Aviation Week & Space Technology

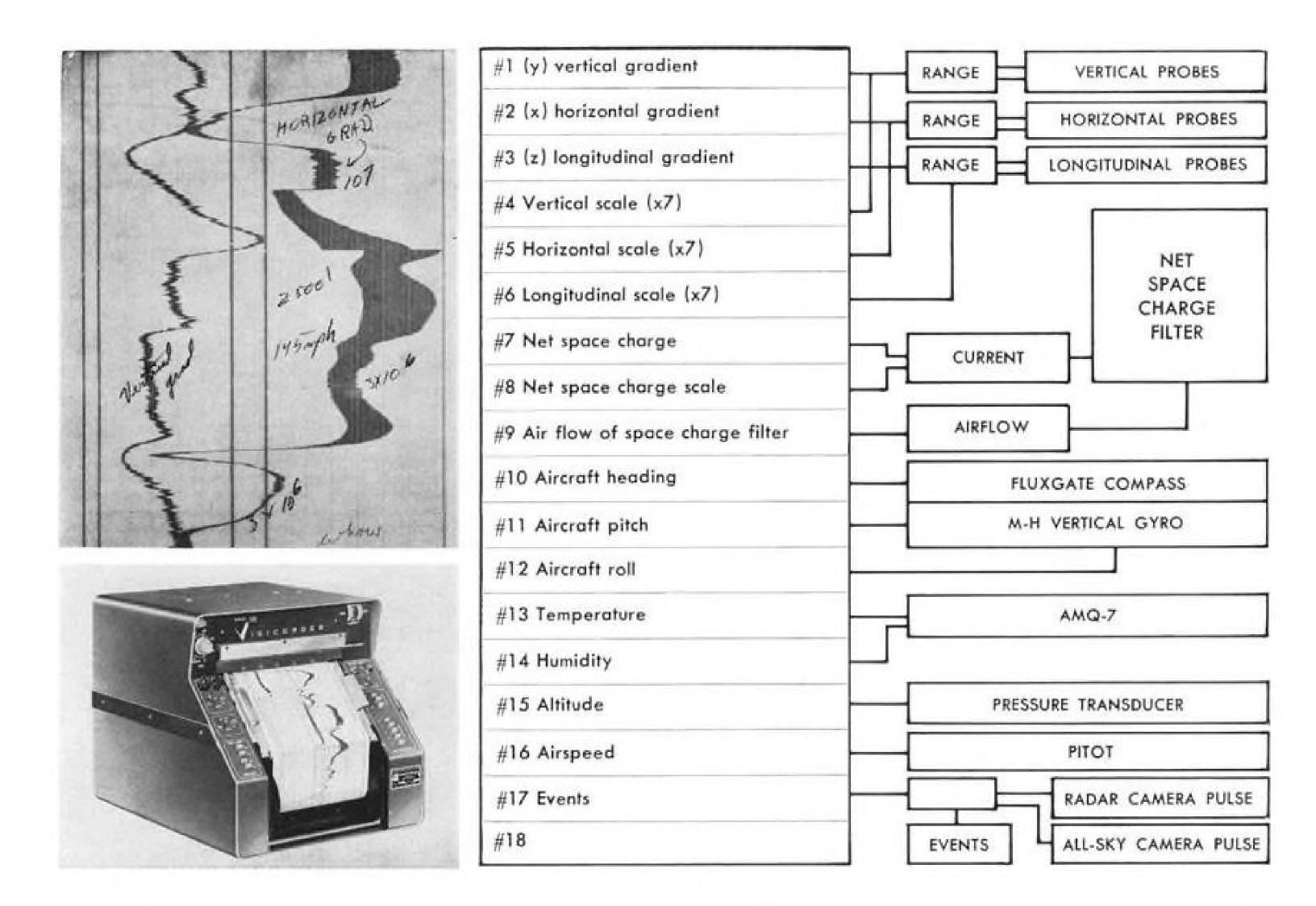
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A McGraw-Hill Publication

October 15, 1962

Space Vehicles
Advance Study
Of Atmosphere





Which comes first...the lightning or the rain?

The Visicorder Oscillograph directly records electrical charges in the atmosphere.

What effect do electrical charges on the atmosphere have on cloud formation? What causes cloud droplets to grow into raindrops? Why does one cloud produce rain while another does not?

These questions are being answered in part by a Model 1108 Honeywell Visicorder Oscillograph, shock mounted in a C45 Beechcraft, flown 15,000 feet over cloud formations above an electrically-charged airspace in Central Illinois.

The Illinois State Water Survey has scattered a network of 50 rain gages across about 400 square miles

downwind from 30 miles of small stainless steel wire stretched in a gridlike pattern 30 ft. above the ground. Seven power supplies energize the wire to about 20,000 volts with each supply having an output of 1 to 3 milliamperes.

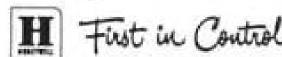
Timelapse sky cameras, radar, and other observatory equipment make records of electrical fields, wind speed and direction. A low-flying Piper traces the plume of electrical charge as it rises from the ground; the Visicorder at 15,000 feet measures the movement of the charge in the higher air, how and where it scatters or dissipates, and what effect it has on the growth of cloud droplets.

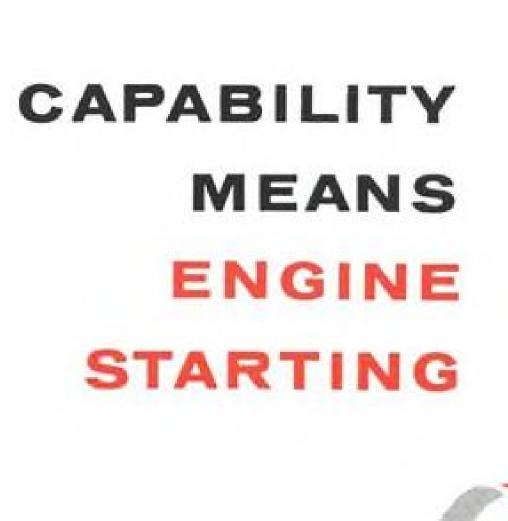
Maybe your research project is not as glamorous as these weather studies, but if it is at all complex, or requires high speeds or sensitivities, or if you need to record many parameters simultaneously—or directly —the amazingly versatile Visicorder can do your job.

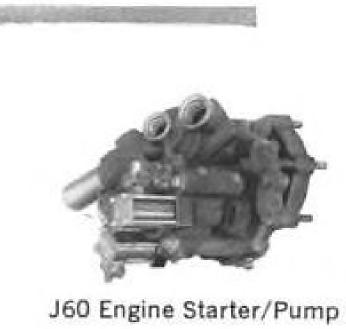
The schematic diagram of these cloud studies will give you an idea of the many capacities of the Visicorder.

For more details about the Model 1108 (24 channels) and other Honeywell Visicorders, write Minneapolis-Honeywell, Heiland Division, 4800 E. Dry Creek Road, Denver 10, Colorado. Our DDD phone number is 303-794-4311.

Honeywell









T55 Engine Starter



T58 Engine Starter



T62T APU Starter/Pump

Light weight, reliability, versatility and long-life between overhaulsyou get them all with Vickers hydraulic starting systems.

Light and Rugged-For example, the starter now in production for the T55 engine installed in the U.S. Army's HC-1B helicopter weighs only 14 pounds . . . has completed qualification tests and has demonstrated reliable field performance. The HC-1B is now in production at the Vertol Division of The Boeing Company.

Main Engine or Auxiliary Use—The dual role of hydraulic starters makes them ideal for self sufficient systems. On the HC-1B helicopter, a small turbine engine with a Vickers hydraulic pump comprises the APU. With the main engines off, it not only provides utility hydraulic power but electrical power as well. Hydraulic power for starting the main engines is supplied by the same APU.

For more information on Vickers hydraulic starters to match the full range of turbine engines, contact your Vickers application engineer or write to Vickers Incorporated, Detroit 32, Michigan. Ask for Bulletin A-5270.

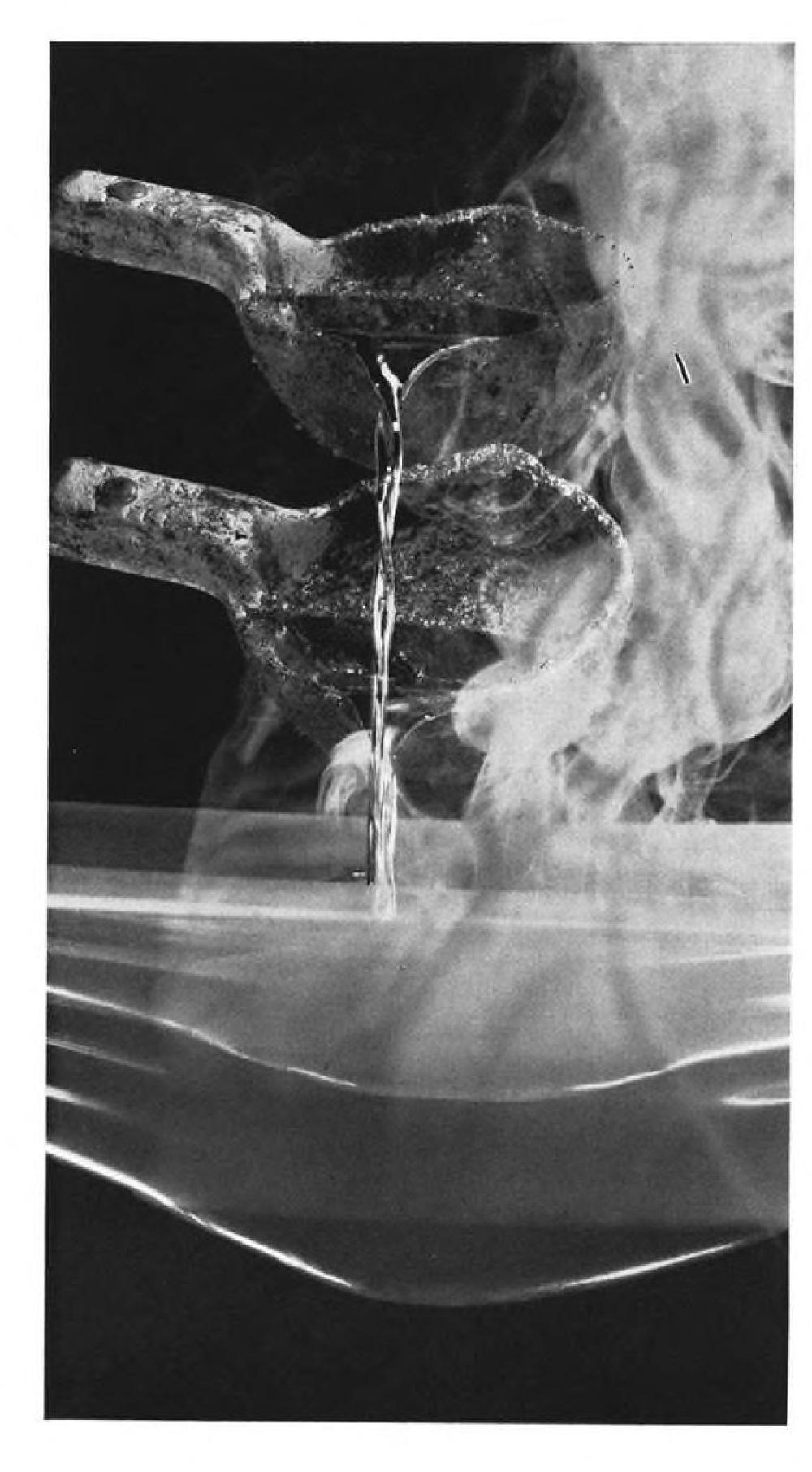


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age or thermal cycling

For complete technical data on Silastic and sources for parts write Dow Corning Corporation, Midland, Michigan, Dept. 0910.



