johns Hopkins Applied Physics Laboratory and were photographed by the Ballistic Research Laboratory's station at Spentie Island, Chesapeake Bay. Each flash represents one million watts power output and lasts about one ten-thousandth of a second, with an interval of 5.6 sec. between flashes.



Russian Ship Begins Return Of Il-28 Bombers

Three fuselages of Il-28 Beagle jet-powered light bombers are visible on the deck of the large Russian cargo ship Okhotsk leaving Cuba. The ship was photographed by U. S. reconnaissance aircraft off northern coast of Cuba Dec. 1. Like returning Russian missile-carrying ships (AW Nov. 19, p. 31), the Okhotsk shows considerable hull below the water line, indicating light loading. Cargo hatch over the hold where the fuselages are secured is 80-90 ft. long, and is similar to that of the Poltava (AW Nov. 12, p. 32). Poltava is designed for rapid loading and unloading of special size cargo at ports without much dock equipment, and except for fantail details, Okhotsk's layout is similar. Note throng lining the Okhotsk's rail, watching flyby of photo plane.



Three LEM Engine Contracts Due

Seventy-man team from Grumman Aircraft Engineering Corp. has been in session with National Aeronautics and Space Administration Manned Spacecraft Center in Houston since Dec. 3 to definitize the contract for the lunar excursion module (LEM) and to select the list of subcontractors on the vehicle.

The LEM spacecraft (AW Nov. 12, p. 29) will be used to land two Apollo astronauts on the moon and return them to the Apollo command module. A principal subcontract in the system involves propulsion, and tentative agreement has been reached between Grumman and NASA that three contracts will be awarded for these propulsion systems:

- Main engine, for lunar landing, will involve extensive throttling capability, and will be developed in two parallel programs, one using the aeration injection technique (AW Nov. 5, p. 27) and another employing a mechanically controlled variable-area injector. Evaluation of these two approaches, after prototype firings, would result in selection of a single contractor to develop the final system, which would use an equal mixture of unsymmetrical dimethylhydrazine and hydrazine, plus nitrogen tetroxide as the oxidizer.
- Lunar takeoff engine, for ascent to, and rendezvousing with, the orbiting Apollo spacecraft, will involve a fixed-area injector affording limited throttling, approximately in the ratio of 3 to 1, by varying propellant flow. Propellant would be same as for the main engine.

Grumman, as LEM prime contractor, will manage the propulsion developments for Manned Spacecraft Center and is expected to award sole-source contracts under the LEM program. Dual contractors for the main engine are expected to be selected from North American Aviation's Rocketdyne Division, United Aircraft's United Technology Center, Aerojet-General, and Thiokol's Reaction Motors Division. Bell Aerospace Corp. is the favored contractor for sole-source selection to develop the lunar takeoff engine.

House Space Group Challenges Advent Program Cost Effectiveness

Washington—House Science and Astronautics Committee expressed further doubts about the wisdom of pursuing the Advent military communications satellite program by declaring last week that the Defense Dept.'s satellite plan cannot be justified on a cost effectiveness basis.

The applications, tracking and data acquisition subcommittee restated an earlier House space committee request for detailed justification before the military commits itself to full-scale development of the Advent project.

Program 'Premature'

The subcommittee, headed by Rep. Ken Hechler (D.-W. Va.), said in its report that it would be "premature" to embark on the Advent medium altitude communications satellite program before other programs like Syncom were evaluated fully. "To develop a new satellite vehicle when the Relay, Telstar and Syncom satellite vehicles would be available with modification (except for transmitting tube of proper frequency) appears to be disregarding the development that has been carried out by others," the House subcommittee report said.

The subcommittee report is based on hearings in September and October on the need for military communications

satellites. The subcommittee said it was "sympathetic" to the need for such a system, but felt testimony by military officials "did not indicate that their plan can be justified on a cost effectiveness basis."

Gen. Bernard A. Schriever, commander of USAF Systems Command, told the House space sciences subcommittee Dec. 15 that "we can have an operational capability with this low-altitude satellite in the latter part of 1964 or early part of 1965." The Hechler subcommittee questioned in its report whether it was wise to embark on the reoriented Advent program when in another year's time—according to testimony by Hughes Aircraft Co.—a synchronous system using "at most nine satellites with far more capability and sophistication could be in operation."

Assurance Asked

The subcommittee report asked the Defense Dept. to provide "assurance that every advantage is being taken of previous development in the field of communications satellites" as well as "detailed justifications" of present and proposed Advent expenditures.

The House space sciences subcommittee made a similar request in its report which was made public last month (AW Nov. 19, p. 117).

Decision Unit Urged For Nimbus Program

Washington—Nimbus weather satellite program should be reorganized so there is a "court of appeal" to settle differences between the Weather Bureau and National Aeronautics and Space Administration, the House Science and Astronautics Applications Subcommittee said in a report last week.

"The relationship existing between the Weather Bureau and NASA," the subcommittee said, "is basically one of co-partners, strongly implying that, in instances of unresolved conflicts of judgment, there are no means of arriving at final decisions other than at the presidential level."

The subcommittee recommended creation of a "court of appeal from which final and binding decisions can be obtained."

The subcommittee report was based on hearings held Aug. 28-Sept. 21. Defense Dept. witnesses at the hearings disclosed the Nimbus launching had slipped about a year from the original target date of the second quarter of Calendar 1962.

Dr. Morris Tepper, NASA weather systems chief, said during the hearings that NASA was conducting the Nimbus program on an "as soon as possible"—rather than urgent—basis (AW Sept. 3, p. 17.) The subcommittee recommended that NASA make it clear that there is a need for urgency in the Nimbus program. In contrast to Tepper, Dr. S. Fred Singer, National Weather Satellite Center director, said during the hearings that he was aware of the urgency surrounding Nimbus.

Olympus Testbed Burns

London—Avro Vulcan bomber testbed for the Bristol Siddeley Olympus 22-R engine was destroyed by fire last week at the Filton production plant.

Airplane was being used for ground runup tests when the fire started. Flaming fuel spread over the ramp, destroying a fire engine. There were no injuries.

The Vulcan, which carried the Olympus 22-R in a double-intake pod sling under the belly (AW Oct. 15, p. 103), had completed about 100 hr. of flight testing. It will be several months before a new testbed can be instrumented.

Loss of the Vulcan will mean a delay in the British TSR-2 strike reconnaissance aircraft program. A version of the engine, which includes an extra stage, is under development for the joint Anglo-French supersonic transport program. Latter engine is designated the Olympus 593. Component parts for prototype engine are now being ordered by Bristol Siddeley.

USAF Halts Saint Work; Shifts to Gemini

By Philip J. Klass

Washington—Air Force has halted work on its satellite inspector (Saint) spacecraft fabrication and test program and plans to fund the purchase of Gemini spacecraft for manned rendezvous experiments as a more promising way to investigate basic rendezvous techniques (see p. 27).

The decision to halt the Saint spacecraft and flight test program was made by the Air Force entirely on its own, without any prompting from the Director of Defense Research and Engineering (DDRE). Radio Corp. of America, Burlington, Mass., is the program prime contractor.

Air Force intends to continue with development of some of the sensor subsystems originally planned for the spacecraft. Meeting is scheduled to be held in the Pentagon early this week to determine which of the subsystem programs will be continued.

The Air Force decision is the result of a number of factors. As originally conceived, the program was intended to investigate rendezvous problems using modified versions of off-the-shelf subsystems, such as the Westinghouse Electric intercept radar originally designed for the Bomarc missile. As the project progressed, it became apparent that extensive modification and fundamentally new developments were required to handle the problem and to operate reliably in the space environment.

As a result, the program overran the original cost estimate and timetable. Originally, RCA had estimated program cost at about \$50 million, but because USAF funds were limited, it agreed to try to shave the original figure to about \$30 million and took the contract at this price.

Amount of dollar overrun is not known, but schedule slippage is reported to be about six months.

Despite the growing vehicle complexity and cost, it was not designed as the prototype of an operational system and therefore had limited growth capability, according to a USAF spokesman.

Observers close to the program say that failure of the USAF to clearly define program objectives, coupled with lack of firm management both in the USAF's Space Systems Division and in RCA, contributed to the present situation.

After the program was already under way, the newly formed Aerospace Corp., as the USAF's technical adviser, injected its own views into the program, resulting in more changes in goals, AVIATION WEEK & SPACE TECHNOLOGY

was told. Often there were sharply divergent views between the USAF system program officer and the Aerospace Corp., according to qualified observers.

RCA spokesmen declined comment other than an official statement, which says that the "program is being reoriented toward achieving longer-term space applications."

The North American Air Defense Command (Norad) was critical of the satellite inspector program, including its basic concept. Norad would be responsible for operating satellite inspectors if and when they became an operational system.

The same argument which Air Force has used to oppose production of the Army's Nike Zeus anti-ICBM missile has been used by some Norad officials against the Saint program. The argument against Zeus, which has supporters in Norad, is that the Soviets can bankrupt the defense by using large numbers of inexpensive decoys and forcing the defense to use an expensive Zeus to bring down each decoy.

Norad pointed out that if the U.S. strategy was based on launching a satellite inspector, at great expense, every time the Russians placed an object in orbit, they could impose a heavy economic drain on the U.S. by placing dozens of decoys in orbit at little expense to themselves.

In addition, Norad criticized the program because the satellite inspector carried no countermeasures equipment to neutralize a satellite if it found one.

Reliability studies by Aerospace Corp. and by RCA suggested that there would be a very low probability of successful rendezvous with the four interceptor vehicles on order.

Successful rendezvous would require a successful launch of both the target and the interceptor, with extremely precise timing of the latter, plus successful operation of a number of complex subsystems on board the interceptor.

As a result of the reliability studies, Aerospace Corp. recommended that the contract funding be increased to buy additional spacecraft and to permit more extensive reliability testing of the subsystems.

As an alternative, USAF told RCA and Boeing to study the possibility of installing the interceptor equipment on the Dyna-Soar (X-20A), but after a month of study this idea was abandoned.

USAF therefore faced the likelihood that several or all of the Saint rendezvous efforts might be unsuccessful, compounding the adverse publicity that has accompanied problems with other major programs such as the Skybolt and Midas.

The decision was a difficult, Air Force officials concede, because its spokesmen long have stressed the need for satellite inspection and rendezvous capability in attempting to arouse public and congressional support for an expanded military space program. But the USAF's candor and its action could win it a stronger position in the Defense Dept. and DDRE.

One of the criticisms frequently directed at the Air Force is that it has failed to weed out its less promising programs in order to provide funds for new projects.

In using the Gemini for rendezvous experiments, Air Force believes it will have a more versatile testbed which will permit a wider range of experiments, including a comparative appraisal of the usefulness of an astronaut versus unmanned automatic rendezvous techniques. Air Force currently is negotiating with the National Aeronautics and Space Administration to work out the details of a joint program.

Some observers speculate that the decision to cancel the RCA flight test program might also have been motivated by Air Force desire to demonstrate a need for a manned military space role. They point out that if the RCA satellite inspector had been successful in its flight tests, the need for a manned interceptor would be open to question, while if the flight tests were unsuccessful, USAF would be placed in an awkward position.

C-5 Assembly Building Design Contract Let

Washington—U. S. Army Corps of Engineers has awarded a \$3.3-million contract to a team of four New York City architectural-engineering firms for design of the \$100-million Saturn C-5 vertical assembly building at Cape Canaveral.

Firms are Roberts and Schaefer Co., Inc.; Office of Max O. Urbahn; Seelye, Stevenson, Value and Cnecht; and Moran, Proctor, Mueser and Rutledge. The team's headquarters is 635 Madison Ave., New York.

Vertical assembly building, part of the C-5 launch complex No. 39, will be one of the biggest ever built. It will be 670 ft. long, 520 ft. high and over 500 ft. wide. The structure will enclose an area of 174 million cubic ft. and will be designed to withstand winds of hurricane force.

Complex No. 39 will cost an estimated \$400 million and is to be completed by 1966, when the first C-5 flight is scheduled.

Flight Safety Awards

Three persons have received the Flight Safety Foundation's Award for Distinguished Service, sponsored by Aviation Week and Space Technology.

Presented the award, which is given to persons achieving safer utilization of aircraft, were:

- Donald W. Douglas, Sr., board chairman of Douglas Aircraft Co., Inc., for "establishment and direction of an organization which provided for the world the ubiquitous DC-3 . . . and a succession of ever larger 'well mannered' civil transport aircraft." Notice also was taken of Douglas development of non-inflammable hydraulic fluid.

- Capt. Samuel P. Saint, of American Airlines, for "accomplishments in the cause of flight safety through improved air traffic control equipment and procedures."

- Maj. Gen. Joseph D. Caldara, for "aggressiveness in carrying out his duties as deputy inspector general-safety in the United States Air Force and personal crusading as the director, Flight Safety Research, Norton AFB."

Awards were presented last week in Williamsburg, Va., by FAA Administrator Najeeb Halaby.

Successful Shot Ends Atlas Test Program

Cape Canaveral—Atlas 21-F closed out the five-year flight test program of the General Dynamics/Astronautics-built ballistic missile weapons system with a successful 5,000-mi. flight Dec. 5 down the Atlantic Missile Range.

Launched by an all-USAF crew from the 6555th Test Wing, the last Atlas F carried an Avco Mk. 4 re-entry vehicle containing a data cassette and jettisonable pod on the side of its airframe. Pod contained eight different radiation detectors, and was jettisoned about 5 min. after liftoff. It was planned to recover the cassette and two movie cameras, which recorded staging of the booster engines, but not the pod.

The launch was the 153rd flight of the Atlas weapon system from both the Atlantic and Pacific ranges since its initial flight from here June 11, 1957. Eighty-seven of these flights were research and development missions to prove out the Atlas, with 59 of them successful, 20 considered partial successes and eight failures. Twenty-nine were Strategic Air Command training launches from Vandenberg AFB, with 21 successes, four partial successes and four failures.

Twenty-eight Atlases have been used as space boosters with 23 successes, two partial and three failures. Atlas has been used in at least nine space launches from

Vandenberg in which confirmation of successful orbit of the Samos or Midas satellites has not been released—presumably on the assumption that the Soviet Union lacks radar systems. At least three of these Atlases have successfully orbited their payloads, and the remaining six have failed due either to the Agena upper stage or the Atlas.

Army Investigating Nike Hercules Blast

Premature explosion of a Nike Hercules surface-to-air missile at approximately 500-ft., following launch by a French army crew at McGregor Missile Range, Ft. Bliss, Tex., Dec. 4, was being investigated late last week.

Board of investigators consists of personnel from Ft. Bliss Air Defense School and White Sands Missile Range, N. M. Incident resulted in death of a French lieutenant and injuries to three French enlisted men of the 520th French guided missile brigade and a U. S. Army enlisted man.

Indications are that there was an early malfunction in the Nike Hercules booster, causing the missile to veer sharply to the left soon after launch. Detonation occurred soon afterward, believed to have been caused by destruct mechanism.

Training vehicles are fitted with two destruct systems to destroy the missiles should they veer from proper course, a so-called "fail-safe" automatic system and a separate system that is manually activated by the range safety officer. Altitude of actual burst suggested premature destruct, too close to launch personnel, triggered by automatic system. Hercules firing resulting in the incident was aimed at a Radioplane RP-76 target drone flying at 35,000-40,000 ft.

Lunar Base Study

Washington—National Aeronautics and Space Administration has asked the Army Corps of Engineers to undertake a six-month, \$100,000 study which would define the requirements for construction of a lunar base.

The study was authorized by NASA's Office of Manned Space Flight and will be made by a force of 10 persons at the Engineers' Gravelly Point headquarters here. There are these objectives of the study, which will incorporate earlier studies by the Air Force and the Army—Project Horizon:

- Determine the effort and nature of facilities required to establish a lunar research capability.
- Prepare schedules and budgetary estimates to carry out a lunar base program.

India MiG-21s

Russia will fulfill its MiG-21 fighter commitments to India, the Indian parliament was told last week by both Prime Minister Jawaharlal Nehru and Defense Minister Y. B. Chavan. But the extent of the commitment is not yet clear.

Delivery of 12 off-the-shelf MiG-21s is included in the commitment. Presumably it also would include licensed-production agreements for the MiG-21 and for the Russian RD9-F 6,800-lb.-thrust class engine for the Mk.2 interceptor version of the Hindustan HF-24 fighter. The Mk.2 version is designed for Mach 2 performance compared with the Mk.1's Mach 1 capability. Production of the Mk.1 as a close-support aircraft would continue.

Both the MiG-21 and the RD9-F engine are to be manufactured at a new plant at Orissa, scheduled to open in about three years. (For other details, see p. 33.)

News Digest

Marquardt Corp. won a \$3.4-million contract to provide the 1,750-lb. thrust ullage rockets for the Douglas S-4B stage, and Tapco received a \$1.3 million contract to develop the 150-lb. stabilization engines for the stage. Both contracts were awarded by Douglas.

Medium-angle camera on board the Tiros 6 weather satellite stopped operating after the 1,074th orbit on Dec. 1. Satellite was launched Sept. 18. Wide-angle camera continues to function.

Rear Adm. Luis de Florez, winner of the 1944 Collier Trophy and inventor of a number of simulation devices for training Navy pilots, died last week in New London, Conn. Adm. Florez, 73, was a graduate of Massachusetts Institute of Technology and was head of the instruments and accessories division of the Navy's Bureau of Construction and Repair (Aviation) in World War 1. In World War 2, he was with the Bureau of Aeronautics and later helped organize and was deputy chief of the Office of Naval Research. Although a pilot for many years, he won his Navy wings in 1939 at the age of 50. He received the Collier Trophy for his work with simulation and training devices.

Navy-Lockheed 2,500-mi. Polaris A3X sixth flight was a partial success Dec. 6 when the first stage burned normally after liftoff from a land pad at Cape Canaveral. Trouble developed during second stage burning. Range safety officer destroyed the vehicle.

AIR TRANSPORT

Five Airlines Claim Industry Is 'Healthy'

Joint statement reverses earlier stand; move seen as attempt to block merger plans of American, Eastern.

By L. L. Doty

Washington—Five U. S. trunklines last week broke industry ranks to declare the airlines are in a "healthy" financial condition, an abrupt switch from the carriers' unanimous public position for at least six years that the industry is in dire fiscal peril.

In an unprecedented action, the five carriers—Braniff, Continental, Delta, National and Northwest—issued a statement through a public relations firm here that they were "fed up with the continuous refrain being circulated by Eastern Air Lines that our industry is in critical financial condition." The move is expected to have far-reaching effects on the public relations posture of the industry.

The statement is viewed here as being directed against the proposed Eastern-American merger. For some time, smaller trunklines have been rebelling against American-Eastern tactics in using the presumably weak financial condition of the industry as an argument for their merger.

The action of the five carriers is particularly interesting since it contrasts sharply with the solid stand taken in 1956 when the fight for a general fare increase began. At that time, there was no dissent from the airlines' position that their industry was in fiscal trouble, although this stand was taken during some of the industry's most prosperous years.

The new stand by the five carriers, which handle some 20% of the nation's domestic air travel business, was probably not developed solely for the purpose of quashing the merger, although

this was undoubtedly the reason it emerged at this time. Several small carriers recently have been concerned that the dismal picture painted by the industry has been a hindrance in solving financial programs.

Both Eastern and American reacted quickly to the statement of the five carriers. American said that it was difficult to understand how their conclusions were reached. Eastern saw no reason for the rosy outlook and said the "facts speak for themselves." TWA and Northeast, each a prospect for possible mergers, were silent.

Western, which has taken no part in the merger proceedings, stayed out of the dispute, as did United.

The five carriers, particularly Delta and National, are currently in a relatively strong financial condition. Their stand on the financial status of the industry, however, is somewhat undermined by the record of the trunklines last year, when a net loss of \$34.6 million was incurred.

In addition, it is difficult to reconcile their statement emphasizing prosperity with those issued during the five-year period when the fare investigation was in process. In this case, which began in 1956 and ended in a CAB decision in late 1960, the Air Transport Assn., representing all trunklines, argued vigorously and consistently for a fare increase as essential to a proper rate of return.

During the drawn-out proceedings, the trunkline industry averaged, for the five-year period, an annual net profit of \$38.4 million, compared with an expected industry net profit of \$25 million for 1962 (AW Nov. 19, p. 41).

In the fare hearings, Braniff, Continental and Delta joined with Western and Capital airlines—now merged into United—to introduce what is now

known as the Foster Study. This study upheld the smaller carriers' contention that a return margin of 10% for the "intermediate air carriers" is the reasonable earnings requirement.

Rate of return for the entire trunkline industry was 7.3% in 1959 and 2.7% in 1960. Profit margin on sales was 3.4% in 1959 and 0.1% in 1960. It should be recalled that National, while it did not oppose a fare increase during the proceedings, did not participate actively in the case.

The present flurry of charges and counter-charges does not imply that a new tension has developed within the industry. For example, industry dissension over the merger case has not reached the intensity that marked the fight for routes in the CAB New York-Florida Route Case.

The present squabble, however, does foretell a significant change in the industry's approach to mutual problems. For several years, beginning with the General Passenger Fare Investigation, the ATA has presented the trunkline industry publicly as being in financial difficulties.

Presumably, this image was designed to protect the industry against fare cuts, higher taxes, user charges and similar additional expenses beyond the control of the carriers. Privately, several small carriers have opposed this policy on grounds that it hampered the floating of loans under satisfactory terms and the raising of new capital.

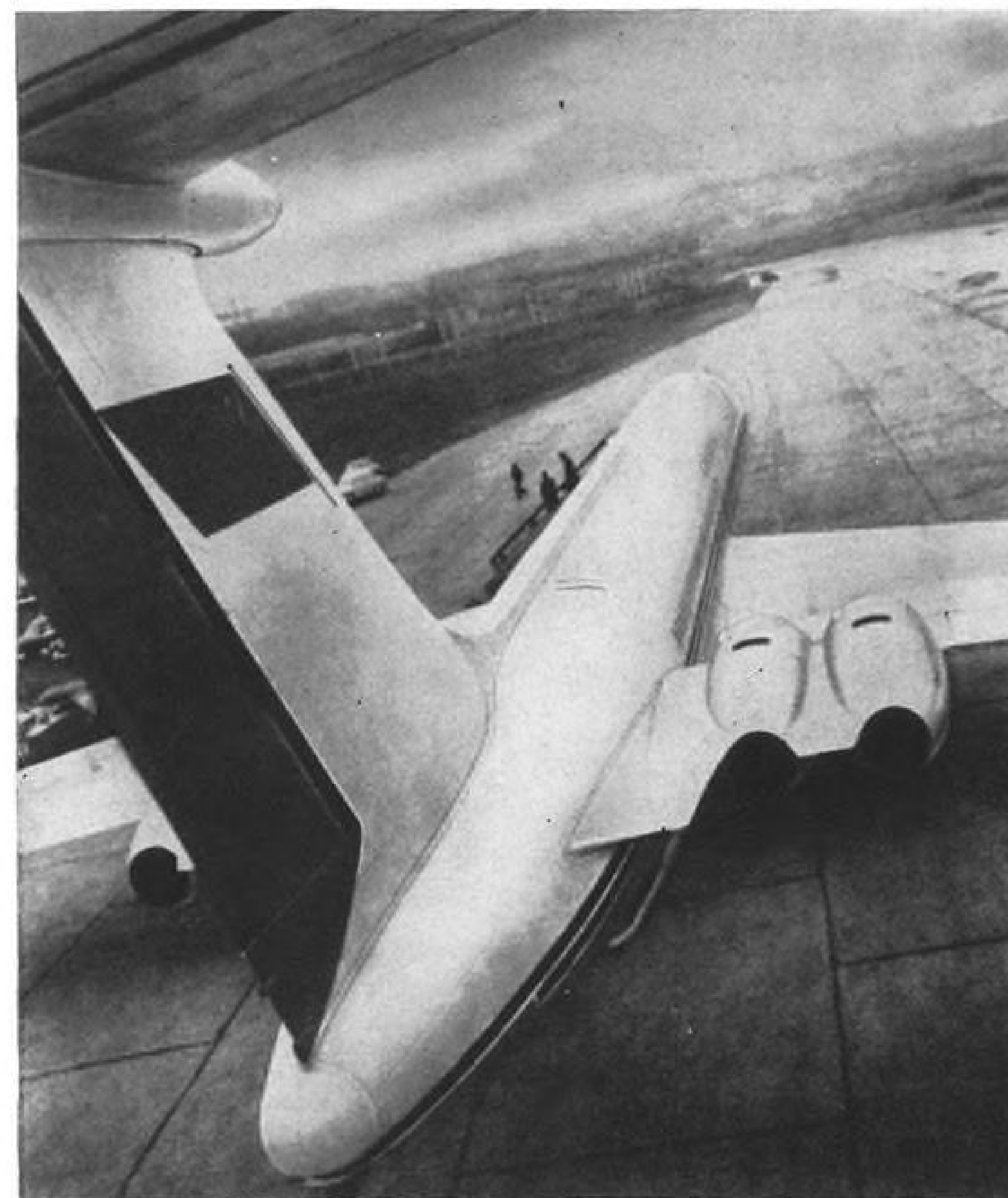
Thus, if the group of five carriers continues to sound the prosperity theme,

Indian Supply Drops

Indian non-scheduled airlines, using DC-3s, have been making supply drops and evacuation flights in the forward battle areas of the Indian-China border dispute, according to a story in *The Statesman*, an English-language newspaper published in India.

Aircraft and crews of Kalinga Air Lines and three other non-scheduled operators—Airways India, Jamair and Darbhanga—have been using 11 DC-3s, often flying at altitudes over 16,000 ft. in the mountainous region.

One fatality has resulted, Capt. S. Bhattacharya of Kalinga being killed in a crash Sept. 21 while dropping supplies at Towang, near the battle line. Several of the civilian crews have received government and military unit citations for their work in dangerous areas.



New Photo Shows II-62 Tail Design

Extremely narrow-chord elevator and split rudder characterize the tail surfaces of the Russian Ilyushin II-62, Aeroflot's latest jet transport (AW Oct. 15, p. 47). The 182-passenger aircraft is powered by four turbofan engines rated at approximately 23,000 lb. thrust each. Engines were designed by an office under N. D. Kuznetsov and the airplane by one of the design collectives managed by Sergei Ilyushin. Engines are mounted on a stub surface whose chord plane lies above the centerlines of the powerplants. Cutouts at the rear show no attempt to separate the flow of adjacent engines. Long dorsal spine extending forward from the base of the fin may house an antenna. Bulge visible on the side of the fuselage below the powerplants is the trailing edge of the wing fillet, extended aft to the trailing edge of the engine mount surface. Russian sources say the airplane was designed to make the Moscow-New York run nonstop with normal reserves at a cruise speed of 560 mph.

a serious split within the ranks of ATA could occur. Even if the five carriers could muster more support for this approach, at least three airlines—Eastern, Northeast and TWA—are in no financial condition at this time to make even a pretense of affluence.

The five carriers expressed confidence in the future of the airlines and said that the industry "has successfully met and overcome the major financial problems that stemmed from the swift propeller-to-jet transport aircraft transition."

In this connection, Eastern President Malcom A. MacIntyre said that "from the end of 1957 to the end of 1961, the trunkline industry increased its stockholder equity by approximately \$80 mil-

lion while its debt grew by \$950 million."

The five carriers said that Eastern was "a big money-maker for 25 years before showing a loss in 1960 and 1961, losses arising in part because of exceptional circumstances, and in part because of its own management decisions."

The statement said that Eastern may show a loss in 1962 due to the flight engineers' strike, but previously, MacIntyre had testified that Eastern would show a profit this year. It added:

"Thus far in 1962 Eastern has noted a loss of \$23 million, which is the major reason for low industry total earnings, but has not taken into consideration the \$16 million which has been

paid to Eastern by other airlines participating in the Mutual Aid Pact."

The five carriers suggested an improvement in TWA's position by noting that, while the carrier lost money during the first half of the year, it showed a substantial profit for the third quarter of 1962. They said that Northeast has recently received what it considers adequate financing to carry the company to a profitable level. They concluded:

"The present difficulties of Eastern, TWA and Northeast are not typical of the airline industry as a whole. Their troubles are exceptions to the general, healthy state of the industry, which is strong and thriving for all its problems, competition, and jet transition costs."

MacIntyre took this position in response to the statement of the five carriers: "While it is true that Eastern Air Lines has faced some unusual circumstances, if Eastern's results are excluded, the picture is not a great deal better for either of those two years [1960-61]."

MacIntyre concluded: "Results this year will have to speak for themselves. But, I note that the two carriers that are relatively healthy and have earned the most according to their nine months reports for 1962, Delta and National, both operated over the routes of Eastern while it was on strike this summer and both benefited by the award to them, in 1961, of monopoly routes from the southeast U.S. transcontinentally to California."

Finnair Buys Caravelles With P&W Engines

Paris—Finnair last week signed a contract for six new type Caravelles to be equipped with U. S. turbojets, marking the first airline sale of a Caravelle with U. S. powerplants.

As predicted in *AVIATION WEEK* (Nov. 19, p. 49), the Finnish carrier ordered its six Caravelles with Pratt & Whitney JT8D-1 turbofan engines. Finnair will take delivery on the first five aircraft between May and August, 1964. Sixth will be delivered in March, 1966.

Finnair also took an option on two additional Caravelles of the same type. Reportedly, one is earmarked for Kar-Air, private Finnish airline.

Finnair will call its new aircraft the Caravelle Super B. Originally, Sud had labeled it the Caravelle Horizon B.

No price was mentioned in announcing the sale. More important, no mention was made that Sud Aviation, as part of the agreement, is obliged to accept Finnair's four earlier Caravelles as partial payment on the new order.

Reportedly, Super Caravelle B price is \$3.6 million. Trade-in price Sud offered Finnair is understood to be close to \$3 million, just about the price Finnair paid for its earlier Caravelles.

Concorde Parameters

London—Minister of Aviation Julian Amery last week said the joint Anglo-French supersonic transport, the Concorde, will normally cruise at 55-60,000 ft. and will have a landing speed comparable with a Boeing 707, about 135 kt.

Amery said Concorde noise will be lower at London Airport check points than that made by 707s, because the takeoff angle will be steeper. Mach 2.2 cruise speed will not be attained until the airplane is 100 mi. away from London because of supersonic booms.

Radiation doses to passengers and crew, he said, will be derived almost solely from cosmic radiation over the North Atlantic and will be less than half the normal maximum (5,000 millirems) for radiation workers.

Boeing Expects Full Production In Transport Division for 10 Years

Renton, Wash.—Airline traffic forecasts conducted by Boeing Co. have convinced the manufacturer that it will have a full production line in its transport division here for at least another 10 years.

Production of its latest model, the short-haul 727 turbofan transport (AW Dec. 3, p. 38) at a rate of eight planes per month after 1963, along with an anticipated production of three to four 720B medium-haul transports per month until 1968-1970, is expected to give Boeing a new impetus following fulfillment of the airline industry's requirements for long-range jets.

Boeing's family of 10 jet aircraft now ranges from the intercontinental 707-320B to the 727, filling virtually all scheduled airline needs with one chief exception—a very short-haul local service airline jet transport.

So far, U.S. airlines have shown extreme interest in the British-built BAC 111 bypass transport for short-haul operations. Several carriers, notably American Airlines, are withholding any decision on this aircraft until Douglas Aircraft Co. decides whether to produce its proposed short-haul 2086 transport.

Boeing considers the BAC 111, the Caravelle and the de Havilland 121 Frident its principal competitors in the sale of the 727. Nevertheless, it is confident that it will sell a maximum of 500 727s in a market which, the manufacturer believes, calls for at least 1,000 aircraft of the 727 type.

The firm's airline market forecasts served as the basis for the development of its family of jet aircraft. Essentially, the forecasted growth was developed on the theory that lower fares, which would generate new traffic, would be introduced and that the "jet innovation" would help open new markets.

The company admits that the optimism of its forecast is a direct result of the assumption that lower fares, based on the higher productivity of jet aircraft, would be introduced by the airline industry. Instead, Boeing says, fares

were raised and the forecast, therefore, is probably overly-optimistic.

With respect to the effect jets would have on traffic growth, Boeing applied its growth-rate to the 1958 base, which it took as the maturity level of the advanced piston aircraft. It then assumed that present jet types will provide a new impetus to airline business until about 1967, "when the initial jet potential will have been fully exploited."

It found that the domestic traffic growth rate between now and 1967 will be between 8 to 9%, of which 5 to 6% will be new growth and about 3% normal growth. The latter is based on the normal expansion of the economy and population, the former on the opening of new markets and the attraction of jet travel.

The manufacturer further assumed that the post-1967 generation of aircraft equipment, in turn, will spark future traffic growth, although the ultimate growth rate will probably be substantially lower than in the preceding period, perhaps between 4 and 4.5%.

Boeing pins this condition on the forecast: a prolonged business recession would create a commensurate decline in air traffic, its recovery occurring only when the economy recovers. It said:

"Even today, the airline industry is becoming increasingly vulnerable to economic fluctuation, a typical tendency of maturing industries. From 1967, on, their vulnerability will be even greater."

Boeing feels that many ultra-conservative forecasts were based on a "share-of-the-market approach." In this connection, the manufacturer's forecast noted that the total common carrier travel market has remained constant for a number of years.

The forecast then finds that a growing volume of air travel can be anticipated, which should force the common carrier trend upward. In addition, the Boeing study does not limit the airlines to common carrier traffic. Instead, it draws this conclusion:

"Air travel has made inroads . . . into the automobile market to attract new business. Meanwhile, the automobile has caused serious losses of rail and bus traffic."

In world air transportation, the Boeing survey indicates that a slowly declining rate of traffic growth can be expected during the next 10 years. Until 1965, the world's airlines will have an average annual growth of about 13%. The forecast then finds that the growth rate will dip to about 9% from 1965-1970 and to 6% from 1970-1975.

Foreign flag carriers and U.S. inter-

national airlines are expected to fly 150 billion passenger miles in 1975, compared with the 37 billion passenger miles flown in 1961. The survey found that foreign and U.S. international carriers' traffic has exceeded that of U.S. domestic carriers, and added:

"By 1968, foreign flag airline traffic is expected to exceed that carried on both U.S. domestic and U.S. international airlines. Foreign carriers will grow substantially and at a higher rate than U.S. domestic airlines."

In its international forecast, started last year, Boeing was again considerably more optimistic than other similar forecasts undertaken earlier by Convair, Canadair, International Civil Aviation Organization and Lockheed, which was the least optimistic of the group.

Boeing found that traffic growth on the plush North Atlantic routes was about 28% in 1959 and 1960 and about 9% in 1961. It forecast an average 18% annual growth factor on these routes for the period through 1965.

The company attributed the pessimism that prevailed among the airlines throughout 1961 to the rapid increase in available seat miles, which was substantially higher than the increase in revenue passenger miles. It explained that it is not uncommon in any industry for a large increase in capacity to exceed demand over a short-term.

Improved personal incomes in Europe, coupled with the establishment of the European Common Market, is expected to bring future growth in tourist travel in Europe, the study found. But the fact that European hotel space increased only 42% between 1950 and 1959, compared with a 172% increase in air travelers, was a negative factor.

Banks Group Forecasts More Airline Earnings

Significant improvement in airline earnings is possible in 1963, the Aviation Securities Committee of the Investment Bankers Assn. believes, because capacity increase will be relatively minor and only a small growth of traffic is required to halt declining load factors (AW Nov. 19, p. 41).

"Unit costs are declining," the committee reported to the association's convention. "The breakeven load factor should continue to decline. Non-operating charges appear to have about reached a peak so that no further pressure on earnings is visualized from these charges."

Capacity is not expected to increase greatly in 1964, the report said, despite deliveries of Boeing 727 jet transports. Barring a general economic decline, the committee forecasts continued benefit from the factors cited for 1963's expected improvement.



Ethiopian 720Bs to Begin Service Next Month

Ethiopian Air Lines will inaugurate service with two Boeing 720B jet transports Jan. 15, using the aircraft on all of its routes throughout Africa and links with Greece, Spain and Germany. First 720B, shown above on a recent test flight near Boeing-Seattle, and its sister ship were flown to the new airport at Addis Ababa early this month. Aircraft is powered by four PW&A JT3D-1 turbofan engines.

ATA Reorganization, Advertising Plans Deferred; Budget Cut 7%

Washington—Air Transport Assn. Board of Directors last week deferred immediate action on a proposed sweeping reorganization of the association and a planned \$5 million nation-wide advertising campaign.

At the same time, the Board of Directors sliced ATA's 1963 budget to \$2,149,000, a 7% reduction from the 1962 figure.

Both advertising and reorganization plans were referred to committees for further study, moves that are interpreted here as meaning the virtual end of both proposals. The reorganization plan met with little enthusiasm and at least one major trunkline is known to be strongly opposed to the advertising campaign and another is known to be lukewarm toward it. However, most of the trunklines supported the advertising plan.

The advertising campaign is to be studied by a top-level management committee appointed by ATA president Stuart G. Tipton. The committee will be instructed to survey the scope, content and objectives of the campaign. Committee findings are to be submitted to the Board at its next meeting in March.

The plan for the campaign emerged last June at the mid-year directors meeting, when the ATA was directed to prepare a presentation for consideration by the Board. The Sullivan, Stauffer, Callwell and Bayles advertising agency prepared the presentation.

Tipton was instructed to name a second committee to study the reorganization plan, which was developed by the

ATA staff in conjunction with the Henry Golightly Co. of New York, a firm of management consultants. Essentially, the plan called for the elimination of ATA conferences and a strengthening of the ATA organization so that conference activities could be handled by ATA staff personnel, rather than by

representatives and officials of the airlines, as in the past.

General feeling among the directors appeared to be that, while the Air Traffic Conference may have its weaknesses, it should be reorganized rather than killed.

The committee named to evaluate the Golightly plan is to examine how industry procedures can be acted upon through the ATA.

Directors also voted to establish the Office of Enforcement as permanent department of the association.

Pan Am-TWA Merger Plan Expected Soon

Washington—Proposed Pan American World Airways merger with Trans World Airlines was the subject of much speculation late last week. Chances appear strong that a joint announcement confirming a full merger agreement by the two carriers will be made next week.

Meanwhile, Seaboard World Airways vigorously protested a Civil Aeronautics Board examiner's ruling that the two airlines will not be required to submit internal studies pertaining to the merger plan in the Transatlantic Route Renewal Case. In taking issue with the ruling by Examiner James Keith, Seaboard said:

"There is no point in discussing in this case the question of whether Pan American and TWA should avoid point-to-point, in favor of area, competition, or whether TWA's second around-the-world service should be discontinued when one of these carriers may within a short time no longer exist."

Seaboard proposed a deferral of proceedings in the case until the issue is clarified.

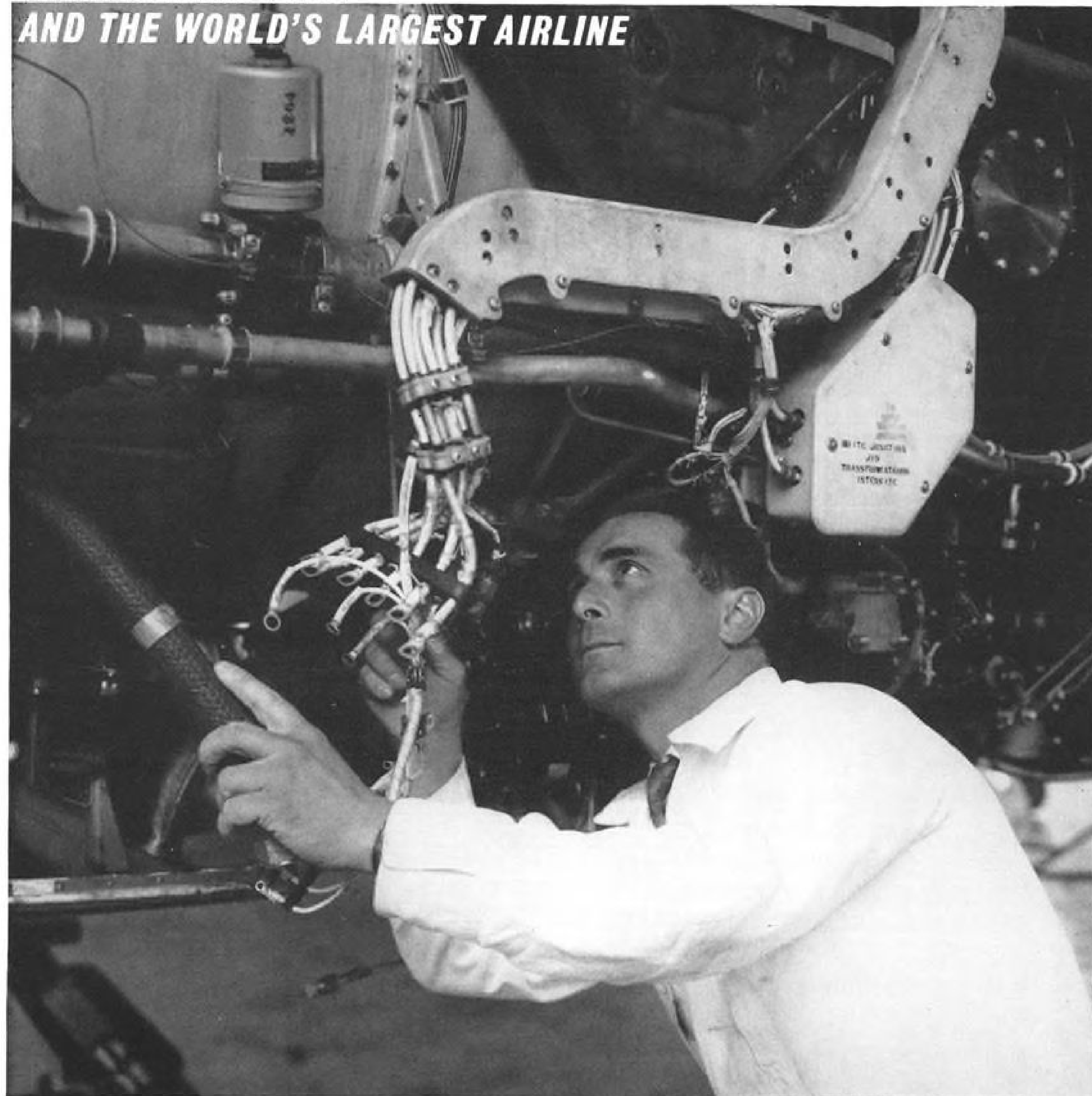
EEC Cartel Rules

Paris—Transport ministers of the six-nation European Economic Community (EEC) have decided to exempt all transport operations temporarily from the new anti-cartel laws.

Ministers, meeting in Paris, said the exemption would run until Dec. 31, 1965. By June 30, EEC experts will be expected to draw up special anti-cartel regulations for transport operations.

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Beech Negotiates DH-125 Distributorship

Negotiations are under way between Beech Aircraft Corp. and de Havilland Aircraft of England for distributorship rights to the DH-125 executive turbojet aircraft. Talks began about two years ago, but apparently have been resumed with increased intensity during the past five months.

Frank E. Hedrick, Beech executive vice president, told Aviation Week that under one possible program de Havilland would gain the use of Beech's entire international sales organization for the DH-125.

Beech would handle U.S. sales.

Coupled with these negotiations is Beech's delay in making a firm decision to go ahead with production of its eight-passenger, twin-turboprop Model 120. A meeting of the executive committee of the company is scheduled for January to decide on the future of the turboprop aircraft.

Original plans called for the aircraft to fly in 1964 and for first deliveries in 1965, but Beech has been reported to be slightly ahead of schedule on the project (AW Oct. 1, p. 18).

Hedrick indicated that any agreement to market the DH-125 in the U.S. would not necessarily mean discontinuance of the Model 120. He said it was possible that both aircraft might be able to live together in the same environment.

DH-125 currently is flying in England and is in production at de Havilland factories at Hatfield and Chester, England. Royal Air Force has ordered 22 and two have been purchased by private firms (AW Dec. 3, p. 110).

Beech is one of several American companies which have been talking with de Havilland regarding possible U.S. distributorship rights. Included among these companies is Pan American World Airways.

However, de Havilland probably is in need of an extensive worldwide marketing organization which a large American manufacturer, such as Beech, would be in a position to provide.

Beech, on the other hand, is no doubt looking for an airplane to compete with American-built turbojet executive aircraft, such as the Lear-Jet and Jet Commander 1121.

Discussions between Beech and de Havilland also are reported to have touched on the possibility of de Havilland building the DH-125 airframe and sending it to the United States where Beech would add the wings and engines, but this is at present regarded as a doubtful possibility.

Modified Swissair 990 Shows Speed Increase

Zurich—Initial flight tests of an operational Swissair Convair 990 medium-range jet transport modified to a low-drag configuration indicate that the aircraft gains an additional 30 mph. in maximum cruise speed plus a reduction in specific fuel consumption.

First aircraft to be modified here at Swissair headquarters under Convair direction was returned to regular service early last week after a series of performance test flights over the previous week-end. The three basic aerodynamic changes were designed to bring the aircraft to within the Convair-guaranteed performance parameters, and Swissair officials say that the tests tend to confirm that the modifications were satisfactory (AW Oct. 29, p. 54).

Airframe Changes

Changes on the airframe, the first operational 990 to be modified for this purpose, included:

- Substitution of Krueger leading edge flaps for the factory-delivered aircraft.
- Aerodynamic streamlining of two engine nacelles by use of a cone device that clamps into a closed position over

the thrust reversers during flight. Cone, which opens when reversers are in use, adds approximately three feet to the over-all length of the nacelle.

- Cutting drag along the fuselage skin by placing fillets over the external wing attachments to the fuselage section.

Modification Costs

Convair, which will absorb the cost of modifying all five 990s operated by Swissair plus two others which the airline has leased to Scandinavian Airlines System, supplied the kit for the modification plus a supervising engineer from its San Diego plant. Actual work, however, was carried out by Swissair technicians.

Tests showed that the true maximum cruise speed of the aircraft was boosted from a previous 590 mph. to about 620 mph. at altitudes of 20,000 and 29,000 ft. At one point, with a tail wind of about 65 mph., the modified 990 reached a calculated ground speed of 683 mph. Federal Aviation Agency has certificated the 990 for a maximum cruise true air speed of 625 mph.

Airline officials say fuel consumption showed a marked decline at Mach numbers of 0.80, 0.84 and 0.88. Exact figures on the percentage decrease, they said, cannot be established until after

further operational tests have been completed.

Workmen required approximately two months to complete the modifications on the first aircraft. Second aircraft is scheduled to enter the dock early this week and, as work progresses, Swissair officials say the time required to complete the modification on an individual aircraft should be substantially shortened.

Cuban Route Boosts CSA Passenger Totals

Prague—CSA Czechoslovak Airlines estimates it will carry more than one million passengers—a gain over 1961 of about 150,000—and log a total of approximately 47,082,100 ton mi. over its route structure during 1962.

A major factor behind the boost, according to the airline, was its Bristol Britannia service to Havana which began early this year.

International services to 34 cities in Europe, the Near and Far East, Asia, Africa and Cuba will account for 29,500,000 ton mi. Domestic services between 11 points throughout the country account for 17,130,000 ton mi., and air taxi operations for the remaining 452,100 ton mi. of the total figure, according to CSA.

The airline's total route mileage is 62,100 statute mi.

In 1961, CSA handled 856,355 passengers and flew 35,481,630 ton mi.

Most profitable routes, according to a Czech Foreign Ministry of Transport official, are CSA's Prague-Havana, Prague-Djakarta and Prague-West Africa services.

London Airport Fog

London—Fog cut visibility to 10 yards at London (Heathrow) Airport and completely halted airline traffic there last week. In a three-day period, the only airplane to land at Heathrow was a Ministry of Aviation Vickers Varsity fitted for automatic landing (AW Nov. 5, p. 47).

International carriers diverted North Atlantic flights to Prestwick, as was the case of British Overseas Airways Corp. Trans World Airlines planes overflew London for Frankfurt. British European Airways Corp. canceled 80 flights in a single day, operating a few out of London (Gatwick) Airport during rare periods of clearing fog.

Varsity landed in near zero visibility after a flight from Blind Landing Experimental Unit base at Bedford. Aircraft is equipped with Smiths Aviation Division autopilot and auto-throttles. Directional guidance was provided by Heathrow's normal ILS system.



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Eastern Pilot Tried Go-Around Prior to DC-7B Crash at Idlewild

By James R. Ashlock

New York — Federal investigators probing the Nov. 30 crash of an Eastern Air Lines DC-7B at New York International Airport have the clipped tops of heavy marsh reeds to indicate the plane's descent rate and path prior to ground contact.

Swath through the reeds indicates the aircraft was not descending at a rapid angle, but was mashing downward at approximately 2-3 deg. The plane was also following a course several degrees left of the runway's 40 deg. bearing.

Evenly spaced slashes in the soil show that the inboard propellers struck the ground first. The engines and underside of the fuselage then hit a knoll, ripping open the left wing and fuel cells. Fire ignited dry vegetation at this point.

Reeds directly in front of the first impact point were unscarred, indicating the plane bounced back into the air before hitting a second knoll just short of a taxiway. Heaviest gashes in the taxiway pavement are on the far side, from which point the plane skidded approximately another 100 yd.

The left wing halted to the right and behind the tail section. The right wing, also severed, landed upside down to the left and forward of the cockpit, arousing the belief that the airplane zig-zagged severely before coming to a stop.

Although the outer skin of the vertical stabilizer was mostly burned away, the tail section aft of the rear pressure bulkhead remained intact. Fire consumed practically all of the fuselage, but not before 25 of the 51 persons aboard had escaped.

Capt. Edward Bechtold, 43, a 16,000-hr. pilot and chairman of the Airline Pilots Assn. eastern U.S. region, died with the two other cockpit crewmen. The flight's two hostesses survived.

Ground fog, which varied in intensity across the airport, was present at the time of the crash. Approach was being made to Runway 4R. The plane never contacted the runway, but veered several degrees to the left and crashed 4,200 ft. down and 500 ft. to the left of the strip. Gear was retracted, leading investigators to speculate that Bechtold was attempting a go-around after a missed approach.

Communication with the pilot just before the accident, which occurred at 9:45 p.m., indicates that at one time he did have visual contact with the runway lights, most likely just before he descended into the shallow ground fog, investigators said.

Bechtold requested that the tower dim the high intensity flasher beacons which mark the runway approach path. The lights cannot be dimmed, but were turned off to comply with the pilot's request.

Flight was No. 512, arriving non-stop from Charlotte, N. C. Field conditions as reported to Bechtold by tower personnel were one mile visibility with ground fog.

The fog was described afterwards as being fast forming and shifting, with dense moving patches. The threshold of Runway 4R is near the shore of Jamaica Bay, where investigators say the heaviest patches might be expected under conditions existing at the time.

An Eastern Electra landed without incident two minutes ahead of the ill-fated plane. The CAB will duplicate the situation in tests using an Electra and a DC-3 to determine whether the taxiing Electra, passing near the Instrument Landing System transmitter shack, may have affected the ILS beam.

Precision Approach Radar has been inoperative at Idlewild since Nov. 13, equipment for the unit being relocated in the Idlewild tower. Notices to airmen (Notams) were issued, and tower personnel also informed inbound flights of PAR unavailability.

A runway transmissometer visual range which measures visibility at the runway threshold was also inoperative. The ILS middle marker had also been out of commission, but investigators say it began operating at 9:40 p.m., five minutes ahead of Flight 512's arrival.

ILS Approach

Investigators emphasize that none of these systems being out should affect a pilot's making a normal ILS approach. Evidence that Bechtold had visual runway contact also tends to discount failure of landing aids as a determining factor in the crash.

Dense fog hampered the drivers of fire fighting and emergency vehicles in getting to the crash scene. The fire was so intense that the foam supply of the fire trucks was quickly exhausted, and more was brought in five gallon cans from a fuel storage facility at the field.

Arthur E. Neumann, CAB investigator from Denver, came to New York to direct the crash probe. He said a full investigation covering the full spectrum of possible accident causes will be conducted. Official hearings on the incident aren't expected until sometime after the first of the year. The hearings will be conducted in New York, Neumann said.



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Grumman Gulfstream turboprop transport with large rear cargo door has received FAA certification. Aircraft seats a maximum of 24 persons.

FAA Certificates 24-Passenger Gulfstream

Grumman Gulfstream turboprop transport has been certificated by Federal Aviation Agency with aft cargo-loading door measuring 62 x 82 in. and a convertible interior capable of carrying up to 24 passengers or a cargo-passenger mix. Maximum zero fuel weight of the aircraft was increased from 26,170 lb. to 29,774 lb. without structural modification. Convertible cabin has a five-track system running its entire length. Gulfstream can carry 24 passengers, baggage and passenger service equipment 1,400 naut. mi. or can carry in excess of 8,000 lb. of cargo 830 naut. mi. Nonstop capability with reduced loads is 2,600 naut. mi. or the aircraft can carry a full passenger load plus 1,000 lb. of cargo over eight 100 mi. segments without refueling.



Seats in the 24-passenger Gulfstream have 33-in. pitch and are separated by a 16-in. aisle. The five-rail track system in the floor allows the seats to be removed from the aircraft cabin and cargo tie-downs to be substituted rapidly.



Cargo/passenger mix is shown above left with cargo at rear of cabin. Right, Rolls-Royce Dart engine is loaded aboard aircraft which still has 12 seats in place in 1,200 cu. ft. cabin. Seats can be stowed aboard aircraft after removal from cabin.





PROGRESS



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BAC

ONE-ELEVEN

TWO ROLLS-ROYCE SPEY TURBOFAN ENGINES

AIRLINE OBSERVER

► British Overseas Airways Corp. last week served notice on the British and French governments that while the airline is interested in the joint Mach 2.2 supersonic transport, it will not be pushed into bringing the airplane into service. BOAC said it recognizes the national importance of the program, but in view of existing commitments—primarily for the Vickers VC.10 jet transport—it must not decide too quickly. BOAC said it will make no commitments for a supersonic transport until flight trials enable the carrier to assess the plane's suitability for service, to prove the safety level is equal to subsonic jets and until the aircraft is proven adaptable to air traffic control facilities existing at the time of its introduction.

► Chief obstacle to the continuing drive by Aeroflot, the Soviet airline, to gain access to the Western Hemisphere is Guinea's recent refusal to grant Aeroflot beyond rights across the South Atlantic from Conakry, a key point in the Russian carrier's plans to operate a route from Moscow to Belgrade, through Africa and beyond to South America (AW Sept. 10, p. 71). Conakry airport, built with Soviet aid, is the only airport available to Russians in west Africa with runways long enough to accommodate long-range aircraft. Aeroflot has discussed an air route between Brazil and Russia with Panair do Brasil (AW Nov. 26, p. 41).

► Common stocks of Delta Air Lines, Northwest Airlines and Western Air Lines listed on the New York Stock Exchange have been particularly strong recently. Through the middle of last week, all three stocks repeatedly recorded new highs.

► Aer Lingus is closely studying the Caravelle, Boeing 727 and BAC 111 for use in its continental European routes. The airline would prefer to continue use of its fleet of Vickers Viscount 800 transports on these routes as the "most economical" aircraft for this operation. However, Aer Lingus feels it must offer jet services for competitive reasons.

► Aviation Traders Engineering, a division of British United Airways, is exploring possibility of a super Carvair car ferry transport, using Douglas DC-6 and DC-7 aircraft, as a follow-on to the company's present DC-4 conversion—the ATL-98 Carvair (AW Sept. 4, p. 46). The firm now has 14 Carvairs and plans an intensive sales program in Hawaii this month.

► Development of a program establishing basic rules for the full exchange of traffic rights in international air transportation is the only item on the agenda of the meeting of the Commission on Air Transport of the International Chamber of Commerce, beginning Jan. 31 in Paris (AW Nov. 26, p. 39).

► Aeroflot's twin-turboprop Antonov An-24s will have flown "several million ton-kilometers" with mail and cargo by the end of 1962. But after nearly three years of testing, the medium-range transports are still not in regular passenger service. An-24s engaged in cargo and route-familiarization flights are based at Kiev and fly to Odessa, Kherson and Nikolaev on the Black Sea, to Simferopol in the Crimea, and to Moscow, Leningrad, Dnepropetrovsk, Donetsk, Lvov and Minsk.

► Japan Air Lines last week ordered three Convair 880-M turboprop transports, bringing the carrier's fleet of this model to eight. Delivery will be made in March and April, 1963, and the planes will be used exclusively on the airline's domestic routes.

► Latest series of highly-publicized aircraft accidents is expected to have a depressing effect on year-end traffic and revenue results. Most carriers had anticipated a profitable Christmas traffic season to round out a relatively successful year, but now feel that December results will drop well behind those recorded in the same month last year.

► San Francisco and Oakland Helicopter Airlines will inaugurate airmail service between San Francisco International Airport and Oakland Downtown Airport and between San Francisco International Airport and Berkeley Heliport on Dec. 17.

SHORTLINES

► Allegheny Airlines carried 92,231 passengers in October, the best one-month passenger mark in carrier's 13-year history.

► Capitol Airways, Nashville-based cargo carrier, has placed its five Whitworth Gloster Argosy turboprop all-cargo transports in commercial service. Aircraft would be used only for military shipments under USAF Logair contracts.

► Delta Air Lines showed an increase of 21% in passenger revenue miles during the month of November compared with the same month last year. Load factor increased from 56.52% to 56.97% in the same periods.

► Ethiopian Airlines last week accepted delivery of its two Boeing 720B turboprop transports and flew the two aircraft from New York International Airport to Addis Ababa. The jets will go into service Jan. 15.

► Federal Aviation Agency is using a new fog chamber designed by the University of California to study airport runway lighting under low visibility conditions. The chamber generates fog through a mixture of compressed air and water. Experimental airport lighting patterns are laid out on the asphalt floor on a 10-1 scale.

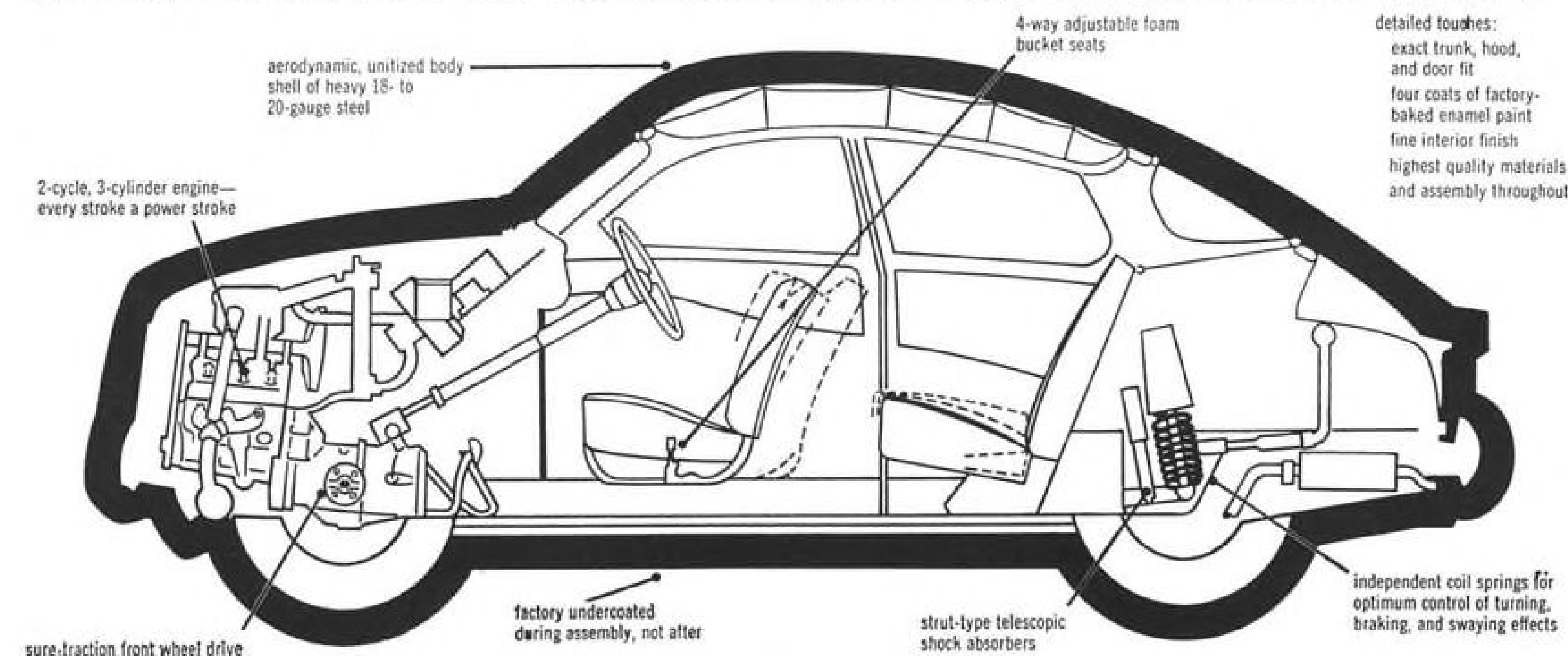
► Ghana Airways soon will begin scheduled air service from Accra to Aden via Bamako, Khartoum and Asmara. The new service will help strengthen air communications between west and east Africa. Vast majority to service in Africa is now north-south.

► Korean Air Lines has purchased two Fokker F-27 Friendship turboprop transports for domestic service and for its route to Hong Kong via Okinawa and Formosa. The order brings F-27 sales to 231, purchased by 72 customers.

► Six-month test period during which U. S. export cargoes will be cleared at airports of origin rather than at international gateway airports began last week. The experiment is being conducted by Commerce Dept., Bureau of Customs and Census Bureau to determine whether the new method will save time and expense to shippers.

► United Air Lines is seeking a coach fare for a twice-daily Sky-Bus service between Cleveland, Pittsburgh and Miami in Douglas DC-6 aircraft. Fares would range 26 to 28% below current jet coach rates.

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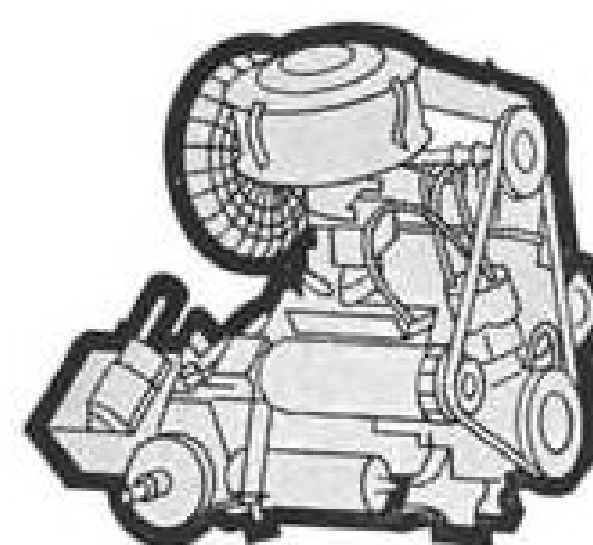
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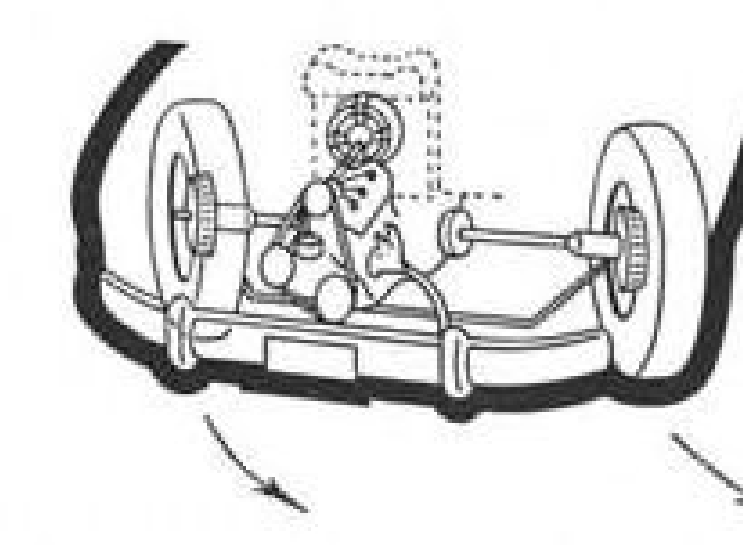
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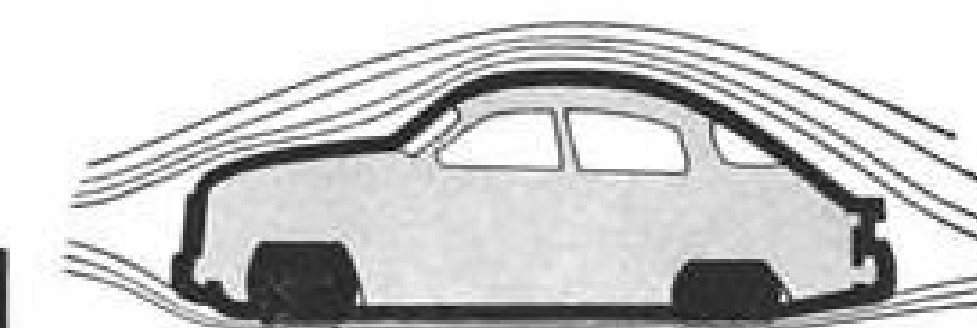
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SAAB ENGINE, an economical, quiet three-cylinder, two-stroke valveless unit, employs Schnürle principle of charging through the crankcase. Simple, efficient design produces all the power of 6 cylinders with only 7 basic moving parts, eliminates 103 points of friction, wear, potential trouble. Engine proved in world-wide competition driving victories, and by the many SAABs which have delivered low maintenance performance past the 100,000-mile mark.



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AERONAUTICAL ENGINEERING



STANDARD ARMY UH-1B shows traditional cluttered appearance of most present-day rotary wing aircraft. Note drag-inducing rotor mast, unfaired engine cowling, and aft cabin area which recedes sharply into tail boom.

Tests Show 250-mph. Helicopters Feasible

By Erwin J. Bulban

Ft. Worth, Tex.—High-speed capabilities of helicopters are being demonstrated here in flight tests with a modified Bell UH-1B Iroquois which has been used to confirm that 200-mph. rotary wing aircraft are feasible now.

Speeds of 225-250 mph. should be possible in the near future utilizing existing state-of-the-art technology, Bell engineers feel.

Tests by Bell Helicopter Co. pilots under a program sponsored by the U. S. Army Transportation Research Command (TRECOM) to evaluate the effects of radical drag reduction schemes, are expected to clarify and strengthen the position of helicopters in the high-speed regime. Helicopter performance in this area has been clouded in recent years by increasing emphasis on more exotic VTOL systems aimed at overcoming what appeared to be inherent speed handicaps in the basic rotary-wing configuration.

Early version of the research UH-1B turbine-powered helicopter thus far has been flown at level flight speeds of more than 175 mph., exceeding by some 40 mph. its standard tactical speed and has beat the existing world's speed record for its class by about 20 mph. (AW Nov. 19, p. 28). Additional modifications planned in the program are ex-

pected to enable the same machine to attain up to 220 mph. next year.

Indications are that lessons learned in the current program will be useful across the board to all classes of helicopters, civil and military. TRECOM Design & Performance Division Chief Paul Carpenter expects that the research Bell UH-1B demonstrations will significantly influence Army thinking on performance requirements for its future helicopters.

Speed Requirements

As he told AVIATION WEEK: "This research has automatically raised the maximum speed requirement in any future helicopter competition by 25-30 kt."

Carpenter added, that from his own viewpoint, up to a year ago, he would have settled for approximately 175 kt. speed in contemplating a research helicopter high-performance program; but on the basis of what he has seen demonstrated thus far with the UH-1B, he would not settle for less than 225-kt. performance should he now be laying out specifications for such a vehicle.

As pointed out in AVIATION WEEK (Mar. 12, p. 247), a basic problem hindering higher-speed performance of rotary wing aircraft has been high-drag configurations that would never have been tolerated in fixed-wing aircraft.

Need was evident to clean up design details to bring the machines' aerodynamic characteristics up to par with the advances made in rotary-wing aircraft powerplants.

Much of the slow pace in facing up to this problem could be attributed to the customer's desire primarily for utility, rather than speed, resulting in box-car-like configurations, and little regard for the penalties paid by cluttered rotor systems. On the industry side, manufacturers were primarily concerned with meeting guarantees and increasing reliability, since speed seemed to be a secondary consideration.

A case in point could be made of the basic UH-1 configuration. Although it, in one instance, represented a major advance by providing the Army with the advantages of a turbine powerplant, part of the high-performance that actually could have been gained as a result of increased power and lower engine weight, was automatically negated by the customer's desire in this case to reduce litter loading to one minute per patient, if possible.

This consideration prompted Bell engineers to consider a broad fuselage configuration, permitting straight-in litter loading, but dictating a beam width sufficient to take the length of the litter, resulting in a high-drag fuselage configuration.



MODIFIED BELL UH-1B shows effects of aerodynamic cleanup. Helicopter still had cluttered mast when photo was taken, but fairing covered most of it, along with engine. Airfoil-shaped fairing was added to rear cabin and numerous minor changes were made.

Such considerations are compatible with a utility helicopter, but impose severe speed performance limitations that are felt should the same machine be adapted for attack roles.

Tacticians had to determine if speed in litter loading was more important than a cleaner, narrow fuselage, whose lower drag would provide increased range with the same power, in weighing their requirements.

Indications are that more consideration will be given towards developing specific configurations for various duties to take advantage of design technology that can provide maximum performance rather than attempt to develop an all-round helicopter expected to handle litters or cargo one day and deliver devastating firepower at long ranges the next, with much hope of high crew survival rates.

Helicopter Research

Considerable research has been done over the years by industry and government agencies on various methods of increasing helicopter performance, but due to lack of funds being available to prove this theory in actual flight, little progress has been made towards taking advantage of this research.

National Aeronautics and Space Administration researchers at Langley Laboratories have been trying for years to get development started on a research helicopter that would be the counterpart of the X-series of research airplanes, but this program regularly kept being deleted from the agency's

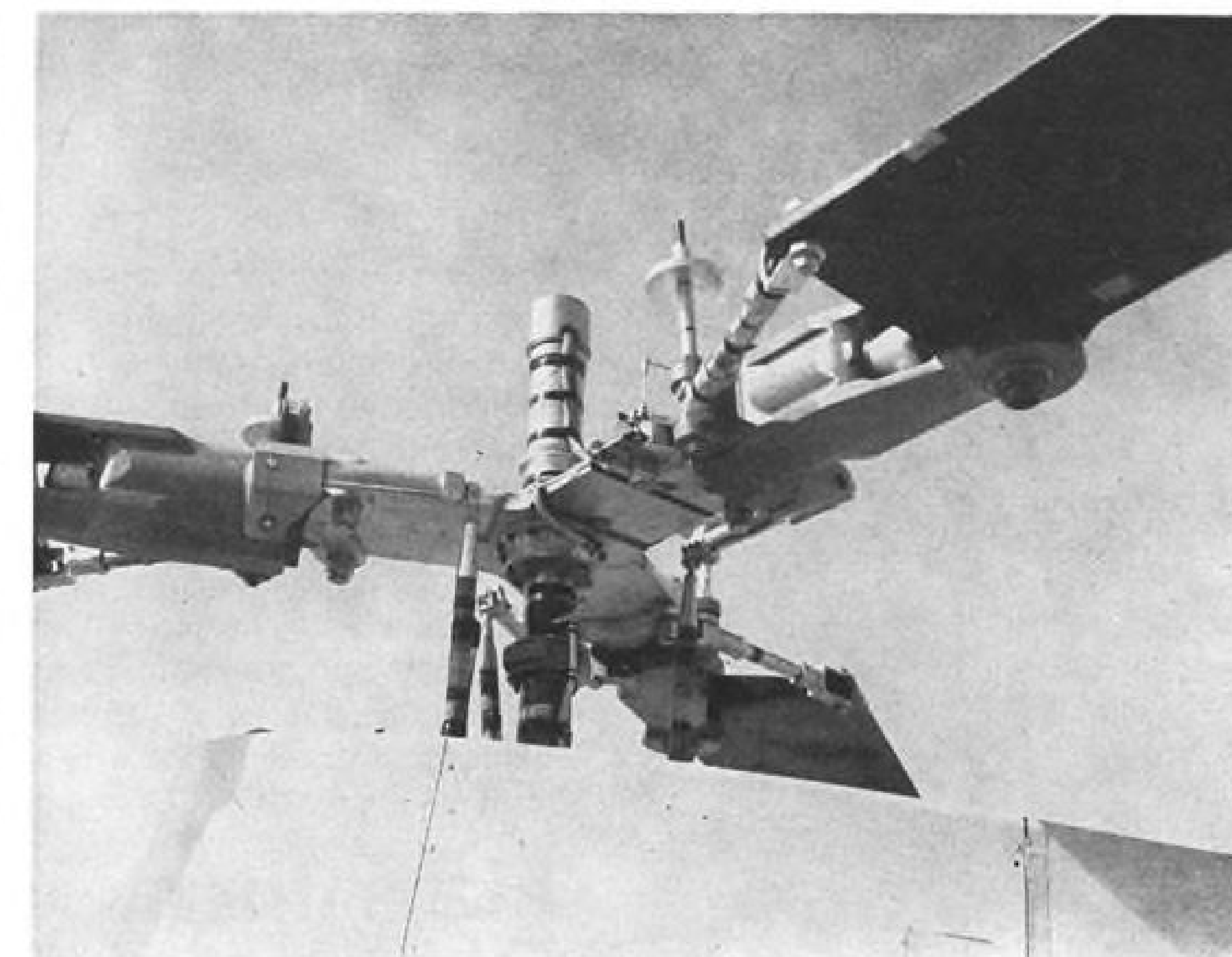
budget. In the spring of 1959, TRECOM, with a limited budget, initiated invitations for bids from industry to do studies on feasibility of increasing helicopter speed, range and cargo delivery efficiencies based on current state-of-the-art technology.

Sikorsky and Vertol were selected from 15 proposals to do funded three-month studies and Bell Helicopter Co., requested permission to participate

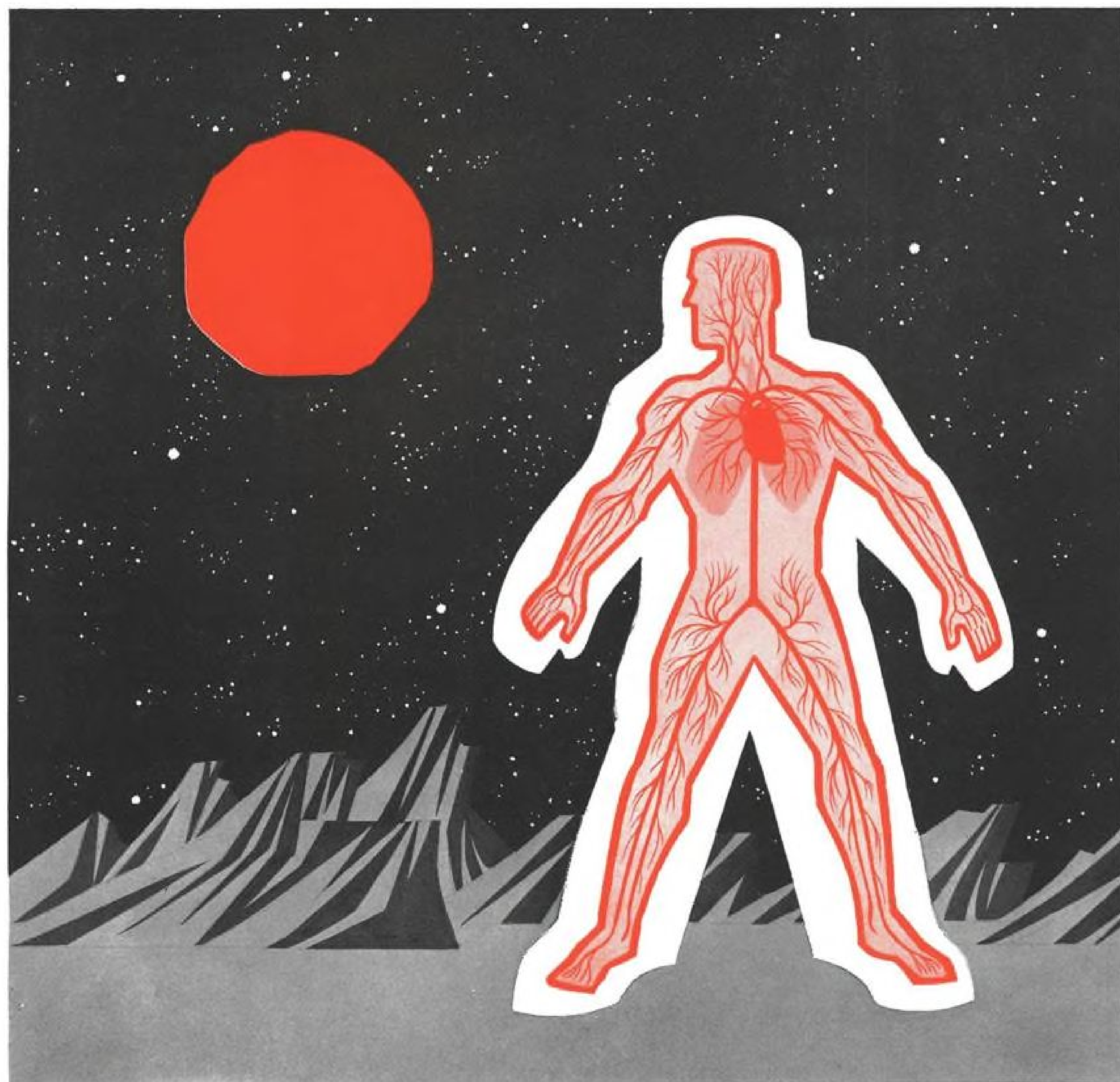
in the program on a company-sponsored basis.

Preliminary design studies submitted by the contestants all showed that a 175-kt. helicopter was reasonably within grasp using good aerodynamic design practices.

The three contractors basically came up with the same conclusions, that fuselage drag could be reduced some 50%, vibration might be the most



THREE-BLADE RIGID ROTOR mounted on research UH-1B. Tube atop the rotor mast is a slip ring device to measure beam and chord bending moments of the hub and blades.



APOLLO SUIT

The first integrated space-suit assemblies will be developed by Hamilton Standard for Project Apollo, under contract to NASA. They will provide comfort and mobility for astronauts outside the craft in deep space and on lunar exploratory missions. Hamilton Standard, as prime contractor, will manage the program, and design and build life support packs. The packs must supply oxygen and pressurization and control temperature, humidity and contaminants. Subcontractor for the suits will be International Latex Corporation.

The space-suit project, an important portion of Hamilton Standard's life support program, applies diversified experience in hydraulics, pneumatics, mechanics, electronics, and packaging. Hamilton Standard blends and develops these basic technologies to achieve an integrated systems approach to life support equipment.

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serious problem at high speeds but this could be solved and that there would be adequate stability at high speeds. But actual flight tests would be the only way to prove these studies.

Results of these studies, which also indicated that fuel consumption could be reduced some 25% at current speeds because of lower drag, generated considerable enthusiasm in the office of Army chief of transportation Maj. Gen. Frank Besson, due to the obvious value in reducing fuel logistics problems.

UH-1B Modifications

Bell last fall was given funds by TRECOM to start a research program, utilizing a modified YUH-1B, to evaluate the effects of drag reduction. One of the initial steps in the modification program, was to incorporate a variable-tilt main rotor system, to permit maintaining a level, low-drag fuselage attitude in highspeed fuselage flight. This reduction of drag on the fuselage also cuts down loading on the rotor. Bell engineers point out that the standard UH-1B configuration imposes approximately 1,000 lb. more loading on the rotor at 120 kt. than must be carried during inplane rotation.

Bell engineers have provided a rotor mast tilt capability from 4-deg. forward tilt through 11-deg. The entire rotor transmission is mounted on a cradle having an axis of rotation intersecting the center of couplings between engine and transmission, splitting the degree of misalignment of couplings during rotation to a figure well within the capabilities of the couplings. Cradle, mounted onto the fuselage on pivots, is rotated by means of two electric-motor-driven hydraulic actuators through an infinite range within the 4- to 11-deg. tilt capability by the pilot.

Fixed Tilt

This variable tilt mast feature is strictly a research tool; indications are that a fixed tilt of perhaps seven degrees will be reasonable amount to provide desired performance. Should further testing show a definite requirement for going as far as 10- to 15-deg., perhaps a two-position rotor tilt provision would be utilized.

Tail rotor pylon also has been extensively modified, additional chord being provided and profile cambered to approximately five degree angle of attack, unloading the tail rotor approximately 50% at high speeds and providing an additional 10% power to the main rotor system.

Most noticeable external changes to the research UH-1B probably are the extensive fairings and reduction of protuberances. A glass fiber honeycomb airfoil-shaped fairing approximately 100-in. long has been added on each side of the aft cabin to reduce the effects

of the normal fuselage suddenly narrowing at this point into the tail boom. A large streamlined glass fiber pylon cuff surrounds the rotor mast and covers the normal protruding engine intakes.

Fairing largely reduces drag and turbulent effects of protruding mast hardware, including swash plate. Normal intakes are replaced by smaller, faired intakes on either side of forward pylon fairing, feeding air to the plenum chamber via glass fiber ducts. Indications are that these intakes provide more positive pressure rise than standard intakes across the engine compressor face, improving engine efficiency. Two small spring-loaded panels, higher up on the sides of the pylon fairing, open up to provide air to chamber until pressure builds up

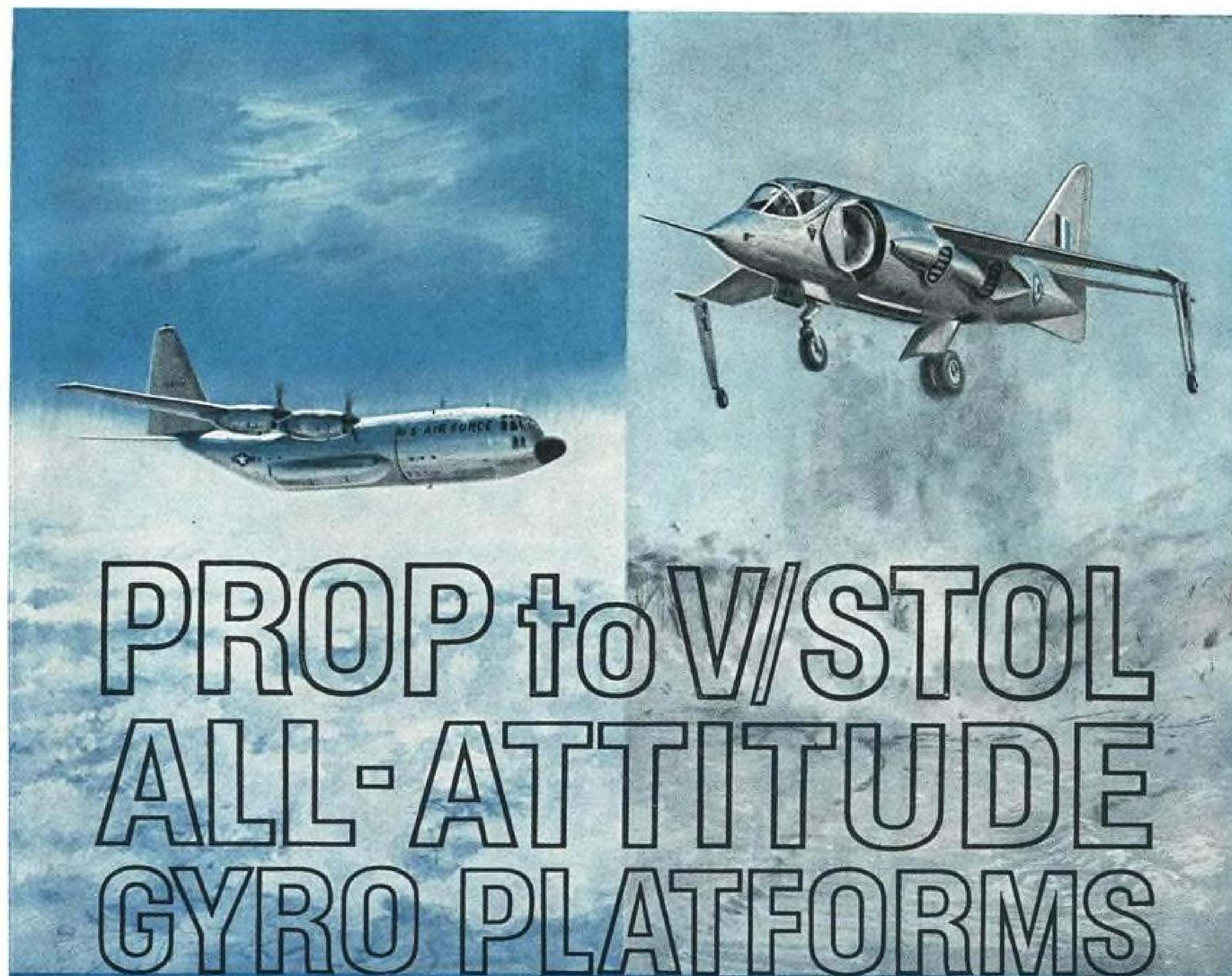
sufficiently through the forward-facing intakes.

Bell is doing considerable study on revising the main rotor control system, modifying the swash plate to enable control tube linkage to rotor pitch arms to be brought in closer to the mast and thus permitting a reduction in width of the pylon fairing. It is believed that eventually this width could be reduced from approximately two feet to only five inches. Also to be tried are glass fiber fairings covering the main rotor blade grips.


Another noticeable change on the two-blade main rotor configuration has been deletion of the Bell stabilizer bar, which was found to account for as much as 10% of the total drag at 150



CLEANED-UP FRONTAL AREA of the modified research Bell UH-1B, top, is evident in comparison with standard model, below. Antennas and rear view mirrors on nose have been removed and landing skids considerably reduced in size.



PROP to V/STOL ALL-ATTITUDE GYRO PLATFORMS



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SPERRY

AIR ARMAMENT DIVISION, SPERRY GYROSCOPE COMPANY, DIVISION OF SPERRY RAND CORPORATION, GREAT NECK, N. Y.



LATER VERSION of the research UH-1B has a three-bladed rotor and will be used to further extend the helicopter's speed range. Rotor configuration will include semi-rigid and rigid types. Note faired engine intake on lower portion of the forward pylon fairing.

kt. Stability has not been compromised to a considerable extent, pilots report, but at higher speeds than now flown, an alternate stabilization aid probably would be necessary.

Skid landing gear has also been extensively cleaned up, small front sections carrying the foot-step have been deleted and fairings have been added to all intersections. Fuselage lines have been further cleaned up by revising the former aft sliding main cabin doors to delete protruding tracks and mounting doors with cleaner piano-type hinges. Antennas and rear-view mirror mounted under the nose also have been deleted.

Main Rotor Loads

Cleanup program has resulted in the research UH-1B having a flat-plate drag area equivalent to approximately 11 sq. ft. compared with more than double that for the standard production configuration. In-plane main rotor loads are down some 40%. Vibration levels have been greatly lowered—pilots report that they are flying approximately 20 mph. faster before they reach equivalent vibration levels on the standard UH-1B.

Research helicopter can match standard UH-1B's speeds at approximately 25% lower power levels; range at same power levels is about 20% greater.

Modifications continue on the research machine, which will next be testing three-blade semi-rigid and rigid rotor configurations, designed to permit speeds up to 180 kt. Configuration will permit blade gimbal system to be locked out to provide full-rigid capability.

Next spring, stub wings of 26.76 ft. span will be added to the research UH-1B. Wings will have ground adjustable sweep from 12.5 deg. to 22 deg. and in-flight adjustable incidence up to 20 deg. Plans have been made to add auxiliary Continental J69-T-9 turbojet engines in pods on either side of the

fuselage next August. This will allow studies of all variations in flat-plate drag and their effects in a high speed environment ranging up through 200 kt. These studies may be useful in determining the value of modifying current inventory helicopters to provide higher performance for special missions.

PRODUCTION BRIEFING

Space Nuclear Propulsion Office has requested bids for support services at the Nuclear Rocket Development Station at Jackass Flats, Nev. Services will include plant engineering, housekeeping and technical activities associated with handling and operating facilities using cryogenics. Bids are due Jan. 10 at the Las Vegas SNPO.

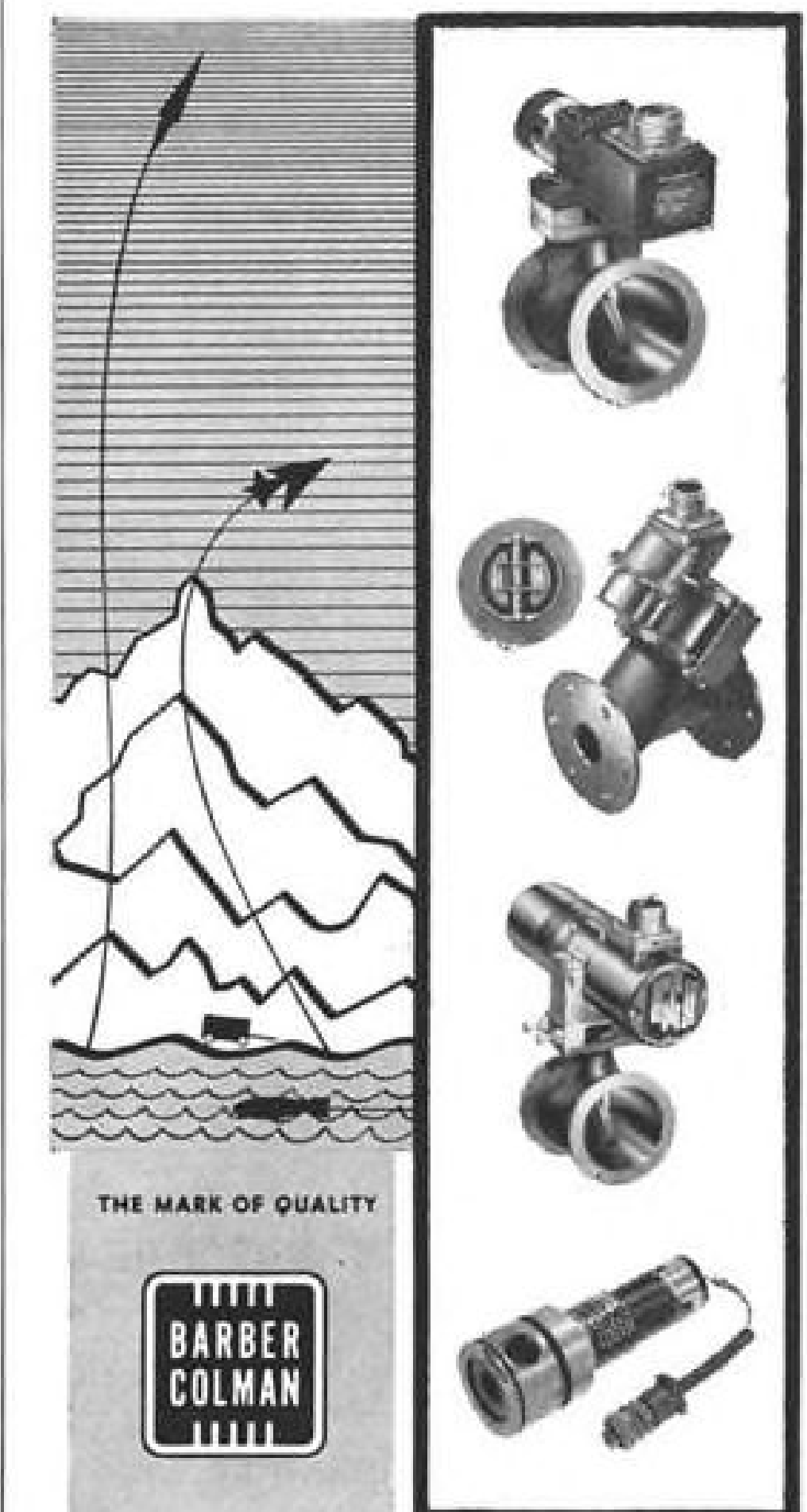
Bid requests will be issued soon after Jan. 1 for construction of a cyclotron for Langley Research Center's space radiation effects laboratory, to be built at Oyster Point near the center. Facility will cost about \$12.4 million and will go into operation in mid-1965.

Beckman Instruments, Inc.'s Systems Division will build 75 electronic test units which will be used to monitor and help calibrate flight information and armament control systems on the NATO version of Lockheed's F-104 jet fighter. Work is financed under a \$575,000 contract from North American Aviation, Inc.'s Autonetics Division, builder of the armament control systems.

International Telephone & Telegraph Corp.'s Kellogg Communications Systems Division will install an inter-site communications system at the Whiteman AFB, Mo., Minuteman ICBM site under a \$6-million Air Force contract.

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USS “T-1” Steel, and “T-1” type A, are two of the most versatile steels ever developed. They combine very high yield strength (100,000 psi minimum), outstanding toughness, and ready weldability. Designers have taken advantage of this remarkable combination of properties to build stronger, lighter structures of many types, and to improve the performance of an impressive array of heavy-duty equipment.

Achieving great strength and toughness in a steel is not an earthshaking event. But combining these properties with weldability *is*, as in the case of USS “T-1” and “T-1” type A Steels. It is this weldability that permits the designer to take full advantage of the strength of “T-1” Steels.