AEROSPACE CALENDAR

Oct. 22-23-Joint Meeting, Canadian Aeronautical Institute-Institute of the Aerospace Sciences, King Edward Sheraton Hotel, Toronto, Canada.

Oct. 22-24-East Coast Conference on Aerospace and Navigational Electronics, Institute of Radio Engineers, Emerson Hotel, Baltimore, Md.

Oct. 22-24-Annual Meeting, National Aeronautic Assn., Statler-Hilton Hotel, Washington, D.C.

Oct. 24-26-Annual Meeting & Exposition, Society for Experimental Stress Analysis, Hotel Schroeder, Milwaukee, Wis.

Oct. 25-27-1962 Electron Devices Meeting, Institute of Radio Engineers, Sheraton Park Hotel, Washington, D. C.

Oct. 26-27-17th Midwest Quality Control Conference, American Society for Quality Control, Denver Hilton Hotel, Denver. Oct. 28-31-17th Annual Transportation &

Logistics Forum, National Defense Transportation Assn., Sheraton-Palace Hotel, San Francisco, Calif.

Oct. 29-Fourth Annual Western Technical Conference, American Institute of Electrical Engineers, Biltmore Hotel, Los Angeles, Calif.

Oct. 29-30-Aerospace Fluid Power Conference, Pick-Fort Shelby Hotel, Detroit, Mich. Sponsor: Aerospace Division, Vickers, Inc.

Oct. 29-30-Meeting on Large Rockets, Institute of the Aerospace Sciences, El Dorado Inn, Sacramento, Calif.

Oct. 29-31-Symposium on Dynamics of (Continued on page 7)

AVIATION WEEK and Space Technology



October 15, 1962

Vol. 77, No. 16

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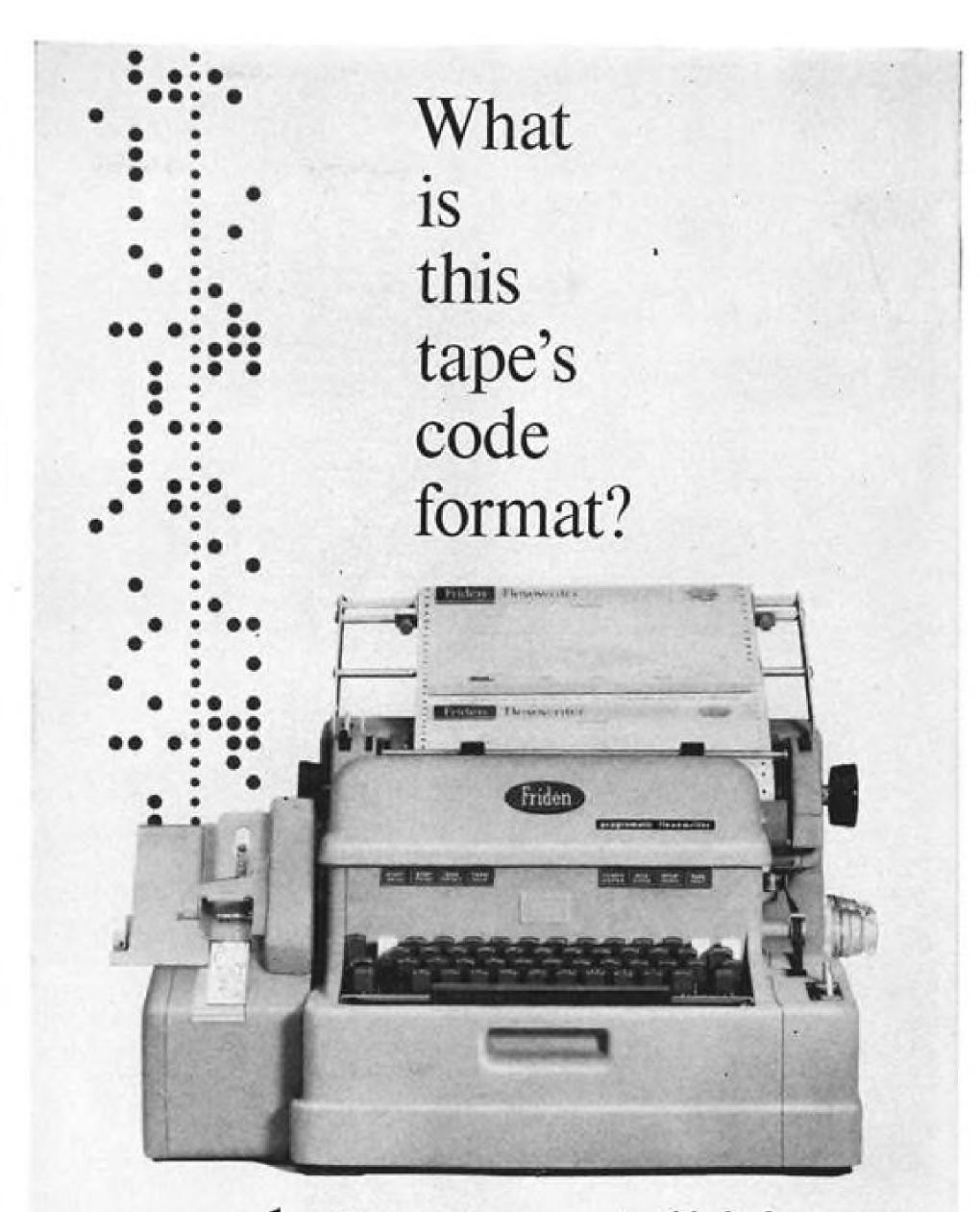
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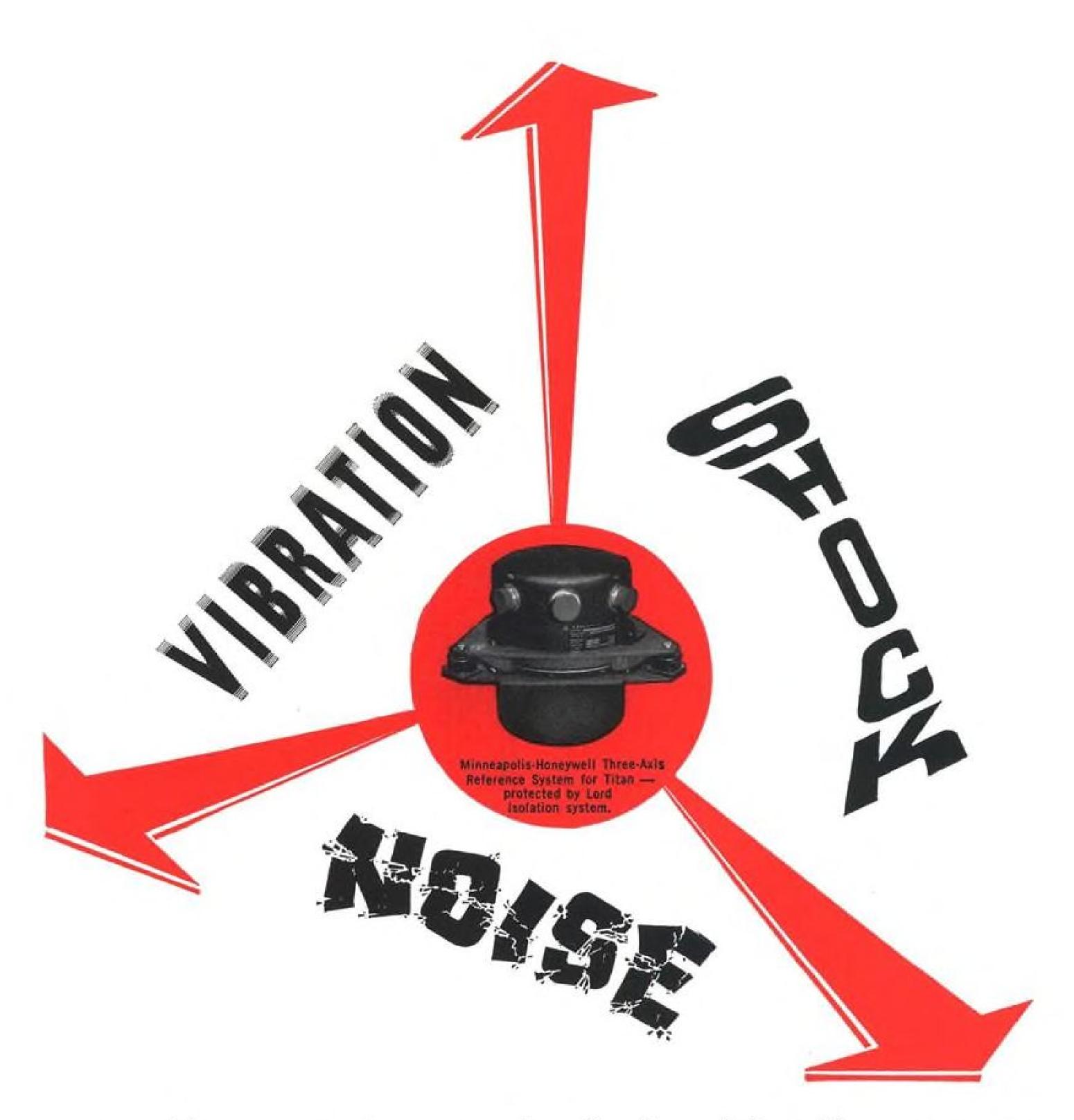
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AEROSPACE CALENDAR

(Continued from page 5)

Manned Lifting Planetary Entry, Philadelphia, Pa. Attendance limited; for information: Sinclaire M. Scala, General Chairman, Room M7023A, General Electric Co., MSD, Valley Forge Space Technology Center, Box 8555, Philadelphia 1, Pa. Co-sponsor: AFOSR.

Oct. 29-Nov. 1-58th Meeting National Aerospace Standards Committee, Aerospace Industries Assn., Ko Ko Motel, Cocoa Beach, Fla.

Oct. 29-Nov. 2-22nd National Convention, Society for Nondestructive Testing, Commodore Hotel, New York, N. Y.

Oct. 29-Nov. 2-World Metal Show & National Metal Congress, American Society for Metals, Coliseum and Hotel Biltmore, New York, N. Y.

Oct. 29-Nov. 2-International Symposium, "Basic Environmental Problems of Man in Space." UNESCO House, Paris, France. Sponsors: International Astro-nautical Federation; International Academy of Astronautics.

Oct. 30-Supersonic Commercial Transport Metals Symposium, Metallurgical Society, Statler-Hilton Hotel, New York, N. Y.

Oct. 30-31-National Conference on Spaceborne Computer Engineering, IRE, Disneyland Hotel, Anaheim, Calif

Oct. 30-Nov. 1-Eighth Tri-Service Conference, Armour Research Foundation, Chicago, Ill. Sponsors: U. S. Army, Navy and Air Force.

Oct. 31-Symposium: Oxidation of Tungsten and Other Refractory Metals, Statler Hilton Hotel, New York, N. Y. Sponsors: Metals and Ceramics Laboratory, Aeronautical Systems Division, Wright-Patterson AFB; Metallurgical Society.

Oct. 31-Nov. 3-Ninth Annual Symposium, American Vacuum Society, Statler Hilton Hotel, Los Angeles, Calif.

Nov. 1-Annual Meeting, General Aviation Safety Committee, National Safety Council, Conrad Hilton Hotel, Chicago, Ill.

Nov. 1-2-Chemtronics Conference, American Society for Quality Control, Statler Hilton Hotel, New York, N.Y.

Nov. 1-2-Sixth National Conference, Product Engineering and Production, Institute of Radio Engineers, Jack Tar Hotel, San Francisco, Calif.

Nov. 2-3-Advanced Technology Symposium, New Mexico Section/American Society of Mechanical Engineers, University of New Mexico, Albuquerque, N. M., in cooperation with AFSWC-Kirtland

Nov. 4-7-14th Annual Conference on Engineering in Biology and Medicine, Conrad Hilton Hotel, Chicago, Ill. Sponsors: Institute of Radio Engineers; American Institute of Electrical Engineers; Instrument Society of America.

Nov. 5-7-Symposium on Protection Against Radiation Hazards in Space, Gatlinburg, Tenn. Co-sponsors: Oak Ridge National Laboratory; NASA Manned Spacecraft Center; American Nuclear Society.

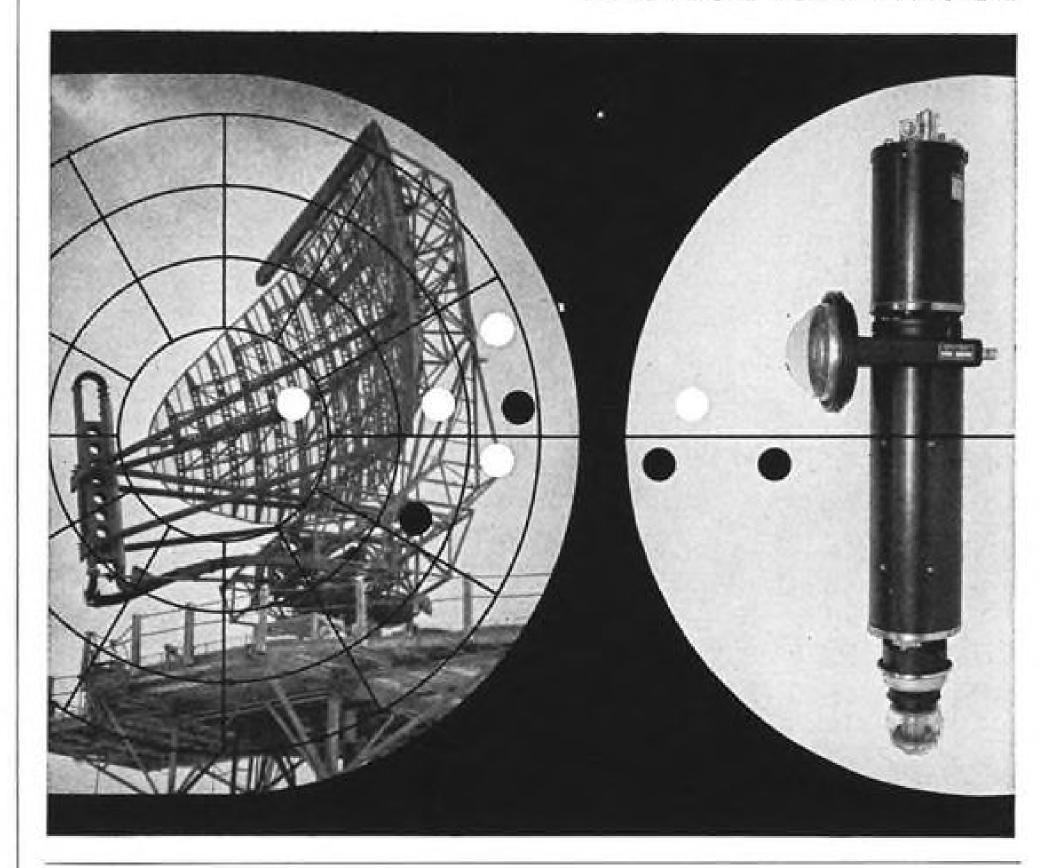
Nov. 5-7-Northeast Electronics Research and Engineering Meeting, Institute of Radio Engineers, Commonwealth Armory & Somerset Hotel, Boston, Mass.

(Continued on page 9)

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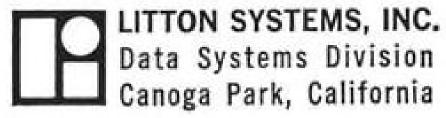


Find a three digit number that is the sum of the cubes of its digits (abc = $a^3 + b^3 + c^3$). - Contributed

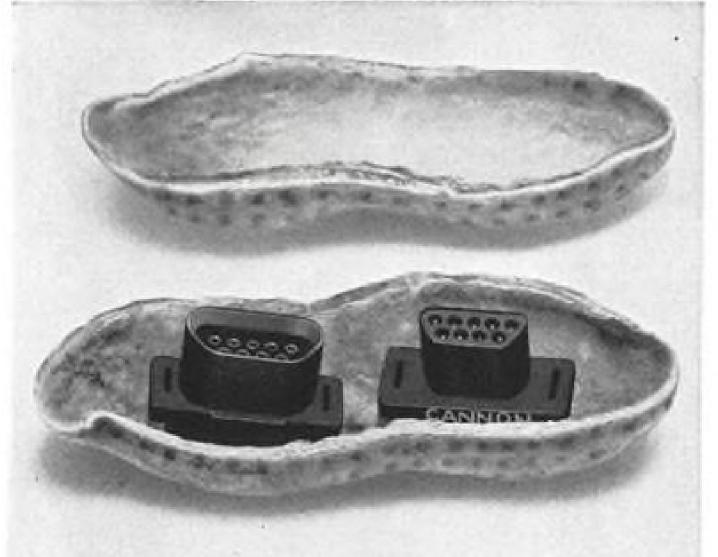
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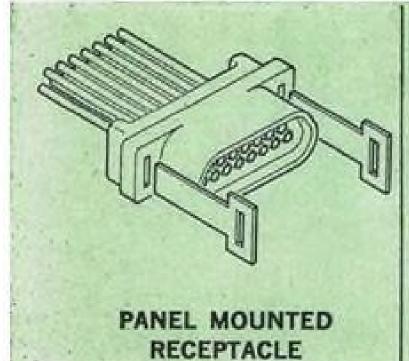


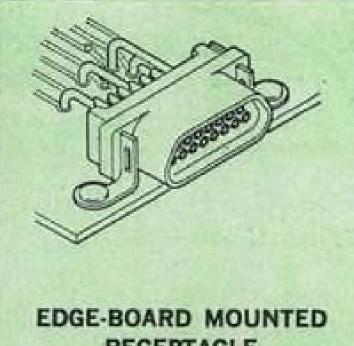
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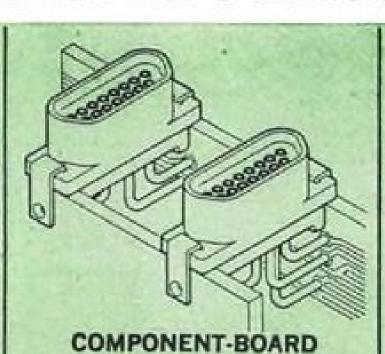
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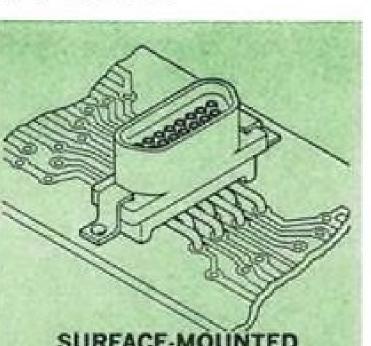
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AEROSPACE CALENDAR

(Continued from page 7)

Nov. 5-16—16th Air Transport Management Institute, School of Business Administration, The American University, Washington, D. C.

Nov. 7-8—Symposium on Lasers and Applications, Antenna Laboratory, Department of Electrical Engineering, Ohio State University, Columbus, Ohio.

Nov. 7-9—International Air Cargo Forum, Dinkler-Plaza Hotel, Atlanta, Ga. Sponsors: Institute of the Aerospace Sciences; Society of Automotive Engineers.

Nov. 12-Wings Club Annual Dinner, Americana Hotel, New York, N. Y.

Nov. 12-15—International Air Transport Assn.'s Sixth Public Relations Conference, Shoreham Hotel, Washington, D. C.

Nov. 12-15—Eighth Annual Conference on Magnetism and Magnetic Materials, Institute of Radio Engineers, Penn-Sheraton Hotel, Pittsburgh, Pa.