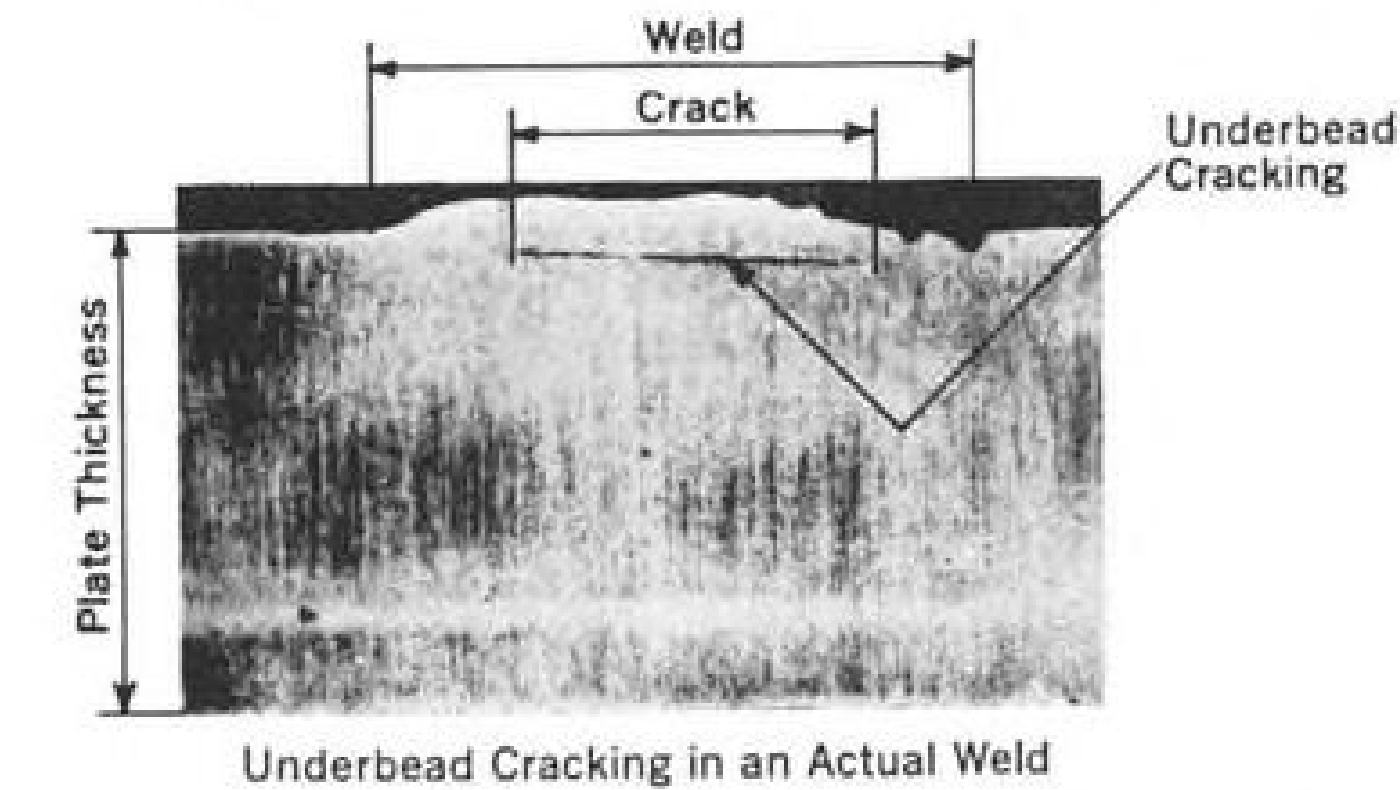
Being heat-treated constructional alloy steels, USS “T-1” Steels require different welding techniques than other high strength steels. They are not difficult to weld, just different. Strong, reliable joints are obtained when the following three precautions are followed. We invite you to read them as a guide to realizing the full benefits of USS “T-1” Steels. They are detailed in a booklet which includes a Welding Heat-Input Calculator, and in our new welder-training film, “How to Weld USS ‘T-1’ Steels” (see coupon).

RULE 1—Use the proper electrodes

When manual-arc welding “T-1” Steels, use only electrodes with low-hydrogen coatings. Or, use a welding method which is “low hydrogen” such as inert-gas shielded-arc or submerged-arc welding.

Hydrogen is the number one enemy of sound welds in “T-1” Steels, as in all alloy steels, because it causes underbead cracking, resulting in unreliable joints.

To be sure you have selected the correct electrodes, remember that low-hydrogen coatings are designated by the last two numbers of the electrode classification as 15, 16 or 18. None other. For example, E8015, E9016, and E11018 are satisfactory for welding USS “T-1” Steels.



When you want to be positive that the finished weld will be as strong as the parent “T-1” Steel, use E11015, -16, or -18 rods.

Never use electrodes or wire-flux combinations containing vanadium to weld “T-1” Steels if the weldment is to be stress relieved. Weld metal containing vanadium is likely to be made brittle by stress relief. (Stress relief is only necessary with “T-1” Steels when re-

quired by codes and one or two other special cases.)

When welding “T-1” Steels to a lower-strength steel, use low-hydrogen rods of the strength level recommended for the *lower*-strength steel.

Proper handling of electrodes is also important. When exposed to air, low-hydrogen coatings will pick up moisture which is a rich source of hydrogen. Keep your electrodes dry. Make it a practice never to open more than 30 minutes' supply of rods at a time. A sure way to keep rods dry is to keep them in a 250-300°F oven. If your rods have absorbed moisture, hot bake them in an oven according to the manufacturer's recommendation. One hour at 800°F is average.

To sum up Rule 1, for manual welding use low-hydrogen electrodes and keep them dry. For submerged-arc or inert-gas shielding arc welding, use thoroughly dry fluxes and water-free shielding gases.

RULE 2—Use correct welding heat

On most kinds of structural steels, high heat input results in superior welds. With “T-1” Steels, just the opposite is true. The best welds in “T-1” Steels depend on *never getting over a certain maximum amount of heat*. Less heat is used so the weld will cool quickly which, in “T-1” Steels, results in good, tough welds. Thus, *you must closely control the amount of heat put into the weld*.

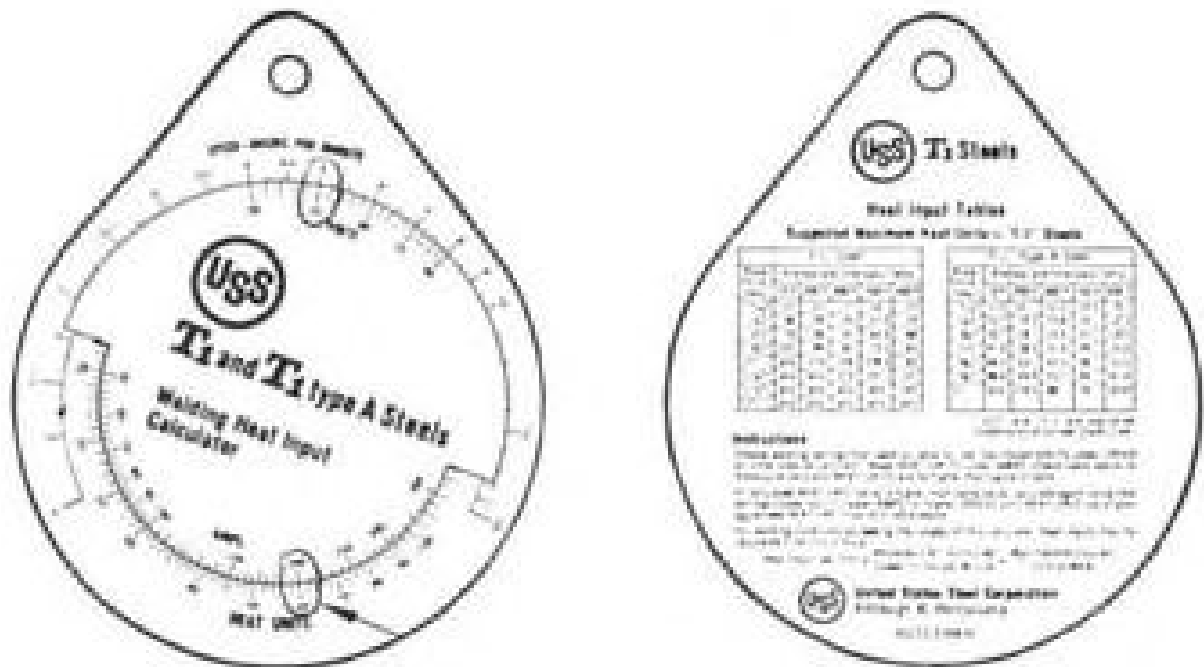
For this reason, never preheat “T-1” Steels except in special cases. Preheating means more heat to get rid of and a longer cooling off period, which can be harmful to welds on “T-1” Steels. The cases in which preheating is necessary are those in which the steel must be warmed to get rid of excessive moisture (a hydrogen source), where the piece is so restrained it doesn't have room to shrink after welding, or when thick pieces over 1" are being welded. Much of the time, however, preheating isn't necessary, and *never preheat “T-1” Steels on hunch alone*.

The heat you put into a weld depends principally on amperages and the speed at which the arc travels along the joint. The higher the amperage, the more heat input. The slower the speed, the higher the heat input. Controlling heat input requires keeping amperage below certain ceilings and keeping the speed of arc travel above certain speeds.

There are two other important items to keep track of: steel thickness and temperature. Thicker sections can safely soak up more heat than thinner ones, so you can use more amps and slower speed. As for temperature, the section may have been heated up by preheating or by previous passes of the electrode. So if the section is already hot, you must cut down on amps or increase speed to avoid excessive heat input.

Heat Input Calculator.

There's an easy way to determine the safe heat input for USS “T-1” Steels: the circular Heat Input Calculator which is provided with the book offered in the coupon. With it you can quickly find out what amount of heat will result from any given setup, and determine how much more you can safely put in. It is a



circular “slide rule” which tells, on the front side, how much heat will be put into the joint if you know the amperage, voltage, and arc speed. On the back side of the calculator are tables showing the safe heat inputs for “T-1” Steels in several different thicknesses at different temperatures. This handy device is designed to help you get good welds every time. Heat inputs may also be calculated from this formula:

Heat Input per inch =
$$\frac{\text{Amperes} \times \text{Arc Volts} \times 60}{\text{Speed, inches per min.}} = \frac{\text{Watt Seconds (Joules)}}{\text{Per inch of weld}}$$

RULE 3—Use recommended welding procedure

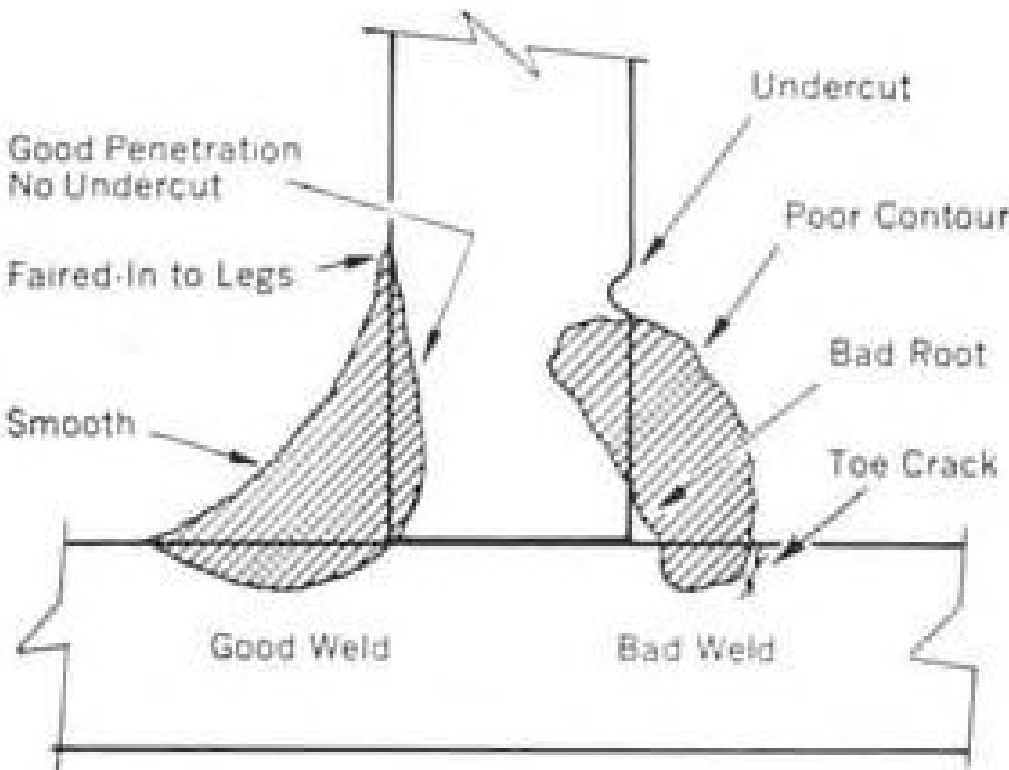
The straightforward stringer bead method is preferred for welding “T-1” Steels. *Do not use the “full weave” method*. Weaving heats the metal more because the arc travel speed is slower and may cause excessive heat input. The proper method is to fill the groove with a succession of stringer beads.

Before a bead can be laid over an earlier bead, the flux, scale, or oxidation must be removed.

Back gouging. The preferred method is arc-air gouging followed by clean-up grinding. *Do not use an oxyacetylene torch*. There is danger of overheating which may cause an unsatisfactory joint.

Speed. Whether you control speed by machine or hand, control it closely. The Heat Input Calculator described above is your guide to the proper speed to avoid excessive heat input.

Fillet welding. Good fillet welding technique is more important with “T-1” Steels because the joints are usually required to withstand greater forces. Fillet welds in “T-1” Steels should be smooth, correctly contoured and well faired-in to the legs of the pieces to be joined. The layers of each weld should be made so that there is good root penetration but no undercutting. The weld shown on the left is ideal, the one on the right is to be avoided.



When thick pieces are joined, and when the weldment is to be stress relieved, fillet welds can be troublesome because of toe cracking. There are several

ways to eliminate toe cracking near fillet welds on “T-1” Steels. In the case of Tee or Ell joints where lower strength welds are often the rule, use low-hydrogen rods of the E90, E80, and E70 classes. Being lower in strength and more ductile, they are less likely to “pull cracks” at the toe of the fillet weld.

Air hammer peening of the weld can also be very helpful in preventing cracks, especially if the weld is to be stress relieved. Joints made even with the higher strength rods (E100, E110 and up) should be free from toe cracks if peened. Sometimes it is necessary to peen each pass; at other times, peening only the toe passes will prevent cracking. After peening, the fillets should be smoothly ground to fair the fillet into the legs of the joint.

Other methods that can prevent cracking include use of a soft wire pedestal, machine grooving the base of the upright piece, and laying down “butter” welds in toe areas. The first two methods allow the upright leg to “shrink down.” The “butter” weld strengthens the “T-1” Steel in the area where a toe crack may start. It is ground off prior to actual fillet welding and must be located so that the toe passes of the fillet will be laid right over the strengthened zone.

Free Welding Help. The above information is spelled out in greater detail in our free book “How to Weld USS ‘T-1’ and ‘T-1’ type A Steels.” Included in the book is a Heat Input Calculator that helps the welder choose the proper welding machine settings. We'll gladly furnish enough free copies for your shop personnel. Also, you'll find our 18-minute, 16mm color motion picture of the same name a big help in demonstrating to your welders the proper techniques for welding USS “T-1” Steels. Send the coupon. USS and “T-1” are registered trademarks.

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Gentlemen:
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☐ Also lend me your 16mm, color sound movie of the same name. I understand there is no obligation.

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This mark tells you a product is made of modern, dependable Steel.



HIGH T-TAIL AND REAR-ENGINE configuration of the Boeing 727 are emphasized in this view of the new short- to medium-range jet transport at its rollout Nov. 27 (AW Nov. 26, p. 42). Plane is painted in brown and yellow color scheme featured on the original prototype Boeing 707. Aircraft is powered by three Pratt & Whitney JT8D-1 engines each rated at 14,000-lb. thrust for takeoff.

727 Designed for Low Approach Speeds

By David A. Anderton

Renton, Wash.—Prime engineering design goal of the Boeing 727 medium-range jet transport program was to obtain lower approach speeds for bad-weather conditions.

Ability to operate the airplane in and out of small fields and to fly short to medium stage lengths economically were two other requirements that influenced the design.

This trio of operational requirements, plus an extensive market survey that defined the traffic potential and therefore both the capacity and the interior layout of the 727, built a rigid frame of reference for the Boeing designers.

Working within these restrictions, the engineers developed refinements of layouts, designs and systems that had characterized their earlier efforts in multi-jet aircraft. The result is that the 727 looks like a Boeing airplane, and in

spite of its high-mounted T-tail and three rear engines, it looks like a conventional airplane. Only when the observer's attention is shifted to detail does the full breadth of the engineering approach dominate the design.

The airplane, which was rolled out of the hangar Nov. 27 (AW Nov. 26, p. 42), is powered by three Pratt & Whitney Aircraft JT8D-1 engines each rated at 14,000 lb. thrust for takeoff. Wing span is 108 ft. 7 in., and over-all length is 134 ft. 1 in. Interior can be arranged to carry 70 first-class passengers in four-abreast seating, or 114 tourist-class passengers in six-abreast seating. Maximum takeoff weight is 142,000 lb. in the specification, but an alternate at 152,000 lb. is being offered to the airlines and Boeing believes that all of them will use it.

Boeing's philosophy in the design of the 727 sprang from operating conditions associated with the short- to

medium-range hauls envisioned for the airplane. On such runs, the 727 would be expected to fly in and out of fields with about 5,000-ft. runways, in all kinds of weather and without relying on extensive approach aids. It would cruise normally at lower altitudes, which would mean exposing the passengers and the airframe to more turbulence over longer periods of time than those associated with long-distance jet transportation.

The only way to approach this problem was to design a wing with high wind loadings for cruise in order to minimize the drag, and with high maximum lift coefficients in order to minimize the stall and approach speeds. Boeing's first major decision on the 727 program was to develop a high-lift system for the airplane which would beat by substantial margins the lift coefficients obtained on the company's earlier transports.

Basically, the 727 wing looks like its counterpart on the Boeing 720 series. But the sweep angle, dihedral angle, airfoil section, high-lift devices and control surfaces differ from those of the 720. Wing loading at maximum flight weight of 142,000 lb. is 86 psf., and for the alternate weight of 152,000 lb., the wing loading is about 92 psf. These figures lie between similar values for the Boeing 720 and 720B series. Maximum landing wing loading, for a weight of 131,000 lb., is 79.5 psf., considerably higher than the 720 series.

Engineers designed and tested a large number of flap systems, including some using boundary-layer control. All of these were tested in wind-tunnels either at Boeing or in the Seattle area. Some of them were promising enough so that full-scale hardware was built and flown on the Boeing 707 prototype, the "Dash 80."

Flap Mechanisms

Chief 727 Project Engineer J. E. Steiner said that at one time during the development of the airplane there were 41 engineers designing competitive flap mechanisms, aimed at practical mechanics and easily maintained structures.

The final result was that the wing was designed with trailing-edge triple-slotted flaps running spanwise from the fuselage to the inboard nacelle and from the inboard aileron to the outboard aileron.

The leading edge of the wing carries Krueger flaps in three segments from the fuselage to the inboard pylon, and four-segment leading-edge slats from that point out to the wingtip.

Boeing has not released actual maximum lift coefficients of this wing, but the company has said that it shows more than 40% improvement over the 720 and 707 wings. Actual ratio of lift coefficient flaps down to flaps up is 1.7 for the 707 and 720, and 2.4 for the 727.

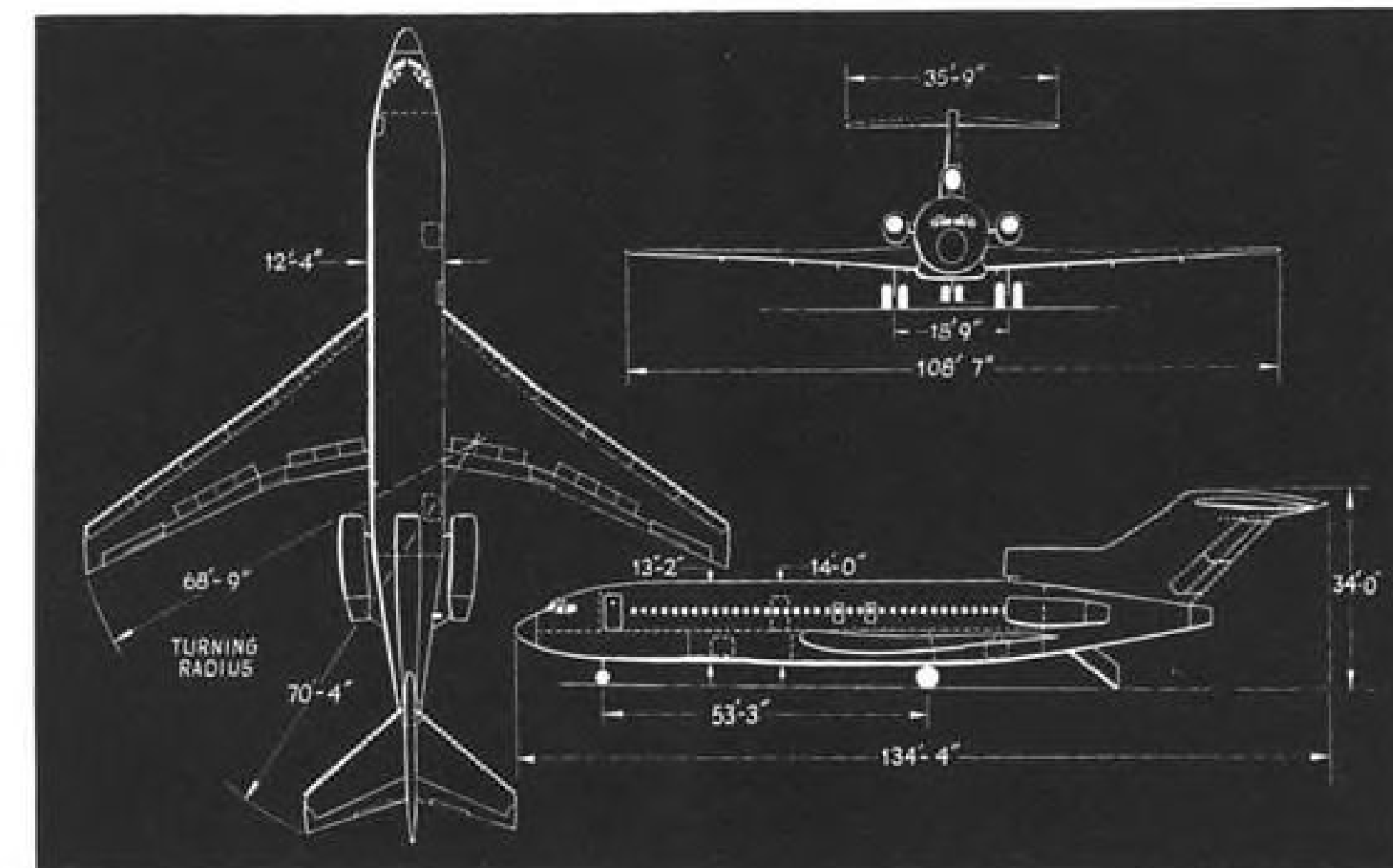
Wing sweep is 32 deg., measured at the quarter-chord point. Both the sweep and the dihedral angle are less than those on the 720.

Because the cruise profiles are different, and because the wing-mounted engines of the 720 affected the wing aerodynamics, the airfoil sections of the 727 wing have been changed. The inboard leading-edge extension is similar to that on the 720. Gross wing area is 1,650 sq. ft.

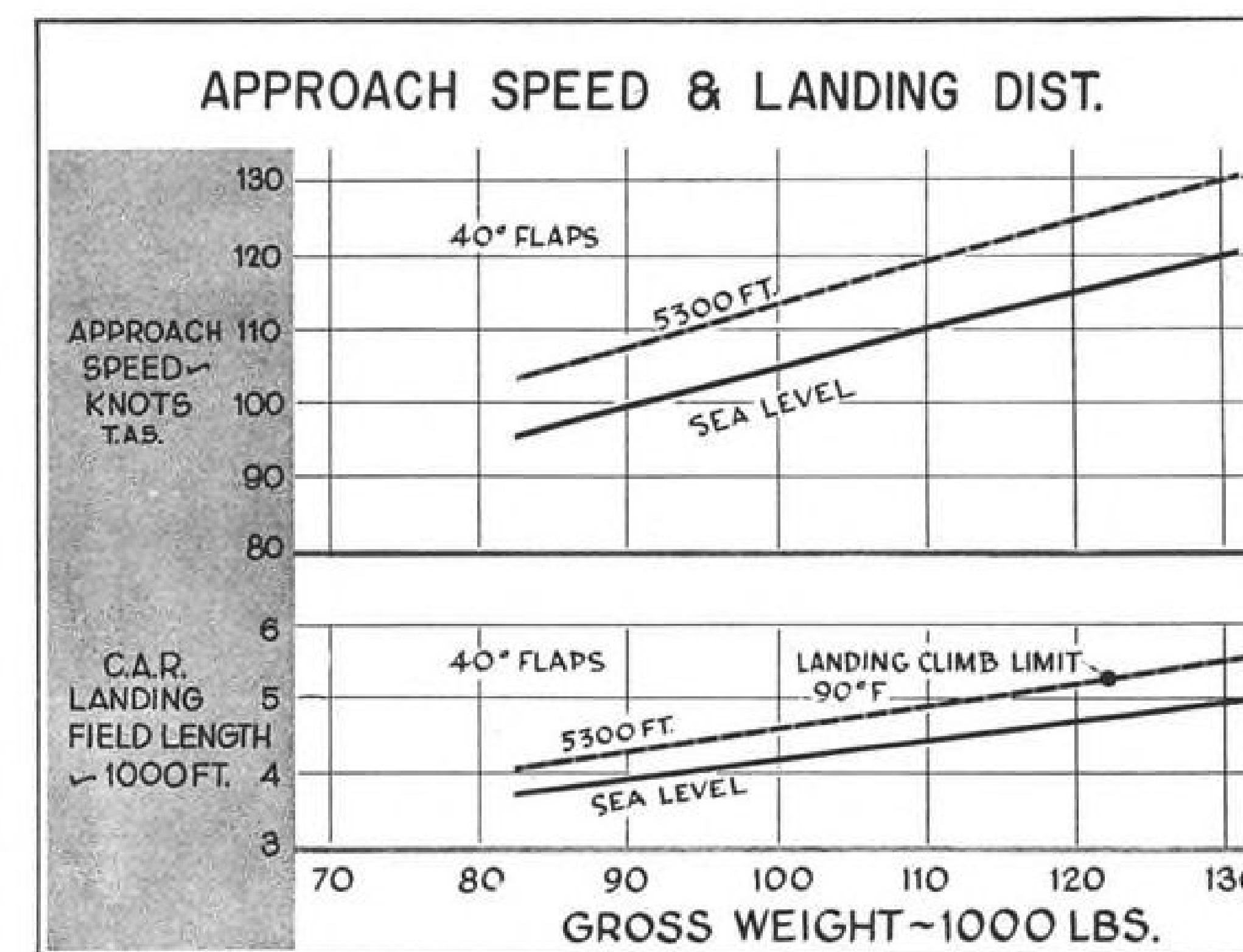
Wing structure is basically a two-spar box beam with conventional rib construction. Surfaces are built from riveted skin-stringer combinations.

From the body out to the wingtip, the volume between the spars is an integral fuel tank, with 7,000 gal. normal capacity.

It is was not enough to provide the



BOEING 727 THREE-VIEW drawing shows basic layout of the three-engined jet transport.



APPROACH SPEED and landing distance may be the limiting criteria on short routes.

727 with large lift increments for the approach and landing. They had to be usable lift increments, which meant that the airplane had to be stable and controllable down to its minimum flying speed and that the autopilot system had to be developed along different lines to take full advantage of the airplane's flight characteristics. Complete description of the autopilot system appeared in AVIATION WEEK (Nov. 19, p. 93).

Surface controls for the 727 were also an evolutionary development from the airplane systems that went before. Combination of ailerons and flight spoilers is used for lateral control; dual rudders handle the directional control and the elevator is conventional. Irreversible hydraulic control systems are

utilized on all three axes.

The wing trailing edge, in addition to carrying the large flaps, also carries—starting at the body and working out along the span—three spoilers on the upper surface, an inboard aileron, four more spoilers, and an outboard aileron.

For lateral control, ten spoilers are available, five per side. Four of these are the outboard spoilers and the fifth is the most-outboard of the inboard spoilers.

The remaining two spoilers on each side are for ground braking only.

The inboard ailerons are used during high-speed cruise flight only; the outboard ailerons operate only when the flaps are down. The spoilers pick up anytime there is more than five degrees deflection of the control wheel. They



The real low-down

When ground troops call for close air support (as in limited war) Republic's F-105D can deliver. Not near support or fairly close, but very close. Under enemy radar, just over the trees.

F-105D is built that way. Built to slip away safely, to strike again another day. Built to do it in any weather, any time.

Pin-point accuracy, all-weather capability and terrain avoidance are automatic with the F-105D. Equally automatic and fully integrated are its fire, flight and navigation controls.

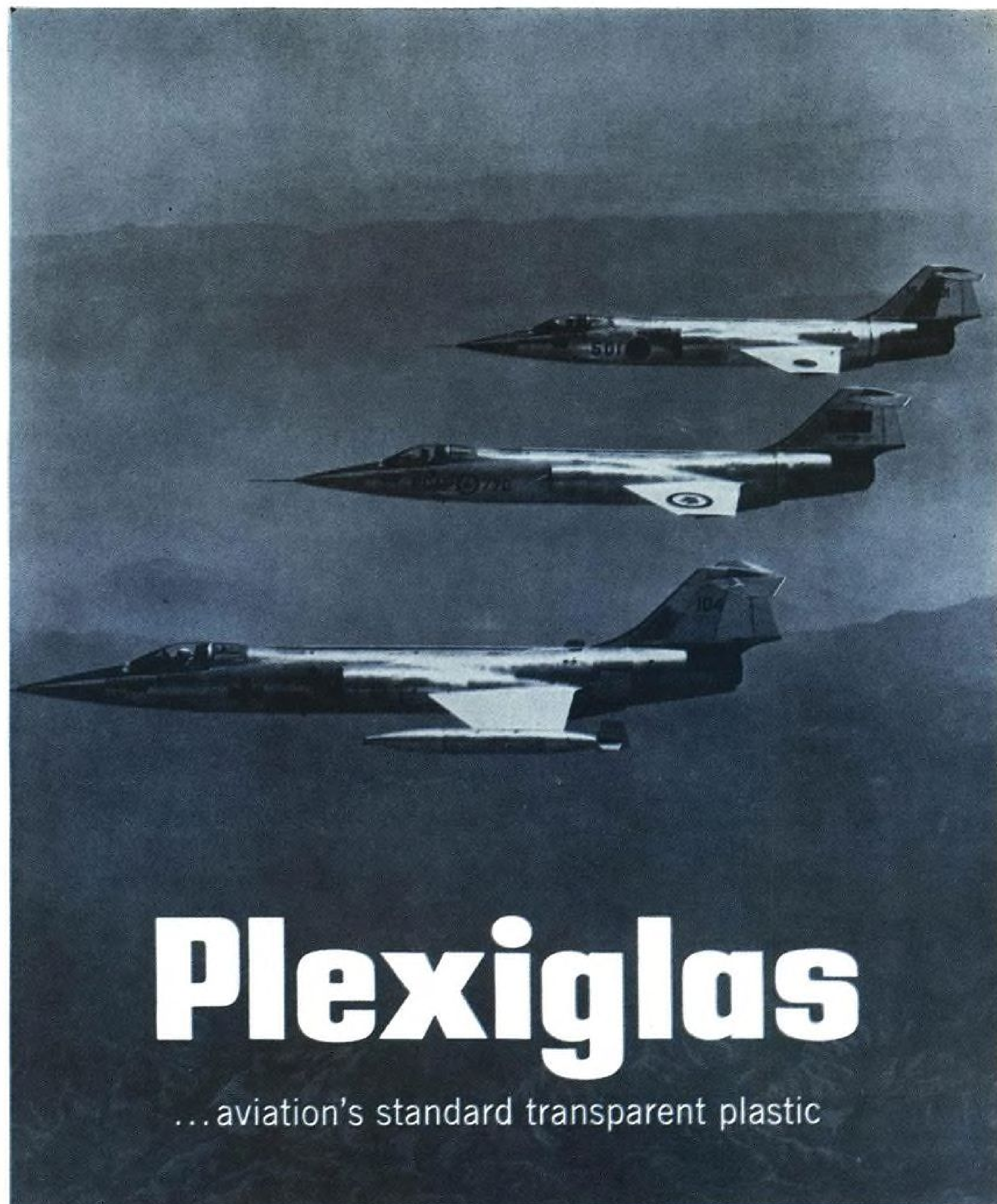
Its punch is versatile: everything from nuclear to conventional bombs, from 20 mm cannon to a wide variety of missiles. Operational speeds range from 200 mph to above Mach 2. F-105D is a fighter and a bomber. One man flies it.

F-105D exists. It is flying in Europe and the Pacific with the U. S. Air Force.



REPUBLIC
AVIATION CORPORATION

FARMINGDALE, LONG ISLAND, NEW YORK



Pilot's canopy on the Lockheed F-104 Super Starfighter is made of PLEXIGLAS® 55 acrylic plastic. The 1500-mph multi-mission fighter is now being produced for international use in United States, Germany, Belgium, The Netherlands, Canada, Italy and Japan.

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are programed so that they deflect only 15 deg. when the flaps are down, and 30 deg. when the flaps are up. Both these deflections should produce a roll rate of one radian per second. Brake spoilers deflect to 45 deg.

Split rudders carry anti-balance tabs. If one rudder system should fail and produce a hard-over signal, the other rudder would deflect automatically to compensate. There are dual yaw dampers, one for each rudder, with authority confined to five degrees on top of any rudder pedal input.

Hydraulic Systems

There are three hydraulic systems; two of these are dual parallel systems for longitudinal and lateral control, and the third is a back-up system for the rudder. First of the systems is powered by dual pumps driven by the left and center engines. It operates the airplane control and flap systems and the landing gear. Second of the systems, which operates simultaneously with the first, is powered by dual electrically driven pumps. If one hydraulic system fails, the second supplies control power automatically and immediately. The third system drives the lower rudder segment and the leading-edge flaps, and is powered by a single electric motor-driven pump.

If the two main hydraulic systems fail, the airplane controls go into manual automatically and the third system drives the lower rudder. Under these conditions, the airplane is not only flyable but can be landed with manual control. The manual system provides enough power to produce a roll rate of six degrees per second, and a full flare with the elevators; but the 727 cannot demonstrate a complete stall under this condition.

Stick Forces

Both lateral and directional control systems produce artificial stick forces or "feel" with springs. For the ailerons, a 10-lb. couple gives the feel at full deflection; for the rudder, the feel is 80 lb. on the pedals.

The elevator has a hydraulic feel system, based on integrated inputs from the stabilizer position and dynamic pressure, read from dual pitot inlets, electrically de-iced, one on each side of the fin. Integration of these two bits of information gives a close approximation of the center of gravity, primarily by defining the trim of the aircraft and its static stability margin for any condition of flight. If one hydraulic system fails, there is no change in feel detectable by the pilot; if two systems fail, the elevator feel is produced by a spring which gives stick forces corresponding to those usually felt at 140 kt.

The forward cockpit shell and wind-

How you can avoid three costly mistakes in the selection of a scientific or engineering computer

And the one sure way to find the computer that suits you best

Selecting a computer can be one of the most important decisions an executive can make. Almost any computer can reduce costs by solving problems, and saving time, but some are far more efficient than others.

This then should lead to a careful study of available computers. And the study must avoid becoming overconcerned with "nuts and bolts" and concentrate instead on overall suitability and purpose.

Basically, the decision has to depend on finding the computer that best serves your needs. The Recomp® line of solid-state scientific and engineering computers has been found ideal for many leading companies. Perhaps it could best meet your needs. The following common mistakes may offer some guidance in your choice.

(1) "Get the cheapest computer"

Just as there is no such thing as a cheap pair of shoes, there is no "cheap" computer. Scientific problem-solving computers sell from \$40,000 and up. They lease from \$1,000 and up a month. But, much more important than initial cost is how much a computer will save you over a period of time.

A computer feasibility study showed that a Recomp computer could save almost \$70,000 more than a lower-priced competitor in a year on a given project. In addition, Recomp offers a broad price range. The Recomp III computer is ideal for small-scale needs. And you can lease one for \$1,495, complete. For medium-scale needs, Recomp II starts at \$2,495. A complete line of peripheral equipment is available for both computers.

(2) "Buy the fastest one"

Naturally, speed is important. But computer operating speed is just a small part of the story. Save a few microseconds here and there and you haven't saved much. More important is total problem solving time.

The Recomp line of small and medium scale computers mark their savings in terms of hours...not microseconds. Recomp computers can save hours in problem solving time because they're simple to program, easy to operate, and have an exceptionally large memory.

(3) "Hire specialized computer personnel"

Not always necessary. Some computers do demand specialized programming personnel to operate them. However, others are so simple to use that engineers can program their problems directly. This ease of programming saves time and increases computer use.

One of the easiest computers to program and operate is Recomp. Engineers with less than eight hours instruction are able to use Recomp computers profitably.

The one sure way to select a computer

The computer requirements of every company are unique. The best way to find the computer that fits your own specialized requirements—without making costly mistakes—is through a computer feasibility study. This is the only way to know exactly what computer suits you and your company best.

Put Recomp side by side with any comparable computer on the market. Let the facts speak for themselves. You'll see why no computer feasibility study is complete without Recomp.

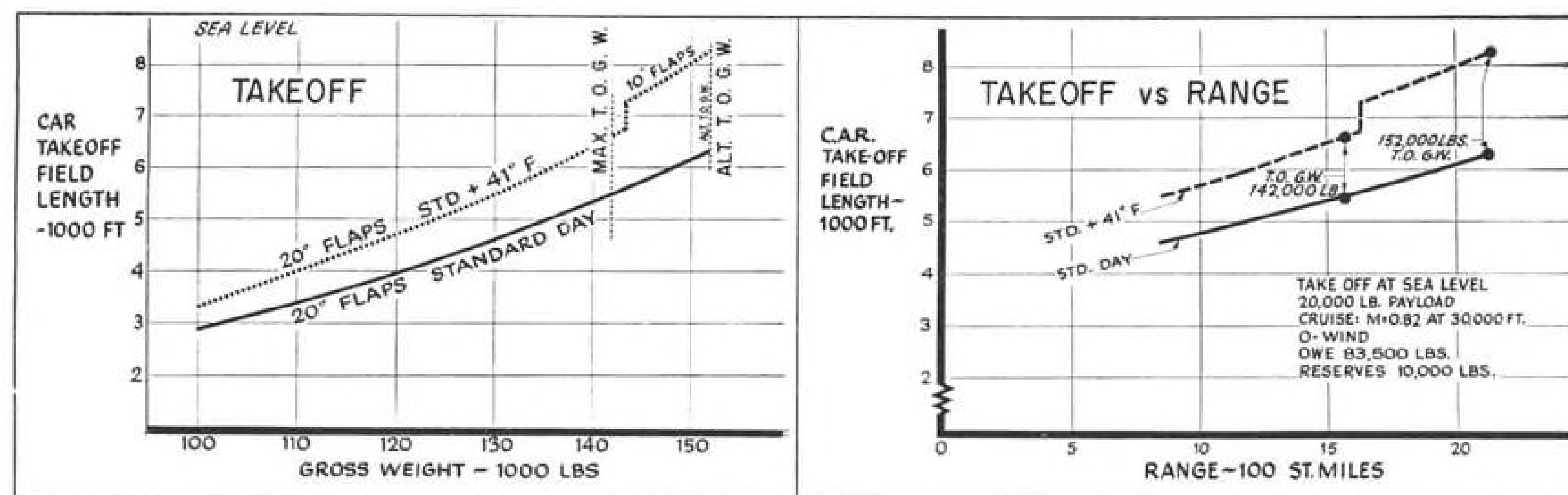
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TAKEOFF DATA (LEFT) ARE COMPUTED based on Civil Air Regulations SR 422B; hot day data are also applicable to standard-day operations at an airport 3,000 ft. above sea level. Takeoff-range curves (right) are based on full mixed-class payload of 20,000 lb. Cruise conditions specified are close to minimum-cost cruise over a large range of stage lengths.

shield are identical to the units used for the 707 and 720. Interior arrangement is very similar to the predecessor airplanes; there are positions for captain, first officer, third crewman and two observers.

Cabin cross-section dimensions are identical to those of the 707 and 720. Standard arrangement of the interior offered by Boeing is a mixed layout, with 28 first-class seats forward in four-abreast layout on 38-in. pitch. Remainder of the cabin has 66 tourist-class seats in six-abreast layout on 36-in. pitch.

Rear Access

Rear access to the cabin is by a ventral stairway, hydraulically operated from either the interior or the ground. A forward airstair is optional with the customer.

The unit can be telescoped into a compartment located below the main forward entry.

There are two belly cargo compartments with a total volume of 855 cu. ft. with central doors 48 in. by 35 in. The compartments are lined with a damage-resistant material developed for the 727.

Problems of internal and external noise received detailed attention during the 727 development program. Use of tuned panels inside the cabin for sound absorption by means of the Helmholtz resonator principle represents a first aircraft application, Boeing says. As a result of the work on the interior, Boeing shows a chart of speech interference level decibels inside the cabin which points out that most noise levels are below 70 db.

On the ramp, the 727 will be noisier than the Electra, but quieter than the 707-120 or the 720B. Actual noise level at a 200-ft. radius for the thrust necessary to start taxiing is calculated at about 117-118 db.

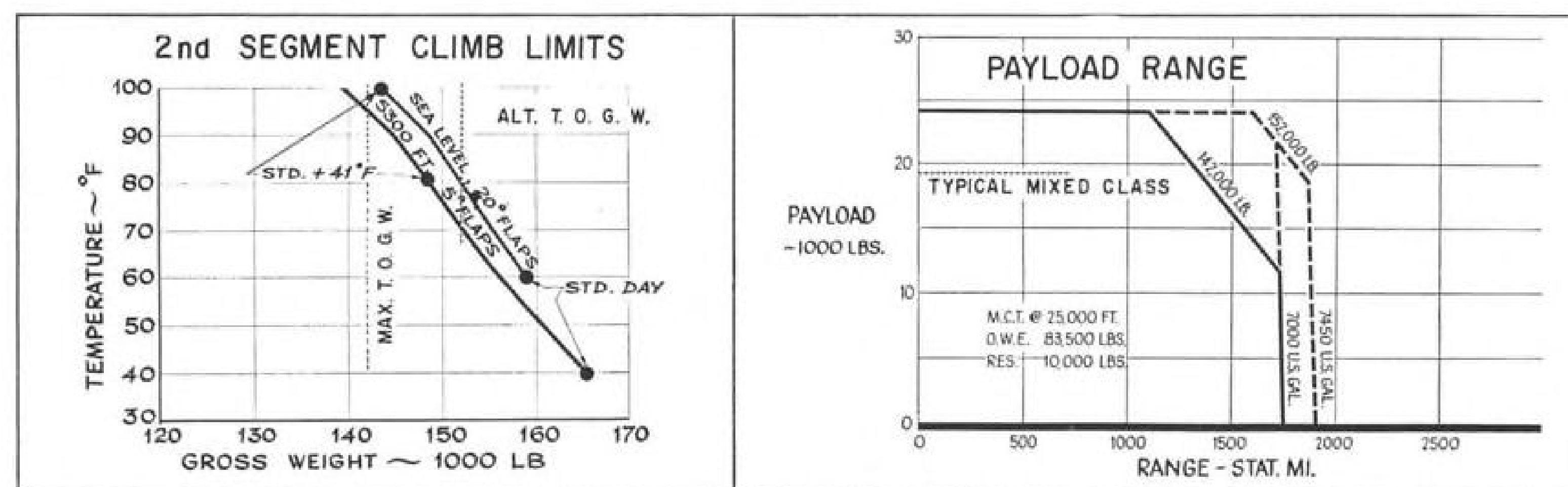
For the community noise level problem Boeing holds out real hope. The 727, the company says, will be quieter by a substantial margin than other transports including piston-engined types. One nautical mile from the end of the runway, the 727 is expected to be making about 109 db., compared with about 110 for a Douglas DC-7C, 112 for the Douglas DC-6B, or 125 for the Boeing 707-120 using water injection power.

With the company committed to build the first 727 as a production aircraft rather than as a prototype, engineers planned an extensive program of tests to minimize the risk. One example of the risk: Currently there are eight airplanes nearly complete in the structural sense. By the time the first 727 is scheduled to be certificated—February, 1964—there will be more than 20 airplanes sitting on the field, ready to go.

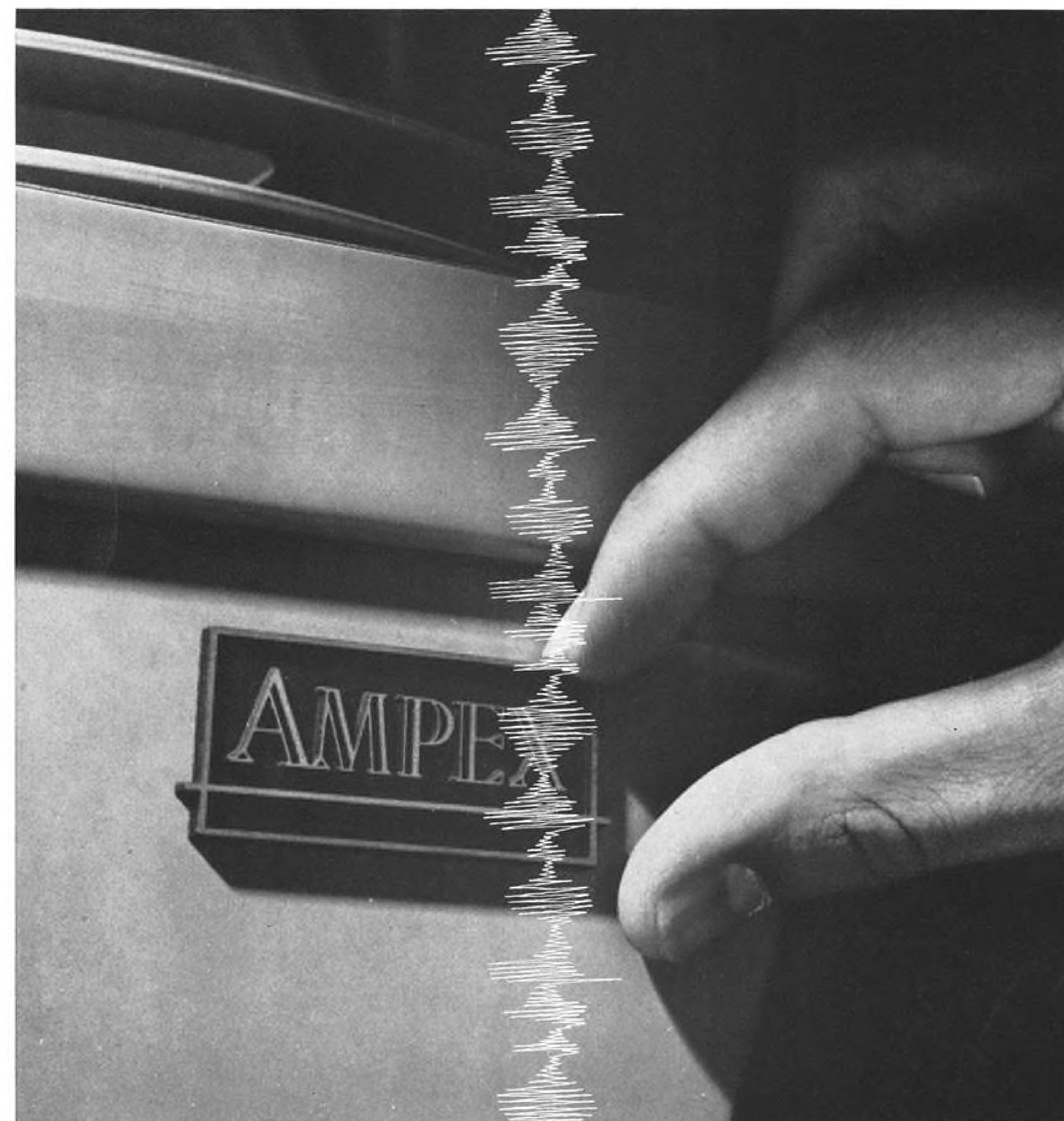
Test Program

Boeing estimates that \$30 million will be spent by the company on the total 727 test program. It started back in the middle of 1959 with wind-tunnel tests aimed at powerplant location and configuration, and is scheduled to end in September, 1964, with the final destruction of the fatigue test airframe.

So far the wind-tunnel program alone has consumed more than 5,500 hr. of running time, of which about 1,700 hr. was in transonic testing. Biggest amount of time—about 900 hr.—went into development of the high-lift devices. The next largest amount of run-



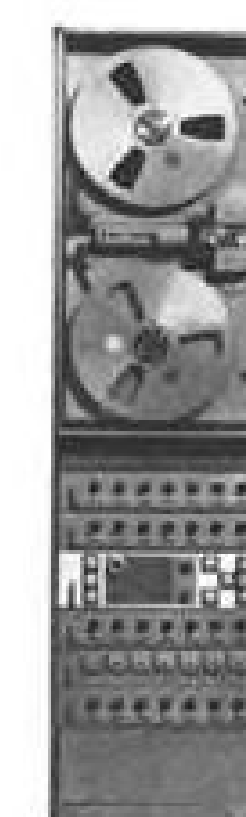
SECOND-SEGMENT CLIMB LIMIT curves (left) show that the 727 is not climb-limited at gross takeoff weight on a 100F day at sea level if the plane uses 20-deg. deflection on the flaps for takeoff. If takeoff distances can be increased, takeoff flap deflections can be decreased and allow a high climb weight. That is shown by the curve plotted for five-degree flap deflection and an altitude of 5,300 ft. Payload-range data (right) are presented for maximum cruise thrust at 25,000 ft., conditions which would probably be used on highly competitive routes where the airplane speed could be exploited.



What name is on the first 1.5 Mc recorder?

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Here it is: a 1.5 Mc per track, multi-track recorder! And Ampex is the first to have it. It's called the FR-1400. It will give you the broadest bandwidth yet in longitudinal recording. What's more, it utilizes solid state electronics throughout—all in one rack. It has four speeds, each electrically switchable with no adjustments needed. And it comes with tape search and shuttle to provide quick data location and permit any portion of the tape to run repeatedly without operator attention. What about per-



formance? Outstanding! It offers better rise time and minimum ringing on square waves, low intermodulation distortion, and improved flutter. Ampex also brings you a new 1.5 Mc tape. In both you'll find the same engineering precision, the same superior quality, that has made Ampex first in the field of magnetic recording. Write the only company providing recorders and tape for every application: Ampex Corp., 934 Charter St., Redwood City, Calif. Worldwide sales and service.

AMPEX

Thiokol Research with High-Energy Oxidizers opens new
PROPULSION PATHS

WHERE SIZE COUNTS...

Thiokol's pioneering broke the size barrier on solids. Continuing R&D at Thiokol has been responsible for scores of technical breakthroughs leading to production of the most reliable propulsion systems in rocketry's current catalog.

At present, Thiokol scientists are engaged in development of new super oxidizers for solids application. A

greatly enlarged microphotograph of one of these crystalline, high performance ingredients is shown in insert illustration below. Promising vastly improved performance—greater lift, range, and payload delivery—in motors now flying, new Thiokol-developed oxidizers will also increase adaptability of solid systems for upper stages of space vehicles, enhance punch and reliability of big boosters.



NUCLEAR MAGNETIC RESONANCE SPECTROMETER. Advanced scientific apparatus used to determine molecular structure of exotic fuel components for purposes of predicting their behavior.

Micro photo of high energy oxidizer.



TO SPACE

WHERE PERFORMANCE COUNTS...

Thiokol is taming many exotic liquid fuels for space flight. Research has already achieved several new propellant combinations capable of providing missions of longer duration with greater payload capacity than other space storables and advanced cryogenics.

In actual firings of oxygen difluoride/diborane on the thrust stand, for example, Thiokol is establishing injec-

tor performance, developing ablative and other chamber cooling techniques and defining propulsion system performance.



ROCKET ROBOT. Remotely controlled device carries experimental motors and "hot" propellant compounds from lab to test area. Speeds developmental work.

Thiokol

CHEMICAL CORPORATION
BRISTOL, PENNA.

Rocket Operations Center: Ogden, Utah

AN EQUAL OPPORTUNITY EMPLOYER

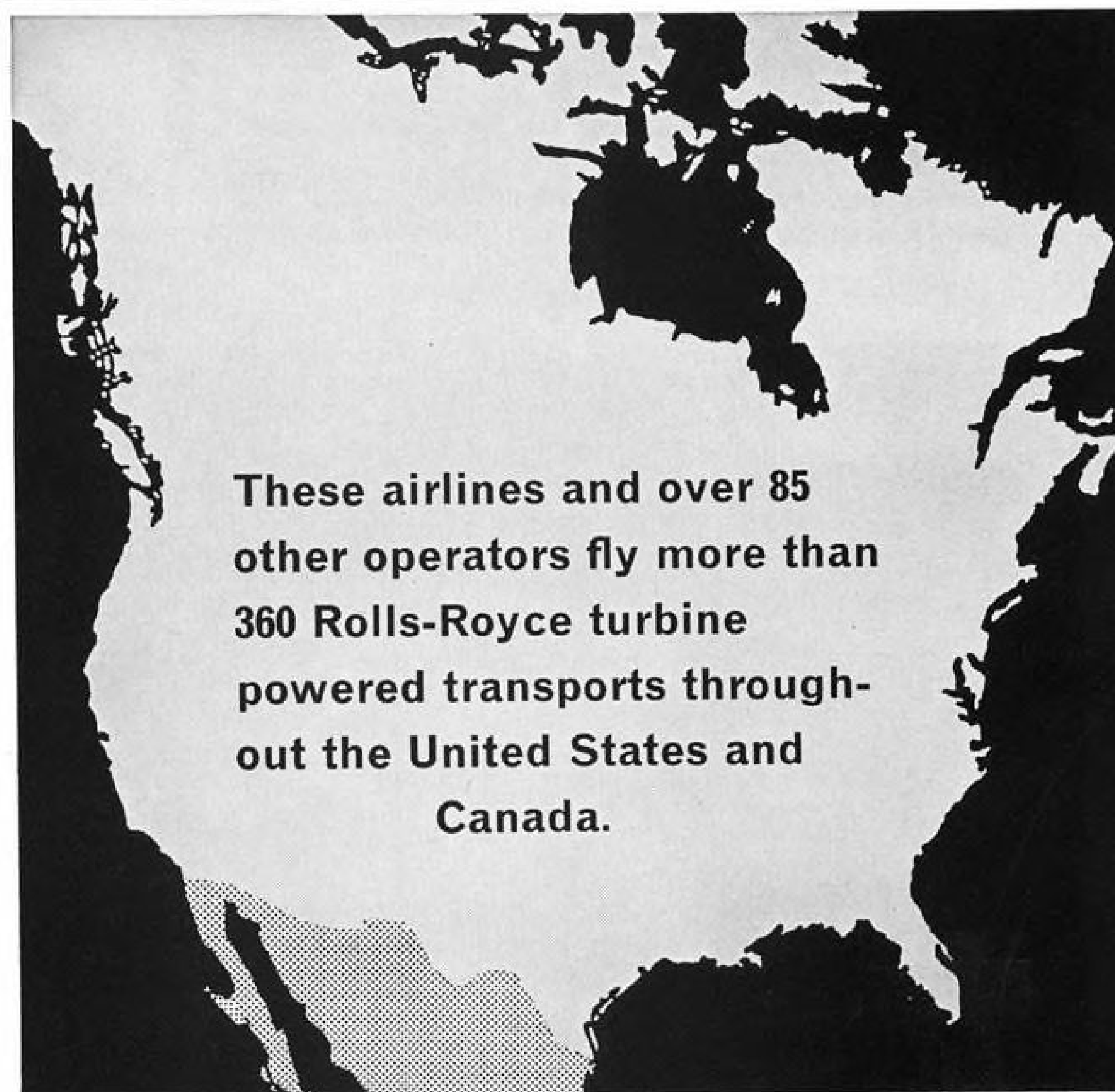
Thrust stand firing with OF₂.



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Boeing 727 All-Weather Program

Boeing has proposed a three-phased program which would develop an all-weather capability for the 727 at some time in the future. Although some of the current approaches to the subject are involved with the relations of airlines and airlines' pilots (AW Dec. 3, p. 43), Boeing feels optimistic that all-weather flying operations will come and finally be approved by every agency or company associated with air transport.

The basic 727 as delivered is capable of operating in reduced minimums: 200-ft. ceiling and one-half mile visibility, the company says. It will be achieved by crew training, and by the improved reliability of the equipment, the improved handling characteristics of the airplane, and by integrated instrument warning displays. This operational mode is subject to approval by the Federal Aviation Agency.

Second phase, also subject to FAA approval, would take the airplane farther along the path, to minimums below 200 ft. and one-half mile. Boeing proposes to add instrument comparators, glide-slope extension and split-axis autopilot control. It would also help to have a radio altimeter, a flare computer and automatic throttle controls, and the company says these features may be included.

Finally the third phase envisions complete all-weather operations, coming from improved situation displays, stick steering, redundancy of systems to permit landings in spite of single failures, and any additional equipment rising out of future developments.

ning time went into flutter investigation.

Engine inlets were tested on the water table, a two-dimensional analogy to airflow from which much useful qualitative data can be gained. Further inlet studies were made in the transonic tunnel at Boeing, the low-speed tunnel at the University of Washington, and in large-scale tests with an experimental JT8D engine on the ground.

Destruction Tests

Two complete airframes are earmarked for destruction. One of these will be the static test aircraft, and is now being mounted in the test frame. Second is the fatigue-test airframe, which will not be available for test until mid-1963.

Second production airplane will be retained by Boeing for flight-test work until the first group of airplanes has been delivered. Reason is that flight-testing of the 720 and 707 series had to be done piecemeal on airplanes made available through the cooperation of customers. Any delays on Boeing's part generally meant that the incompleting test installation had to be ripped out and installed in another airplane, again with the customer's acquiescence. This routine was the despair of the flight-test department, but was necessary under the circumstances. The 727 program will not go the same route.

The Dash 80, aging 707 prototype which has been on flight status for more than eight years, was used as a flying test vehicle for two major areas of 727 development: engines and flaps. It logged almost 250 hr. in these tests, and startled observers saw the brown-and-yellow aircraft apparently floating around the Seattle area, its huge trailing-edge flaps and leading-edge slats

fixed in place, and its four wing engines augmented by a fifth powerplant, mounted like a wart on the left rear fuselage. Unconfirmed reports say the 707 stalled at less than 80 kt.

Other test equipment included the "iron bird," a \$2 million rig with full-scale dimensions and components of the airplane's control system.

Boeing will build to a production rate of three per month at the end of 1963, and by mid-1964 will reach a scheduled eight aircraft per month. First four airplanes off the line will go into the certification program; the following three complete the first batch and all of the first seven will be delivered to United Air Lines.

The 727 is being fed right into the same production lines that are now turning out 707 and 720 series airframes. The reason primarily is one of maintaining the level of employment nearly constant over a long time period. Boeing planners say that skilled technicians working on systems installations, or final assembly, or fuselage interiors, can handle any of the Boeing airplanes irrespective of type. To them, the specific job is the important task, not the general airplane class on which they are working.

Steady Employment

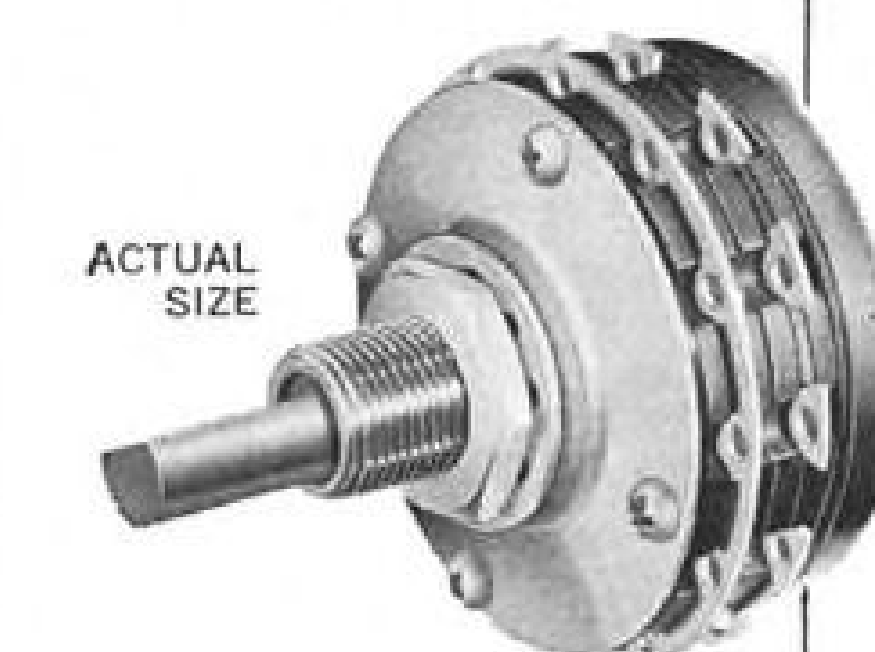
This means that by proper phasing of 727 production into the huge works at Renton, the company can avoid the employment peaks and valleys that generally characterize the shift from one type of production to another.

One of the most important adjuncts to production has been the mock-up. Traditionally relegated to a side corner of a hangar somewhere, the mock-up has been viewed generally as a means of impressing the customer. Boeing has

custom
packaged
precision
switching
systems
are

'GO'

at MASON



ACTUAL
SIZE



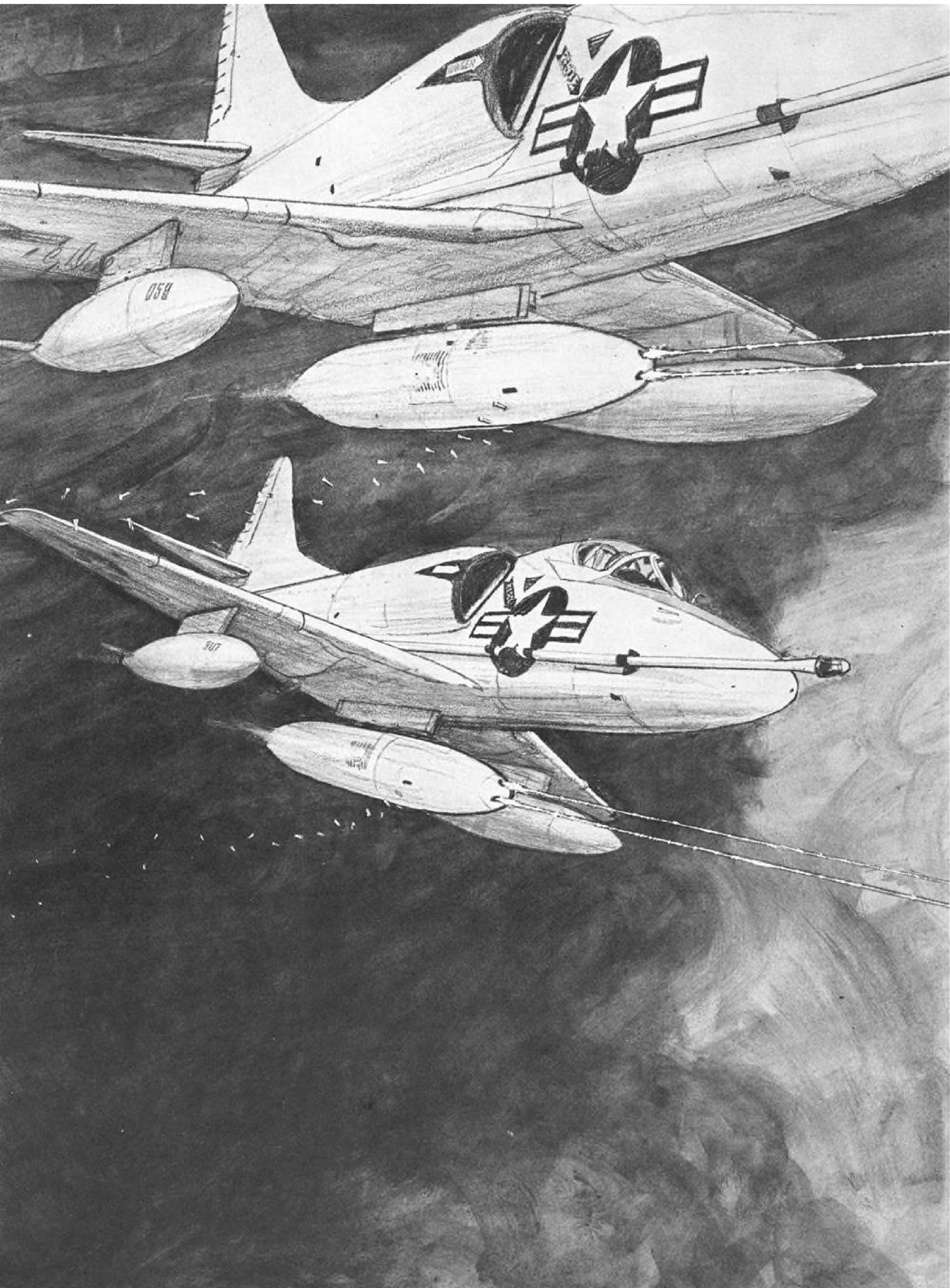
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New miniature 30° Throw "L" Series Rotary switches specifically designed for a variety of missile, aircraft and ground support equipment applications. Available in 1 to 6 decks, any pole in shorting or non-shorting types. Available with a variety of power drives for remote operation. Meet or exceed applicable military requirements. Write for new Bulletin containing complete specifications.

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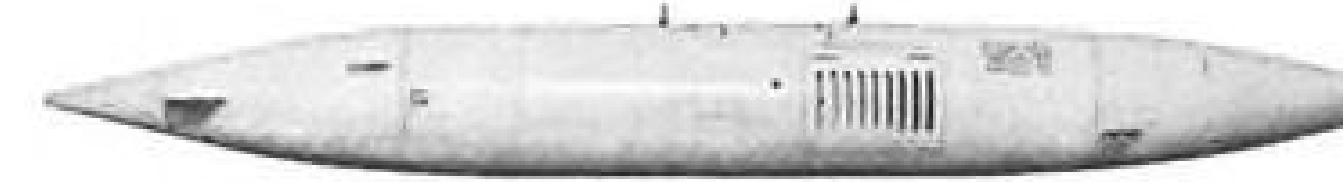
Hughes makes news in armament!

Minor brushfire or major conflict—today's air-to-surface tactical missions require new flexibility in armament. There are a greater variety of small, hard-to-see targets which must be attacked at short range from aircraft flying at low altitudes. Total time to fire is shorter.

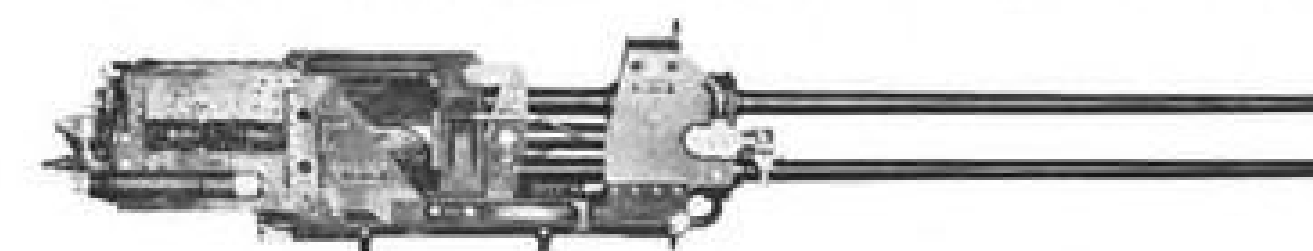
The optimum weapon in this difficult environment is the high-rate-of-fire gun. It is extremely accurate. It reacts instantly. It has high lethality against a wide range of targets. Other advantages are low cost, logistic savings, over-all simplicity and reduced pilot exposure.

Gun Ordnance has been a major activity of the Hughes Tool Company — Aircraft Division for more than twenty years. This continuing gun development and production capability has culminated in advanced weapons—ideally suited for today's requirements.

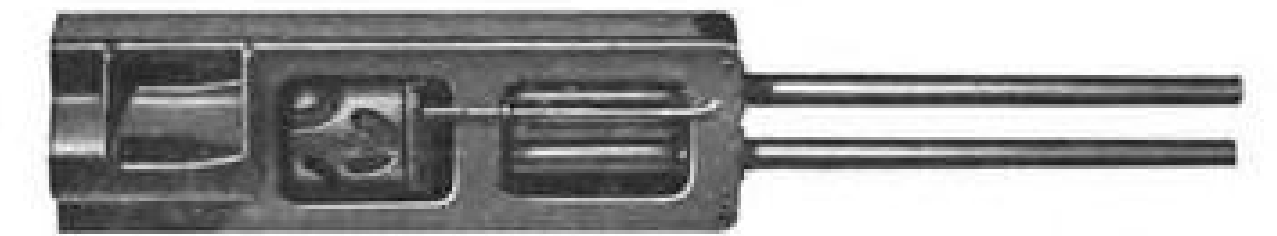
Hughes gun ordnance capability includes the complete system—the gun, its installation, controls, gunsight and specialized ammunition. These systems are tailored to the individual missions of fixed wing aircraft, helicopters and ground vehicles.



Hughes HIPEG—20mm gun pod—Unique in the field of external armament stores, HIPEG is a complete, high performance gun system. Its Mark 11 gun fires 4000 rounds per minute—the highest firepower rate per pound of all 20mm guns. It comes up to rate instantly and fires the most powerful 20mm round available. The HIPEG system combines the gun and 750 rounds of ammo in a supersonic enclosure. Developed for the U. S. Navy, it is now available for application on a wide range of fighter and attack aircraft as well as helicopters. Advantages of Hughes HIPEG: It can be removed for servicing and replaced by loaded pods for quick turn-around. Alternately, the pods can be left off to allow the aircraft more versatility in non-gun missions. HIPEG provides more missions per aircraft—greater aircraft utilization. As required, Hughes HIPEG pods can be installed in multiples to provide greater firepower density or longer duration.



Hughes ammunition developments include 20mm armor-piercing rounds specialized for use against ground targets as delivered from fixed wing aircraft, helicopters and ground vehicles. Also in development, a new 20mm salvo round for the MK 11 gun against area targets.



Hughes Heligun has 4000 round-per-minute firepower at only 30 lbs. weight—seven times more firepower per gun than current weapons. Designed specifically for aircraft where heavier guns are precluded, Hughes new Heligun utilizes principles proven in its 20mm counterpart—the HIPEG. Firing the 7.62mm NATO round, the Heligun will provide dense firepower from helicopters, fixed wing aircraft or ground vehicles. Features include: Self power. Instantaneous rate. Low frontal area. Positive protection from cookoff, hangfire and double feed. Pneumatic or cartridge charge, low velocity ammo feed from standard M13 links and only 190 lbs. average recoil.

Helicopter Armament Systems—Hughes gun packages—designed for LOH use—can also be easily adapted for other helicopters. One package has a pair of M60 machine guns and offers: elevation control, quick installation, low drag, special gun sight. Alternately, the new Hughes Heligun could replace existing guns to offer a fourfold increase in firepower and a five times reduction in drag. A fixed wing version would contain the Heligun in an external pod. An interchangeable package contains the XM-75 grenade launcher.



◀ Hughes HIPEG 20mm Pod with MK 11 Gun (4000 round-per-minute firepower) gives the Navy's A4D maximum effectiveness against small targets such as tanks and other ground vehicles.

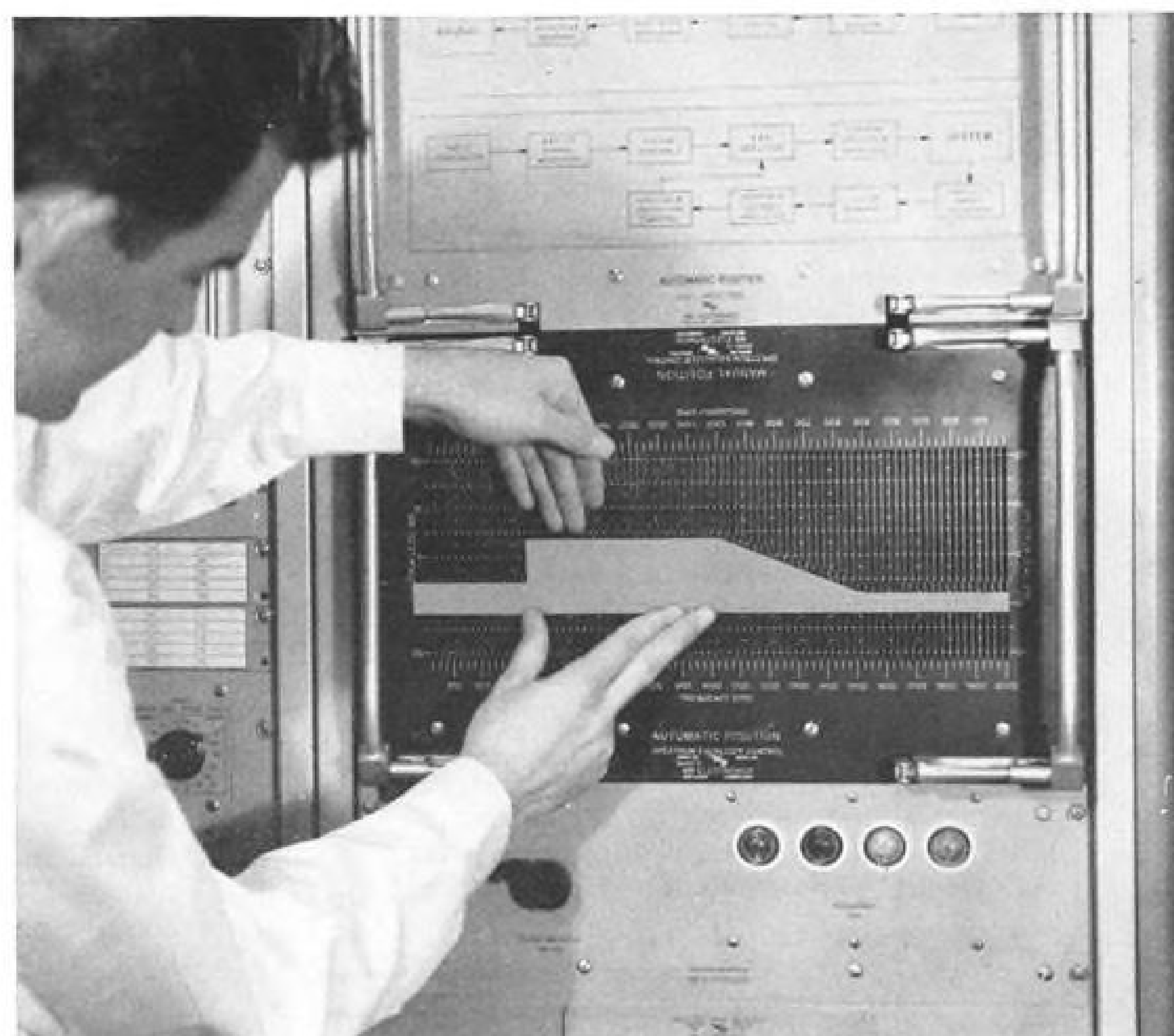
Twenty years of experience applied to expansion of the state of the art...complete engineering laboratories, enclosed firing ranges and manufacturing activities in one compact facility. These are the factors which have made Hughes unique as a producer of advanced armament for free world defense. Individuals with a need-to-know are invited to request further information. Please contact the Vice President-Marketing, HUGHES TOOL COMPANY, Aircraft Division, Culver City, California.



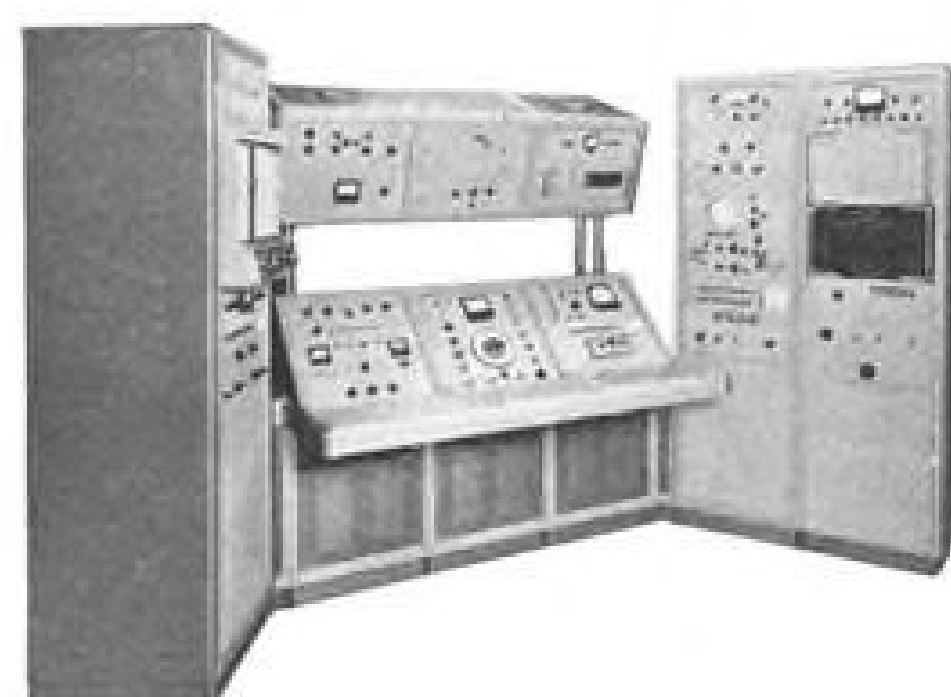
MB's T-388 Automatic Equalizer cuts equalization time to 5 seconds...

Production random vibration is now practical with MB's completely automatic spectrum equalizer. Set up time is eliminated and equalization realized within 5 seconds. Savings in test time and labor for missile and aircraft manufacturing can easily reach many thousands of dollars per missile tested.

Operation of the T-388 automatic equalizer is extremely simple and can be readily handled by non-technical personnel. A flat or shaped spectrum is easily programmed on the spectrum control panel by setting the slide wires. A template of the spectrum can be used for the



Templates of your test spectrum can be used for rapid set-up of the T-388 Automatic Equalizer.



setting as shown above. The equipment does the rest.

The T-388 also provides higher test accuracy and versatility. Equalization to $\pm 1\frac{1}{2}$ db is obtained and equipment automatically compensates shifts in resonant frequencies and changes in amplitudes. Normal frequency range is 15 to 2000 cps in 25 cps bandwidths; any 2000 cps bandwidth can be obtained between 15 and 10,000 cps by simple front panel selection.

Other unique features of the T-388 Automatic Equalizer include:

- Spectrum analyzer has 3 types of readout: 1) precision, direct

reading in g^2/cps ; 2) visual display on scope for continuous monitoring; 3) permanent record of test using X-Y plotter.

- Highly accurate equalization through the use of 80 distinct channels of narrow bandwidth (25 cps) covering a 2000 cps band.

A test laboratory equipped with the T-388 unit will not only save many hours of valuable test time, but will also be prepared for present and future test requirements.

For detailed information on the T-388 Automatic Equalizer write to MB Electronics, 781 Whalley Ave., New Haven 15, Conn.

Over 50 Multi-Filter Equalization Systems purchased by leading test laboratories

The important contribution which the MB Multi-Filter Equalization System makes to the field of vibration testing has been recognized by leading environmental testing laboratories. To date over 50 units have been purchased...a remarkable record for equipment of this type. MB engineers will gladly consult with you on how to apply the unique advantages and savings of the Multi-Filter Equalization System to your test programs.



YH-51A Wind Tunnel Tests

Full-scale model of Lockheed YH-51A rigid-rotor helicopter has completed initial wind-tunnel tests in the 40- x 80-ft. tunnel of the Ames Research Center of National Aeronautics and Space Administration. Tufts on the body and tail surface provide visual indication of flow patterns during test operations. Note relatively stiff rotor blades and stabilizing bar system mounted above the rotor. Lockheed system uses gyroscopic forces from the rotor and the stabilizing bar to improve the dynamic stability of the helicopter. Aircraft recently made its first flight (AW Nov. 26, p. 23), but a simpler test vehicle has been flying for a period of more than one year.

broken with tradition long ago on this subject. There is a sales mock-up, which is impressive, and which is aimed solely at customers; but there is a huge mock-up area, complete with its own shop and highly skilled technicians available to study every conceivable problem that can be reduced to the mechanics of engineering or production.

The company uses three classes of mock-ups:

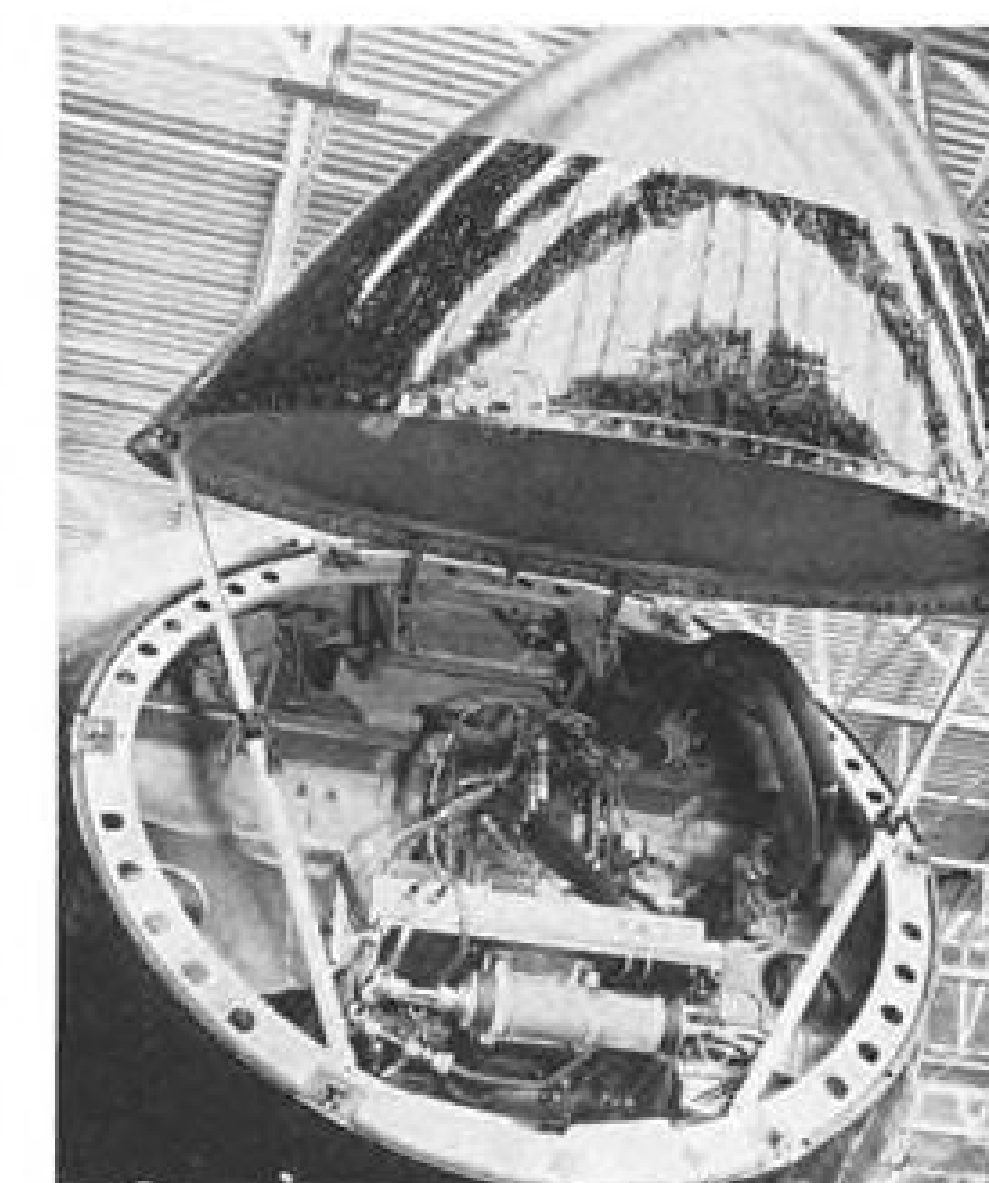
- Class 1, for the study of specific engineering problems. This can be, and frequently is, the plywood-and-cardboard type of mock-up.
- Class 2, for working out the over-all design features, primarily as an engineering aid.
- Class 3, for studying production installations, developing them for the line, and as a major manufacturing tool.

Major use of Class 3 mock-ups comes in the fitting of systems into the airplane; wiring and plumbing are two of the usual applications here.

Management of the 727 program is on a functional basis, with manufacturing, finance and engineering personnel reporting to the Transport Division manager. Program management is a staff function within the division; men are assigned to the 727 project, but continue to report to their functional groups. The project group at the staff level gets its support from aerodynamics,

stress, flight test and the other functional groups in the division.

The 727 program manager reports to a divisional vice president, a level high enough and a route direct enough to get things done.



Vibration Exciter

Hydraulic vibration exciter has been mounted in nose section of No. 1 prototype of the de Havilland Trident three-jet transport, now undergoing certification tests at Hatfield, England. Second exciter is being installed in tail section. Devices are used for flutter testing and speeds will be extended up to 450 kt. during this phase.

FREE TO COMPANY OFFICIALS LOOKING FOR A NEW PLANT SITE

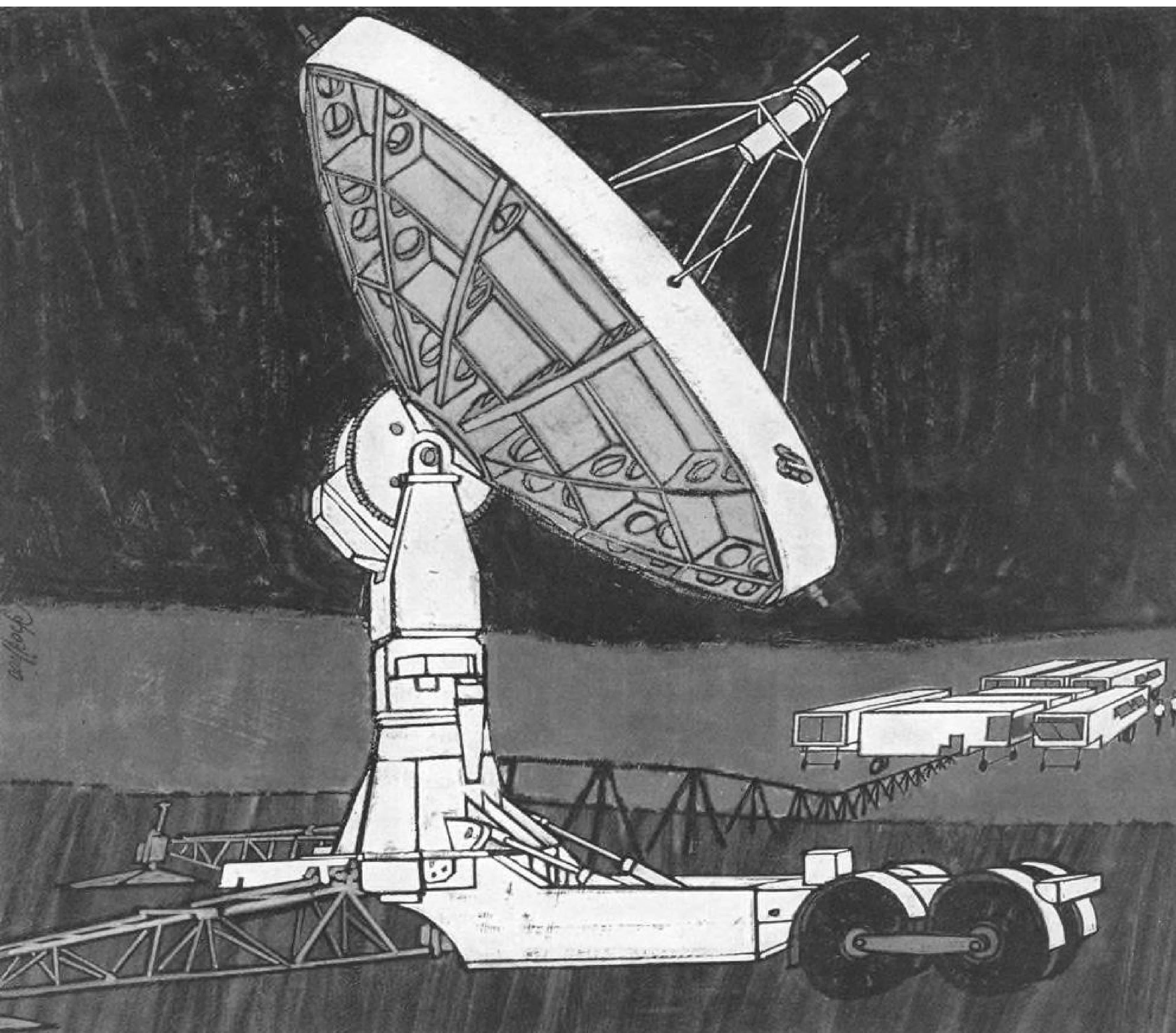
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TAILOR-MADE. This confidential report is not taken off the shelf. It will be prepared specifically for you, based on the requirements for your new plant as you give them to us. Send these requirements on your business letterhead to Commissioner Keith S. McHugh, N.Y. State Dept. of Commerce, Room 211K, 112 State St., Albany 7, N.Y.

Keith S. McHugh

Keith S. McHugh, Commissioner
New York State Department of Commerce



The SYNCOM ground terminal story. It is a moving one.

The SYNCOM experimental satellite will employ surface terminals that have no permanent locations. They can be moved as often as necessary. That's a unique feature about Project SYNCOM. It's our job to design and construct the mobile ground facilities under contract to the U.S. Army Electronic Research and Development Laboratory.

Bendix Radio's participation in Project SYNCOM—a NASA R&D program in which the U.S. Army Satellite Communications Agency has responsibility for surface terminals and communications testing—is a typical example of our capability in the fast moving communications field. Bendix Radio's experience and performance in developing equipment for fixed ground stations and shipboard terminals for the military communications satellite program helped lead

to our selection by the Army to participate as a prime contractor in the NASA SYNCOM project. Project SYNCOM is to demonstrate the feasibility of communications between surface stations via a lightweight satellite in a 24-hour synchronous orbit at the 22,300 mile high altitude.

The SYNCOM ground stations in some respects represent a state-of-the-art Super High Frequency equipment development. This development also provides basic SHF building blocks for consideration in other advanced Government-sponsored programs.

Take advantage of our experience and minimize development costs in communications systems by contacting Government Sales, Bendix Radio Division, The Bendix Corporation, Baltimore 4, Maryland.

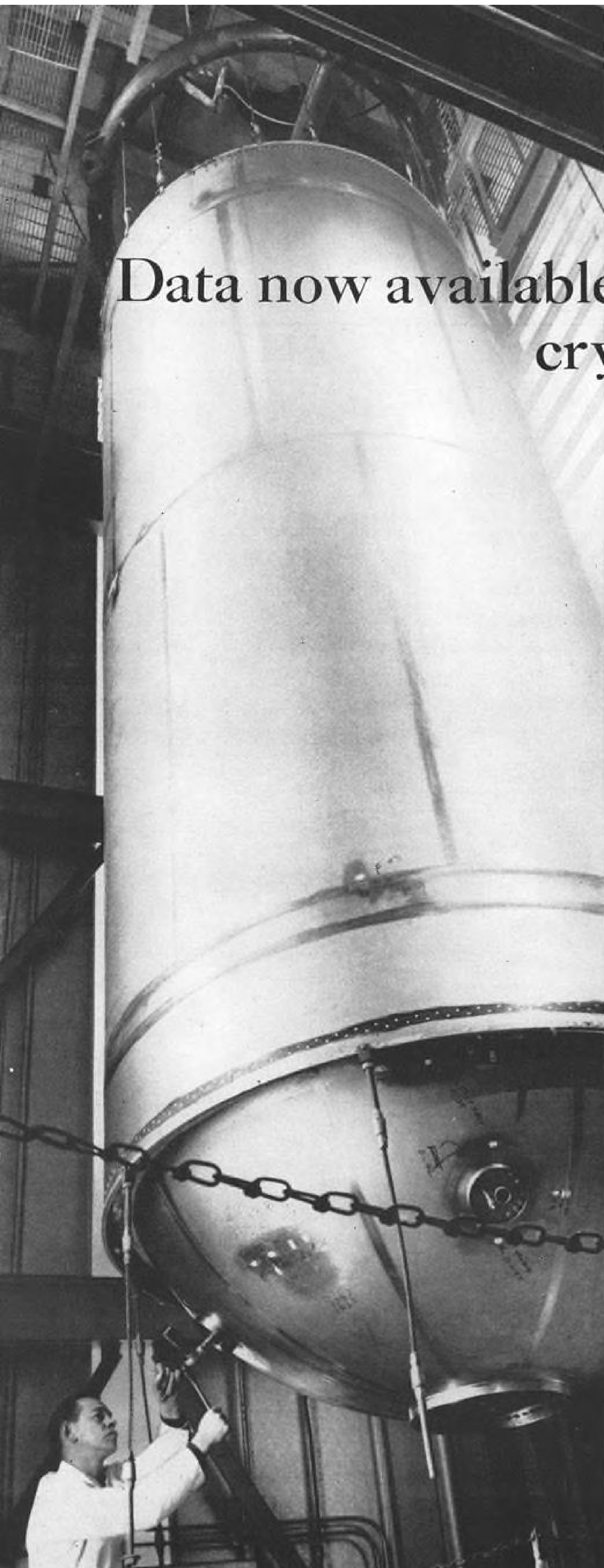
Bendix Radio Division



Despite radical changes from predecessors, including rear-mounting of engines and a different wing, the Boeing 727 retains traditional Boeing look. A total of 131 aircraft have been ordered by seven airlines.



Integral ventral boarding stairs will open into coach section of the three-engine, short-to-medium range airliner. Forward door, which can be equipped with integral folding airstair, opens into first class compartment.



*7,000 gal. titanium tank
for liquid hydrogen
built by Beech Aircraft*

Data now available on **Titanium's** cryogenic properties

Titanium can hold more liquid hydrogen at less tank weight than any other material and still give you impermeability to hydrogen, generous elongations and notch toughness at -423°F .

Some specifics. The liquid hydrogen tank shown here was built and successfully hydrostatically tested by Beech Aircraft Corp. Capacity: 7,000 gallons. It was fabricated from sheet supplied by Titanium Metals Corporation of America to less than AISI tolerances, in thicknesses ranging from 0.014 to 0.025 inches.

Cryogenic alloys. The alloy used was Ti-6Al-4V ELI, one of two alloy grades advanced by TMCA specifically for liquid hydrogen service. The other grade is Ti-5Al-2.5Sn ELI. The designation ELI stands for Extra-Low Interstitials. Typical properties of these grades at -423°F :

Ti-6Al-4V ELI: tensile strength, 263 ksi; yield strength, 248 ksi; notch tensile strength, 211 ksi; elongation, 7%.

Ti-5Al-2.5Sn ELI: tensile strength, 229 ksi; yield strength, 206 ksi; notched tensile strength, 233 ksi; elongation, 15%. Compare these properties with stainless and aluminum. You'll see why titanium guarantees more payload!