Nov. 13-14—Retardation and Recovery Symposium, Imperial Motel, Dayton, Ohio. Sponsor: Aeronautical Systems Division's Flight Accessories Laboratory.

Nov. 13-18—17th Annual Meeting and Space Flight Exposition, American Rocket Society, Pan Pacific Auditorium, Los Angeles, Calif.

Nov. 16-17—Second Canadian Institute of Radio Engineers Symposium on Communications, Queen Elizabeth Hotel, Montreal, Canada.

Nov. 19-20—Mid-America Electronics Conference, Institute of Radio Engineers, Hotel Continental, Kansas City, Mo.

Nov. 26-27—Western States Section Meeting, The Combustion Institute, Aerojet-General Corp., Sacramento, Calif.

Nov. 26-29—Annual Coordinated Meetings: American Nuclear Society, Atomic Industrial Forum, and joint AtomFair, Sheraton-Park and Shoreham Hotels, Washington, D. C.

Nov. 27-29-40th Meeting, Aviation Distributors and Manufacturers Assn., The Kenilworth, Miami Beach, Fla.

Nov. 28-30—1962 Ultrasonics Symposium, Institute of Radio Engineers, Columbia University, New York, N. Y.

Dec. 4-6—Fall Joint Computer Conference, Sheraton Hotel, Philadelphia, Pa. Sponsors: American Federation of Information Processing Societies; Institute of Radio Engineers.

Dec. 6-7-Vehicular Communications Conference, Institute of Radio Engineers, Disneyland Motel, Los Angeles, Calif.

Dec. 10-12—Conference on VTOL Aircraft, New York Academy of Sciences, Henry Hudson Hotel, New York, N. Y.

Dec. 17-18—Symposium: Structural Dynamics Under High Impulse Loading, Wright-Patterson AFB, Ohio. Co-sponsors: Air Force Office of Scientific Research (Mechanics Division); Aeronautical Systems Division.

Dec. 26-31-Space Physics Meeting, American Rocket Society and American Assn. for Advancement of Science, Philadel-

Jan. 21-23-31st Annual Meeting (including Wright Brothers Lecture), Institute of the Aerospace Sciences, Hotel Astor, New

York, N.Y.

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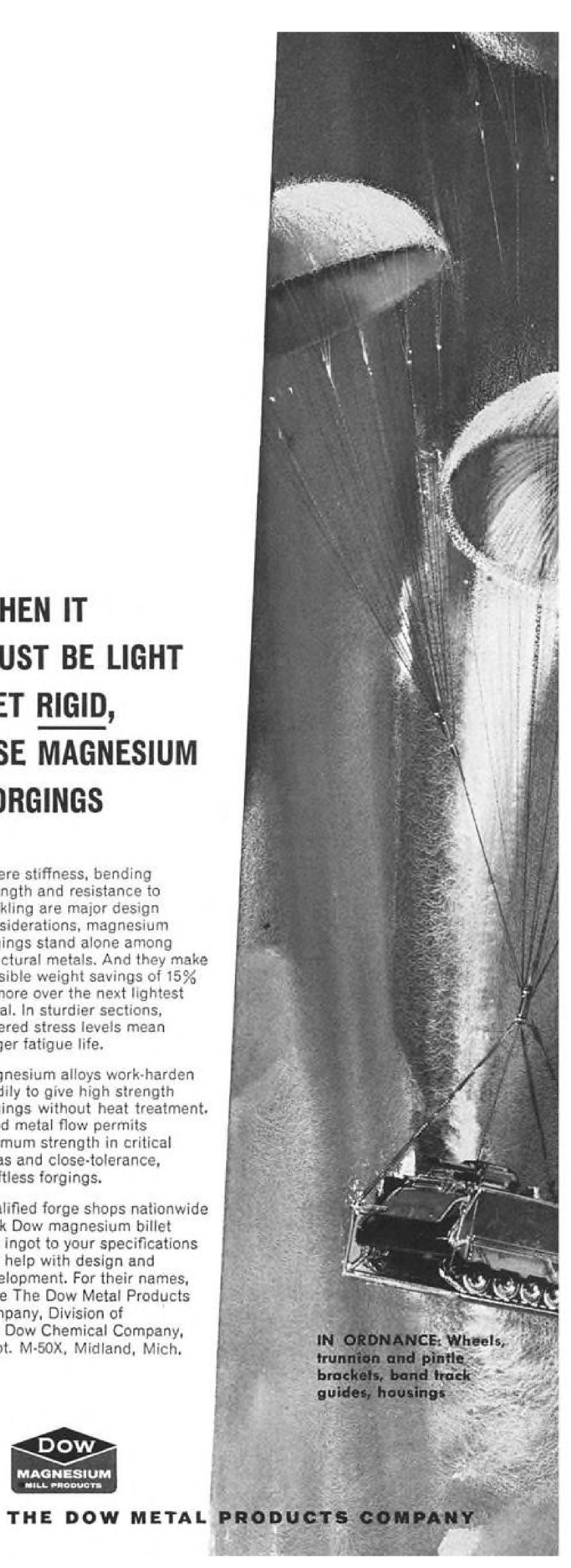
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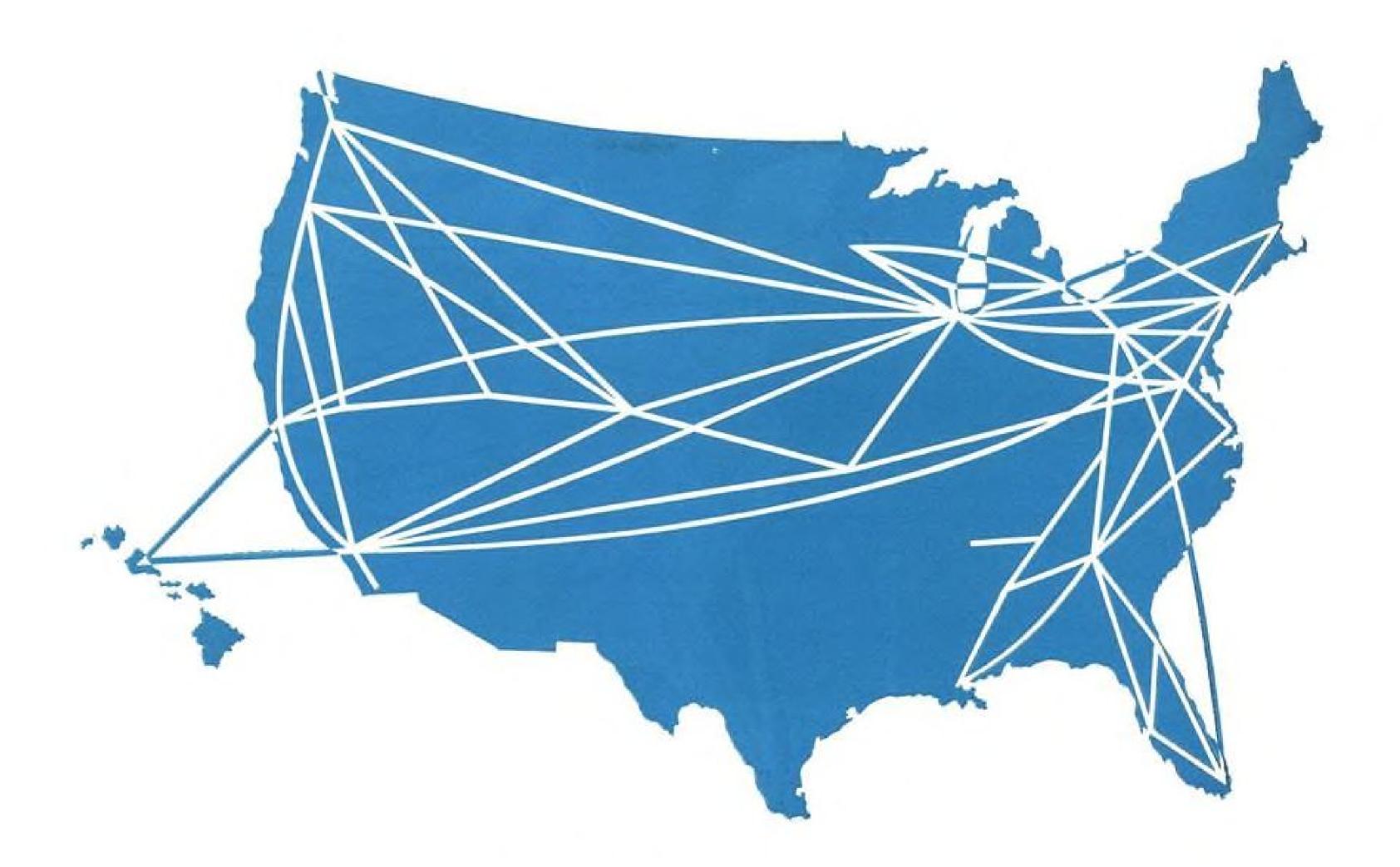
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oxidant and inexpensive hydrocarbons | have on the emerging countries is | folds Group, major steel manufacturers.