Then contact TMCA, the nation's only firm devoted exclusively to titanium and the only company providing the full-time comprehensive technical service you require. Phone, write or wire TMCA for cryogenic data today.



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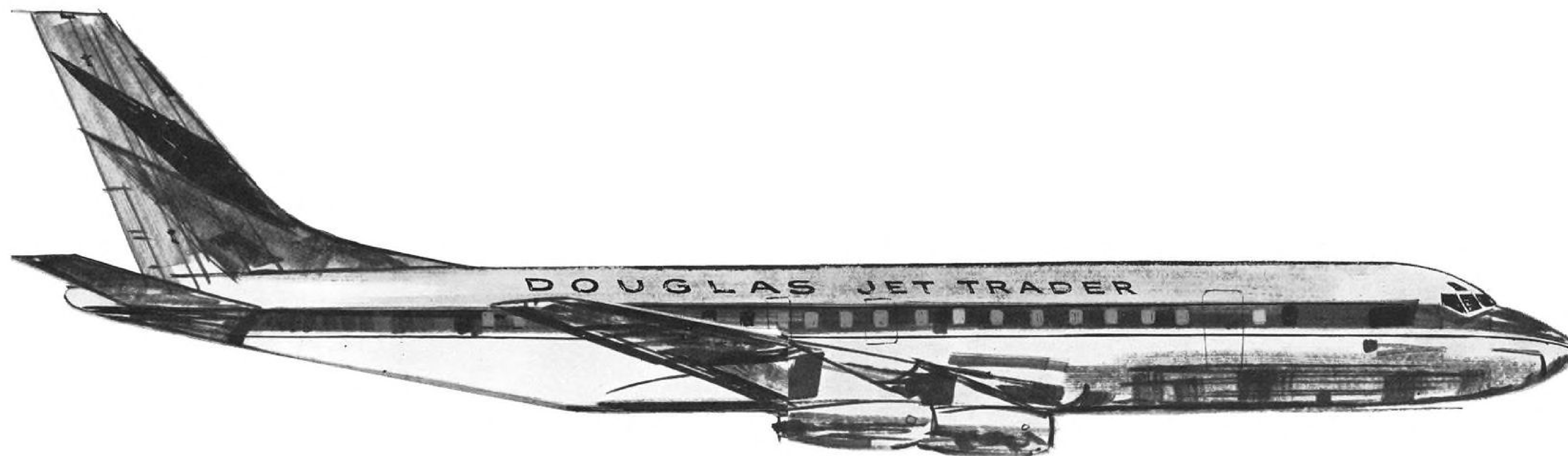
Piasecki 16H helicopter is currently being tested with wings in combination with rotor system. Addition of wings affords the vehicle added speed, range and stability. Note USAF B-47s in lower background at Philadelphia International Airport.

Piasecki 16H Tested in Wing-Rotor Combination

Powered by a Canadian Pratt & Whitney PT-6 turbine, 16H's ring-tail performs counter-torque function in hovering and provides propulsion during cruise phase. 16H has five seats. Shown below, vehicle has rotor blades and wings folded in parking configuration.



AVIATION WEEK and SPACE TECHNOLOGY, December 10, 1962



COUNT ON DOUGLAS FREIGHTERS TO "DELIVER THE GOODS"

THEY DO A "COME-THROUGH" JOB EVERY TIME. LOOK AT THE RECORD



DC-8Fs are the *first* pure jet freighters. And they carry cargo at fastest speed and lowest cost per ton mile in aviation history.

C-133s are the *only* transports that can swallow ICBMs whole, cutting days from trips between manufacturing and launch sites.

C-124s are the mainstays of our military global supply system; did yeoman work in Dew Line deliveries; supplied the South Pole; served as flying hospitals during the Korean conflict.

DC-7Fs play a major role in airline freight operations.

C-118s and C-54s were the Air Force's workhorses during the Berlin Airlift...showed the

dependability built into Douglas transports.

DC-6As were the first to break-through the high cost barrier to the expansion of air freight.

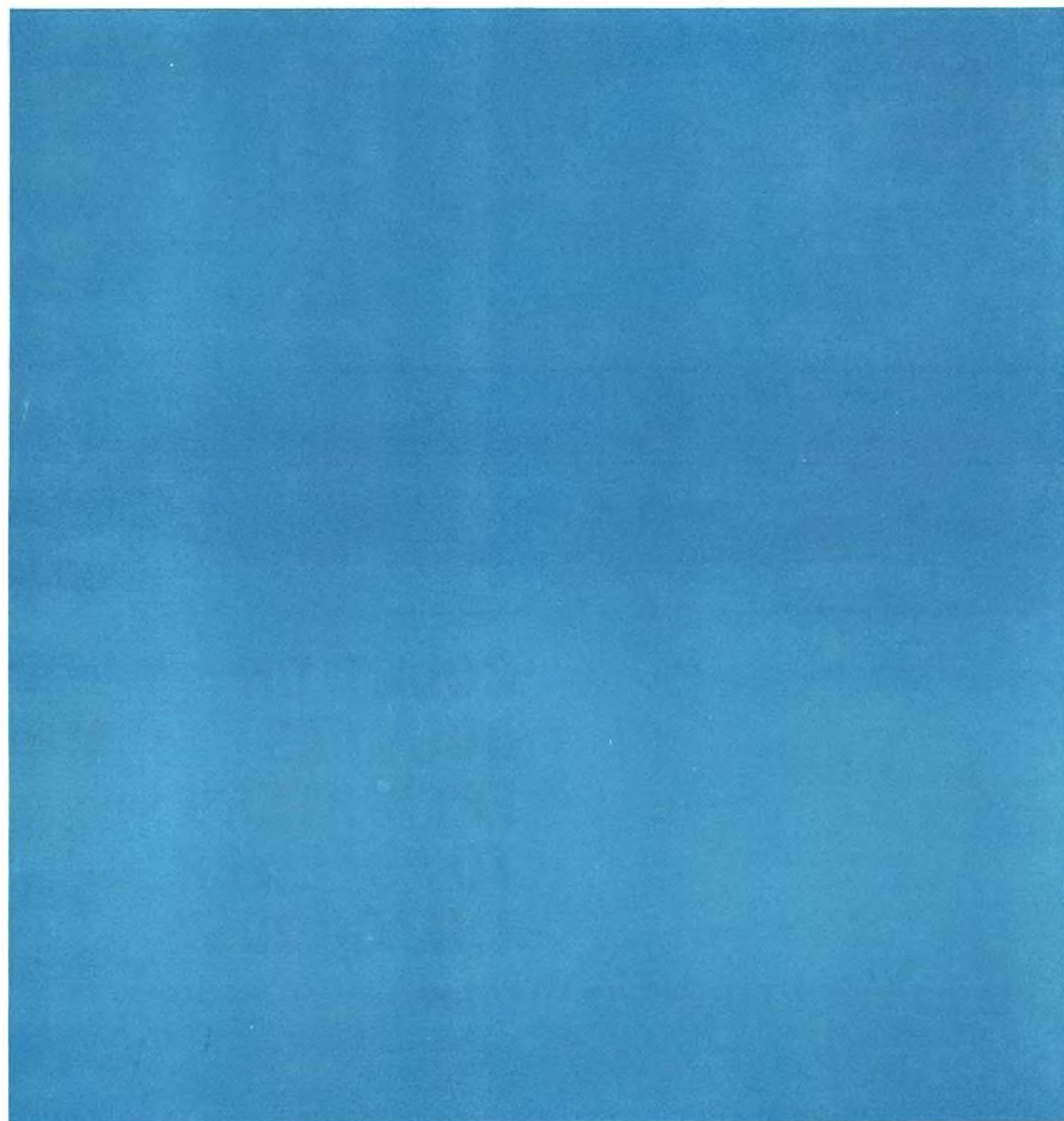
C-47s were the mainstays of our World War II military supply effort, flew "the hump" regularly to keep our life-lines to the Far East open.

DC-3s are characteristic of what can be expected of all Douglas transports...more than 2500 commercial and military versions are still flying after 25 years of rugged service.

It all adds up to this conclusion: for transports that perform better, last longer, maintain easier, and stay in there when the going is roughest, you can depend on Douglas.

DOUGLAS BUILDS GREAT TRANSPORTS



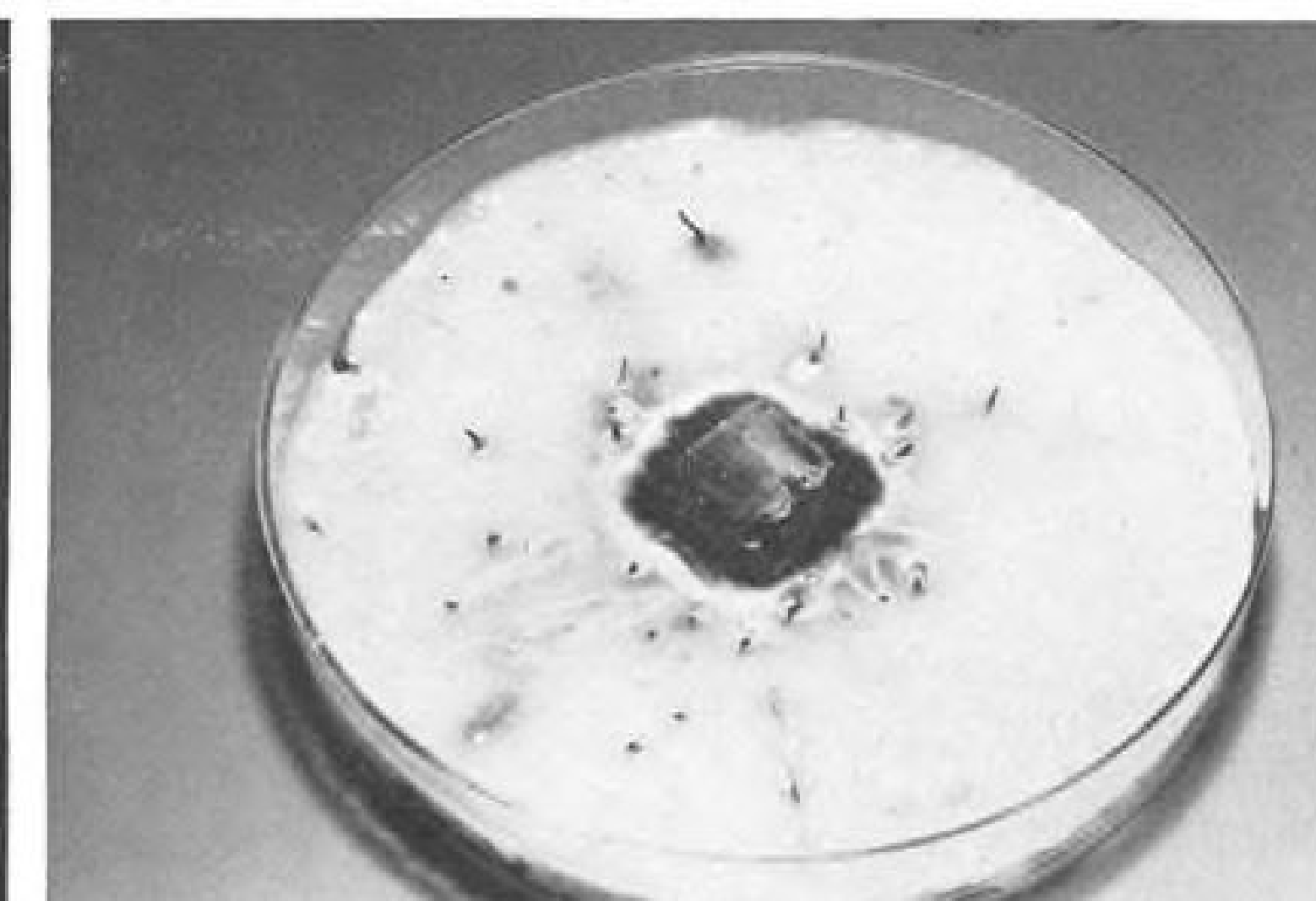


FOR BLUE SKY THINKERS IN ELECTRONICS... In electronics, planning for the future in space, communications and national defense calls for a liberal mixture of practicality and imagination. ■ The air dielectric coaxial cable systems and related microwave equipment engineered by Phelps Dodge combine capability of operation with almost unlimited applicational values. They have played strategic roles in opening up and materially advancing the microwave art in missile launching and tracking, radio astronomy, radar detection and atomic energy instrumentation. ■ These complete Phelps Dodge rigid and coaxial cable systems—based on Styroflex®, Helical Membrane, Spirafil, Foamflex and Corr-O-Foam cables, together with related connectors, delay lines, waveguides, TV plumbing and accessories—have earned the enthusiastic approval of electronic engineers in a wide variety of critical systems designs. Perhaps they can help you pluck a new idea out of the blue.

PHELPS DODGE ELECTRONIC PRODUCTS CORPORATION
A DIVISION OF PHELPS DODGE CORPORATION / 300 PARK AVENUE, NEW YORK 22, N. Y.



SPACE TECHNOLOGY



VARIOUS FUNGI STUDIED BY AVCO'S RAD Division include panus stipticus, above left; armillaria mellea, above right and armillaria fusipes, below left. Below right is a culture of panus stipticus photographed by its own light. Photo was a three-hour exposure with No. 103AF spectrographic film. Magnification is four times.



Fungus Is Studied as Radiation Detector



LIGHT TIGHT BOX, left, holds bioluminescent fungi and photomultiplier tube. Signal from tube is amplified and recorded on the instrument at right.

Certain types of fungus may be used by future space pilots to indicate radiation levels within their spacecraft, just as miners once used canaries to detect gas in mine shafts, if research now under way at Avco Corp. should prove the concept to be feasible.

Using two species of fungus—panus stipticus and armillaria mellea—which convert part of the waste energy of oxidation into luminescent light rather than heat, Avco's Research and Advanced Development (RAD) Division, Wilmington, Mass., is attempting to correlate the effects of such factors as radiation, temperature, shock, vibration, acceleration, sound, partial pressure, oxygen and ozone concentration on the respiration of these simple plants. Effects are indicated by change in luminosity of the plants, which is detected by sensitive photomultiplier tubes.

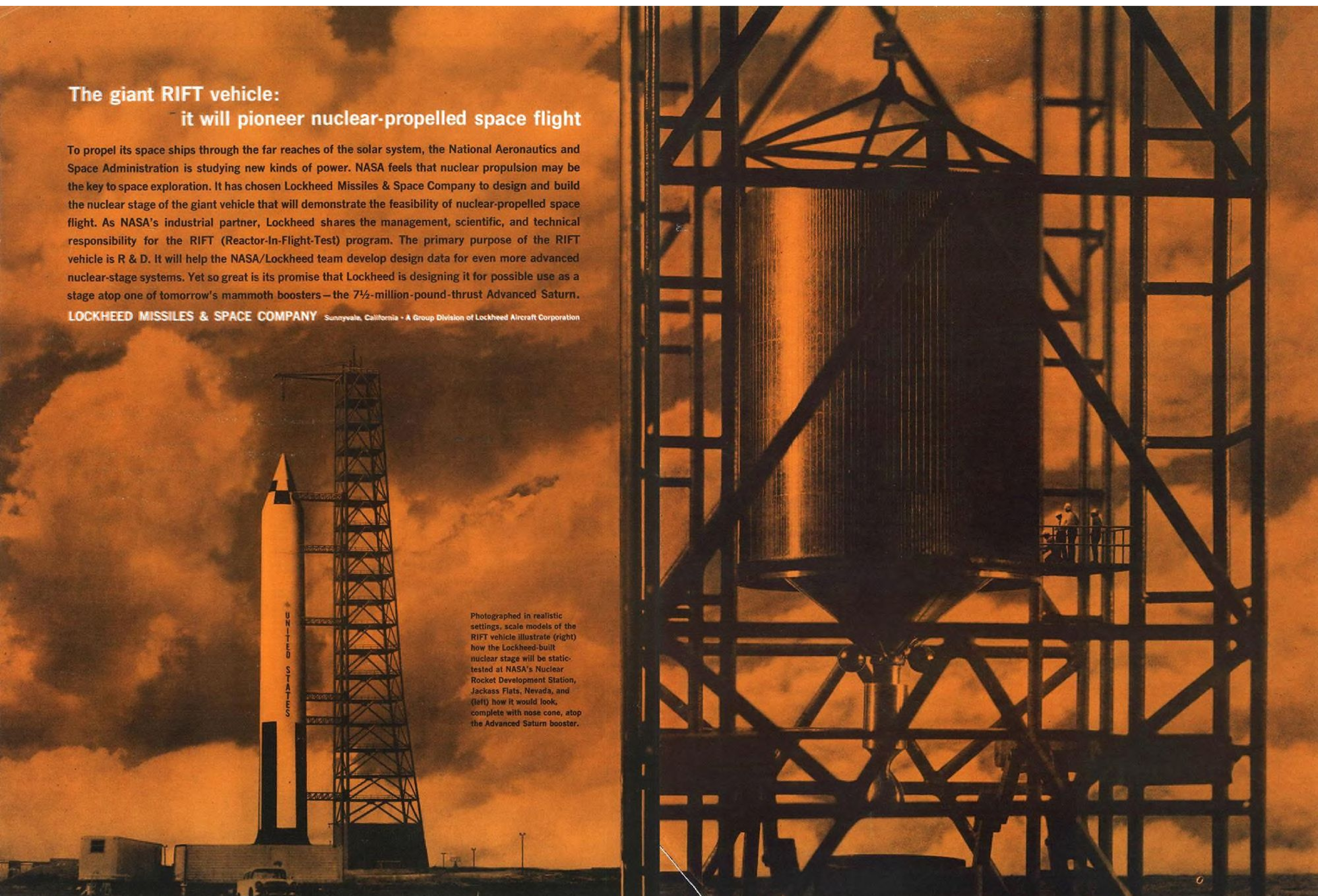
Earliest application of the fungi,

The giant RIFT vehicle: it will pioneer nuclear-propelled space flight

To propel its space ships through the far reaches of the solar system, the National Aeronautics and Space Administration is studying new kinds of power. NASA feels that nuclear propulsion may be the key to space exploration. It has chosen Lockheed Missiles & Space Company to design and build the nuclear stage of the giant vehicle that will demonstrate the feasibility of nuclear-propelled space flight. As NASA's industrial partner, Lockheed shares the management, scientific, and technical responsibility for the RIFT (Reactor-In-Flight-Test) program. The primary purpose of the RIFT vehicle is R & D. It will help the NASA/Lockheed team develop design data for even more advanced nuclear-stage systems. Yet so great is its promise that Lockheed is designing it for possible use as a stage atop one of tomorrow's mammoth boosters—the 7½-million-pound-thrust Advanced Saturn.

LOCKHEED MISSILES & SPACE COMPANY Sunnyvale, California • A Group Division of Lockheed Aircraft Corporation

Photographed in realistic settings, scale models of the RIFT vehicle illustrate (right) how the Lockheed-built nuclear stage will be static-tested at NASA's Nuclear Rocket Development Station, Jackass Flats, Nevada, and (left) how it would look, complete with nose cone, atop the Advanced Saturn booster.





WHERE ELSE CAN YOU RENT A COMPLETE COMPUTER
SYSTEM WITH THESE CAPABILITIES FOR
\$1100 A MONTH?
YOU CAN'T.

The LGP-30 is an unfair competitor. No other computer in its class even comes close. □ You can't find another computer with a memory this large (4096 words—2000 more than the nearest competitor) at such low cost. □ Ease of operation and programming? Even non-technical personnel can master it. You can learn to program the LGP-30 in hours and free yourself from dependence upon computer programming specialists. □ Mobile? Completely. It can be used by any number of people in any number of places and departments. Just plug it into conventional outlet. No expensive installation. □ Bonus! The readily available Program Library for the LGP-30 will undoubtedly include the program you need—and save you a small fortune. It's the most extensive Program Library in this computer class—and covers problems in gas, oil, and electrical transmission, civil, highway, and structural engineering, product design, chemical and paint manufacturing, metal and mineral processing and many more. □ If you require a larger computing system, take a look at



the LGP-30's big sister (or brother)—the RPC-4000. Completely transistorized, 8008 word memory, computing speeds up to 230,000 operations per minute. It's the desk-size computer with room-size computer capacity. For more information about rental or purchase, write Commercial Computer Division.



**GENERAL
PRECISION**

COMMERCIAL COMPUTER DIVISION/GENERAL PRECISION, INC./BURBANK, CALIFORNIA

Avco scientists believe, probably would be as an X-ray dosimeter for manned spacecraft. Research originally began a little more than two years ago with seven species and was funded entirely by Avco. For the past year, the work has been supported by the National Aeronautics and Space Administration's Office of Life Sciences and has tended to concentrate on the two species listed previously.

Intensive Research

These two types of fungus were selected for more intensive research when it was discovered that the panus variety experienced very little or no reaction from all but one of the various stimulations applied to it and that the armillaria reacted readily to all. Polarity of their reactions leads Avco scientists to believe that an optimum dosimeter design would incorporate both types, with the armillaria serving as the sensing element and the panus as a control.

Experiments at Avco-RAD's Wilmington laboratories have been conducted in light-tight chambers with the fungi grown on agar media on Petri dishes. Photomultipliers, responsive to wavelengths between 300 and 700 millimicrons, were suspended 4 cm. above the dishes. Emission spectrum of this fungi lies between 470 and 640 millimicrons.

Ultraviolet light at all wavelengths was applied to both the panus and armillaria fungi. Armillaria was stimulated to emit light in direct proportion to the amount of applied radiation, with recovery to pre-irradiation levels usually within 3 hr. Panus reacted slightly to ultraviolet irradiation, but died at 280 millimicrons.

Little Reaction

In all other tests—shock, vibration, acceleration, etc.—the armillaria reacted with light intensity variations anywhere from 100 to 1,000% of normal and then recovered. The panus displayed very little reaction.

Exposure of the panus to X-ray dosages between 100 and 5,000 roentgens occasioned a sharp rise in luminosity, followed by a series of rises and drops, with eventual recovery within 12 hr. after irradiation. Armillaria have not yet been subjected to X-rays, but Avco hopes to extend its research to cover this area as well as others—such as simulated solar radiation.

Fungi also displayed a periodicity in the strength of their light emissions, reaching a high point between 6 and 9 p.m. and a low between 6 and 9 a.m. Light intensity varied about 30%. This precise regularity persisted under all tests and Avco scientists believe that the phenomenon could be used in a timing system aboard spacecraft.

3 Benefits That Command and Justify Value Analysis



SIMPLIFIED INSTALLATION



Smooth outer shell with no indentations provides you with 100% useable sealing area for easy location of "O" ring. The longer continuous surface and truer roundness of the shell give better contact for press-fit installation.

INCREASED LIFE



Internal, full-length tangs* provide maximum surface contact with groove in carbon cup, reducing rate and amount of notch wear. In conventional design, the notch wears unevenly in the carbon to a point where forward movement is impaired and seal leakage results. This common point of failure is eliminated in Gits' new type 63 seal. Field experience shows that seal life has been extended 200% to 300%. Pressure and speed capabilities have also been increased.

ECONOMY & QUALITY



The one-piece carbon cup is economical to produce. Its rugged, uniform cross-section provides stability over temperature changes, and reduces distortion of lapped faces for better sealing. This seal also incorporates an internal coating† of Teflon for improved seal action.

For more information on this and other Gits seals, write for your copy of Gits' new Seal Design and Specification kit. GITS BROS. MFG. CO. 1846 S. KILBOURN AVE. CHICAGO 23, ILLINOIS

GITS
SHAFT SEALS

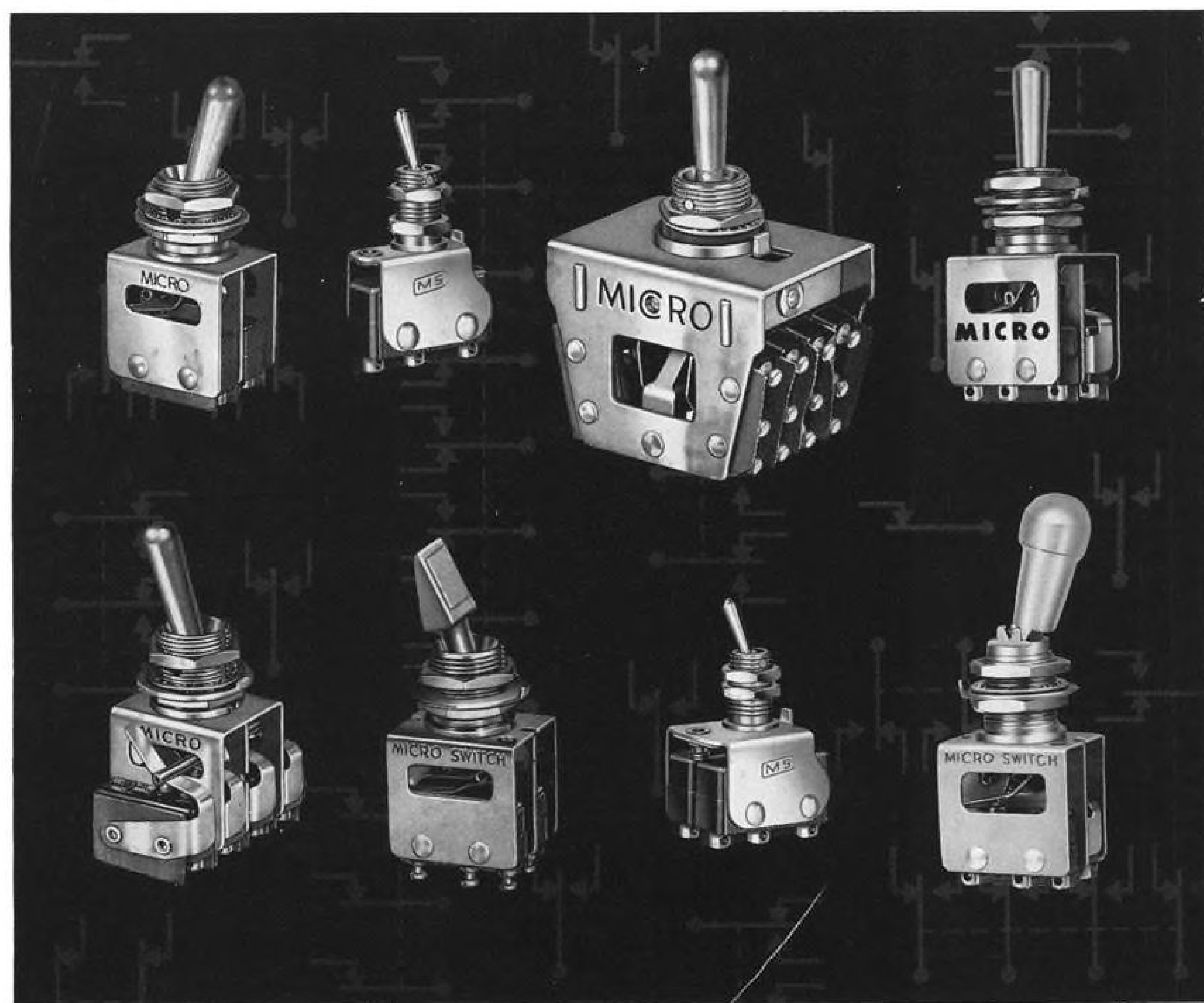
*patents pending
†patented



MICRO SWITCH Precision Switches

**VERSATILITY
RELIABILITY
SWITCH-ABILITY**

MICRO SWITCH "AT" TOGGLE SWITCH ASSEMBLIES



The "AT" Toggle Switch Assemblies illustrated here are just a few of more than 100 assemblies designed to actuate from one to a dozen miniature precision snap-action switches. This Series provides a broad range of circuit combinations in electronic, aircraft, mobile and marine applications where reliability and panel space economy are essential.

In the Series are: 2 and 3-position toggles; maintained

and momentary lever positions; pull-to-unlock levers; sealed levers; and special features such as an "electric memory" unit and "dry circuit" capabilities. All are manufactured with MICRO SWITCH precision—the precision that means long life and reliability. For engineering service look for our Branch Office in the Yellow Pages. Or, write for Catalog 73.

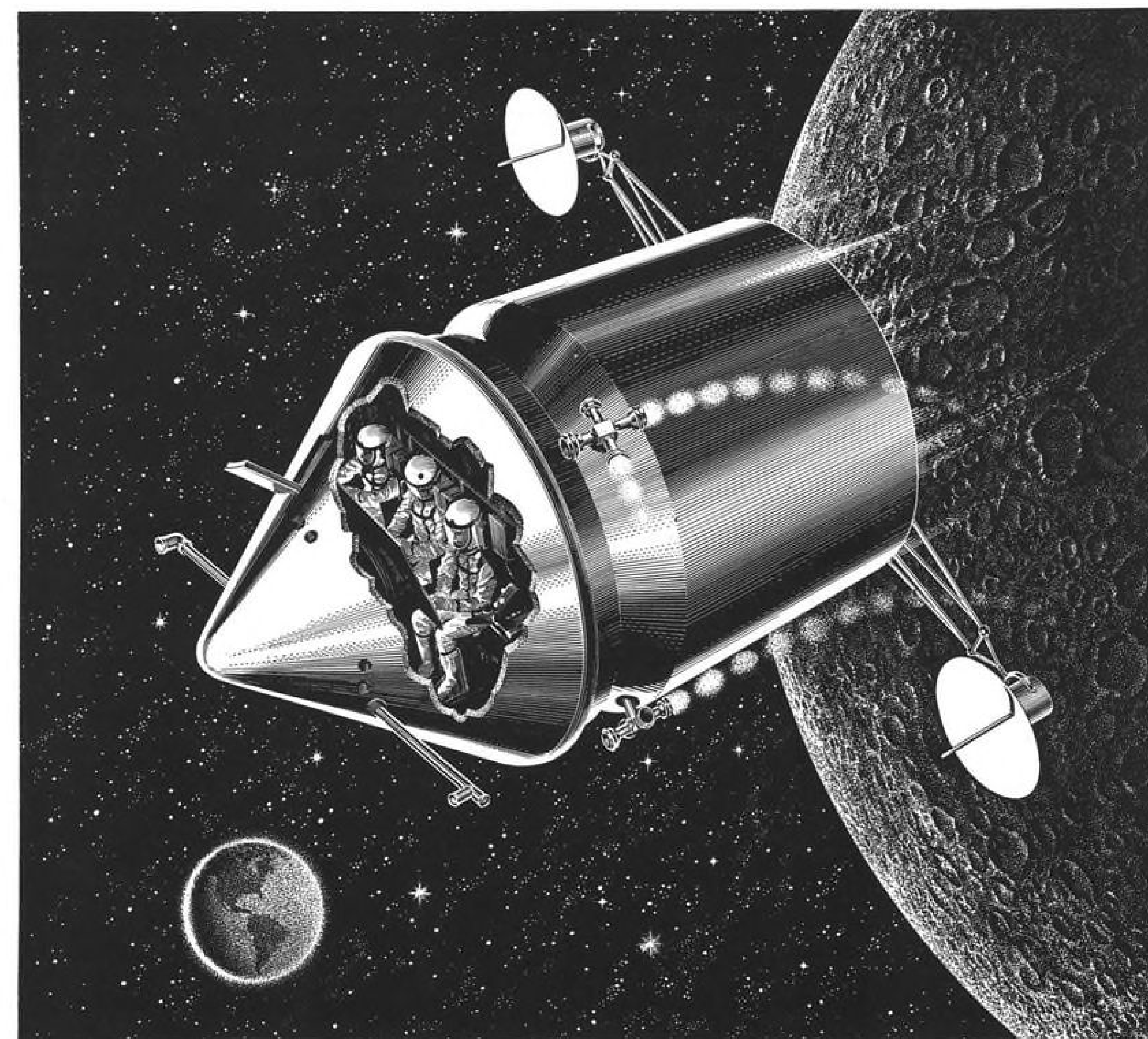


MICRO SWITCH

FREEPORT, ILLINOIS

A DIVISION OF HONEYWELL

IN CANADA: HONEYWELL CONTROLS LIMITED, TORONTO 17, ONTARIO



IN AEROSPACE, MARQUARDT MEANS...

Reaction control engines for Project Apollo

Marquardt is currently engaged in the development and fabrication of the reaction control rocket engines for the service module of the Project Apollo Spacecraft—The National Aeronautics and Space Administration's initial manned expedition to the moon. The Marquardt engines in the service module are part of the flight and stabilization control system, providing attitude control and stabilization enroute to the moon and back, and during lunar and earth orbit.

Marquardt has successfully designed and built advanced control systems for aerospace vehicles for nearly two decades. Absolute reliability and precise accuracy are necessary for satellite rendezvous, station keeping, orbit control, landing and lift-off from distant planets. Reaction control

systems by The Marquardt Corporation are relied on to do these vital jobs.

Engineers and scientists interested in joining Marquardt on Apollo and other significant aerospace projects are invited to direct résumés to Professional Personnel at the address below.

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LSi/ASTRONICS' AZIMUTH SURVEY SYSTEM

Assures Immediate Accuracy—Day or Night Operation—Any Weather Condition

This lightweight, tactical model of the North Seeking Gyro is a third generation system, incorporating the refinements of over five years of active development at LSi/Astronics on several different models of the North Seeking Gyro. This particular model is adaptable to a wide variety of applications that need accuracy in seconds of arc without operator calculation (a minute of arc divides a circle into 21,600 parts).

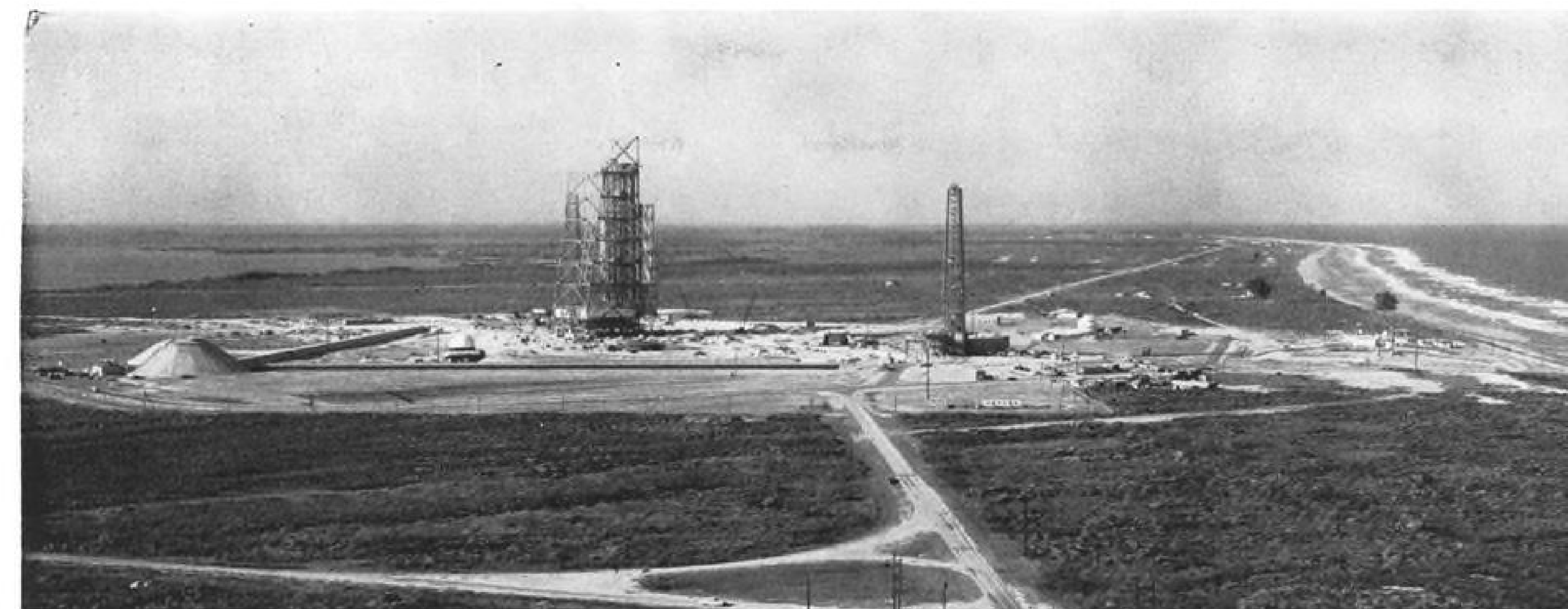
Ideally suited to both tactical and strategic support, the North Seeking Gyro can be provided with either a theodolite head for manual operation or a self-aligning link that permits automatic operation for target angle transfer—rapidly, accurately. Applications include ■ Tactical Field Support ■ Hard Site Aiming Back-up ■ Stable Platform Alignment. For additional engineering data please write Dept. AW-1993-1.



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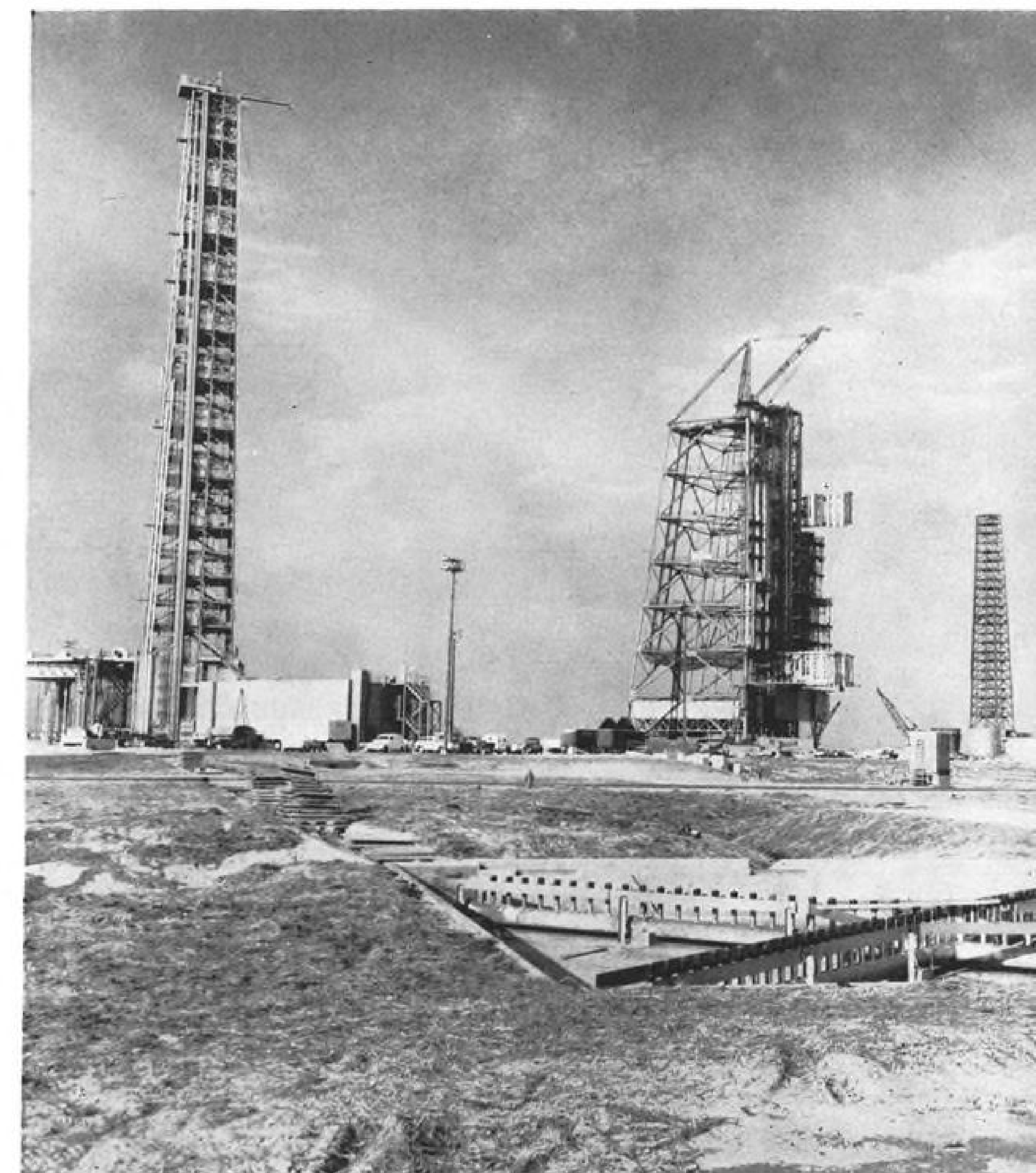
ASTRONICS DIVISION

3171 SOUTH BUNDY DRIVE, SANTA MONICA, CALIFORNIA



Saturn Complex 37 Construction Advances Rapidly

Saturn Complex 37 at Cape Canaveral, Fla., (long-range view, above, closeup at right) is at an advanced state of construction and the first of its two launch stands is expected to be finished in the spring of next year. National Aeronautics and Space Administration's Launch Operations Center will begin checkout of pad B (left) immediately after acceptance of the stand from the Army Corps of Engineers. Pad A (right) is not expected to be completed until next summer. Its construction has not been pushed as hard as that of B, pending decision on the introduction of the Saturn C-1B vehicle (AW July 2, p. 106) into the over-all launch vehicle program and the planned frequency of Saturn C-1 launchings. C-1 vehicle consists of S-1 first stage and S-4 second stage; C-1B comprises a Block-2 S-1 booster and S-4B second stage. If a heavy schedule is laid out for the C-1, then both A and B pads at Complex 37 would be used for that vehicle and a separate launch complex would have to be built for the C-1B. If the C-1B is introduced early, then pad A will be modified slightly to accommodate it. Between the two 268-ft. tall umbilical towers at pads A and B is the 285-ft. tall launch service structure. Rail-mounted, the service structure incorporates a series of hinged floors which can be closed around the vehicle as it is assembled on a pad. The 90-ft. boom atop the structure has a 60-ton lift capability and will be used to hoist stages on to the launch pedestal (to the left of the towers). Liquid hydrogen and liquid oxygen storage tanks have been installed, each with a 125,000 gal. capacity.



TRAFFIC PATTERN.. HALF A WORLD LONG

The Problem . . . Space Vehicle Recovery

How do you guide a manned, maneuverable re-entry vehicle to a routine landing . . . from 200 miles up, 10,000 miles out?

What are the basic system requirements, the operational concepts of a Recovery Control Center? What limits and tolerances will exist for each stage of the recovery process (re-entry, hypersonic flight, terminal approach, etc.)? What are the flight parameters, the human factors? What is needed in the way of vehicle energy management, ground guidance, range instrumentation, data processing, data handling, display, communications, trajectory analysis, information flow analysis?

For over three years a Raytheon team led by R. L. Schroeder and John Zvara has been investigating these and other recovery problems. Primary emphasis has been placed on NASA's Gemini and Apollo, USAF's X-20 (Dyna-Soar), SLOMAR, and recoverable booster programs.

Result: A unique conceptual techniques capability. Understanding of what must be done to make a Recovery Control System work. Allied experience in real-time data processing and display, communications, and hypersonic vehicle guidance.

Schroeder, Zvara and other Raytheon scientists have published many technical articles on recovery control requirements, problems and concepts. We have collected a number of these and bound them under a single cover. If you would like a copy of this comprehensive document on system requirements for manned space vehicle recovery, write: M. B. Curran, Dept. GM 13-6B, Raytheon Co., Lexington 73, Massachusetts.



Raytheon's John Zvara (left) and R. L. Schroeder

RAYTHEON



Can you think of a more punishing test for landing gear reliability?

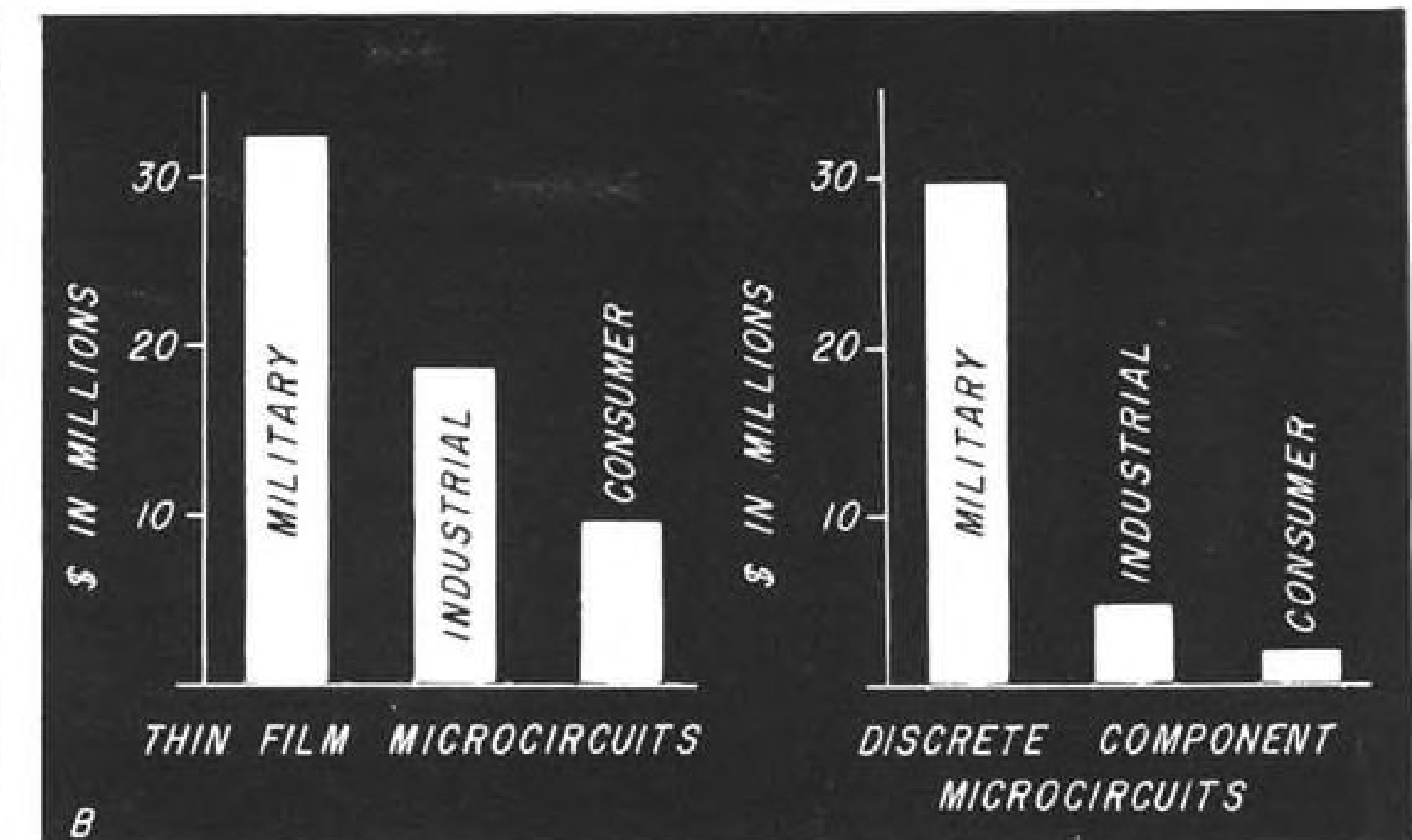
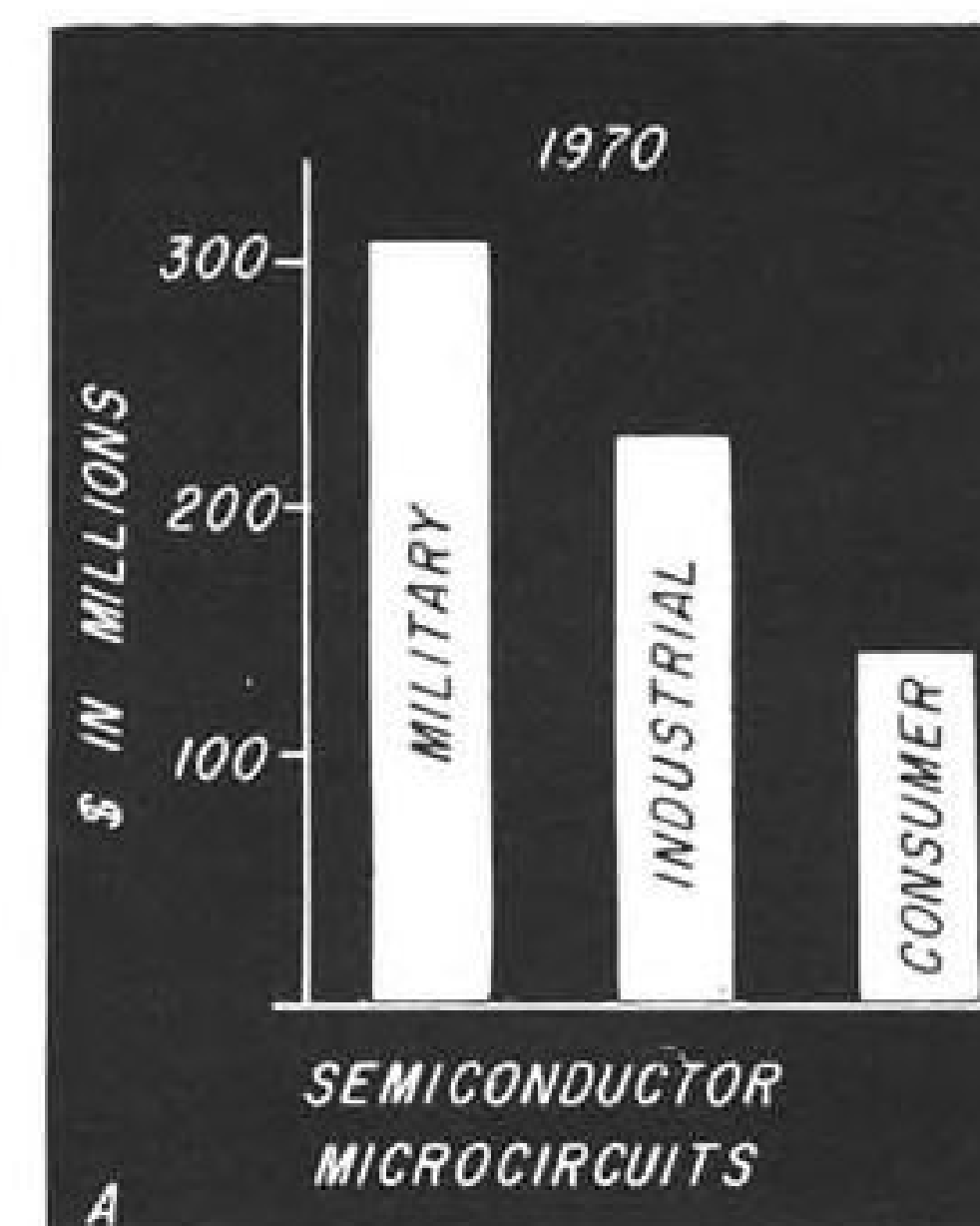
Bringing a plane down on a carrier deck calls for a lot more than an ordinary amount of strut strength. Nevertheless, the durability demonstrated here is designed into every strut we build—whether it winds up on a carrier-based fighter or a land-based bomber.