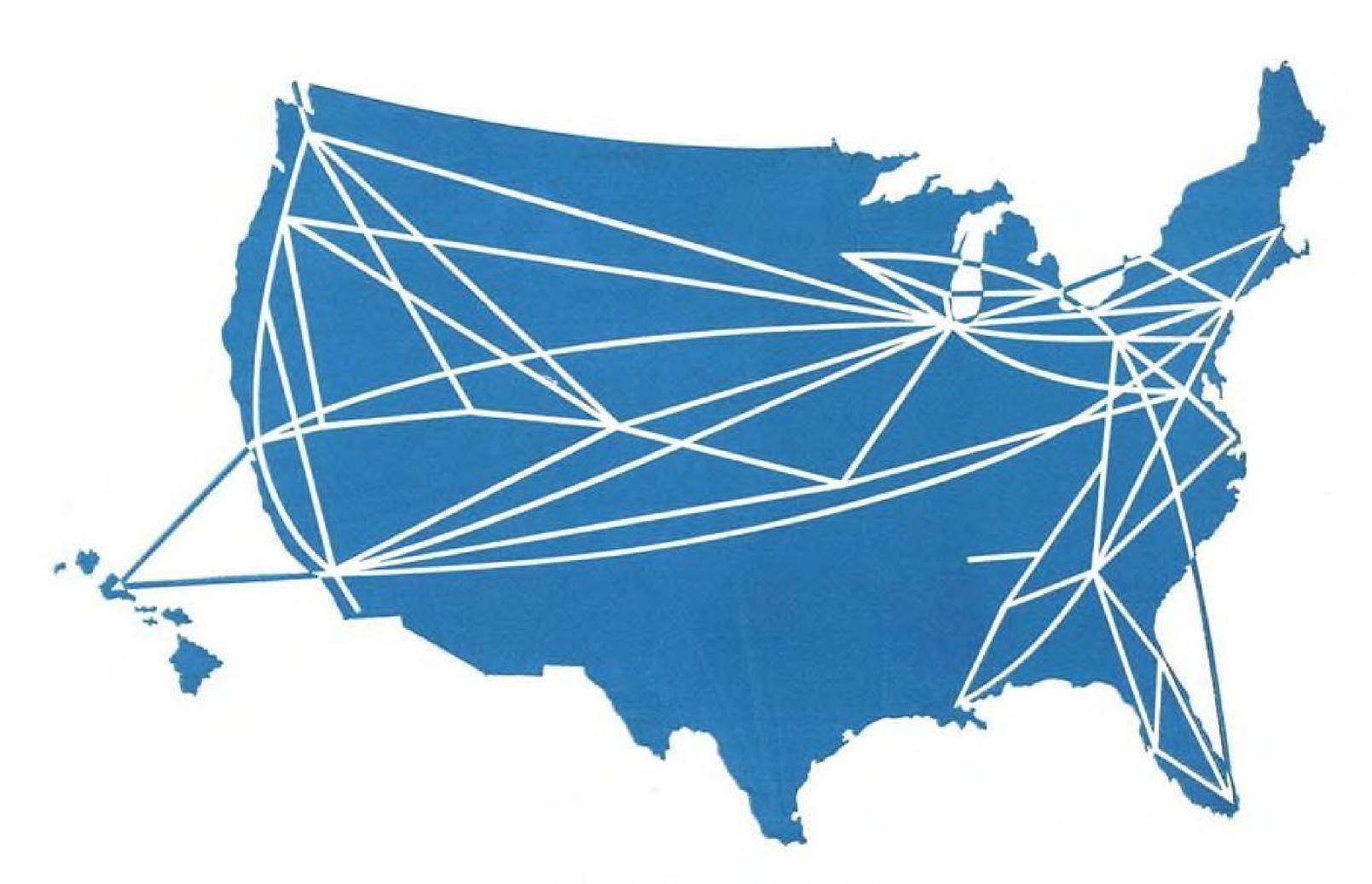
Leesona believes its efforts, plus the States and international partners, will These new Leesona power sources, of soon result in working installations of

quires little maintenance. Units with *Energy Conversion, Ltd., is a new But space missions are only the first | power levels from those required for a | corporation founded by four British part of the story. At the same point in one-family dwelling up to communal or companies: National Research and Detime that Leesona Moos began studies of | industrial ground-power stations have | velopment Corporation; British Petro-Hydrox fuel cells, a concomitant project | been projected in Leesona Moos studies, | leum Company, Ltd.; British Ropes, Ltd., leading manufacturer of rope and advanced system...a cell using air as The impact Carbox and Aminox can steel cable; and Guest, Keen, and Nettle-



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WORLD'S LARGEST JET FLEET | THE EXTRA CARE AIRLINE

Motorola Integrated Circuit Electronics...

Types of circuits available; Advantages and disadvantages of hybrid types and functional electronic blocks; The approach to custom-designed circuits

In recent months a dramatic change has occurred in the electronics field.

The widely discussed era of integrated circuits electronics has graduated from an engineering vision to practical reality. And the next few years will find integrated circuits progressing from designers' drawing boards to production lines in electronic equipment ranging from space gear to consumer products.

The total impact of this new technology on the industry, and the magnitude of the envisioned progress is still a matter of widespread conjecture. Though by this time many facts have been substantiated, there is still considerable confusion and misconception as to what can and what cannot be done with integrated circuits at this time.

You may have heard, for example, that integrated circuits will greatly reduce equipment size and weight.

This is certainly true. In fact, size and weight reduction is the most dramatic advantage. What the transistor has done to vacuum-tube equipment of a decade ago, integrated circuits will ultimately do to present equipment. Thus, the erstwhile rack of complex equipment which the transistor reduced to single-drawer size, can be further cut to "match-box" proportions.

You've heard, too, that integrated circuits will improve equipment reliability.

And this should be true.

Though reliability is difficult to prove in integrated circuits, since interwoven components cannot be individually tested to their maximum ratings, none of the manufacturing processes by which integrated circuits are made (diffusion, epitaxial growth, alloying, etc.) is new. transistor-proven techniques, complete integrated circuits are expected to have the same order of reliability as other time and field tested semiconductor devices.

You may also have heard that integrated circuits will cut equipment costs.

This, unquestionably, is one of the most compelling reasons for circuit integration - but it bears qualification.

Integrated circuits by the thousands are fabricated simultaneously. A single paper-thin wafer of semiconductor material contains hundreds of identical circuits, and dozens of wafers are processed simultaneously. The basic material cost of an integrated circuit is little greater than that of a transistor and, with reasonable yields, the cost of the circuit approaches that of the device. In addition, the assembly time of integrated circuit equipment will be but a fraction of that required for circuit wiring.

But the design and production of a functional electronic block circuit (those in which all component parts are fabricated on or within a single tiny block of semiconductor material) are as yet costly operations unless your requirements permit large scale use of identical circuits. The great cost-reducing features of such circuits become apparent only when quantity requirements are so large that distributed design costs do not add appreciably to the price of each unit. On the other hand, hybrid (multiple chip) integrated circuits can be built now at a fraction of the cost of functiona electronic blocks in small quantities.

If you are in the equipment manufacturing field you may have the impression that integrated circuits will permit a reduction of your engineering staff.

This is probably not the case unless your equipment can be built entirely from a limited number of "stock" circuits. You will need a staff of specialists Through the exclusive use of these capable of correlating conventional circuit design with the unique requirements of integrated circuit technology. Motorola can provide design assistance, but retention of specific features of each

manufacturer's equipment demands an in-house engineering effort.

Finally, you may have heard that integrated circuits limit equipment design flexibility due to the relatively small number of circuits currently available.

Nothing is further from the truth.

Today, the integrated circuit capability of Motorola's Semiconductor Products Division has been developed to the point where working samples of a broad range of custom-designed circuits are being delivered in less than six weeks after receipt of an order. Right now, much the same design flexibility obtainable with transistors is achieved with hybrid integrated circuits. With functional electronic blocks, the same flexibility is available in the logic circuit area, and we are approaching a corresponding state of sophistication with linear circuits.

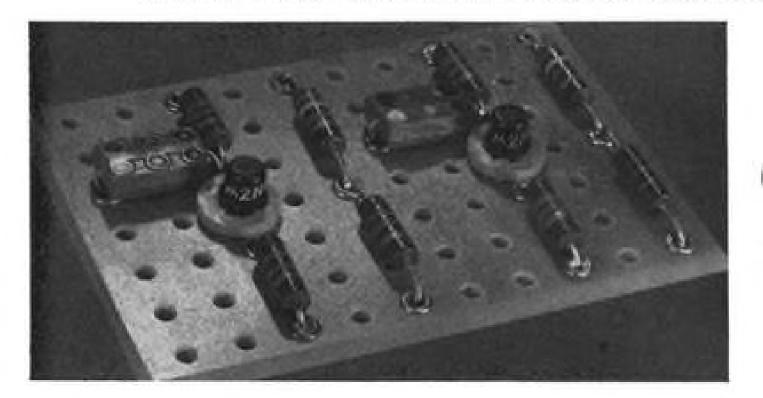
Types of Integrated Circuits

Today's integrated circuit technology involves basically two fundamental processes - a thin-film process, by means of which passive electronic components (resistors, capacitors, etc.) are deposited as material layers on a passive substrate, and a semiconductor device technology where both active and passive elements are formed on or within a tiny block of semiconductor material (silicon).

The semiconductor device technology utilizes multiple masked diffusion, surface layer passivation and patterned metal film alloying to make active and passive elements, all properly interconnected and isolated, in a single block. The ranges of component values are somewhat more restricted than in standard circuits and useful values of some functions (i.e. inductance) are difficult to obtain. Parasitics differ from those of conventionally wired circuits.

The thin-film technology utilizes multiple evaporation, sputtering, or vapor

integrated circuits is indicated by simultaneous fabrication of dozens of identical circuits on portion of wafer shown at right. Elimination of interconnecting wires enhances reliability.

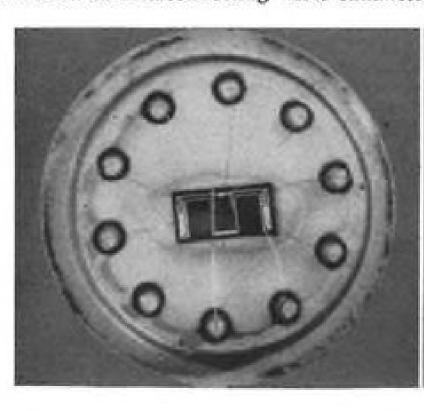


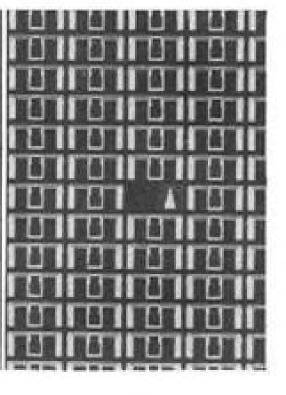
Comparison of 50 mc amplifier breadboard using conventional

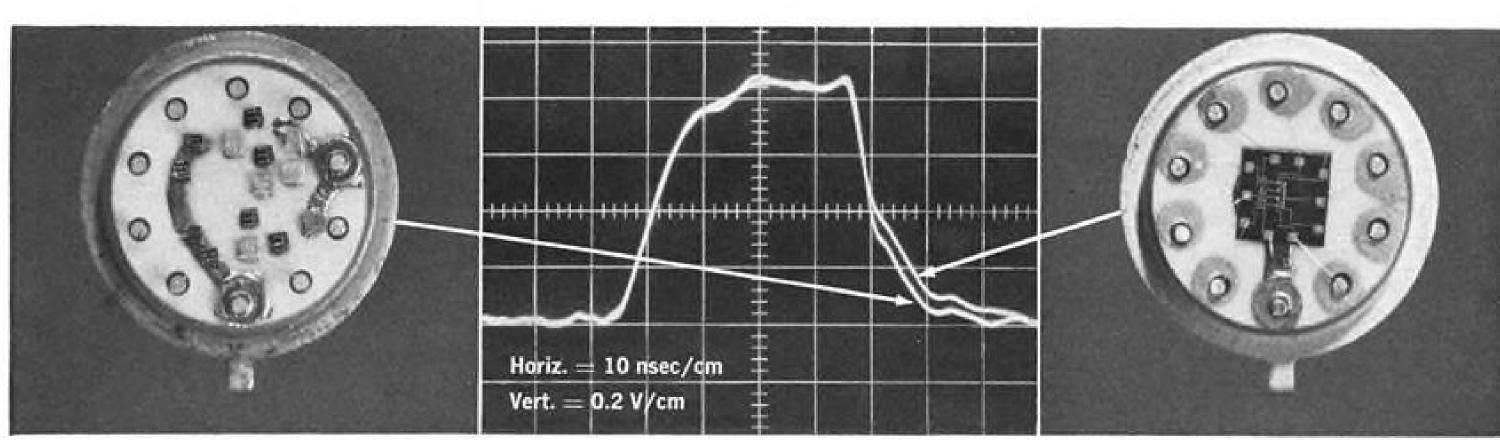
components with equivalent integrated circuit (in center) dra-

matically illustrates space savings. Potential cost reduction of









In custom design approach to integrated circuits, the equipment manufacturer's conventional wired prototype is converted into a multiple chip circuit (left) for evaluation. Necessary design changes can be made quickly and inexpensively at this stage.

Final single block circuit (right) offers mass-production cost savings. Comparison of output waveforms of multiple-chip and single block integrated circuits used in an operating arithmetic unit shows that performance of both types is quite similar,

decomposition to deposit (at the present time) the passive circuit components on an insulating (or dielectric) substrate. Active elements must be attached separately to their film circuits and, while the range of values of some components is greater than obtainable through semiconductor technology, such circuits require more material types and processes, and are often larger in size.

Motorola, through extensive research in both integrated circuit fields, has successfully developed a capability for comtechniques in yet another, or third, tech- consultation with Motorola engineers. nology-compatible integrated circuits. Playing a vital part in this process is the epitaxial growth technique that has recently made an explosive impact in the semiconductor field. Through this combination Motorola has produced integrated circuits with increased versatility,

nent tolerances and higher speed.

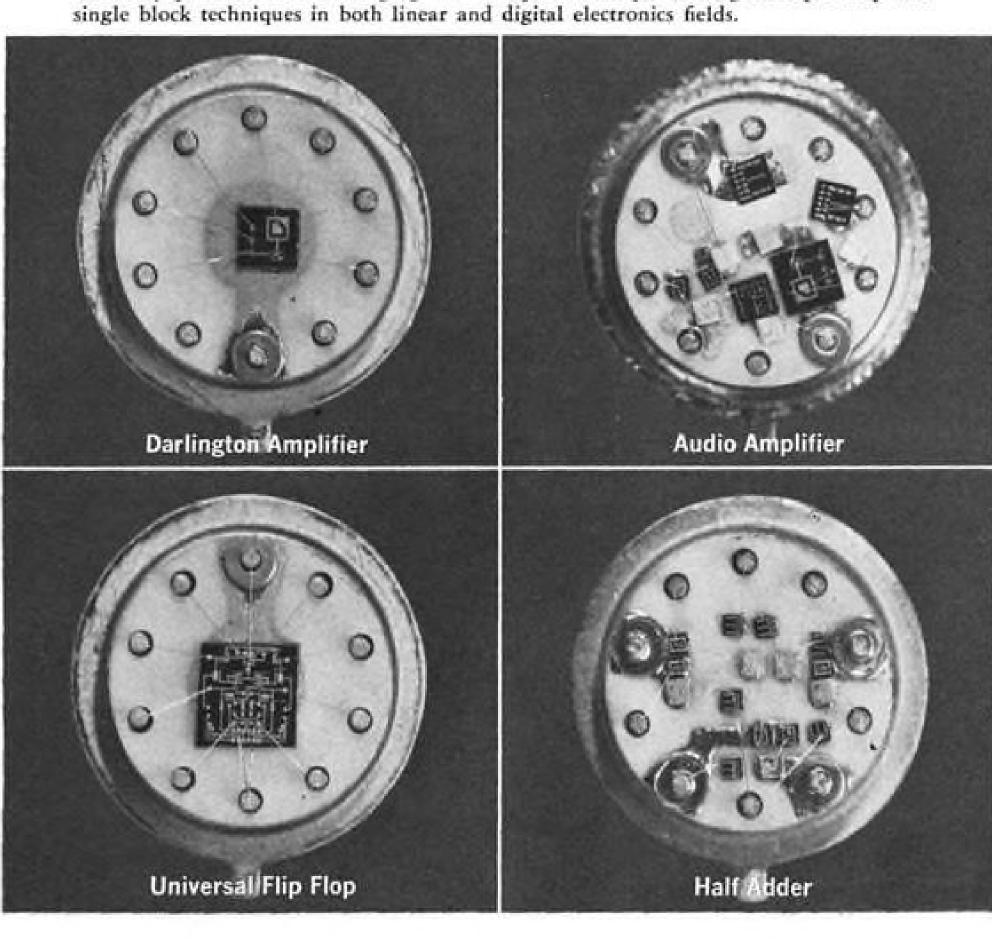
greater functional scope, tighter compo-

Custom Design Approach

As a first step, the equipment engineer must evaluate the complete system and determine whether to "integrate" all or a portion of the equipment. His next step is to produce conventionally wired prototype circuits for performance evaluation. Often parts values and other parameters must be changed to make the conventional design suitable for cirbining the best features of both cuit integration. Usually this involves same characteristics as fully integrated,

Then comes the actual development of the integrated prototype. This can be that production changes can be easily started by the equipment manufacturer with special integrated components obtainable from the Motorola Semiconductor Products Division. These parts, each one individually packaged, have all the

Integrated circuit capability of Motorola's Semiconductor Products Division is illustrated by practical circuits ranging from simple to complex, using multiple chip and



electrical characteristics of the elements in the final circuit, but they can be conventionally wired for integrated circuit evaluation and final modifications.

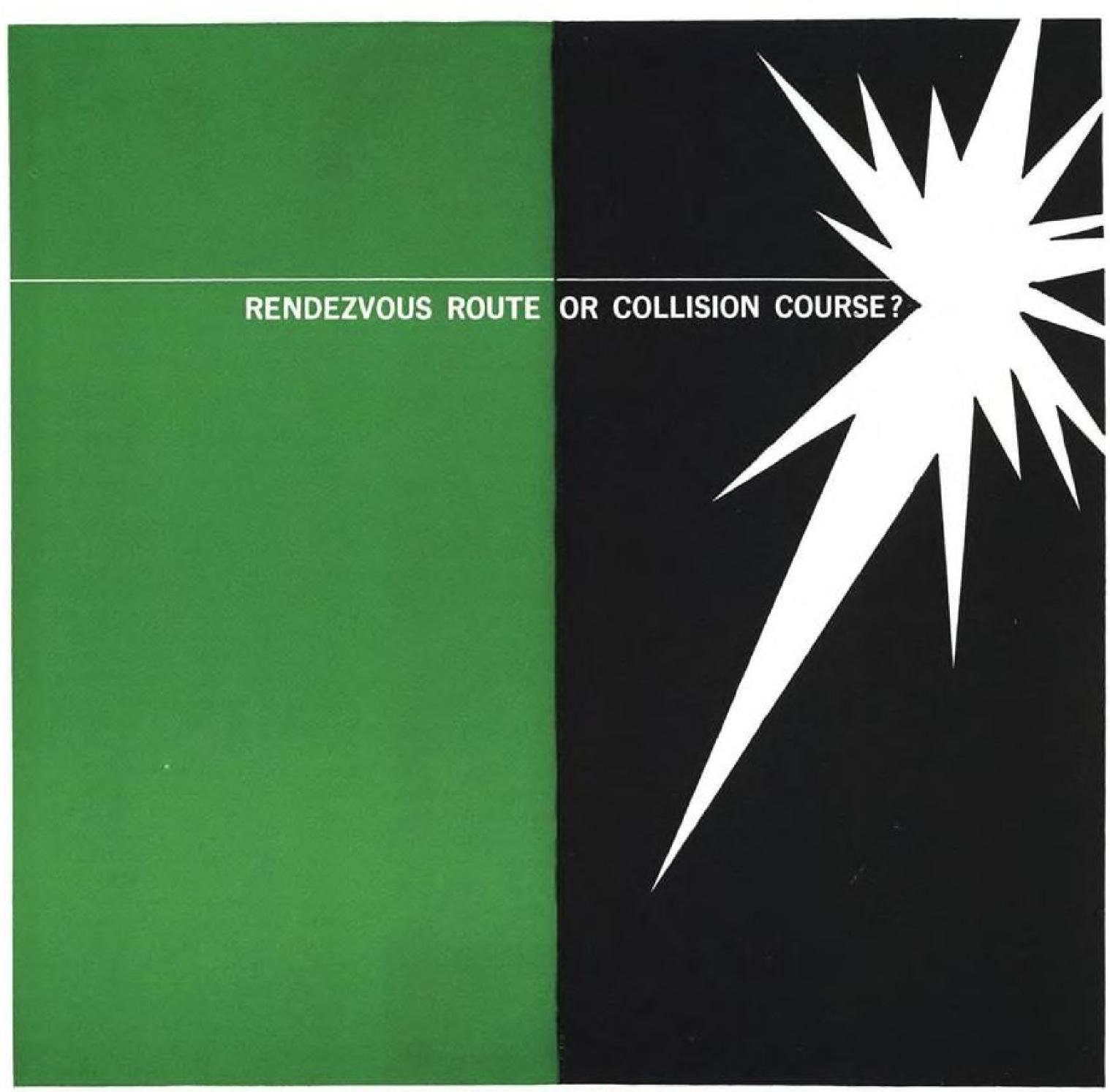
The next step, at Motorola, is to convert the equipment manufacturer's prototype into one or more hybrid integrated circuits in which parts identical to those of the prototype are bonded together on multi-lead headers. This becomes an interim circuit form which, in some instances, represents the final product.

Hybrid circuits have many of the single-block devices (see photos above). They have the additional advantages made and that design modifications are relatively simple and inexpensive. Moreover, they can be produced quickly at Motorola, since a great many integrated "components" are stocked for immediate use. The hybrid circuit, therefore, has much to recommend it as an interim, and for small runs, as a final product.

From the hybrid to the final single block circuit is a matter of developing the optimum pattern and the masks necessary for the various process steps. From a manufacturing standpoint, this is the most costly part of the entire operation. Still, it is entirely justified for equipments involving a large number of the same circuits. The reason - singleblock circuits, after development, are the least expensive to make, and potentially the most reliable. With many individual bonding operations eliminated, it is the single-block circuit that offers the greatest cost-saving potential. It does this, however, at the expense of flexibility since such units cannot be modified during production without starting back at the beginning of the manufacturing operation.