That's one reason our struts meet the most exacting en-

gineering specifications. One reason Bendix supplies struts for so many military aircraft.

Bendix® struts are high in strength, light in weight. They are designed with special emphasis on durability, reliability and economy. May we tell you more? Write to Airframe Equipment Sales Manager, South Bend, Indiana.

Bendix Products Aerospace Division



SALES FORECASTS for three types of microcircuits in 1970, reported to have been made in industry-sponsored survey conducted by Stanford Research Institute, indicates impact of integrated components on electronics industry during the present decade. Total semiconductor microcircuit sales for 1970 are estimated at \$680 million (left), thin film microcircuits at \$61 million (center) and discrete component microcircuits at \$37 million (right). Eight aerospace and avionics companies sponsored the survey.

Report Sees Semiconductor Dominance

By Barry Miller

Menlo Park, Calif.—Semiconductor microcircuits and hybrid devices using semiconductor substrates are predicted to be the dominant types of microcircuitry in use in avionic equipment by the end of this decade. These microcircuits will continue to be made and supplied by semiconductor component manufacturers, not by equipment makers, as is widely believed.

These are two of the principal points from a cooperative industry study recently completed by Stanford Research Institute here. The \$100,000 study, sponsored jointly by eight aerospace and avionics companies—Boeing, Amphenol-Borg Electronics, Clevite, Delco Radio Division of General Motors, General Precision, National Cash Register, Philco and Sperry Rand—is seeking answers to the vexing problems created by the advent of microcircuitry (AW Mar. 19, p. 55).

Entitled "Impact of Integrated Components on the Electronics Industry 1960-1970," the study's objectives are:

- Estimating the present market.
- Projecting marketing trends.
- Identifying types of circuit applications which will be first to use large quantities of integrated components.
- Describing progress being made in the concepts, their technologies and shortcomings.
- Describing the effects on user-supplier relationships.
- Determining attitudes of users on the economics and other key factors influencing the decision to design with integrated components.

- Discussing probable changes in methods of assembly and interconnection.
- Comparing marketing approaches.

By integrated component, SRI defines the component, or part, that performs two or more functions now performed by conventional components. In addition, the definition of integrated circuit is restricted to devices capable of achieving packing densities in excess of 200,000 parts per cu. ft., thus distinguishing it from quartz crystals. (The integrated component is what AVIATION WEEK & SPACE TECHNOLOGY, in the absence of any accepted industry standards, has been identifying (AW July 9, p. 46) as a microcircuit.)

SRI uses the term integrated component generically to describe the following three types:

- **Conventional assembly**—This type

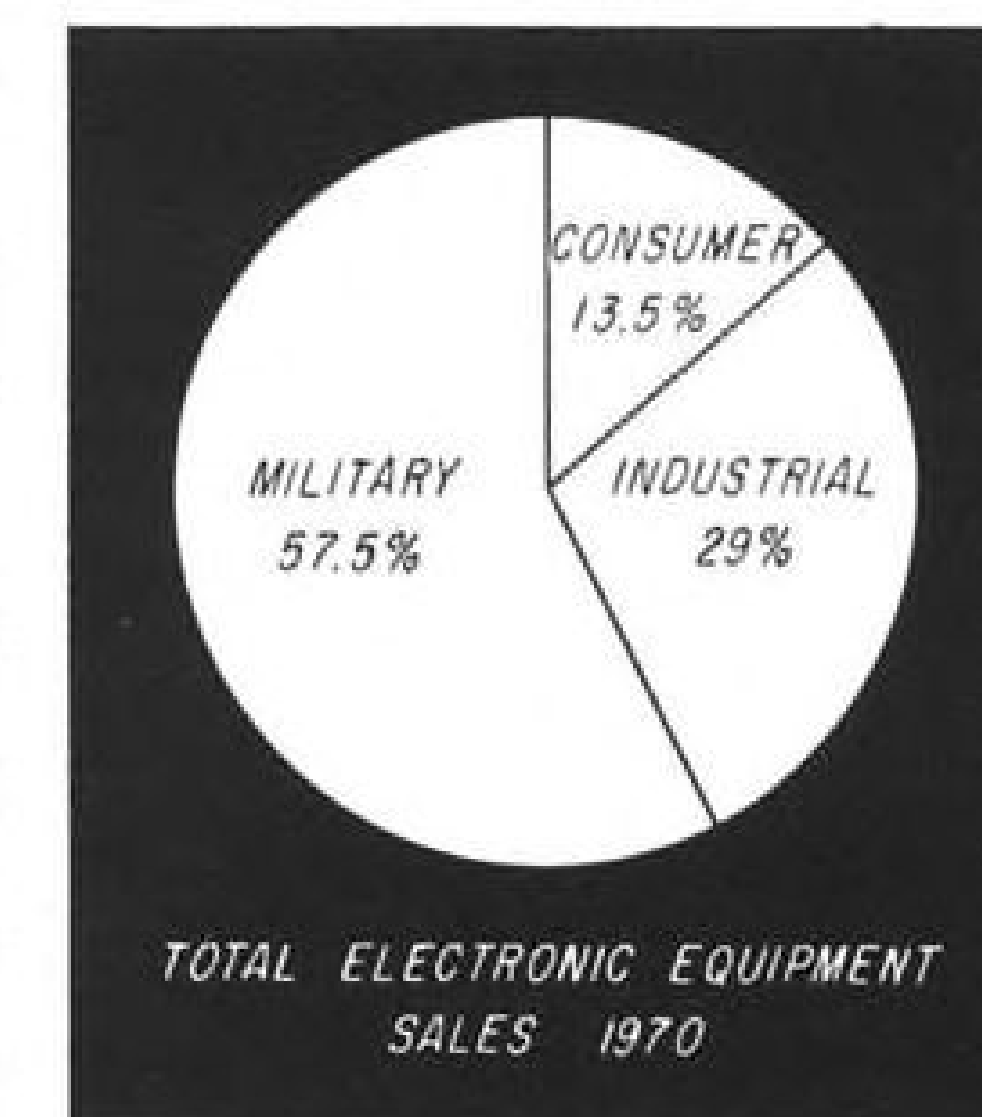
uses conventional components soldered or welded to supporting structures in any one of many packaging techniques, such as the cordwood, Micromodule, swiss cheese and pellet approaches. (AVIATION WEEK has identified the conventional assembly as a discrete component microcircuit.)

- **Passive substrate assembly**—This is the insulated substrate with individually deposited passive components. Active elements, transistors and diodes, are attached. (This is the thin film microcircuit.)

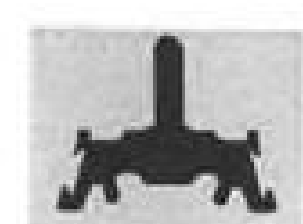
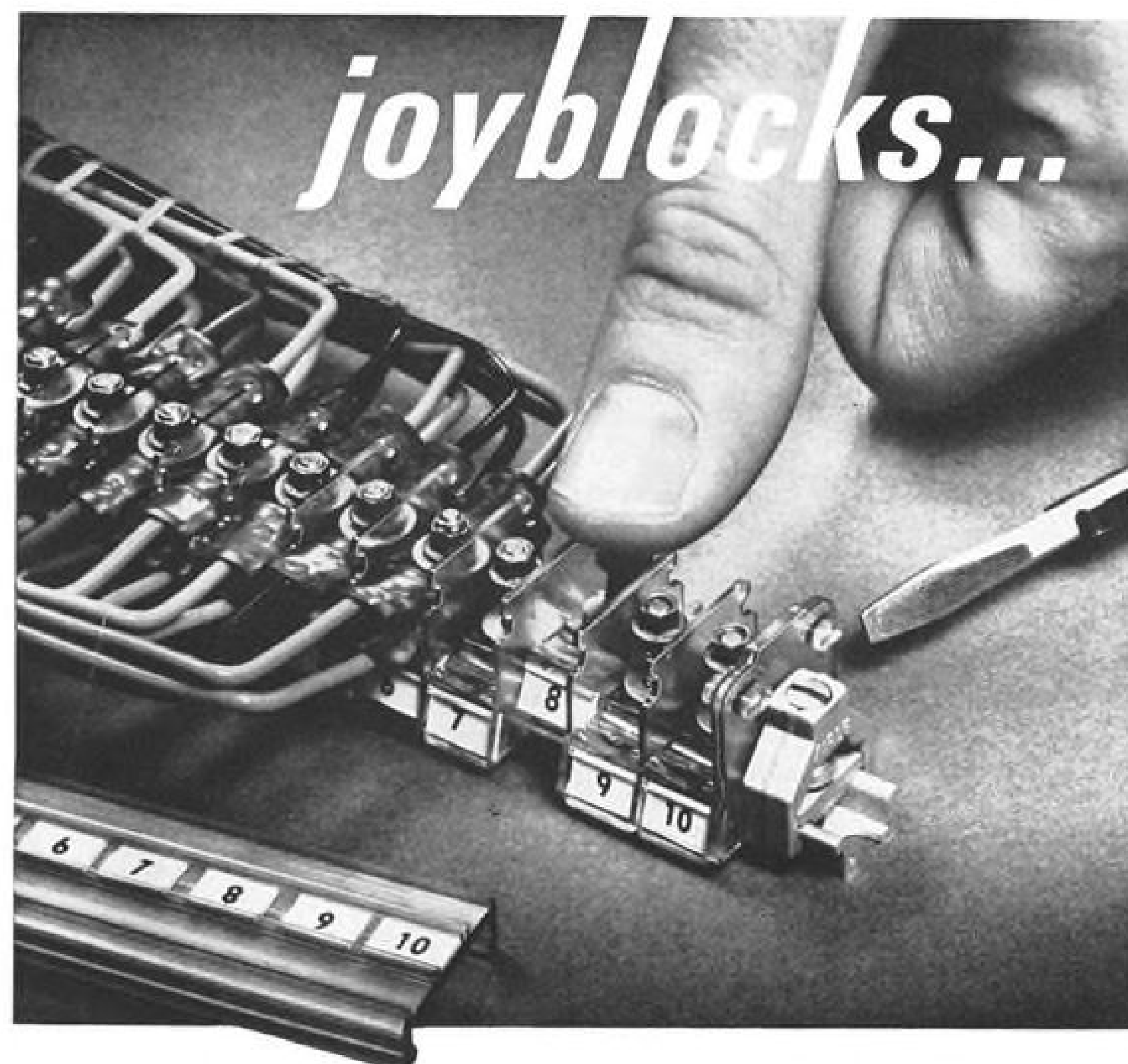
- **Active substrate assembly**—This employs an active (semiconductor) substrate with active elements typically diffused into it and either diffused passive elements or thin films deposited over its oxidized surface. (This is the semiconductor microcircuit or a hybrid variety of it.)

Richard H. Randall of Stanford Research's Division of Economics Research discussed the objectives, definitions and methodology of the survey, but he declined to elaborate on the results of the institute's efforts. Many of the results of the study were learned in industry, however, from some of the 200-300 people in 80 organizations, interested in integrated components, and canvassed during the past year by Stanford Research interviewing teams.

Survey forecasts electronic equipment sales of \$19.3 billion in 1970 breaking down into \$11.1 billion for military, including National Aeronautics and Space Administration, \$5.6 billion for industrial and \$2.6 billion for consumer markets. Of this total, integrated components are expected to account for



DIVISION of the total projected electronics equipment market in 1970.



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\$778 million, roughly 50% more than the annual sales of all semiconductor components by American manufacturers last year—13 years after the invention of the transistor. This figure compares favorably with figures cited by Robert C. Sprague (AW May 14, p. 28) at the National Electronics Components Conference where he estimated a \$465 million market in 1967 doubling by 1972.

Active substrate assemblies, according to these projections, will account for the largest share of this \$778 million market, approximately \$680 million or roughly 87.5%. This estimate corresponds qualitatively, insofar as the percentage breakdown is concerned, with the views of many equipment and systems manufacturers surveyed earlier this year (AW Mar. 19, p. 55), who indicated their beliefs that microelectronics would be essentially a semiconductor-based industry.

Market Breakdown

Thin films markets would be larger than those allotted to passive substrate assemblies as they would be used in hybrid combinations on active substrates. This is not readily reflected, however, in these figures since the hybrid device using a semiconductor substrate is lumped into the active substrate assembly category by definition. The likelihood that techniques of evaporating active elements on passive substrates would reach technical maturity in this decade apparently has been ruled out.

Breakdown for the three types of integrated components according to their end market for 1970 is as follows:

Conventional assemblies (discrete component microcircuits):

- Military—\$30 million.
- Industrial—\$5 million.
- Consumer—\$2 million.

Passive substrate assemblies (thin film microcircuits):

- Military—\$33 million.
- Industrial—\$18 million.
- Consumer—\$10 million.

Active substrate assemblies (semiconductor microcircuits):

- Military—\$310 million.
- Industrial—\$230 million.
- Consumer—\$140 million.

If these figures are an adequate projection of the approximate percentage breakdown of the market among the three general end market categories, the military market, as expected, would be the largest single one, accounting for 48% of the total.

Of the total 1970 military electronic market reportedly projected by SRI, NASA's requirements account for a sizable portion—28.8% or \$3.2 of \$11.1 billion. Other shares in billions of dollars include aircraft 0.8, missiles 1.6,



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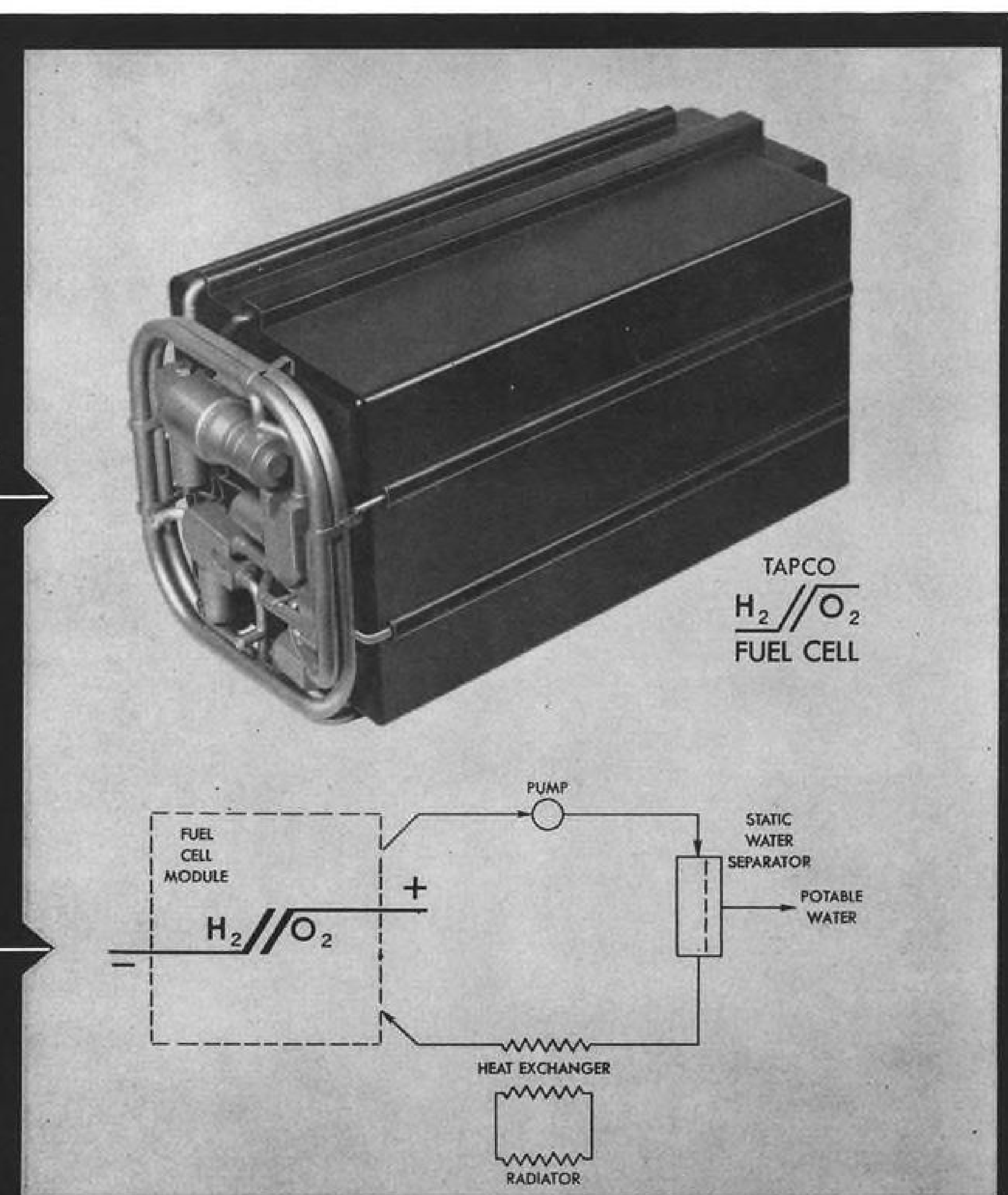
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Assembly is completed when the resin-impregnated glass filament is wrapped around the stacked propellant. This operation, too, calls on standard procedures—requiring only a basic mechanical motion. Its adaptability to superboosters such as this—150 feet by 38 feet—is merely a matter of development at the launch site.

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For those who believe, as Hercules does, that the space race is purely and simply a thrust race, we have compiled considerable documentation of our concept and its proposed programming. For details, write: Chemical Propulsion Division, Hercules Powder Company, 910 Market Street, Wilmington 99, Del.



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shipborne equipment 0.5, communications 1 and R&D 4.

About 23% of all military active element groups will be using integrated components by 1970, the study is understood to indicate. By active element groups, SRI singles out a transistor or tube with associated groups of passive components.

By the end of the decade, any of the three categories of integrated components will be able to satisfy half of the military avionics and NASA requirements. The remaining half can be met by conventional active element groups.

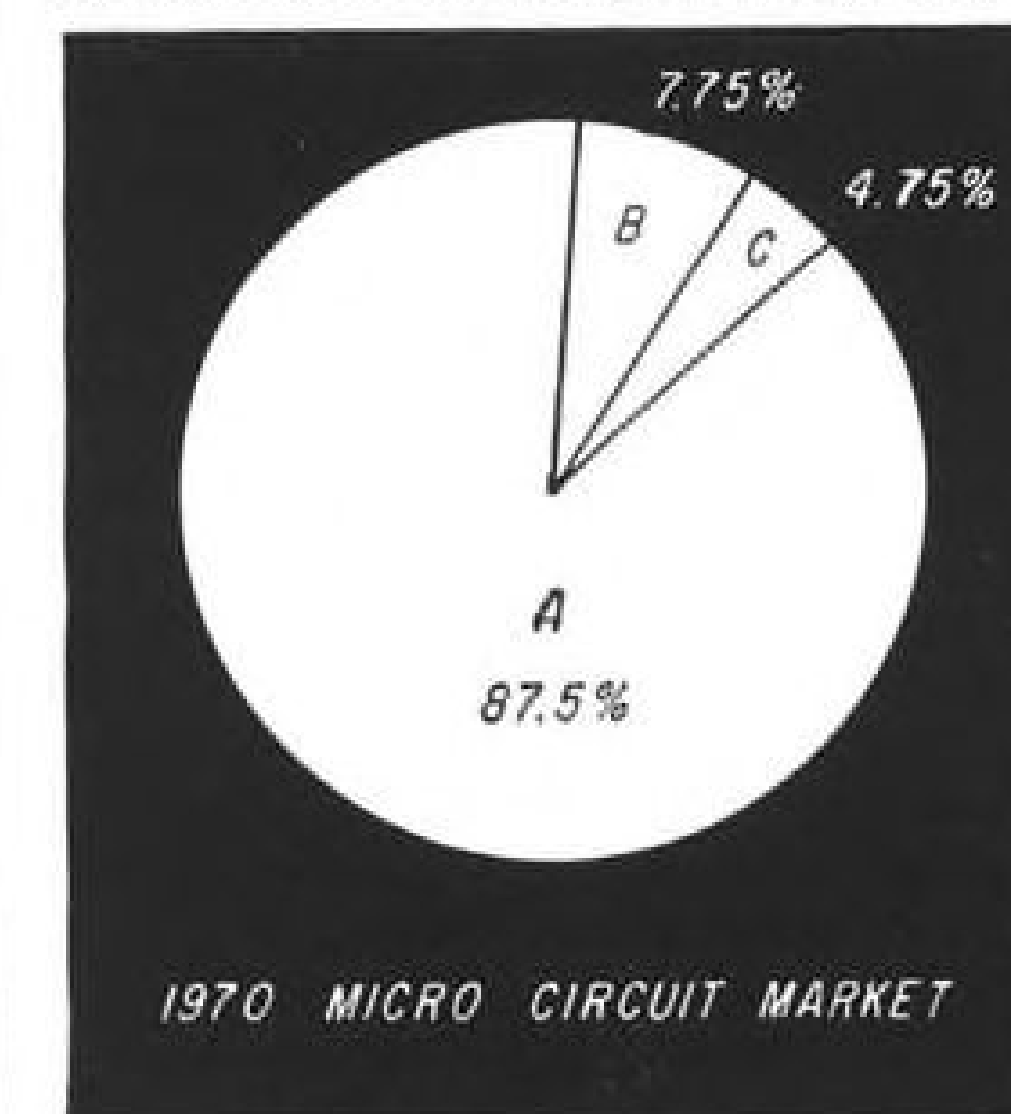
Survey results indicate that the development and fabrication of active assemblies will rest with what is today the semiconductor component industry, as it does now with their transistor and diode precursors.

In-House Capability

Only about 20% of electronic equipment manufacturers are reported to indicate they expect to have an in-house capability for making active substrate assemblies by 1970. The remainder appear to prefer selecting vendors from among multiple sources.

Of 39 selected electronic equipment manufacturers, about 60% had some in-house development activity on passive elements. None of the 39 had any in-house active substrate capability, although 40% of the total were said to report such activity in process at other facilities operated by their organizations. These results also tend to suggest that the user plans to buy the active substrate assemblies from vendors, and certainly indicate no mass trend toward in-house active substrate capability.

High percentage of in-house passive element effort in the preceding sample



SEMICONDUCTOR microcircuits are expected to have the largest share of microcircuit market in 1970 with 87.5% (A), followed by thin film microcircuits (B) with 7.75% and discrete component microcircuits (C) with 4.75%, according to recent study of the industry.

might be interpreted in a number of ways. Although the identity of the 39 companies is unknown, many aerospace and avionics equipment/systems companies (General Dynamics/Astronautics, Lear Siegler, Servomechanisms, Lockheed Missiles & Space, Autonetics, Douglas, to mention a few) have developed extensive thin film capability in the past several years.

Varied Motives

Their motives varied from a preference for this as a microcircuit technique to the belief that active element substrates would not progress as rapidly as they have in the past two years. A number are known to anticipate purchasing the active substrates with active elements diffused in them and then in-house tailor depositing the passive components to meet particular needs.

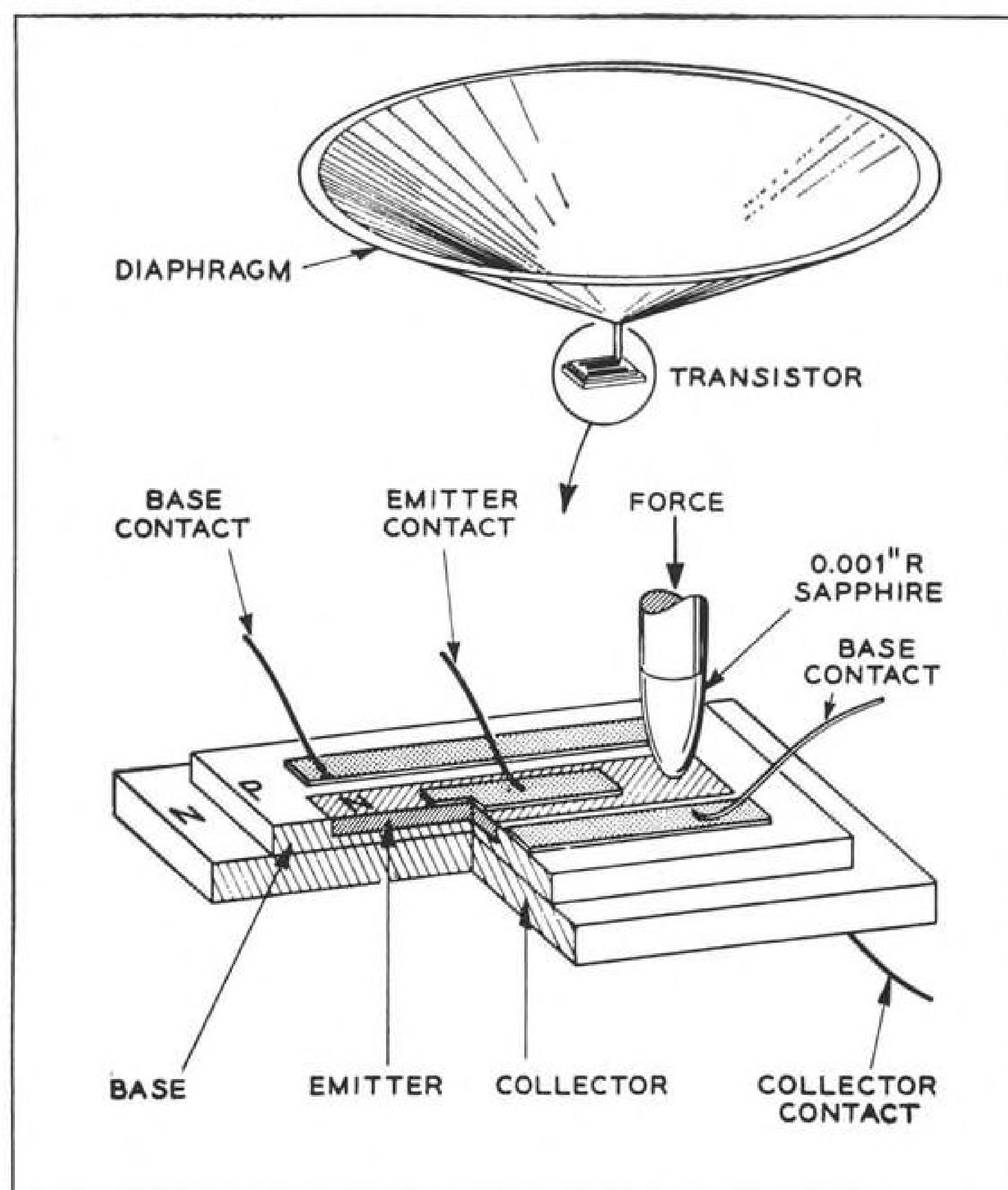
Impact of integrated components on the electronic industry will be felt more acutely in the second half of this decade than it will or is being in the first, Randall points out. SRI's study indicates, he explains, that the most rapid growth in integrated components will occur after 1965, despite the optimistic sales estimates for the next several years sometimes proffered by industry representatives.

Digital field will be a principal application area of integrated circuits, the survey indicates. Digital applications require large numbers of similar types of circuits in which passive element tolerances need not be tight. This is particularly inviting to active substrates, and the possibility of quantity uses promises increased yield and reduced prices. Active substrate assemblies' particular suitability for digital applications, the study is reported to suggest, poses the possibility that circuits capable of redesign could be synthesized in digital, rather than linear form.

Component Business

Emergence of integrated components may have its greatest impact in the component business, especially on the passive component manufacturer whose market will be curtailed as both active and passive substrate assembly makers realize passive elements in semiconductors or with thin films (AW Mar. 9, p. 55). SRI estimates that \$100 million will be shaved from the sales of both resistor and capacitor sales projections for 1970 as they are edged out by integrated components.

In the SRI survey, Randall explains, the institute attempted to measure the penetration of each type of integrated component in terms of its technical capability for this decade, whether the promised cost savings could and would result from their introduction and whether they would be suitable for reasons of size, weight, reliability, avail-



Bell Develops Semiconductor Microphone

Semiconductor microphone, more than four times as sensitive as carbon type and using only 1-5% as much current, has been developed by Bell Telephone Laboratories based on piezo-electric property of semiconductors. Diaphragm vibrations are transmitted to thin junction on transistor by sapphire stylus. Device has signal-to-noise ratio of 54 db. at sound pressure of one dyne/sq. cm. at a frequency of 1 kc. Device's tiny size opens up many biomedical uses. Raytheon announced similar type device at Wescon in August.

ability, number of identical groups, etc.

SRI found that there is reason to expect improvements in reliability and reductions in cost over conventional component and packaging techniques, as integrated component advocates have repeatedly claimed.

Factors relating to cost that are of concern to potential users of integrated components include the displacement of engineering and assembly labor, the displacement of field maintenance (How much is the customer willing to spend to reduce field maintenance?), and the extent to which the supplier must reduce his prices before integrated components become attractive to the user.

Surprising possibility for integrated component application is reflected in SRI estimates of the consumer sales of electronic equipment in 1970. The market for television receivers alone is predicted to be \$980 million (radio \$356 million, records and tape \$285 million,

phonographs \$350 million and miscellaneous \$570 million).

As for the validity of the market price tags projected by the study, Randall concedes less confidence in the estimates of markets at the end of the decade than in those at mid-decade, for which money has already been committed.

Survey Team

Four SRI staff members assisted on a part-time basis by others, conducted the survey. They collected data from component manufacturers, from assemblers of electronic equipment, from research and development organizations and from industrial associations. Questionnaires were employed in the survey and the study team relied heavily on the counsel of scientists at the institute who have been engaged in integrated component research and development for many years.

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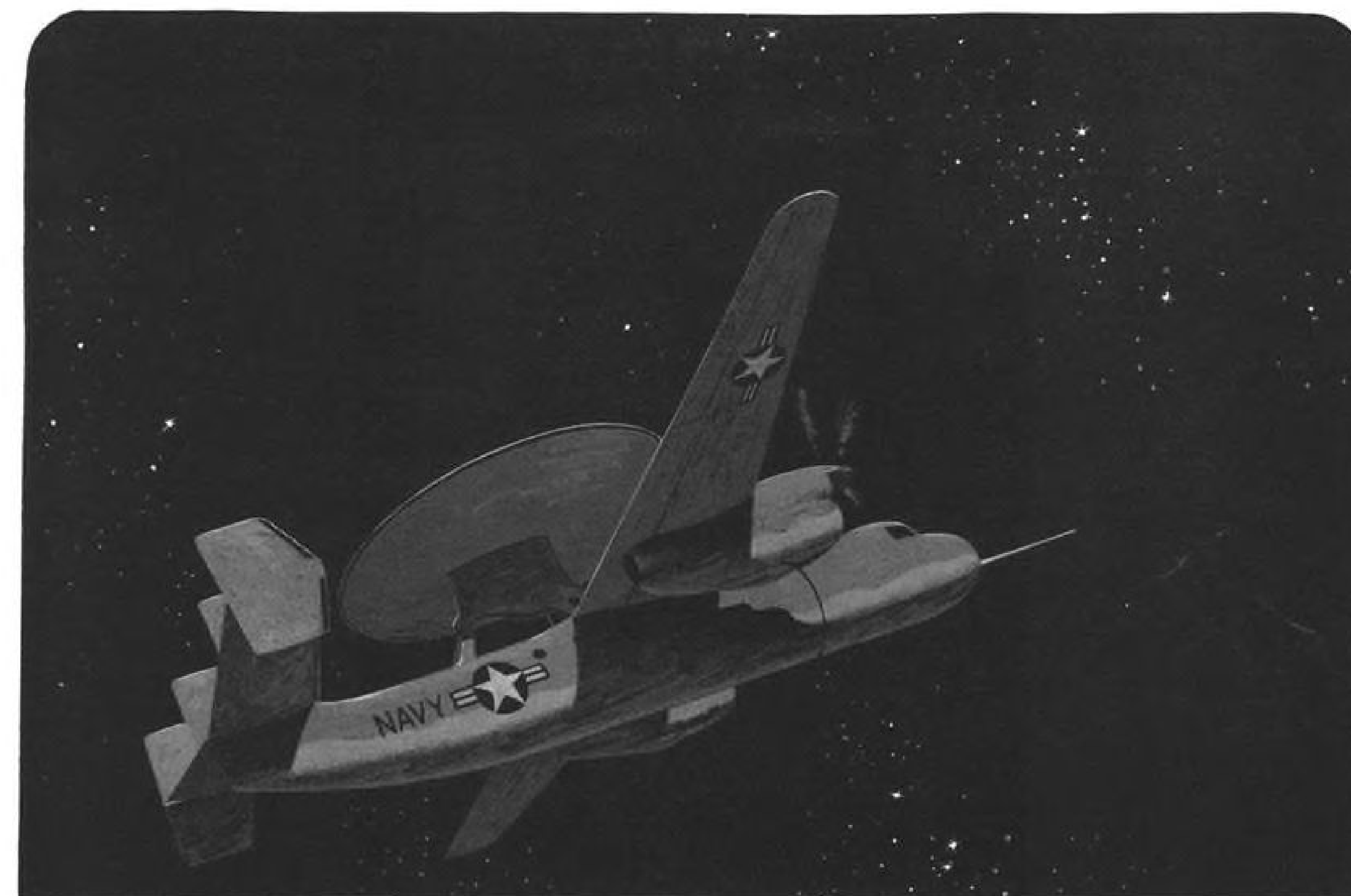
3 MICROWAVE SYSTEMS Dalmo Victor has been deeply committed in microwave systems for many years. Leadership has been established in telemetry, automatic tracking, countermeasures, and distance measuring with capabilities for satellite rendezvous control and soft lunar landings.

4 MAGNETIC SYSTEMS Another Dalmo Victor achievement area, involving such unique developments as anti-submarine and undersea warfare systems, space vehicle stabilization and attitude control systems, and other contributions in magnetics, and in related fields.

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New Material Laser Operated Continuously

Continuous operation of the recently discovered gallium-arsenide laser, which previously had been operated only on a pulsed basis, has been accomplished by International Business Machines Corp.

The firm's Thomas J. Watson Laboratory has achieved infrared radiation output power levels of 10 to 25 mw. with applied power of 50 mw. at temperature of -271°C , but not all of the emitted radiation was coherent—the characteristic of a laser. Radiation was produced at a wavelength of 8,400 angstroms using a current density of 100 amperes per square centimeter, about 1% of the current density in the earlier pulsed gallium-arsenide laser (AVW Nov. 5, p. 40).

The Massachusetts Institute of Technology's Lincoln Laboratory, which first reported intense infrared radiation from a gallium-arsenide diode, and Bell Telephone Laboratories, which holds the basic laser patent, are both expected to report advances in the new type of semiconductor diode in the near future.

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Mobile Tracking Lab

Mobile infrared tracking-measurement laboratory, designed by Barnes Engineering Co. for Deutsche Versuchsanstalt fuer Luftfahrt, West Germany's equivalent of NASA, can be used to obtain infrared signature data on aircraft or re-entry vehicles. The mobile laboratory includes automatic infrared tracker to follow target, plus radiometers for measuring infrared radiation.



FILTER CENTER

► **Union Carbide Buys Laser Activity**—Union Carbide Corp. is purchasing the Applied Physics Laboratory of Quantatron, Inc., from Allied Chemical Corp., climaxing months of negotiations for this laser activity, first reported by AVIATION WEEK (AW July 30, p. 24). The laboratory will be set up as a Union Carbide affiliate, to be called Korad Corp., headed by Dr. Theodore Maiman, who was in charge of laser activities at Quantatron. Dr. E. L. McCandless, formerly with Union Carbide, will be vice president. The new company will concentrate in laser materials, a commercial high-power laser device, and laser applications and engineering. Korad is expected to continue about \$500,000 in government R&D laser contracts. It will share occupancy of the Quantatron facilities in Santa Monica, Calif. with the latter's microwave group which is expected to vacate the premises at a future date.

► **GE to Develop Nuclear Altimeter**—General Electric's Armament & Control Section, Johnson City, N. Y., will develop low-altitude altimeter which uses radio-isotopes placed along the runway and a nuclear counter in the aircraft. Work is sponsored by USAF's Aeronautical Systems Division under a \$34,000 contract.

► **The Rampart to Watch**—Precision pencil-beam radar, under development by Raytheon for Air Force to measure radar signatures of re-entry bodies, is reported to be able to track objects as small as a basketball at a distance of 1,000 mi. Known as RAMPART (radar advanced measurements program for analysis of re-entry techniques), the radar will use a 60-ft. dish and have a peak power of 24 megawatts. High-speed tracking and data processing units will permit radar to make 100 measurements per second. Rome Air Development Center is sponsoring development under contract expected to total about \$4.3 million.

► **LFE Develops New Type Paramp**—New class of low-noise parametric amplifier using multiple idler circuits which enables it to amplify at signal frequency considerably higher than pump frequency, has been reported by Laboratory for Electronics, Inc., Boston. Technique opens the way to operating parametric amplifiers at extremely high microwave frequencies. Demonstration models amplify at 10 mc. using pump frequency of 7.2 mc., and at 13.3 kmc. (gc.) using a pump frequency of 9.6 gc. Next step in pro-

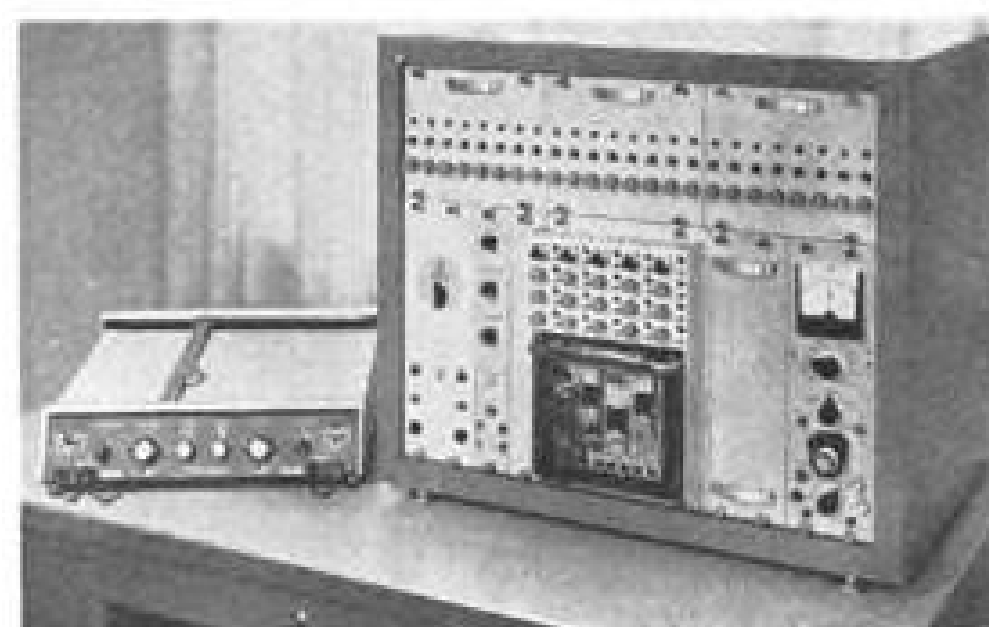
gram is to obtain amplification at 13.3 gc. using a 5.6 gc. pump, company says.

► **RCA Wins Midas Tube Pact**—Contract to develop about 24 10-watt S-band traveling wave tubes for use in the transmitters aboard the Midas missile alarm satellites was won recently by Radio Corp. of America's Astro-Electronics and Harrison Tube divisions. Harrison will make the tubes, Astro the power supplies and exciters. Initial procurement from Lockheed Missiles and Space Co., prime contractor for the Air Force's Midas system, will run about \$1.5 million.

NEW AVIONIC PRODUCTS

• **Instrument** which measures the operating parameters of passive avionic components by first measuring their impedance and then converting this into an analog voltage suitable for go/no-go comparison or digital voltmeter display. Instrument will measure capacitance, dissipation factor or power factor, inductance, leakage current and resistance. Manufacturer: Fairchild Semiconductor Corp., Instrumentation Dept., 545 Whisman Rd., Mountain View, Calif.

• **Compact, low-cost analog computer**, Model AD-2-24PB weighs 125 lb., sells for under \$3,000 in basic configuration. Modular construction permits expan-

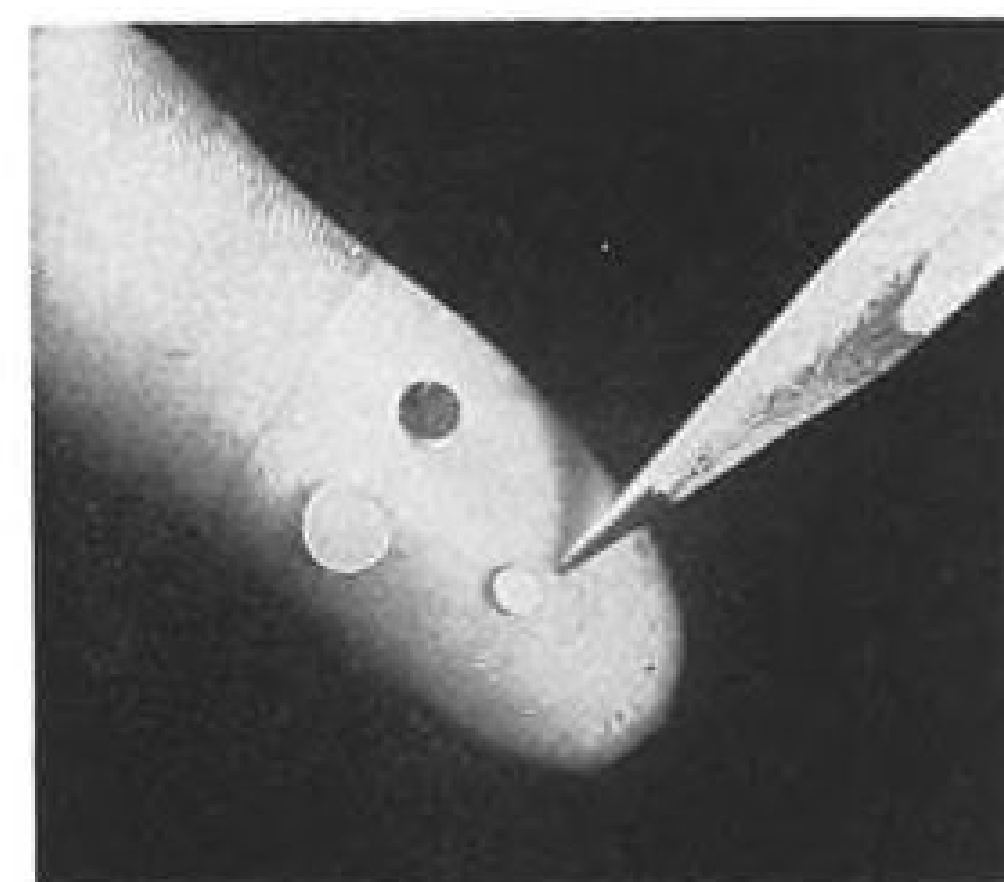


sion to 24 amplifier capacity and addition of interchangeable multipliers and diode function generators. Computing speeds of 0.025 to 1,000 sec. can be selected. Accuracy is quoted at 0.2% per amplifier and 0.035% per multiplier. Manufacturer: Applied Dynamics, Inc., 2275 Platt Road, Ann Arbor, Mich.

• **Tunable C-band parametric amplifier**, with tuning range of 5.4 to 5.9 kmc. (gc.), and a fixed pump frequency of 17.5 gc., offers minimum bandwidth of 20 mc. with 17.5 db. gain over tuning range. Typical maximum single sideband noise figure is 3 db., including waveguide circulator, according to manufacturer: Sperry Microwave Electronics Co., P.O. Box 1828, Clearwater, Fla.

• **Tapped quartz delay lines**, which permit addition of multiple inputs and outputs with operation up to 70 mc., are available with taps at any submultiple of the total delay time up to 1,600 microseconds, with certain additional taps up to 5,000 microseconds. Microsonics, Inc., 60 Winter St., Weymouth 88, Mass.