The era of integrated circuits has arrived. They are practical and they are available, even though the future, unquestionably, will bring many improvements to this infant technology.

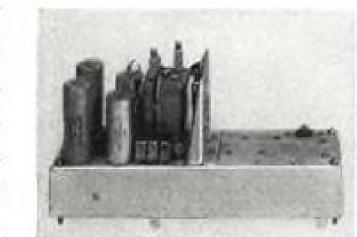


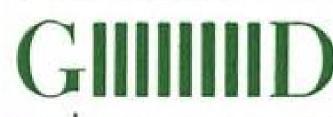


A QUESTION OF SUPREMACY:

Pilots of U. S. Navy fighting planes will shortly be able to rendezvous or fly in formation with greater security under a wider range of conditions ... for they'll know exactly how

far they are from each other. M Air-to-air ranging will be added to their present TACAN sets with the General Dynamics/Electronics - Rochester SC-704 modification kit. No bigger than a "best seller," lighter than the circuits it replaces, it permits as many as 5 planes to judge their distances from a sixth, such as a group leader or air tanker. Conversion time? Negligible - only 3 fast hours. And the SC-704 actually improves the





reliability of the air-to-ground function of the TACAN set because the vacuum tube modulator is replaced with a new, completely solid-state modulator. - Proficiency in

> air and missile-borne ranging equipment comes naturally to a division of General Dynamics, where the B-58 Hustler and Atlas ICBM were born and bred; General Dynamics/Electronics-Rochester is today': seed-bed of advanced ideas in the technol ogy of navigational equipment and rada beacons. Every product we make starte with a question. We solicit yours. Write 140: North Goodman St., Rochester 1, New York.

GENERAL DYNAMICS ELECTRONICS - ROCHESTER

Aviation Week & Space Technology

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Number 16

COVER: First Vickers VC.10 four-jet transport, owned by British Aircraft Corp., is presently undergoing flight tests involving low and medium speeds up to 300 kt., as well as flights to 32,000 ft. The VC.10 recently was demonstrated at the annual Farnborough air show. Aircraft has completed 44 flights, totaling 56 hr. 50 min. (See additional photos p. 54.)

PICTURE CREDITS

Cover—Ron Appelbe; 28—(left top and bottom) USAF, (top right) CBS; 33, 47—Sovfoto; 45—Boeing; 54, 55, 102, 103—Ron Appelbe; 58, 59, 60, 80—NASA; 73—Perkin-Elmer; 78—(bottom left) NASA, (bottom right) Wide World; 79—Wide World; 85—Douglas; 87—Lockheed Propulsion; 91, 93—Sperry Gyroscope Co.; 107, 109, 111—Beech Aircraft; 125—Omnipol Foreign Trade Corp., Prague; 127—Sikorsky; 129—Hughes.

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The design is thousands of years old. Called "Man," it has evolved reasonably efficient techniques for coping with weather, saber-toothed tigers, city traffic, floods and income taxes.

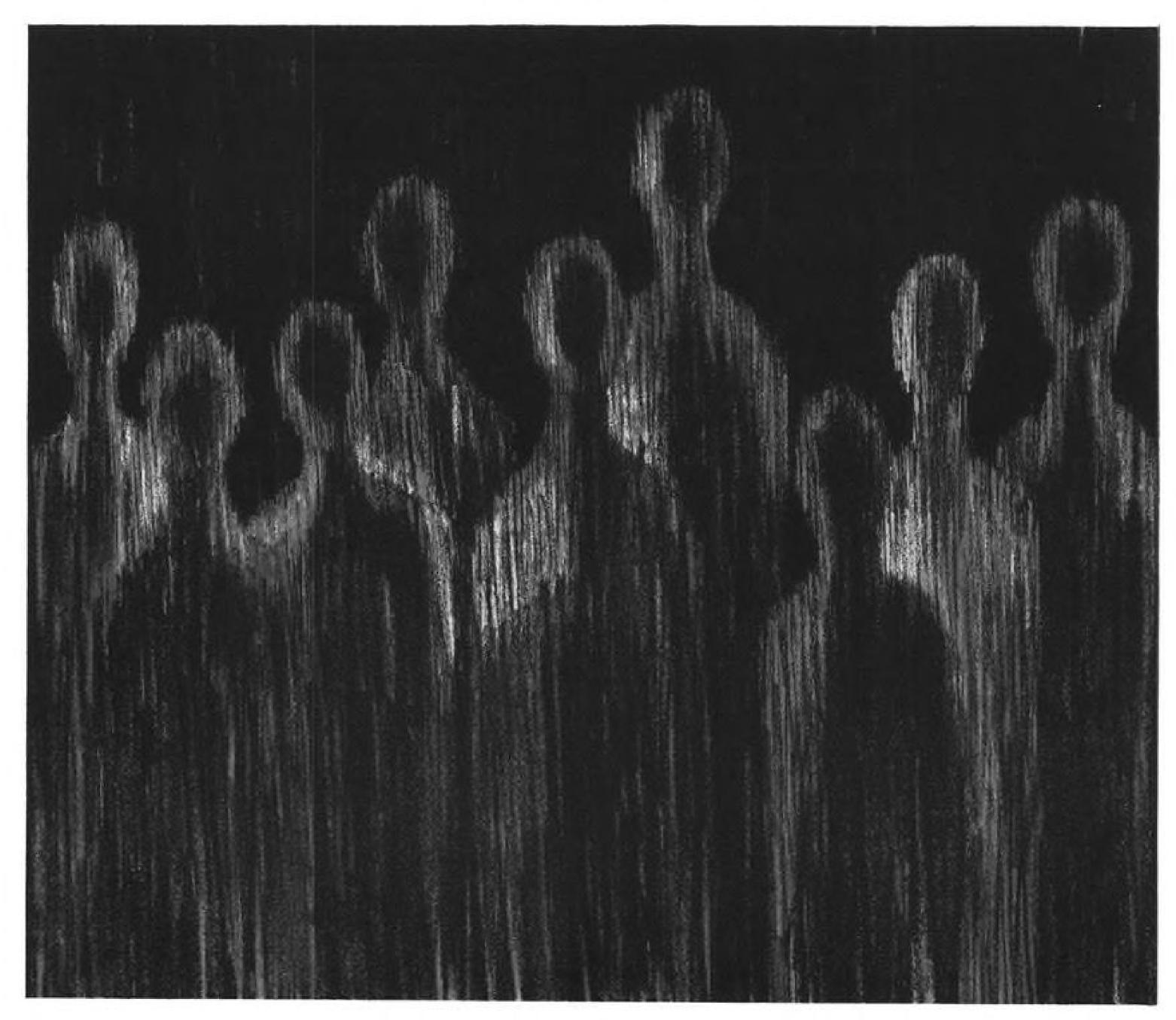
But now it faces a problem of a new order of magnitude...survival beyond the protective cocoon of the earth's environment. In this airless, weightless, radiative region, man needs a big assist. Douglas is working to provide it. Douglas scientists are far along in studies of ecological systems for the maintenance of human life under

EARTH'S MOST COMPLICATED SYSTEM extra-terrestrial conditions.

These research areas cover the

... AND HOW DOUGLAS IS ORIENTING IT TO OUTER SPACE varied life and physical

sciences and engineering systems which are involved. They range from psycho-physiological analyses to the actual planning of the establishment and support of cities on the moon.



Development of improved man-machine relationships and detailed planning of the giant vehicle systems that are involved in space exploration are among more than 500 research and development DOUGLAS programs now under way at Douglas.

EDITORIAL

First Class Folly

United Air Lines' President W. A. Patterson has sounded a significant chord in his appeal to airline managements to seek an intelligent and economically sound solution to the problem of declining first-class traffic (see p. 43). First-class traffic is certainly on the skids. Statistics show this clearly. On the prime North Atlantic run, economy class accounted for 87% of all traffic last year. On the domestic front, coach passed first-class for the first time last year, garnering 57% of the total market with an increase to 62% for the first half of 1962. First-class traffic showed a 16% drop in 1961 domestically and 20% on the North Atlantic.

But statistics tell only part of the story. In seven long-haul jet trips during the past month ranging from Alaska to Europe, we found only one first-class compartment containing enough passengers to make a bridge game, while the economy sections were jammed. It is a joke among airline people now that the empty firstclass seats are the only place they can put the nonrevenue, pass-carrying passengers. On one transatlantic flight the first-class section was empty and used primarily as a clubhouse for the crew. In addition, 12 elaborate gourmet-type meals for no-shows (or switches to economy class?) were wasted and a pair of stewardesses were paid for a pleasant ride to London. Meanwhile, the economy section was crowded and bustling, and severely strained the limited facilities provided for the large quantity of passengers. Mr. Patterson cites some interesting figures on the high cost of providing this first-class service that makes its appeal as a revenue producer sag even lower.

Price Difference Unrealistic

The decline of first-class traffic has been caused by a basic change in the nature of air travel started a decade ago by the advent of coach service and accelerated by the huge seating capacity and high velocity of the jet transport. The jet transport is generating an ever-increasing demand for safe, reliable and cheap air transport from the traveling public. The airlines have also accelerated this decline in first-class travel by their fare policies that have priced first-class tickets out of the market. For example, the difference between a New York-London round-trip first-class ticket (\$900) and an economy ticket (\$486) is \$414. What can an airline offer the transatlantic traveler in two 6-7 hr. flights that is worth \$414? On the domestic scene, the New York-Los Angeles transcontinental round-trip differential between first-class and coach is \$63.

As Mr. Patterson notes, large corporations and U.S. government agencies have gaged this discrepancy between price and service and switched their tremendous volume of business from first-class to coach and economy

With this change in corporate and government policy,

first-class lost much of its appeal as a status symbol. Without the solid foundation of the expense account trade, its collapse as a mainstay of airline revenue was inevitable. We predict that before this year is finished airlines will be grossing more from the cargo carried in the big bellies of their jet transports than from the sparsely populated first-class compartments.

There will always be some first-class market and some airlines may turn a welcome dollar by catering to it as a specialty segment of their business. But first-class revenue will never again be the financial backbone of the air transport business. We agree with Mr. Patterson that the industry must take a fundamentally new look at the situation that confronts it with this declining firstclass market. It must get back to a far higher percentage of single class service that will enable it to attract a larger volume of passengers and transport them at less expense to the airlines. Only in this combination of rising market and lowered cost can the airlines find a truly effective key to their future financial growth.