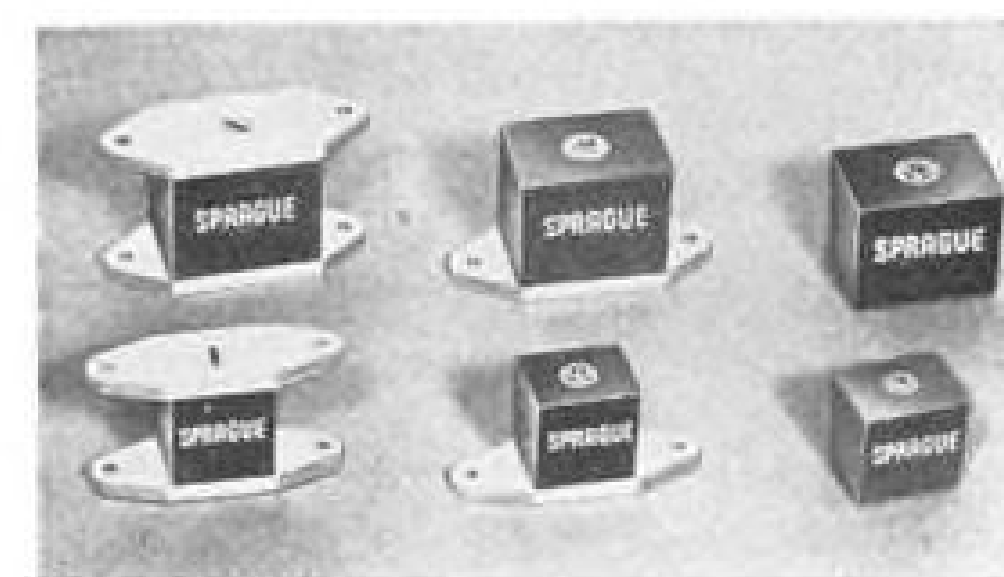
• **Microminiature thermistors**, Series D, available in resistance values of 50 ohms to 10 megohms, with temperature coefficients of $-3.9\%/deg. C$ to



$-6.8\%/deg. C$, for operation over temperature range of $-55C$ to $150C$. Thermistors are available in pellet diameters of 0.100, 0.150, 0.200 and 0.250 in. with standard thickness of 0.031 in. Manufacturer: Gulton Industries, Inc., 212 Durham Ave., Metuchen, N. J.

• **Lightweight traveling wave tube**, Type RW-101, permanent magnet focused, has noise figure less than 6.5 db., provides more than 27 db. gain with collector voltage of 300 v. and helix voltage of 260 v. over frequency range of 2.6 to 3.4 gc. Tube weighs 14.5 lb. with magnet, can be operated in any position, is priced at approximately \$2,000. Manufacturer: Warnecke Electron Tubes, Inc., 175 West Oakton St., Des Plaines, Ill.

• **Transmitter-type mica capacitor**, encapsulated in mica to prevent leakage,



is interchangeable with MIL Types CM65 and CM70, but can be operated at temperatures up to $125C$ at full current ratings. Application data is available in Bulletin No. 1230. Sprague Electric, 327 Marshall St., North Adams, Mass.

WHY BLACK?

(ADVERTISEMENT)

New Cessna Models Have Styling Changes

Larger interior and slight increase in useful load marks the 1963 Cessna 310H, with improvements in the new Models 182/Skylane and 210 being primarily confined to styling and additional equipment.

Public unveiling of these three airplanes in December rounds out Cessna Aircraft's new 1963 model line of 19 airplanes. One plane, however, remains to be displayed to the public in April—the new tandem-engine twin-boom 4-6-place Skymaster, on which details have been provided earlier (AW Oct. 22, p. 103).

Cabin Enlarged

Cabin interior of the new light-twin 310H is 22-in. longer, providing additional baggage area behind the five-and-six-seat versions, with utilization of this area depending on payload and optional equipment. Gross weight of the airplane has been increased 100 lb. over the earlier Model 310G, giving the new airplane a gross of 5,100 lb. Useful load is increased about 90 lb.

Increase in gross weight has been accompanied by redesign of the main landing gear and nose gear shock strut to permit full gross weight landings. The new gear accommodates air columns absorbing 50% greater loading and provides even softer landings at the higher gross weight than the 310G's gear. Nose gear tire is of four-ply construction to take extra loads.

Engine controls also are modified to employ flexible armored-strand and conduit assemblies, eliminating about 30 parts over the previous system.

Other Improvements

Additional 310H improvements include new air-oil separator with simplified routing, glide slope antenna molded into the glass fiber fuselage nose cap and an accumulator-type propeller unfeathering system as optional equipment.

Optional gear includes the Nav-O-Matic 800 three-axis autopilot.

Price of the basic 310H airplane is \$62,950 flyaway Wichita, marking an increase over last year's model, which listed at \$59,950 on the basis of a \$2,550 price cut from the 1961 310F.

Cessna's best-seller last year, the new 1963 Model 182/Skylane, is basically a similar airplane with improved styling. It has additional equipment available, such as the Cessna Nav-Com—a 90-channel transmitter and 190-channel receiver—as standard equipment on the de luxe Skylane version, and costing



1963 MODEL 210 has new interior with all-aluminum frame seats.



IMPROVED STYLING, new avionics gear mark the 1963 Skylane and Model 182.



CESSNA 310H has larger cabin, increased useful load and redesigned landing gear.

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The Astrolabe, shown behind the modern pilot's hand in the illustration above, was an ancient navigation instrument used by Champlain in his explorations of the land that is now Canada. It symbolizes the spirit of this great company in its programs to solve the new and vastly complicated navigation problems of space exploration.

The tremendous scientific, technological and engineering advances of our era have resulted from explorations in every field of endeavour. In the field of global navigation, Computing Devices of Canada is a world leader in the development of "Push-Button" control systems for the most demanding and complicated air navigation requirements. Systems such as PHI, ANTAC, VICOM and SKYLINE were the answers to many problems created by supersonic speeds, low altitude photo reconnaissance, anti-submarine warfare and other vital roles of modern military and civil aeroplanes and helicopters.

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\$1,275 plus installation on the less-expensive Model 182. Also available is the Nav-O-Matic 300 heading hold device including omni-station coupler, selling for \$1,995 plus installation, or the single-axis Nav-O-Matic autopilot selling for \$1,125 installed. A lightweight Cessna automatic direction finder is available for \$1,187 plus installation, as is an azimuth-type directional gyro having a face with perspective section lines and blue horizon, which will cost \$556, plus vacuum system and installation.

Model 182 Price

Price of the basic Model 182 for 1963 is \$16,450, compared with last year's model price of \$15,990; the basic Skylane will sell for \$18,990 compared with \$18,490 last year.

The 1963 version of the Model 210 retractable landing gear airplane also features a new interior with all-aluminum frame seats and has available as optional equipment the Nav-O-Matic 300, the Nav-O-Matic 200, the lightweight ADF and directional gyro. The new Model 210 will sell for \$24,625 in its basic equipment configuration, an increase over last year's \$23,975 price.

Noise Reduction Work Planned for Potez 840

Addition of a larger air-conditioning air-intake duct and a dehumidifier are among steps being taken to lower cabin noise levels in the Potez 840 now being shown to prospective customers in North America.

Addition of four-bladed propellers to the turboprop's four Turbomeca Astazou 2 engines also is expected to lower cabin noise by as much as 2 db.

At present, a single air intake is used to feed air to the 840's pressurization system. Dual air-intake ducts, each larger than the present single duct are expected to lower noise generated by the system.

Addition of a compressor stage to the engines, which is to be done for production models of the 840, will increase engine power to a maximum of 680 shp., according to Don Payton, president of Turbo-Flight, Inc. of Chicago, North American distributors for the airplane.

Other changes to be made on the production aircraft, according to Payton, include installation of two-button power controls with power settings of 100% for takeoff and 87.5% for cruise, and a retractable air stair to replace the present single-piece ladder.

Second Potez 840 prototype, being used as a demonstrator in North America, will continue on a sales tour of the country (AV Oct. 15, p. 123). Potez factory now has 23 production places scheduled, according to Payton.

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Recent aerodynamic and structural tests by the US Air Force on reinforced fiber glass blades mark another first by Curtiss - Wright — first to have a fiber glass bladed propeller successfully complete the Military Qualification Test.

Designed and built by the Curtiss Division for the Tri-Service X-19 VTOL aircraft, this new lightweight propeller system is no longer a concept, but a proved reality. The inherent advantages are many:

fiber glass blades are 40% lighter than conventional blades, less costly to manufacture, and far easier to repair in the field.

The successful military testing of these Curtiss-Wright fiber glass blades—a major milestone in VTOL development—may suggest further evaluation for *your* program. Write for our literature which fully describes the advantages these blades offer to VTOL aircraft.

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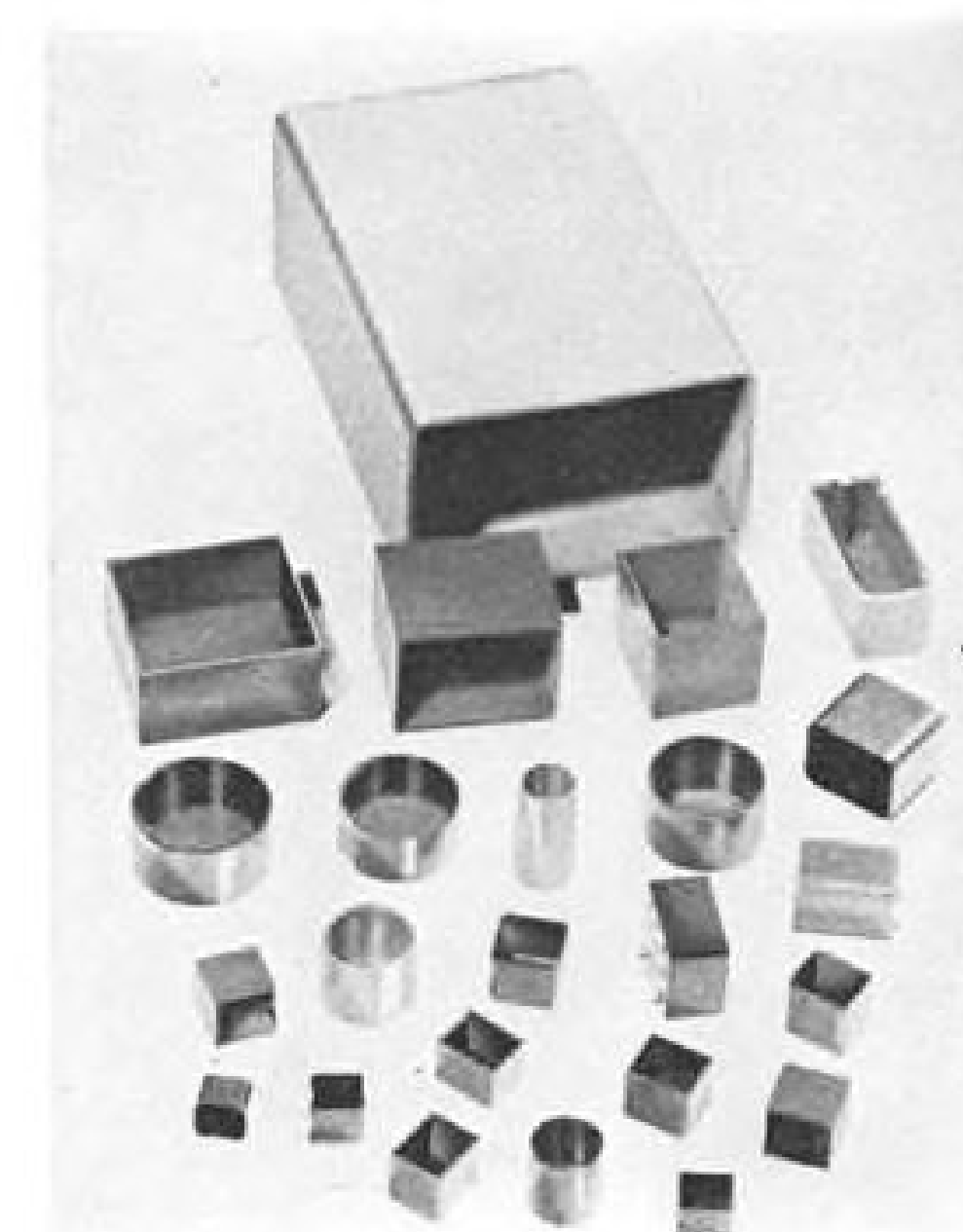


Pilot can control entire operation of engaging a pre-set lift sling attached to the load thereby eliminating the need for ground crews to work directly beneath the helicopter. Or, hook can be used semi-automatically with a ground crew placing sling in open throat of hook. Load can be released by: automatic touchdown electrical release, or pilot-operated electrical release, pilot-operated mechanical release, or ground crew can release hook manually. Safety lock prevents inadvertent midair release, the manufacturer says.

Aeroquip Corp., Jackson, Mich.

Plastic Module Cups

Line of molded plastic cups for encapsulating electronic components or modules is resistant to acids, alkalis, and fungus and shows excellent qualities of arc resistance, dielectric strength, dissipation factor, and surface resistance, the manufacturer says.



Cups are available in round or rectangular configurations in a wide variety

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U. S. Engineering Co., 13536 Saticoy St., Van Nuys, Calif.

Cryogenic Pressure Potentiometer

Series of cryogenic pressure potentiometers have temperature sensitivity of less than 0.005% Fahrenheit through



their operating range of -320°F to $+160^{\circ}\text{F}$. A time constant of 3 milliseconds and ability to withstand 50g to 2,000 cps. vibration makes units suitable for airborne missile applications.

Trans-Sonics, Inc., Burlington, Mass.

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Hydropoise, Inc., Scottsdale, Ariz.

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CINCINNATI

Moss Attacks Government News Control

(Government management of news surrounding the Cuban crisis has set off the first major public debate on information secrecy since the Kennedy Administration took office. It has become one of the most heated debates on this subject since World War 2, when the necessity for military security first began to make restriction of information a public issue. Because of the importance of this subject to the aerospace industry, Aviation Week & Space Technology is reprinting a speech made recently by Rep. John E. Moss (D.-Calif.), chairman of the House Government Information Subcommittee, to the California Press Association Conference in San Francisco—Ed.)

Newspapermen across the nation have been in a state of editorial shock in recent weeks because of attempts by federal officials to manage news about government activities, particularly activities surrounding the Cuban crisis. There have been critical editorials in dozens of newspapers. In Washington, a group of newspapermen who regularly cover government agencies decided they had better form a Freedom of Information Committee within their organization. In Tulsa, members of the national professional journalism society, in convention assembled, asked the federal government to repudiate attempts at news management, and they urged passage of a national freedom-of-information law.

It certainly is not news of the man-bites-dog category when the federal bureaucracy tries to create a favorable effect by managing the news it generates. In fact, the most surprising development is that Washington newsmen have waited so long to set up their own committee to look into the situation. For nearly eight years the Special Subcommittee on Government Information of the House of Representatives has been investigating all aspects of the government's news management operations. During that period and for a number of years before the subcommittee started its work, many thoughtful editors and reporters warned of the dangers of manipulation of government information.

Let me read you a pertinent comment on the subject:

"It has become apparent that tighter controls are being used for greater manipulation of information—for 'management of the news'—on the Department of Defense level. Under the President's new orders for still further centralization and control, it appears that information officers of the various services may be relegated to the status of a ventriloquist's dummy on the knee of the Defense Department's publicity man. The vast military establishment, thus, would speak with one voice—and that the voice of a politically appointed propaganda expert."

This is not a comment on the government information controls imposed in the Cuba crisis, although it could well apply. It is a warning in an official report of the House Government Operations Committee

filed with the House of Representatives in June, 1958.

The point is that management of government information is not a new technique. It has been going on for a long time, and a lot of us have been complaining about the practice for a long time. But if government news management is an old practice, it has not yet become venerable. There have been some new, and most disturbing, developments in the business of government news management during the past few months. . . .

In 1958, when the complaint against news management which I quoted was filed in an official House of Representatives report, it seemed that the publicity men in every federal department and bureau were managing the news for the greatest possible publicity effect. The problem was most apparent in the huge Defense Dept. where we uncovered case after case of information allegedly withheld on the excuse of military security suddenly released for "policy" reasons—sometimes political policy and sometimes international policy.

That is no longer the case. We still have the public information experts in the various agencies—Arthur Sylvester with his 35 years of newspaper background in the Defense Dept., Robert Manning with his foreign and domestic news experience in the State Dept., Pierre Salinger in the White House, and public information men with broad news backgrounds in top jobs in nearly every department. Their publicity shops still are grinding out press releases, and they still select release dates that will give their stories the best possible play.



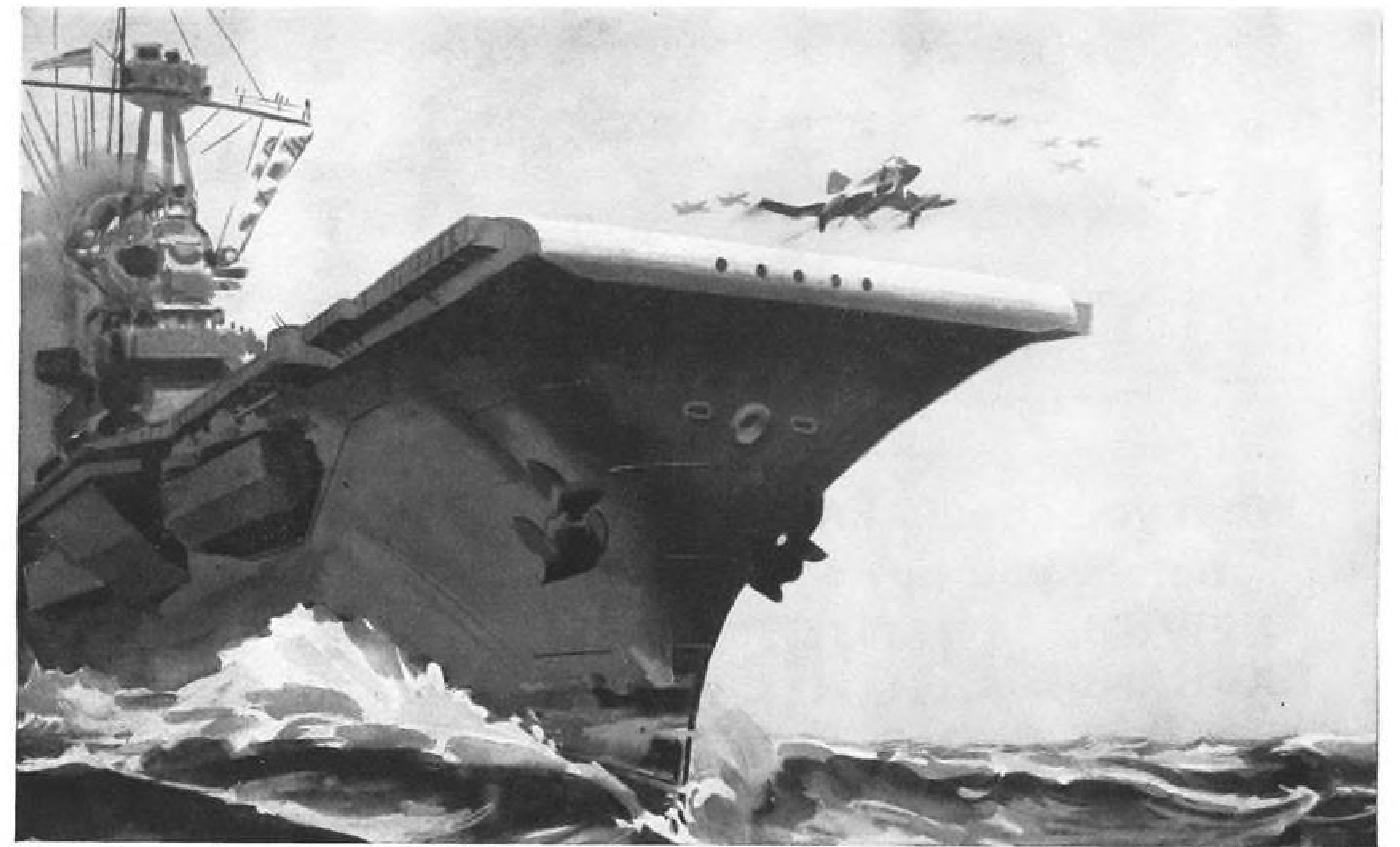
Rep. John E. Moss (D.-Calif.), has been a member of Congress for 10 years, and early this year was named deputy majority whip—fourth-ranking majority post in the House of Representatives. As chairman of the Government Operations Committee's government information subcommittee since 1955, he has become the "watchdog" of news suppression by executive departments of the federal government.

But now the publicity men in the various departments are not making nearly as many basic policy decisions about the handling of important news generated by their agencies. To a remarkable degree the White House itself is retaining direct control over the handling of government information. It is true that, in the past, the National Security Council and the President have made basic decisions on how certain significant information should be handled. But the President and his NSC advisers heretofore have not handled the hour-to-hour monitoring of the details of news management as they did during the Cuban crisis. Now important news-making events, ranging from a backstage greeting to members of Russia's Bolshoi Ballet to the bomb tests in the Pacific Ocean, are under firm presidential control. This is not all bad, nor is it all to the good. But it is a clear fact that those of us interested in a free flow of government information had better recognize. And when we realize what sort of news management is going on in Washington today, we'd better start considering what—if anything—we're going to do about it.

President Kennedy had been in office only three months when he laid the question of news management before the nation's press. In a speech which is remarkable for the many important questions it posed and left unanswered, President Kennedy asked whether the tests of national security, as well as the tests of news judgment, should be applied to sensitive stories about government actions. Time after time in his speech to members of the American Newspaper Publishers Association 20 months ago, President Kennedy asked whether the dangers of the cold war required the nation's press to exercise special restraint in printing news about government actions—news which might be of greater value to our cold war opponents than to the American people. It was obvious that the President wanted an affirmative response to his call for the press to exercise some sort of self-censorship. And it was just as obvious that the press was not about to take upon itself the burden of deciding that the national peril was so great that a sort of do-it-yourself censorship without government guidelines had to be set up.

At the time, I pointed out that Executive Order 10-501, which controls military information, provides for appeals against unjustifiable restrictions on information. This appeals procedure also could be used as the bare minimum system for press guidance in exercising the restraints the President called for. Just two months ago the House Government Operations Committee, in a report filed with the House of Representatives, again called for implementation of the appeals system which is provided in the Executive Order. But no effective action has been taken even to set up a workable, bare minimum system.

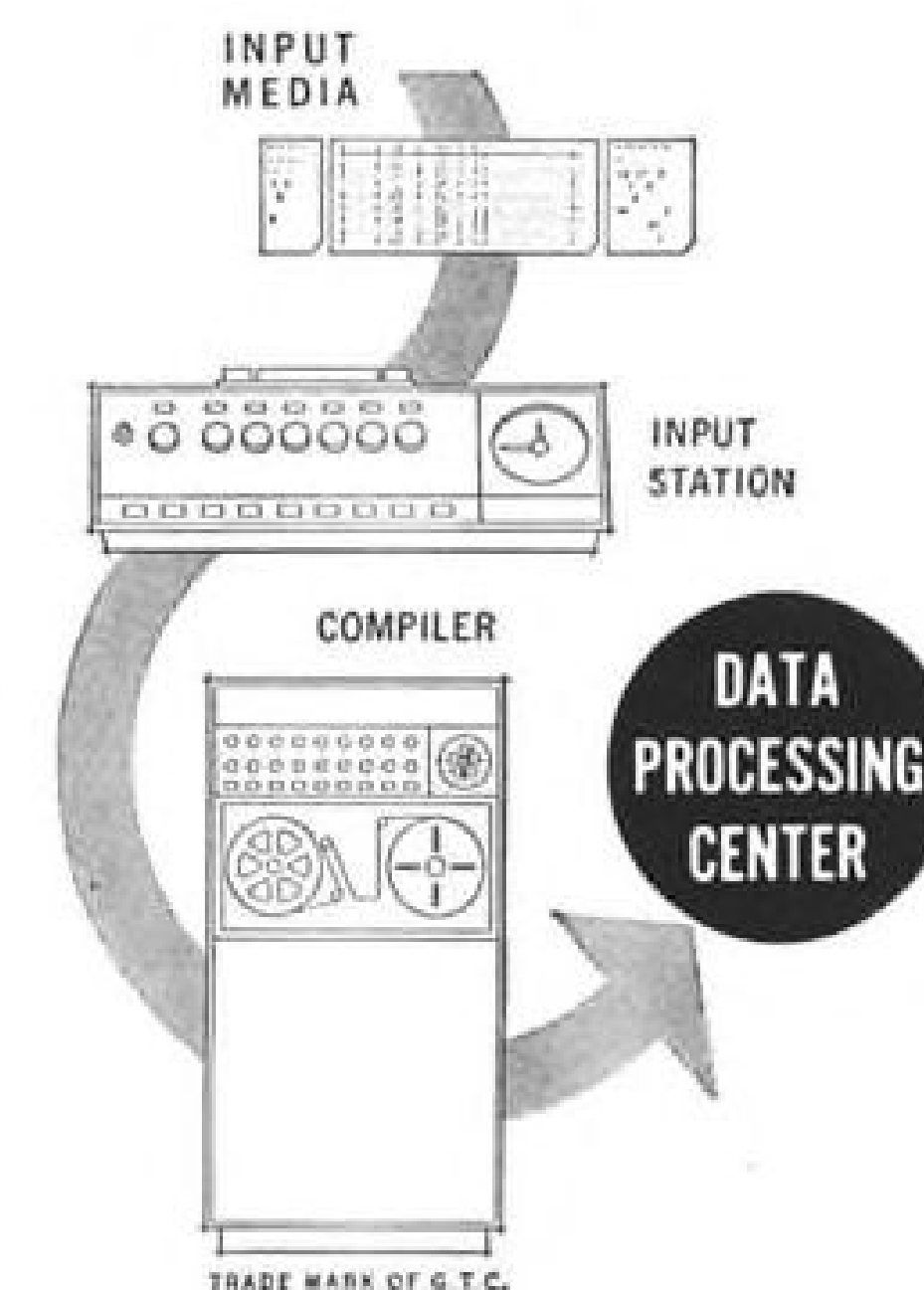
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was provided for the exercise of restraint by the press, there were restraints imposed—not by the press but by the government, itself. Some of the earliest effects were felt here in the West. In late 1961 the underground nuclear test sites in Nevada which previously had been open to reporters and photographers were tightly closed. Instead of first-hand information about testing activities, the press got handouts. I am not referring to information of a sensitive nature which was withheld for reasons of military security. That sort of information is protected by law and by Executive Order; the subcommittee has stated repeatedly that government information which falls under the espionage laws and the security regulations must be protected to the greatest of our ability. The information I refer to included the routine pictures and the routine details of the Nevada tests. This sort of information, which had been readily available in the past, was put out only in carefully phrased press releases, timed for their effect on national policy.

There was comparatively little hue and cry in the press about this news management, just as there was too little complaint, too late, about the refusal to permit objective press coverage of the bomb tests in the Pacific. Here, again, information which in the past could be gathered first hand by reporters and photographers now was available only in handouts. The reason given was that national policy required careful handling of news generated by government action.

Growth of Secrecy

There has been comparatively little mention in the general press about the growth of secrecy in another important area. There was a wire service story last spring reporting that a new Defense Dept. order required secrecy about all military space activities. There were a few follow-up stories when the Special Subcommittee on Government Information urged the declassification of the reported secrecy order so that there could be public discussion and understanding of the necessity for blanket secrecy about military space activities. I can now report some progress. Just this week Assistant Secretary Arthur Sylvester issued a memorandum to the public information men in the military services telling them how they are to handle announcements of military space shots. The basic directive setting up the security policy for military space programs has not been declassified, but the system for managing the information about military space efforts now is out in the open.

Assistant Secretary Sylvester's new memorandum states that the Defense Dept. wants to promote "all possible information about military space programs consistent with the protection of security information." The memorandum encourages military space experts to send information about their activities to Assistant Secretary Sylvester's Office for consideration of whether the information can be made public. No one criticizes sincere efforts to tell the public about military space activities while protecting that information necessary to the nation's defense. But an important aspect of the new memorandum is that all space

launches by military agencies, whether they are for a military purpose or to gather information of a scientific nature, are covered by the blanket of secrecy. All information about the billions of dollars spent by the military in space research is channeled through the Pentagon's single public information voice. I can assure you that the Special Subcommittee on Government Information will do everything possible to promote a wide public discussion of this system for management of news about military space efforts. And I want to report that Congressman George Miller of Oakland, Calif., is just as concerned as I am about the growing secrecy surrounding military space activities.

As chairman of the House Committee on Science and Astronautics, Congressman Miller has first-hand knowledge of the damage that excessive secrecy can do to our scientific space programs.

National Policy

You may wonder why I emphasize the problem of secrecy about military space activities. After all, as I said earlier, the subcommittee has no objection to necessary secrecy which protects true military security information. But the excuse of military security can so easily be used to hide information about government actions until it, in the opinion of someone, better serves the national policy to release the information. Such has been the case with the military space secrecy directive. Every two weeks the government is supposed to issue a Satellite Situation Report showing the course of all satellites in orbit—our satellites and the Russian satellites. Early last September, the bare details about Russian satellites in orbit were embellished by a report from the National Aeronautics and Space Administration listing six Russian attempts to send space probes to Venus and Mars. NASA reported that each of the attempted Russian space shots failed, and only one of the six went into orbit around the earth.

Complete Blackout





Following the September report of Russian failures, there has been a complete blackout on information about Russian satellite efforts. No longer does the Satellite Situation Report list new Russian satellites in orbit—not even those satellites announced with a fanfare of publicity by the Russians. For example, the Soviets proudly announced to the world that their Mars probe was launched Nov. 1, and a week ago reported that it had traveled more than 4 million miles out into space. Our official listing of spacecraft is silent about that launch. The same silence covers the Soviet launchings of Cosmos 9 on Sept. 27, Cosmos 10 on Oct. 17, and Cosmos 11 on Oct. 20. I am not revealing secrets by telling you these facts, even if they are deleted from our own official listing of satellites. How can such facts be considered secrets when the Russians themselves have announced these launchings? Apparently we are applying a system of selective secrecy to tracking information we gather about Russian satellites. Our government releases information about Russian satellites when it fits national policy but the lid is closed at all other times, and the Ameri-

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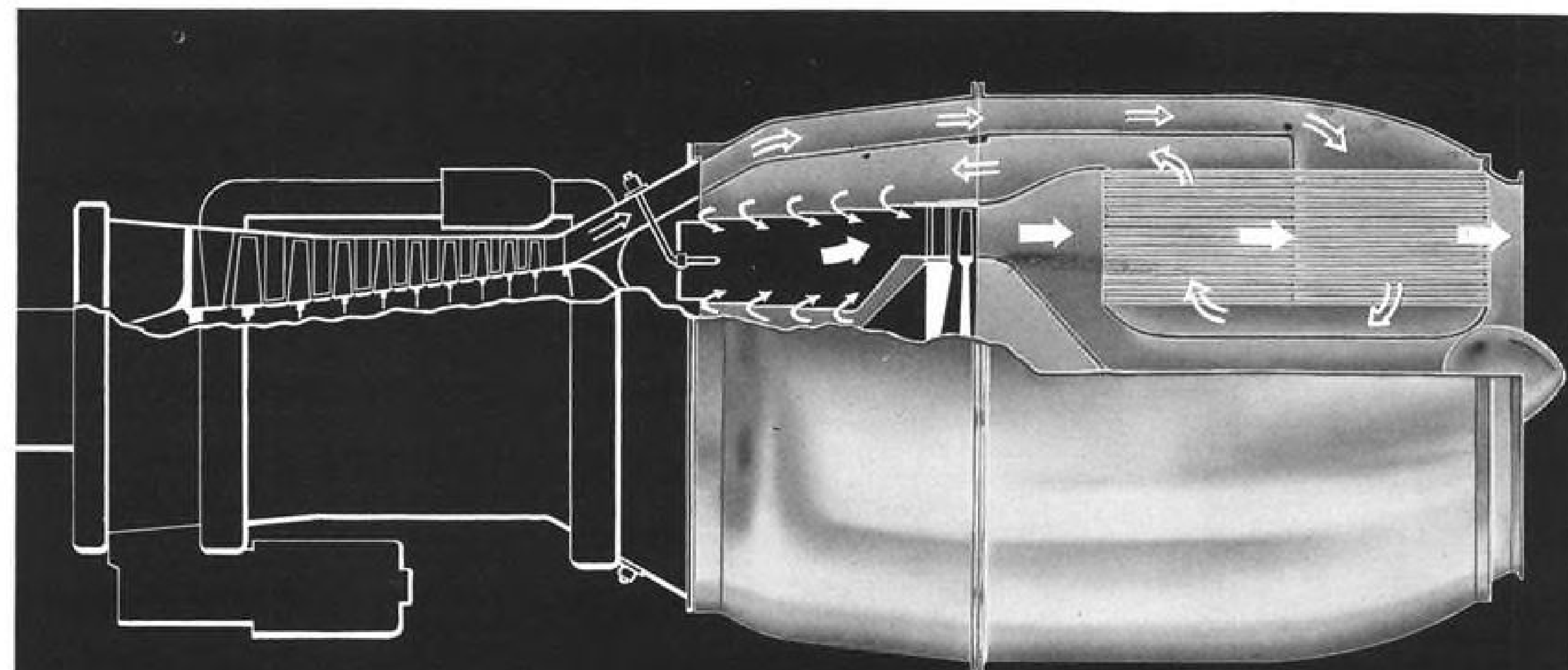
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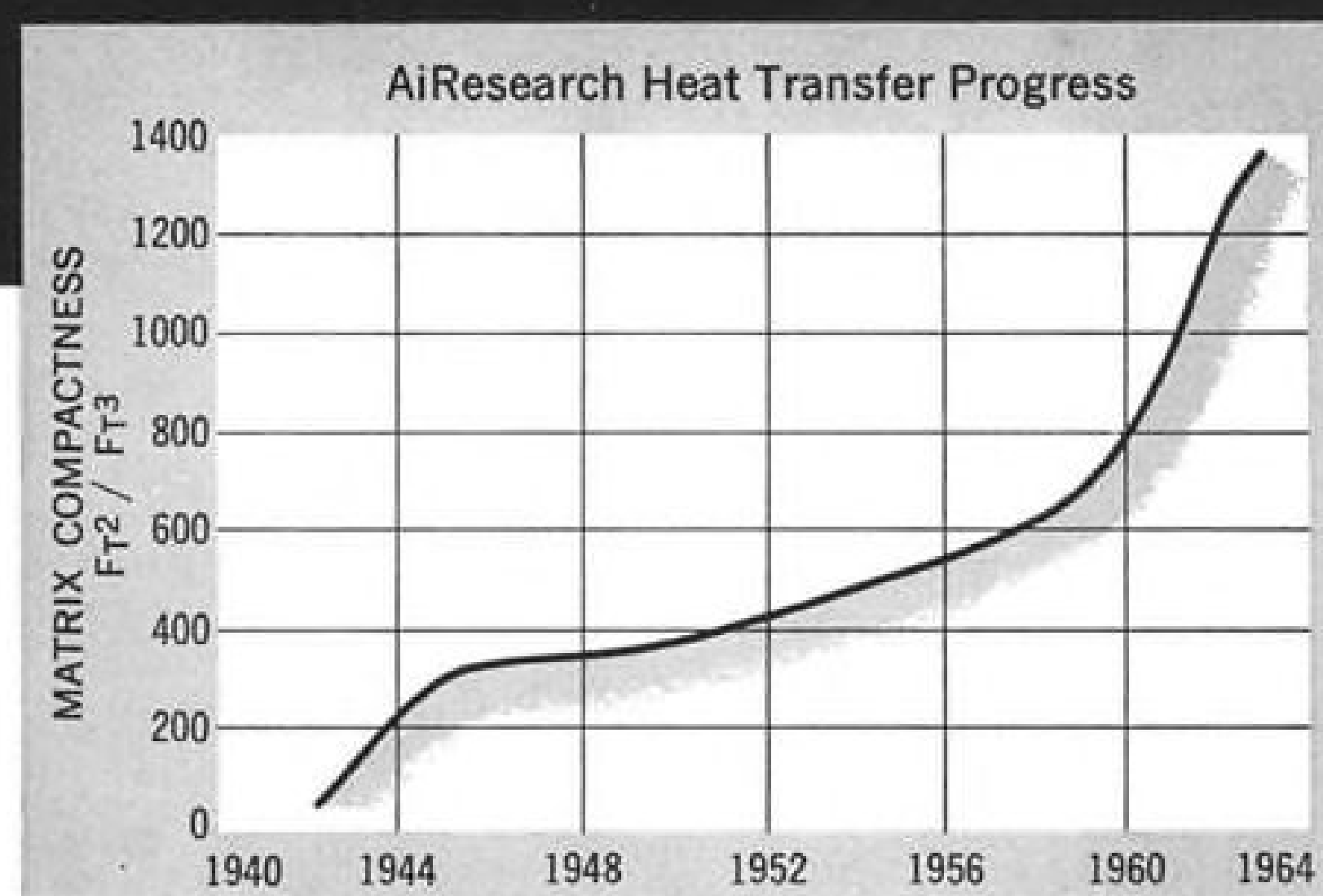
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can public has no reliable U.S. source of information to match against Russian claims of space achievements. Certainly, we are not fooling the Russians—they know where their satellites are—we are only confusing the American people.

This is the kind of news management that causes grave concern because it is such an easy step—if that step is taken in secret—from managing news about Russian successes and failures to managing the news about our own space achievements. If we can cover up Russian successes, some scientists point out, we can certainly cover up our own failures.

And this is the kind of news management that leads to a dangerous delusion of the American people.

Cuban Crisis

The growing management of government news as a weapon of national policy was brought to a head by the Cuban crisis. During this period every important government action which could affect our cold war posture was controlled carefully to make sure the actions supported national policy decisions made by the President and his top advisers—and this includes news generated by government actions. I'm not concerned about the management of insignificant government news. It is not important that the President returned from his campaign tour because of the Cuba crisis while he told the public—and even his own press secretary—that he was returning merely because of a head cold. I'm not worried because the society reporters for Washington news-

papers were not permitted backstage when the President and the First Lady talked to members of the Bolshoi Ballet, even though they were scooped by a Tass representative who was backstage as an official of the Russian government. I'm not even concerned about the 12-point White House memorandum listing sensitive stories which the press was asked to withhold during the Cuba crisis. The areas listed in the memorandum were, after all, nothing new. Each one came from well-known Defense Dept. directives adopted long ago to spell out the controls on military-security information in a 1953 Presidential Executive Order. I'm not much bothered by the 24-hr. delay in making public the pictures of the Cuban missile sites, nor by the lack of information on exactly which Russian ships would be stopped by the U.S. Navy maintaining the quarantine line.

I am, however, gravely concerned about the methods used to establish these controls on information, and I feel an even deeper concern about the effect of these actions upon the system for gathering and transmitting information about the government—the system which we call a "free press," a system which is basic to our democratic society.

The 12-point White House memorandum was nothing new, but the unplanned method by which it was issued certainly is a new approach to censorship of government news. A few representatives of the wire services and the broadcasting networks were called together hurriedly to discuss the Cuba crisis with the President and his top

information advisers. They were given a very brief time to consider whether a memorandum listing sensitive information which the Defense Dept. was required to keep secret would also be accepted by the press as a guideline for the type of information that should not be made public if picked up by an enterprising reporter. Their agreement to pass the memorandum on to the rest of the press and the general acceptance of it are proof of the responsibility which the press exercises in the United States. But I do not believe a few press representatives should be put in the difficult position of accepting or rejecting guidelines for self-censorship after one hurried conference. Twenty months ago the President first called for the press to exercise "restraint." Twenty months ago the press rejected the suggestion for do-it-yourself censorship and asked for clear guidelines from the government.

There was plenty of time to develop, for wide public discussion, the guidelines for the exercise of "restraint" requested by the President.

Announcement Lag

The 24-hr. delay between the announcement that U.S. reconnaissance photos proved the existence of the Cuban missile sites and the decision to release the pictures is not, in itself, objectionable. Under the Constitution, the President is the Commander-in-Chief of our armed forces and directs the nation's foreign policy. He exercised his Constitutional authority in deciding which Russian ships would be

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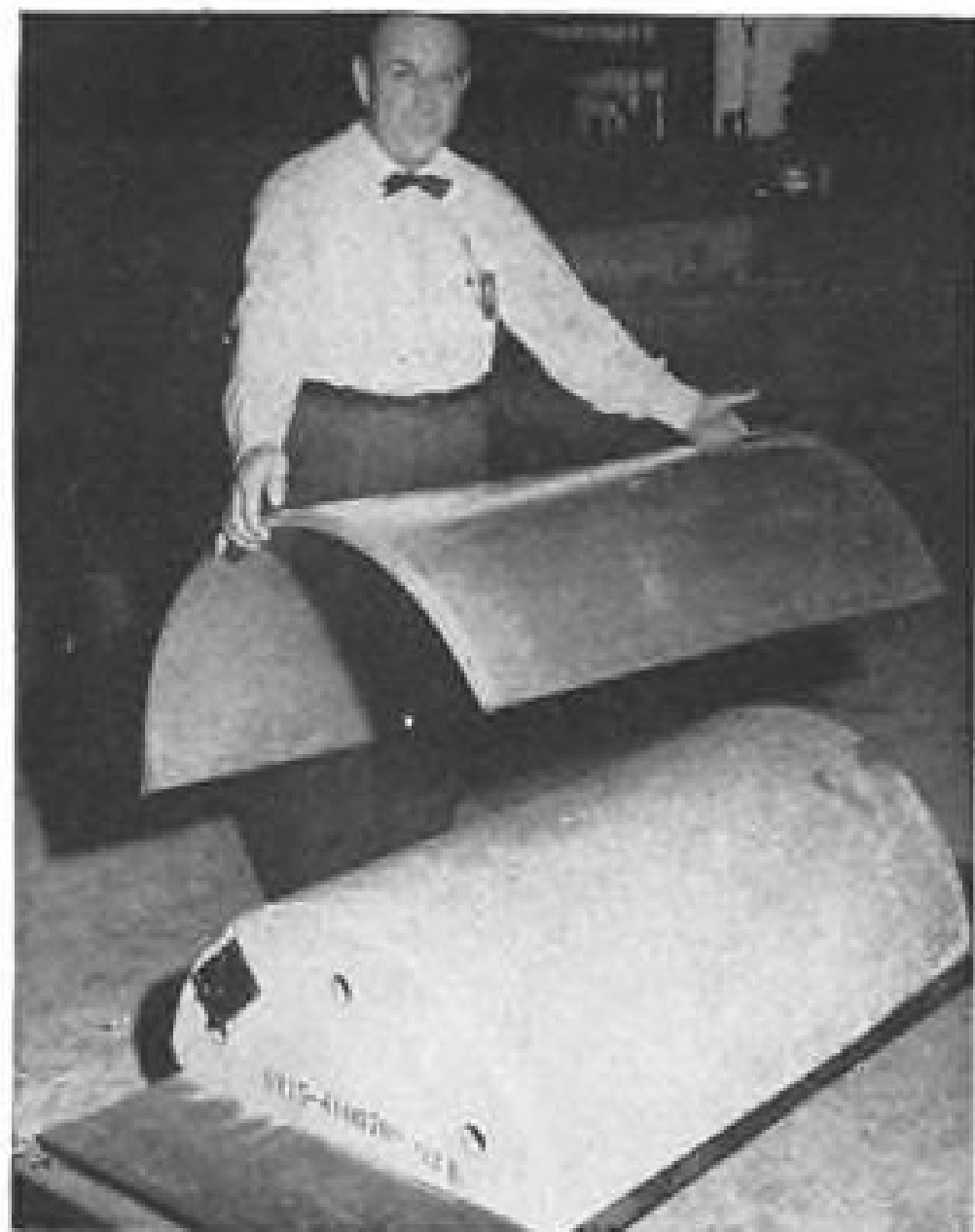
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Crusader Air Duct

Engine air duct of Chance Vought F-8C (formerly F8U-2) Crusader Navy fighter is shown after being stretch-formed on die at bottom of photo. Skin is .050 semi-finished aluminum. Concrete block was mounted on half-inch firm rubber pad to equalize pressure on the block during the forming process.

stopped in the quarantine, and he decided when the various government actions would be announced to the public. The authority to withhold such information appears to be clear; the disturbing factor is the indication that the individual withholdings are based increasingly on military intelligence considerations at the expense of the desperate need to keep the American people informed about what is happening. It is well and good to assert that the government must act and speak to the Russians with one voice, and at the proper time. But it is critically important that the American people also be told the facts so that the government does not find itself in a deep crisis with an uninformed public incapable of offering the necessary support and understanding.

These are the horns of the dilemma on which we find ourselves. We have in the past few weeks experienced a degree of government news management which is unique in peacetime. News generated by government actions admittedly was used as part of our cold war weaponry. And the weapons were successful. Seldom has our nation achieved a victory in international negotiations comparable to the victory in the Cuba crisis. Speaking and acting as the nation's one voice, President Kennedy prevented the cold war from becoming a nuclear holocaust. As a result of his position, there is every hope that the cold war combatants will be brought closer to a solution of their differences.

The President has the Constitutional duty to do what he believes necessary to carry out national policy. If it is necessary for the President to direct his public information appointees to manage the news generated by government actions, it appears that he has the power to do so. But the Congress, the press and the American public have the responsibility to examine carefully the exercise of that power. Some important steps most certainly can be taken to prevent unjustifiable management of the

news about day-to-day government operations and to prepare for the information problems which will arise in any future crisis. The first step is a broad public discussion of the situation, and the press must lead that discussion. A number of news organizations already have made plans to meet with government officials and continue the discussions which were generated by the information controls imposed during the Cuba crisis.

These discussions must include careful consideration of the news management techniques developed prior to the Cuba crisis—the selective secrecy which is hiding military space activities, the news management apparent in the nuclear tests in Nevada and the Pacific and all of the other developments which have received too little public consideration.

The discussions also must look to the future, to the question of what sort of censorship is planned in the event of another crisis short of war and the question of what information controls are planned should there be an all-out conflict. I hope careful consideration of the problem will prevent a repetition of the absurd State and Defense Dept. directives requiring employees to report every contact by a reporter. President Kennedy has directed a change in the State Dept. directive and he has promised to withdraw the Defense Dept. directive if it restricts the flow of essential news from the Pentagon. I believe it does restrict the flow of news, for a directive to report all press contacts is nothing more than an attempt to channel all information through the Pentagon publicity office.

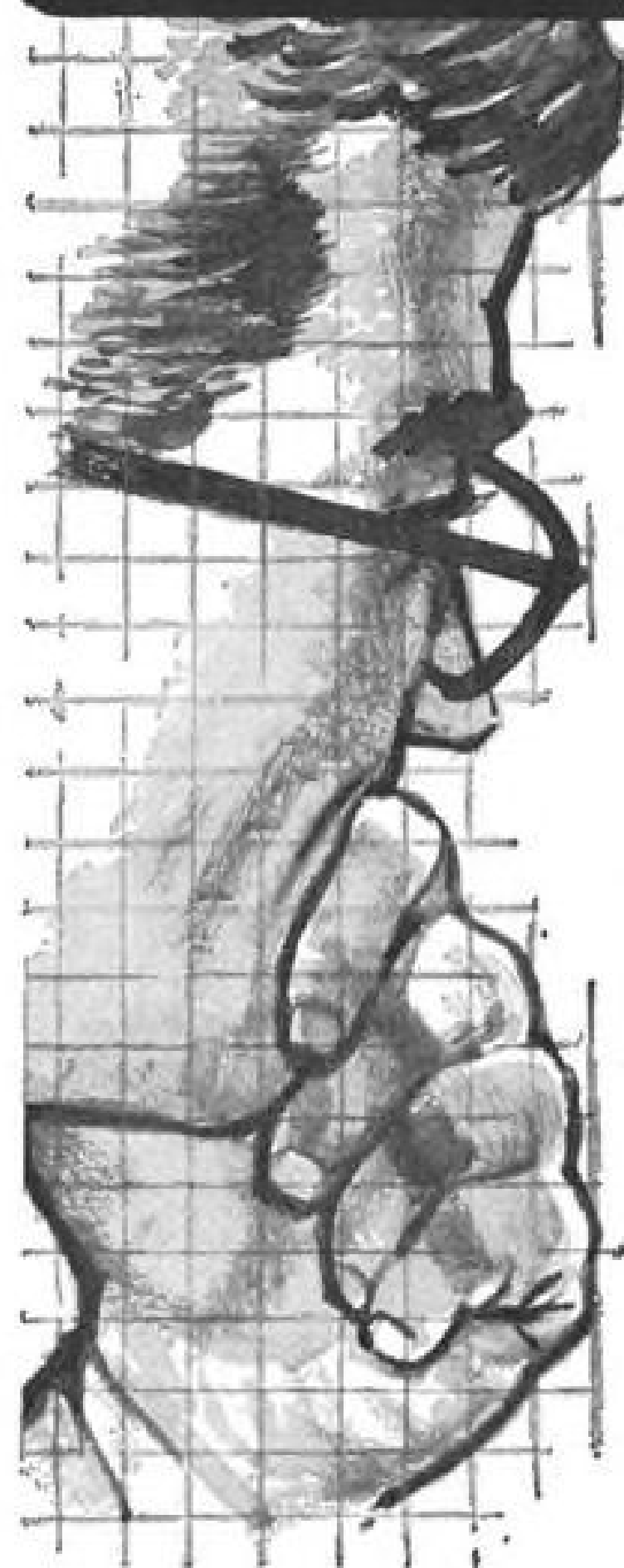
We also must work out a system to replace the spur-of-the-moment guidelines on sensitive news such as the 12-point memorandum which a group of news officials hurriedly accepted. We must not wait until another crisis forces the government to set up a censorship system with little or no press cooperation and with no advance public knowledge. We have just gone through a disturbing period of unplanned and unprecedented government news management. Like it or not, we know now that some similar action will be taken the next time the cold war threatens to heat up. We had better get busy right now to make sure the people's need to know the facts of government is fulfilled. We must either protect the flow of government information necessary to a democratic society or prepare to see our system of government dangerously weakened.

Aeronutronic Builds Future Command Post

Ford Motor Co.'s Aeronutronic Division will train Army personnel in the operation and maintenance of "Operations Central"—the battlefield command post of the future—which Aeronutronic is developing at its Newport Beach, Calif., Engineering and Research Center.

Command post is part of a multi-million dollar Army-sponsored program to develop an electronic command and control system to assist field commanders in making battlefield decisions.

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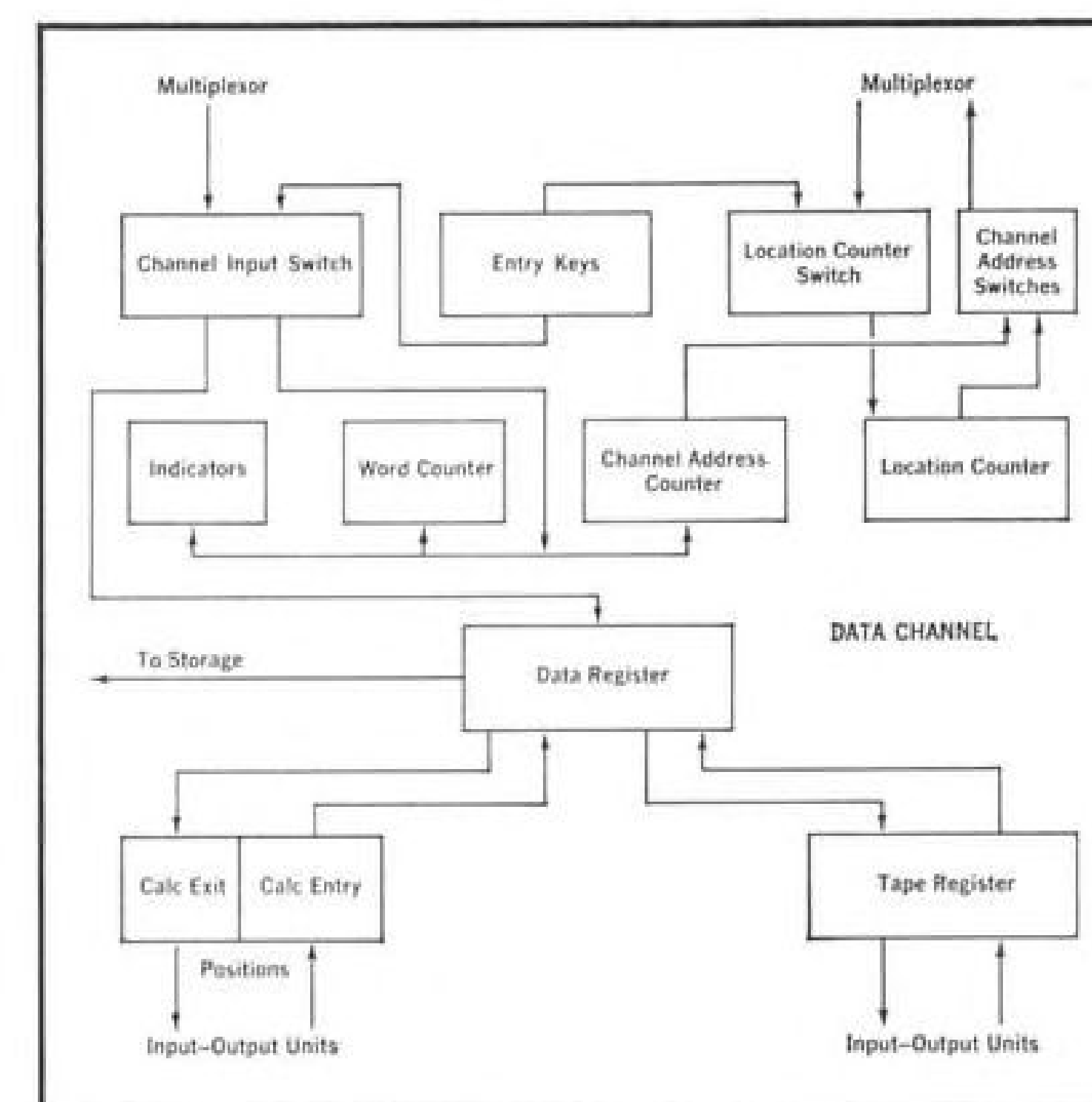
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OTAPE	TOTAL	1-FAIL	2-FAIL	3-FAIL	4-FAIL		
INP	81	0	0	0	0		
LIB	0	0	0	0	0		
COL	81	0	0	0	0		
NUMBER OF ON-LINE INPUT RECORDS							
NUMBER OF OFF-LINE PRINT RECORDS							
NUMBER OF SYMBOLS: DEF 4*DEFOP 0*UNDEF 0							



This type of written input-output program is relatively time-consuming and costly to prepare, particularly when input-output routines are used repeatedly.

In an effort to increase efficiency, more and more instructions have been built into computers in the form of circuitry. This means fewer written programs are necessary. However, built-in computer instructions that facilitate the solution of a particular type of problem may limit the computer's capacity to handle a variety of problems. Because of this, IBM is studying new ways of organizing data processing systems. The goal is to improve the speed and proficiency of specialized problem solving without sacrificing the flexibility of general-purpose machines.

Computer architects at IBM are attempting to achieve the most efficient relationship of built-in instructions and programming systems to the range of problems to be solved. They are transferring many input-output and programming operations to built-in circuitry. One example is the IBM 7090 data channel shown above. In addition, they are developing common languages which make it possible to use the same program on different machines. At the same time, they are working to increase over-all speed by

Input of routine data with a unit such as this IBM 7090 data channel reduces program writing, speeds up processing, and cuts the cost per answer.

developing time-sharing and concurrency techniques that make greater use of the entire system. For example, IBM programmers have developed a method by which a large computer can handle a number of problems at once, thus reducing the cost per answer. This involves a supervisory program that monitors the execution of the multiple tasks assigned to the central processor. In addition to these multiple problem-solving techniques, an experimental system permits the computer to handle several different programs simultaneously. From developments such as these will come the advanced architectural techniques necessary for a new generation of computers.

If you have been searching for an opportunity to make important contributions in machine organization, optics, solid-state physics, or any of the other fields in which IBM scientists and engineers are finding answers to basic questions, please contact us. IBM is an Equal Opportunity Employer. Write to: Manager of Professional Employment, IBM Corporation, Dept. 524Z2, 590 Madison Ave., N. Y. 22, N. Y.

CRUCIAL SYSTEMS CHALLENGES OF THE '60's



Combating Information Saturation

Today's decisions at the highest level of military command require a range, precision and speed of communication and information processing beyond virtually anything conceivable in the past. Further, optimization of the electronic portion of a command control system cannot be considered independently of the capabilities of the ultimate, human decision-maker in the chair of command.

A good case in point is the SAC global command and control system 465-L, for which ITT International Electric Corporation carries systems development, design and management responsibilities. In order to further multiply the effectiveness of the military commander, faced with the crucial task of assimilating vast quantities of information projected on the

screens before him, ITT engineers and scientists recently added a remarkable new capability to 465-L: data presentation in color.

Operating at speeds that appeared incredible only a short time ago, the system enables computer outputs to be converted to alpha-numeric form...photographed...developed and projected on control center screens in as many as 7 colors in a matter of seconds.

This new capability opens up a whole new field of data format techniques to be explored. An obvious and immediate value is the enhancement of human perception through color changes denoting differing degrees of situation criticality.

OPPORTUNITIES IN MANY COMMAND AND CONTROL AREAS NOW OPEN TO SYSTEMS ENGINEERS AND SENIOR PROGRAMMERS

Many of these positions are on 465-L. Other opportunities relate to large-scale commercial digital communication systems, oceanic systems, and satellite control. Your inquiry about any of the positions listed below will receive immediate attention.

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OPERATIONS ANALYSTS. To establish systems requirements in satellite control, air traffic control, ASW and command/control. Also, assignments in man/machine communications and information retrieval.

SYSTEMS IMPLEMENTATION ENGINEERS. Electronic engineers to develop tests for stressing and evaluating communication-display-computer systems. Recommend improvement and refinements. Also, field positions for installation and integration of digital command/control systems.

INFORMATION SYSTEMS ENGINEERS. For design of command/control and advanced communications systems. Experience in traffic, antenna and propagation theory, and mathematics as applied to communications and space technology.

DIGITAL SYSTEMS ENGINEERS. Engineers with management ability to direct sub-systems engineering effort on a global command/control system. Experience is desired in message traffic control, data processing systems, data display and multi-sequencing techniques.

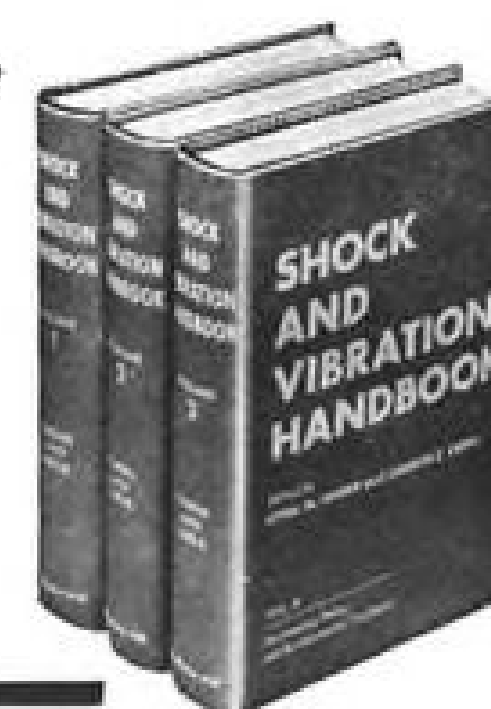
Write fully in strict confidence to Mr. E. A. Smith, Manager of Employment, Box 19-C, ITT-International Electric Corporation, Route 17 and Garden State Parkway, Paramus, New Jersey.
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WHO'S WHERE

(Continued from page 23)

Honors and Elections

Sir Geoffrey de Havilland, president of the de Havilland Companies, has been appointed a member of England's Order of Merit.

Frederick Emmons Terman, vice president and provost of Stanford University, has been named recipient of the Institute of Radio Engineers' Founders Award (given on special occasions only) for his "distinguished leadership... and contributions to scientific research and education." Named recipients of the Medal of Honor (the highest annual technical award in the field of electronics): John Hayes Hammond, Jr., president of Hammond Research Corp., for his "pioneering contributions to circuit theory and practice to the radio control of missiles and to basic communications methods"; George Clark Southworth, consultant, for his "pioneering contributions to microwave radio physics, to radio astronomy and to waveguide transmission."

H. Webster Crum, vice president of the Aircraft Distributors and Manufacturers Assn., has been elected chairman of the General Aviation Council for 1963. Mr. Crum is vice president-sales and service, Lycoming Division of the Avco Corp.

Dr. Robert J. Jeffries, president of Data-Control Systems, Inc., has been elected president of FIER (Foundation for Instrumentation Education & Research) for 1963.

Changes

Harold T. Hokanson, manager of the new Defense Resources Application Operation of General Electric Co.'s Defense Programs Operation, Washington, D.C.

Vernon L. Smith, chief engineer, Radiation at Stanford, Palo Alto, Calif., a subsidiary of Radiation, Inc., and Gene E. Tallmadge, assistant chief engineer.

Richard G. Weber, chief-command and technology, Minneapolis-Honeywell's new Military and Space Sciences Department, Washington, D.C., and John E. Gray, chief-support systems technology.

Douglas Hembrough, director-international marketing, Librascope Division of General Precision, Inc., Glendale, Calif.

H. Kenneth Ishler, general manager, Transistor Division, Concord, N.H., of Sprague Electric Co.

Robert O. Gardner, director of engineering, Calibration Standards Corp., Alhambra, Calif., a subsidiary of Royal Industries, Inc.

William G. Purdy, general manager-Titan 3 program, Martin Co.'s Denver (Colo.) Division.

Glenn S. Summerfelt, general manager, Aerial Survey Division, Chicago Aerial Industries, Franklin Park, Ill.

John D. Stimson, manager, United Aero-Space Division of United ElectroDynamics, Inc., Pasadena, Calif.

Rodney D. Stewart, project manager of the RL-10 rocket engine program, National Aeronautics and Space Administration's Marshall Space Flight Center, Huntsville.

Lt. Cdr. Ralph E. Moyer (USN, ret.), assistant manager-missile engineering, Beech Aircraft Corp., Wichita, Kan.

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HEAT TRANSFER ENGINEER
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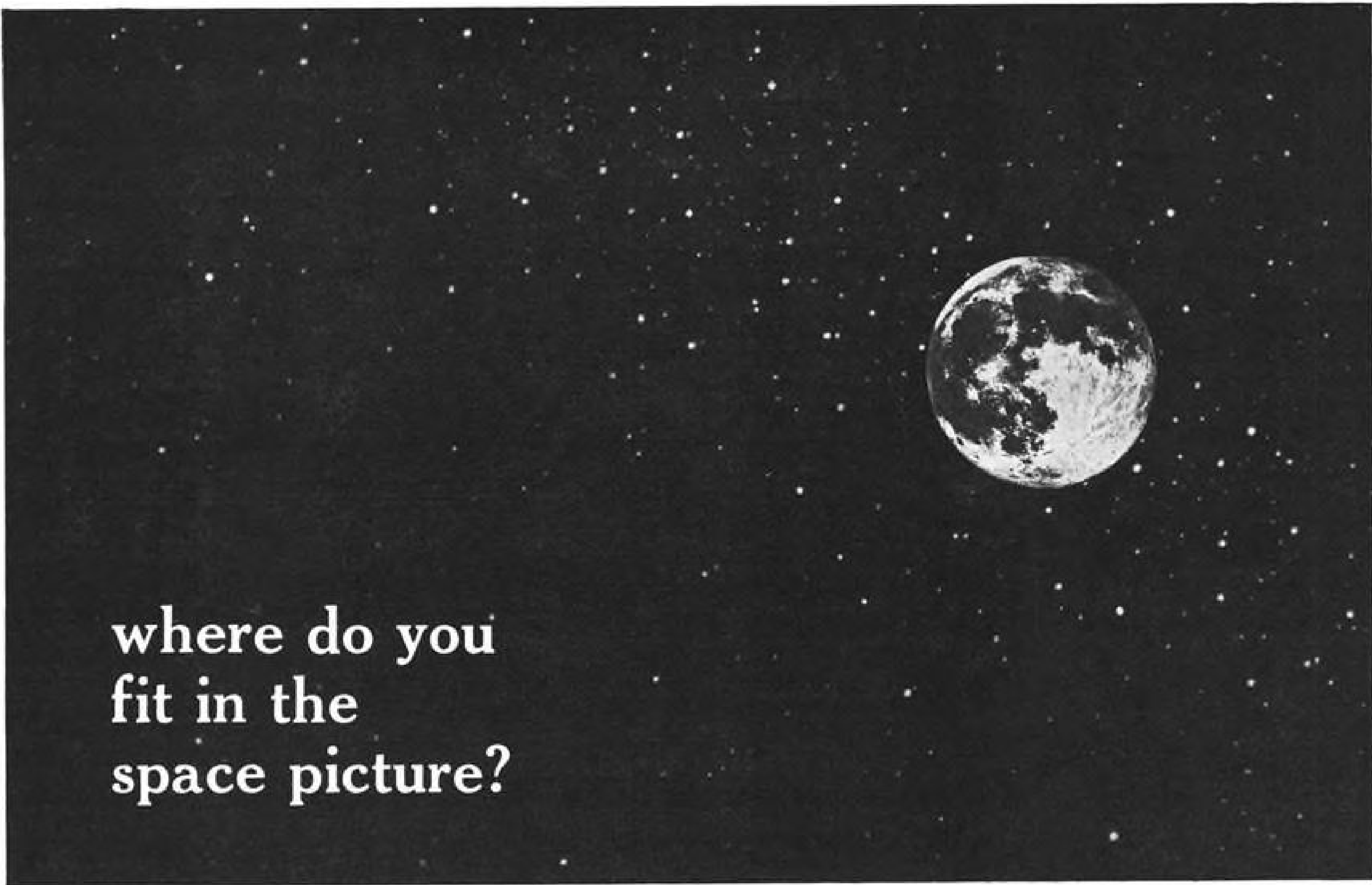
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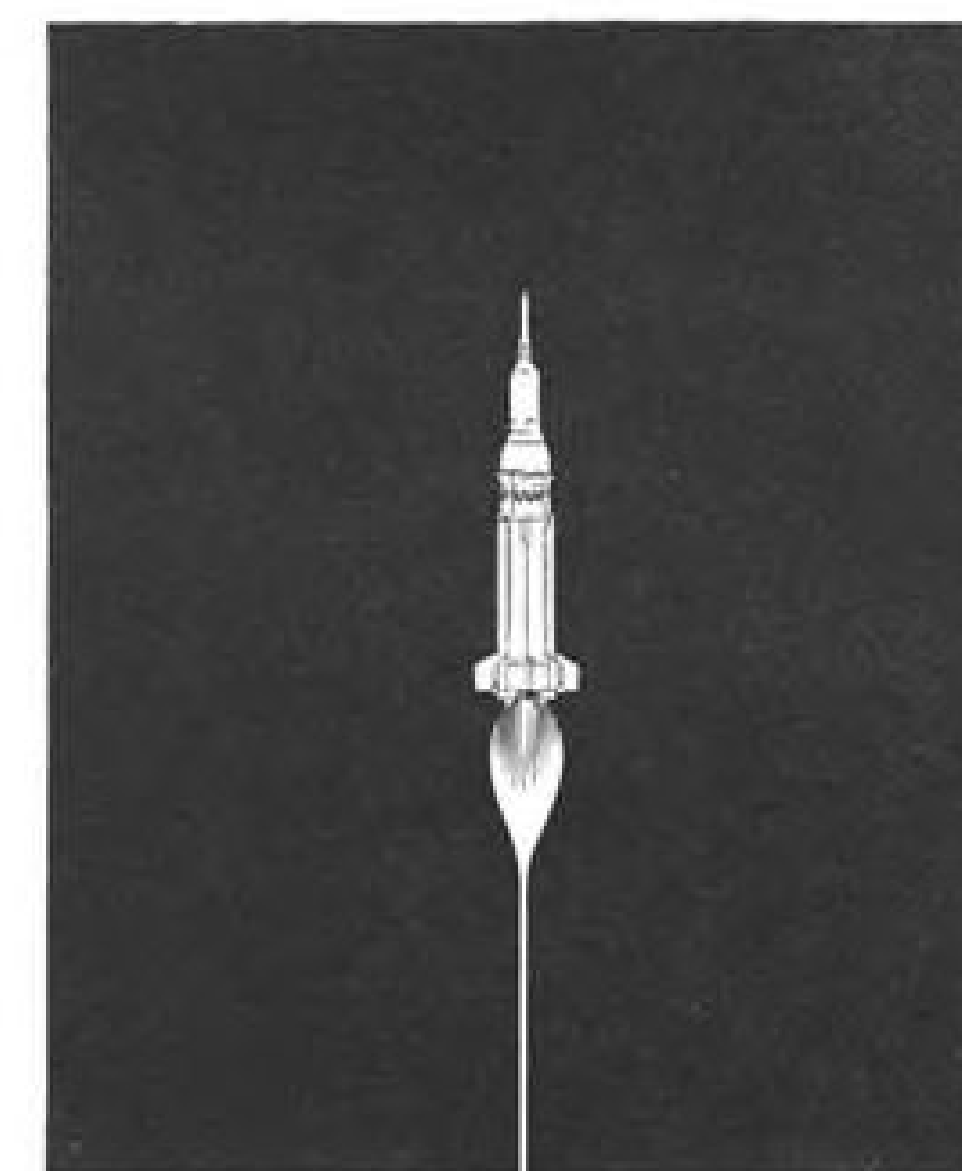
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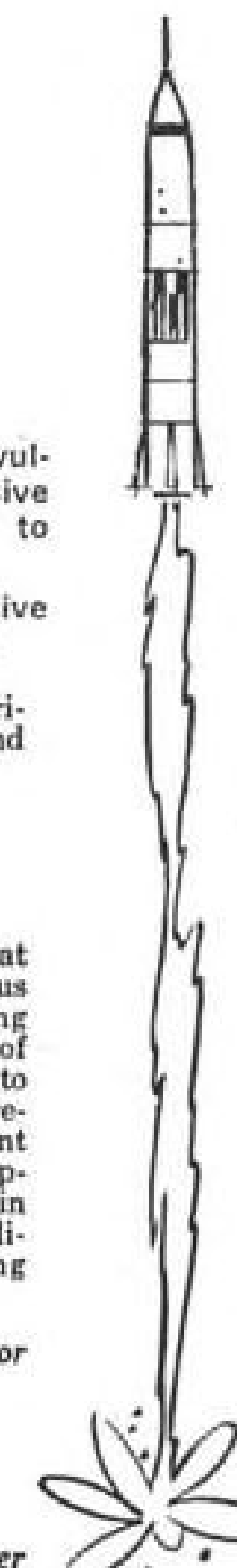
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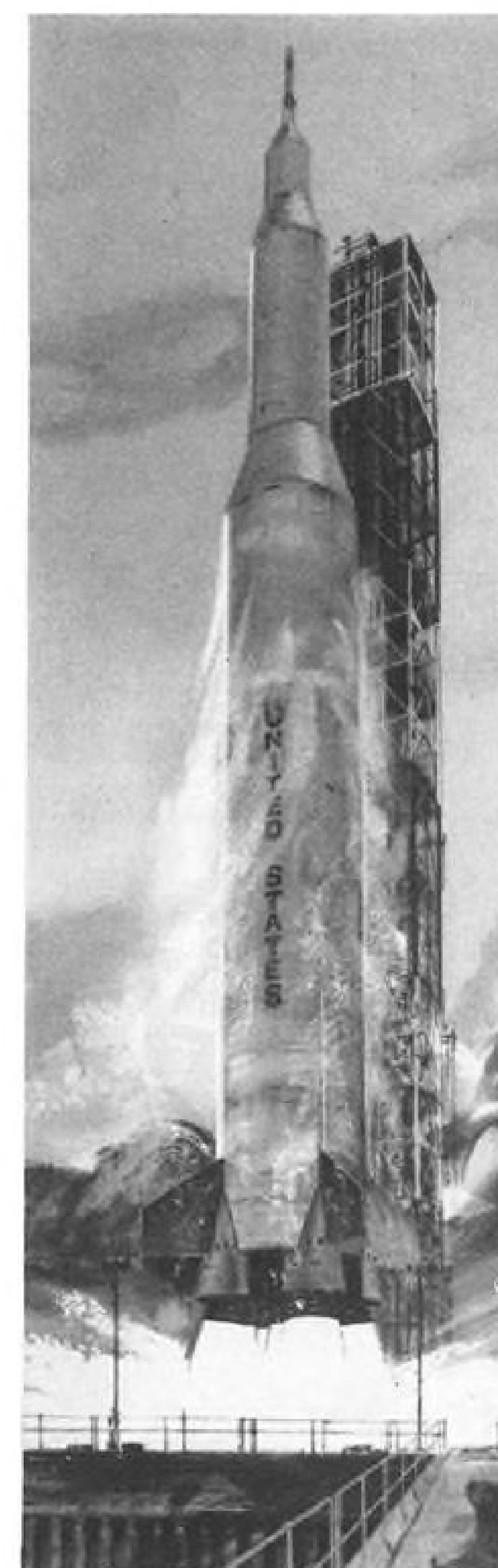
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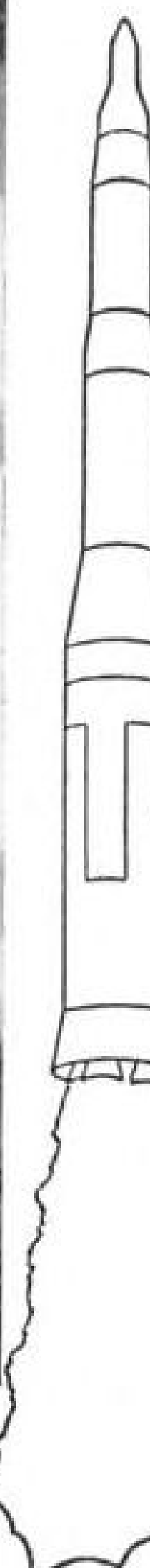
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Official Proposals

Bids: December 17, 1962

Notice of Sale of Federal Surplus Property

The State of Indiana acting by and through John T. Hatchett, Commissioner, Department of Administration, for and on behalf of Dale M. Brower, Director, Indiana State Agency for Federal Surplus Property, will receive sealed proposals or bids on the sale of the following line items, by line item:

Line Item	Helicopter Model	Engine Serial #	Approx. Weight
1	H5G	48-531 P-225594	4740 lb.
2	H5G	48-553 P-227144	4740 lb.
3	H5H	49-2008 P-24815	4740 lb.

Located at Shamrock Engineering, Inc., 865 South Lake Street, Gary, Indiana.

These craft are partly disassembled and probably complete; however completeness is not warranted.

All property is offered for sale "as is, where is" basis without any recourse against seller.

Sealed proposals or bids, shall be received at the office of Dale M. Brower, Indiana State Agency for Federal Surplus Property, Building 12117, Camp Atterbury, Edinburg, Indiana, until 2:00 P.M. legal time as prescribed by the Acts of the Indiana Legislature in Chapter 172, year of 1959, the 17th day of December, 1962, at which time and place all bids will be publicly opened and read aloud. Any bids received after designated time, for any reason will be returned.

All bids will be forwarded to Mr. W. D. Musser, Regional Property Coordinator, Chicago, Illinois, HEW Office, for approval, prior to award. The State reserves the right to reject any and all bids. Copies of sale invitation may be obtained by writing or phoning Dale M. Brower, Building 12117, Camp Atterbury, Edinburg, Indiana, phone Edinburg 526-5525, giving the redispal case # R-5 Ind. 108 and your complete address.

All property being sold can be inspected between the hours of 9:00 A.M. and 4:30 P.M., on December 5th and 12th, 1962, by contacting Dale M. Brower, or his agent at the Shamrock Engineering Co., 865 South Lake Street, Gary, Indiana. Said property will be sold for cash to the highest responsible bidder or bidders acceptable to the Commissioner of the Department of Administration and approved by W. D. Musser, Regional Property Coordinator, HEW Office, Chicago, Illinois.

A deposit of 10% of the total amount bid, in the form of postal or certified check, or such other form or security as may be acceptable to the contracting officer, made payable to the State of Indiana, must accompany the bid. Payment may be made by cash, certified check or cashier's check. The successful bidder or bidders shall remove the property purchased within twenty (20) working days after being notified that he or they have been the successful bidder or bidders. If said property is not removed within twenty (20) working days after being notified that he or they have been the successful bidder or bidders due to any cause, the State of Indiana will retain the amount deposited as liquidated damages. A

non-collusion affidavit and contractors bid form will be furnished by the owner. All bidders shall present at the making of a bid a workmen's compensation certificate of insurance, Form 19 or 105. Also, furnish a certificate of insurance covering manufacturer's or contractors liability in the sum of five thousand (\$5,000.00) dollars, for each person and for each and or any accident involving more than one person.

CONSIDERATION OF BIDS: The State of Indiana reserves the right to reject any or all bids, to withdraw the property or any item thereof from sale, to waive any technical defects in bids, and to accept any one item or group of items in the bid, as may be in the best interest of the Government. Unless otherwise specified, bids must be submitted on the basis of the unit specified for the lot in the invitation, and bids may be submitted on any or all items. In case of error in the extension of prices in the bid, the unit prices in the bid, the unit prices will govern.

OFFICIALS NOT TO BENEFIT: No member of or Delegate of Congress or Resident Commissioner shall be admitted to any share or part of this contract or to any benefit that may arise therefrom, unless it be made with a corporation for its general benefit.

BID GUARANTEE AND LIQUIDATION DAMAGES: The bidder agrees that (1) the bid will not be withdrawn within the time specified for acceptance after the opening of bids, will during the time remain firm and irrevocable, and that (2) the bidder will pay to the State of Indiana the purchase price of the property in accordance with the bid if accepted. If a bid deposit is required, the bid must be accompanied by said deposit. If after award the Purchaser fails to pay the balance of the purchase price, fails to remove the material, or otherwise fails to perform any of its obligations, he will thereby lose all rights, title, and interest in the material hereunder, and the State of Indiana may, at its election, retain the material and may retain the amount paid by; the purchaser, or collect, as liquidated damages, a sum equal to 20% (20 percent) of the purchase price plus any accrued charges hereunder. The balance, if any, shall be remitted to the purchaser.

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John T. Hatchett, Commissioner
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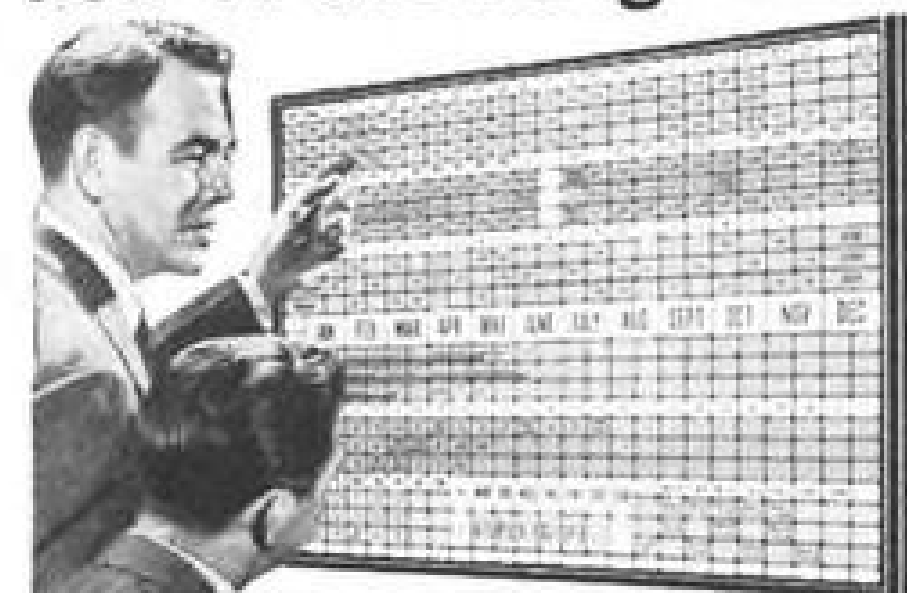
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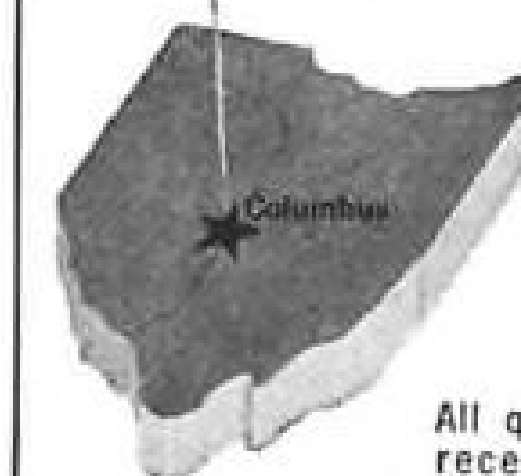
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LETTERS

Vietnamese Markings

Your Nov. 12 edition of *Aviation Week* has an excellent pictorial coverage of Vietnamese training for anti-guerrilla warfare, however, your captions are a little misleading. For example, the T-28s on p. 92 do not have USAF markings. They are, in fact, marked with Vietnamese insignia. The markings are quite similar, as evidenced by the enclosed page; a black and white photograph makes it even more difficult to discern.

The AD-6 also has Vietnamese markings. The bird-like marking on the engine cowling indicates fighter. Both the T-28 and the AD-6 also have the Vietnamese fin flash which is alternating yellow and red stripe, the outside yellow stripe being twice the width of the remaining stripes.

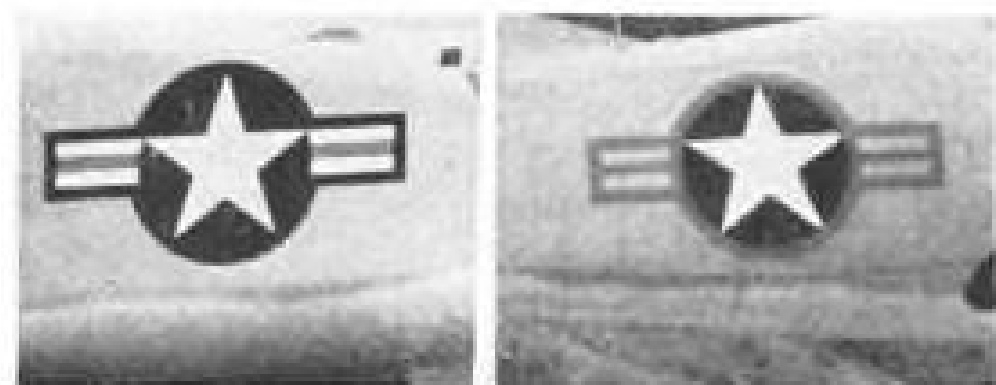
The C-123 aircraft appears to have the standard USAF markings.

Another interesting point concerning the T-28s is that they are ex-U. S. Navy T-28C aircraft. This is evidenced by the Navy Bureau numbers on the tail and the aft lower fuselage configuration. The T-28C was a carrier-suitable aircraft and, as such, had a cutout for the hook and a tail bumper.

I hope that you do not consider my comments in the "nitpicking" class for they are offered solely as constructive comments.

HARRY GANN

American Aviation Historical Society
Buena Park, Calif.



United States aircraft insignia (left) consists of a white star and stripes on a blue field with a blue outline and a red center stripe. South Vietnamese insignia (right) is a white star on a blue field with a red outline and alternate red and yellow stripes. In this particular instance, the former U. S. insignia on the aircraft in question had simply been painted over with the new colors.—Ed.

Declining Fare Choice

Your editorial entitled "First Class Folly" (AW Oct. 15, p. 21) was excellent and deserves a careful follow through by your reporting staff. Obviously, the great majority of airline passengers feel that "first-class" flights are not worth the extra expense.

A recent personal experience shows that there is a strong possibility that passengers are facing a gradually declining choice in their fare, simply because tourist class flights are being replaced by "first-class-only" flights.

Mr. Patterson of United Air Lines was quoted extensively in your editorial. Perhaps this gentleman can offer some good reasons for the cancellation of the United, 4:30 p.m., "tourist-class" DC-6 flight from Cleveland to Hartford, forcing the after-

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

noon passenger to fly on either of two "first-class only" DC-6s.

On this route, a limited choice still exists since a tourist jet leaves Cleveland at 7:30 in the morning. So it is not the fact that is disturbing but rather the trend. Unless strong and effective opposition is brought up, the time will come when passengers are forced to pay the exorbitant fares quoted in your editorial simply because no choice other than "first-class" exists.

ROBERT C. WILLIAMS
Manchester, Conn.

Space Censorship

The policy of withholding information in various activities by our government presents a kaleidoscopic confusion and pattern of contradiction that bespeaks a sad commentary on our times. In particular, I would like to point out a strange situation concerning the release of information on the space activities of both the USA and the USSR. The following facts speak for themselves.

1. Information on the launching of satellites from Vandenberg Air Force Base in California is classified, as has been clearly indicated in newspapers, the trade magazines . . . via radio and via TV.

2. During the week of Oct. 8 the Western Edition of the N. Y. Times contained an article discussing the procedure of "registering" with the United Nations Committee on Outer Space 66 U. S. launchings, including some 20 of the "secret" satellite launchings from VAFB. In this register were given apogee, perigee, nodal period, and orbit inclination of all the aforesaid satellites together with the names (?) of all these satellites. Nothing in the register is noted as being classified.

3. Mr. James Webb, Director of NASA, recently revealed to the public the fact that the U. S. has detected, since October of 1960, five failures and one "partial success" in Soviet attempts to reach Mars and Venus with interplanetary spacecraft. Among these were two attempts to place spacecraft on trajectories to Venus on Aug. 25 and on Sept. 1, of this year.

4. Following the procedure established during the IGY, the spacecraft of Aug. 25, having attained earth orbit, was called 1962 alpha-pi. The Sept. 1 launch is then 1962 alpha-tau; other launchings in the interim between Aug. 25 and Sept. 1 having been accounted for by 1962 alpha-rho and 1962 alpha-sigma (AVIATION WEEK was misinformed since it in a previous article has alpha-rho noted

as the Sept. 1 launching, when in fact Mariner 2 is alpha-rho). Alpha-sigma was a vehicle from VAFB.

5. The NASA satellite situation report of Oct. 10, Vol. 2, No. 16, deliberately ignores the Soviet Sept. 1 Venus probe attempt (the Aug. 25 launching is listed). Thus there is no listing in either the objects in orbit accounting or in the decayed objects (i.e., re-entered) lists.

The facts listed above certainly give one pause to wonder. Items 1 and 2 above are clearly inconsistent. Items 3, 4, and 5 are also at variance with each other.

This sort of censorship and contradiction may be in keeping with the likes of that Cuban aberration, Castro, but it is most unbecoming to the United States of America. The veil of secrecy shrouding the Soviet Sept. 1 launching makes one wonder if this attempt to reach Venus was really the failure it was stated to be. After the communication failure of their February, 1961, Venus probe, perhaps the Soviets are merely withholding an announcement of success until their Sept. 1 probe reaches Venus and communicates the data it has collected.

Finally, it should be noted that the lack of data on the Soviet's spacecraft dates from the time when the U. S. terminated information releases on its VAFB launchings.

SAUNDERS B. KRAMER
Sunnyvale, Calif.

Prime Answer

Continued congratulations to Litton Systems, Inc., for providing a sideline of diversified and intriguing problems.

The problem presented in your issue of Oct. 29 (p. 91), *Problematical Recreations* 142, caused some degree of head scratching and shouts of impossible, but eventually resulted in a solution which is simpler than the one given in your issue of Nov. 5 (p. 81). This answer is given below for the benefit of those who would like to perform a check without accomplishing the cumbersome task of finding the product of 1001 consecutive numbers.

The first number is:

$$N_1 = \left[\frac{1000}{P} n' \right] + 2$$

Which reads:

The first number is equal to the product of all prime numbers from 0 to 1,000 plus 2.

Thus the first number is obtained by finding the product of only 169 numbers. The number 5 can also be omitted for a still shorter solution.

The proof of the answer is very evident—any number, up to 1,000 which is added to the first number is a multiple of one of the factors of the first number.

The number 5 can be omitted because any number ending in a multiple of 5 is a non-prime number.

D. W. GAILEY
GE Missile and
Space Vehicle Dept.
Philadelphia, Pa.

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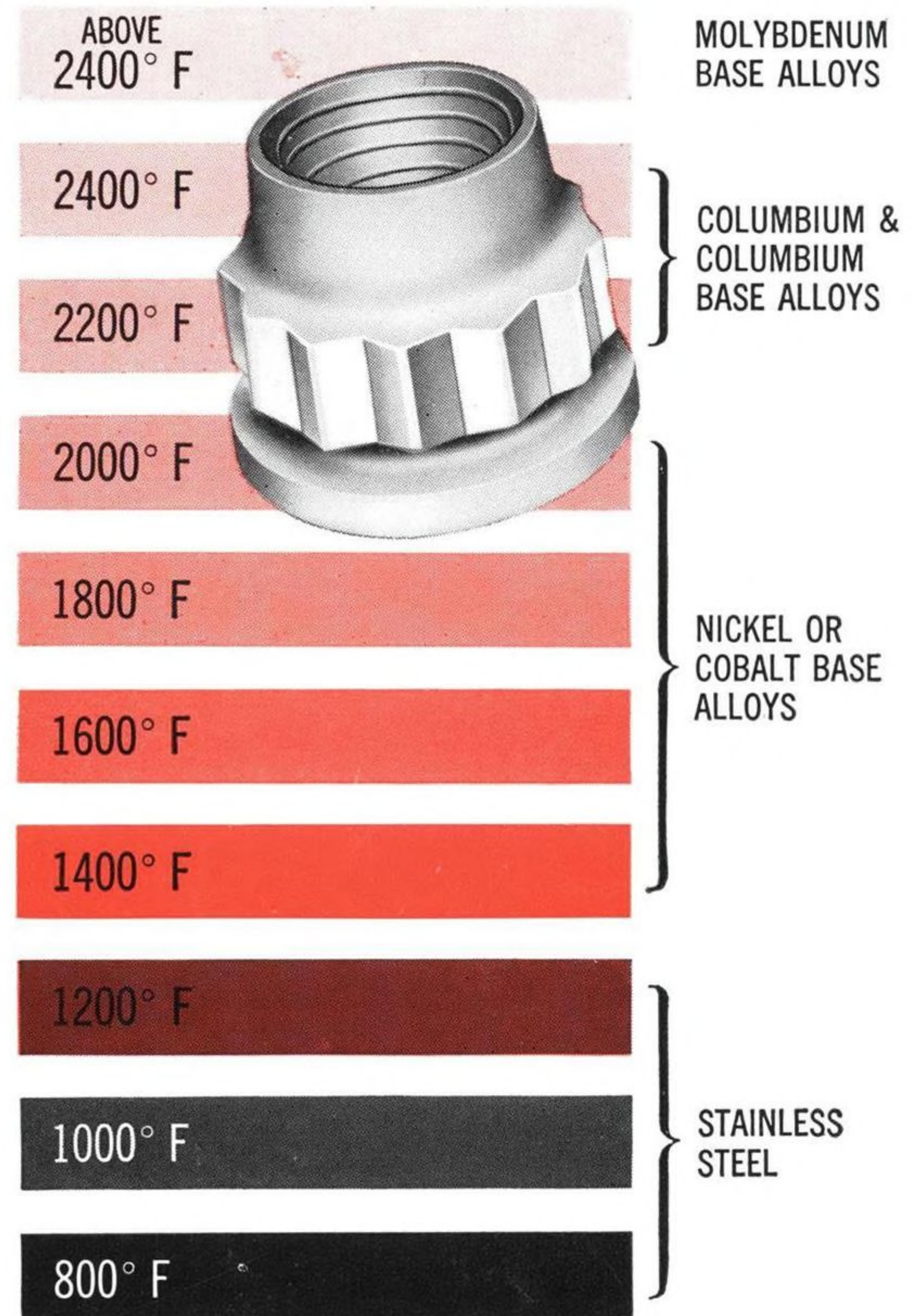
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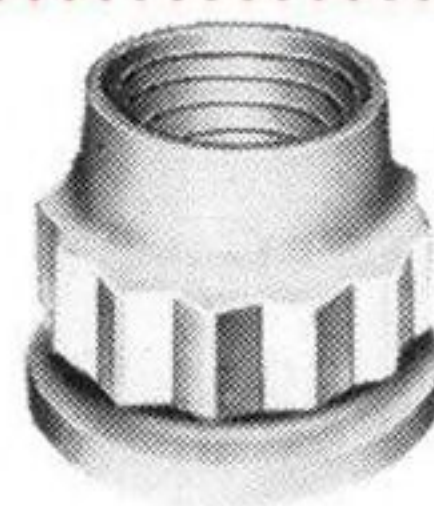
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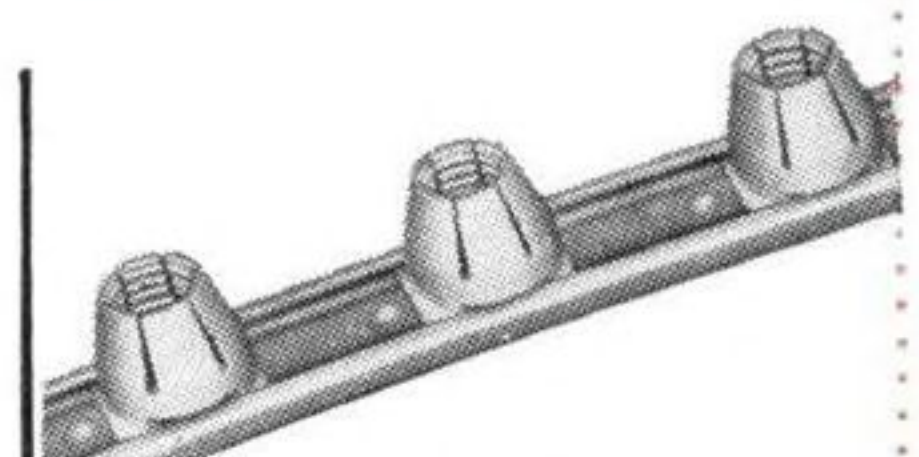


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