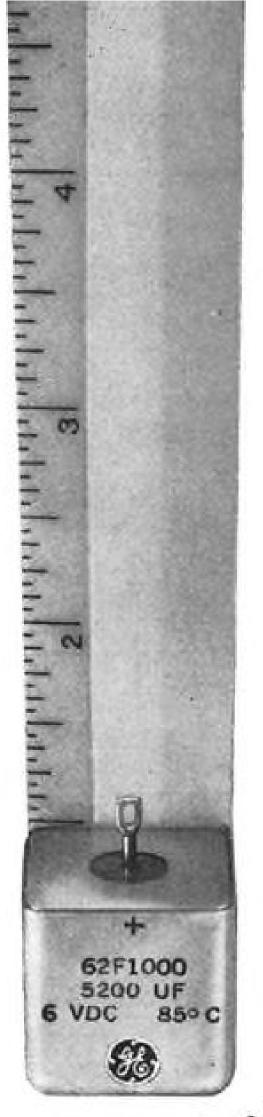
Added Safety Requirement

It is also interesting to hear another airline president (AW Sept. 17, p. 39) speak publicly about the once forbidden subject of safety and fear of flying as a major airline problem. In this era of turmoil and change that is casting the shape of the airlines' future there are technical as well as economic problems to be solved. These include the basic problem of safety and its corollary of air traffic control.

Next to accidents, the traveling public is most irritated by schedule delays, cancellations and the myriad other annoyances caused by mechanical and traffic control snarls. We think almost everybody in the air transport industry and the government agencies that regulate it could do a great deal more than they do now about the basic problems of safety and schedule reliability. This is an inescapable responsibility of airline management. Without sharp and sustained pressure from the very top of the airline structure, there will be little improvement at the lower operating levels and there will certainly be no accelerated action from the federal officials who are charged with enforcing safety procedures and operating efficient traffic control systems.

Airline managements have been too prone to be satisfied with federal officials who were most interested in taking the course of least resistance and "not rocking the boat." But it is becoming more and more apparent that the industry needs more than glib phrases and wellposed pictures from its top federal aviation officials. It is up to airline managements to take the lead in applying the heat to these officials wherever it will stimulate the required action soonest.

-Robert Hotz





QCR capacitors today's highest v-µf in one cubic inch

For your limited space applications you can now specify the new QSR, porous-anode Tantalytic® capacitor, with the largest μf capacity in a cubic-inch tantalum unit. It stores 5200 μf (6v) in a cubic inch, yet only weighs 65 grams.

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Progress Is Our Most Important Product



WHO'S WHERE

In the Front Office

Harry H. Wetzel, executive vice president, The Garrett Corp., Los Angeles, Calif., succeeding K. B. Wolfe, now vice president and special assistant to the president. J. J. O'Brien succeeds Mr. Wetzel as vice president and manager of AiResearch Manufacturing Division in Los Angeles.

Dr. Robert L. San Soucie, vice president and technical director, Electronics and Avionics Division, Emerson Electric Mfg. Co., St. Louis, Mo., and Richard L. Loynd, vice president-programs for the division.

Fred W. O'Green, a vice president of Litton Systems, Inc., Woodland Hills, Calif., and general manager of the Guidance and Control Systems Division-U.S.A. Also: Dr. Frank R. Moothart, assistant general manager of the division.

J. Martinez, group vice president, Maxson Electronics Corp., New York, N. Y. Eugene J. Cronin succeeds Mr. Martinez as vice president-marketing of Maxson Electronics Division

Ray de Haan, a vice president, New York Airways, Inc., in charge of maintenance and engineering.

Dr. Burton F. Miller, vice president-research and development, TRW Electronics, Inc., El Segundo, Calif. Dr. Miller will continue as vice president-advanced technical planning of Thompson Ramo Wooldridge, Inc., the parent company.

Alfred Multari, vice president and formerly director of engineering, appointed technical director-all company activities, Tempo Instrument, Inc., Plainview, N. Y. Also: Joseph Kinpointer, manufacturing manager; Emanuel Poulos, vice president and chief engineer-research, appointed head of Advanced Engineering, a new depart-

T. E. Piper, assistant to the vice presidentoperations, General Dynamics/Pomona.

Thomas P. Smith, assistant treasurer, American Airlines, Inc.

Capt, William C. Fortune, USN, project manager of the NASA Marshall Space Flight Center's Mississippi Test Facility, Huntsville, Ala.

Col. James K. Dowling, Chief of Information for the North American Air Defense Command (NORAD), Ent AFB, Colorado Springs, Colo. Lt. Col. Paul V. Porter succeeds Col. Dowling as Director of Information for the Air Defense Command, the Air Force component of NORAD.

Honors and Elections

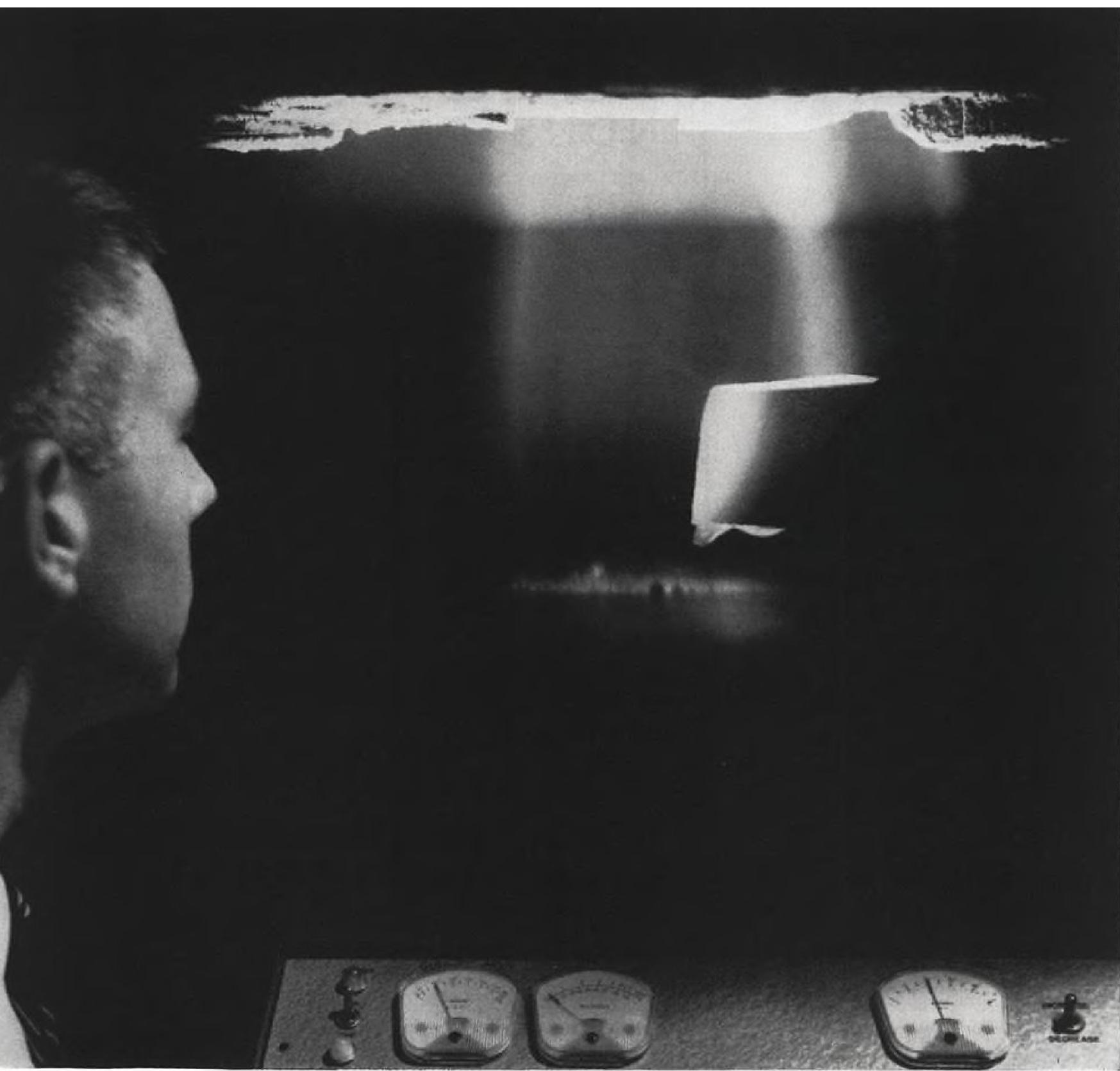
Andrew G. Haley, Washington attorney and general counsel of the International Academy of Astronautics, has been awarded the British Interplanetary Society's Astronautics Medal for 1962 for "contributions to astronautics in the fields of space law and international cooperation."

John B. Montgomery, president of Daystrom, Inc., has been elected president of the Air Force Assn. for 1962-63, succeeding Joe Foss, Marine fighter ace, who was named AFA board chairman.

(Continued on page 131)

INDUSTRY OBSERVER

- ► Counter-insurgency version of F-86 Sabrejet fighter proposed by North American Aviation's Los Angeles division would be powered by two podded General Electric J85 turbojets under the wings, replacing the single GE J47 engine in the fuselage. Ducting system for the J47 would house flexible bag fuel tanks with capacity determined by mission requirements. Counter-insurgency F-86 could have several times the range of standard models.
- ► Lockheed rigid-rotor CL-595 research helicopter (AW Jan. 29, p. 27), powered by a Canadian Pratt & Whitney PT6 turboshaft engine, has made its first flight, lasting about 30 min.
- ▶ Watch for further cuts in West German Defense Ministry development projects and hardware orders in moves designed to fit available funds. VJ-101D VTOL interceptor under development by southern group may be one of first programs to be cut (AW Oct. 8, p. 30). Another borderline item: West German order for France's Sud Super Frelon helicopter. Top ministry officials will review programs with Defense Minister Franz Josef Strauss this week.
- ► Soviet Union is studying use of the U.S. Rogallo wing concept for paraglider missions associated with space flight.
- ▶ Dept. of Defense is placing increased emphasis on beyond-the-horizon radar, operating in the high-frequency band, as a promising technique for expanding coverage of present ballistic missile early warning systems (BMEWS) at minimum cost. The new radar, expected to be far less expensive than existing BMEWS, utilizes ionospheric back-scatter of radar energy.
- ▶ Beech Aircraft is proposing to build its Queen Air 80, re-engined with Canadian Pratt & Whitney PT6 powerplants, as a new liaison aircraft for the Army. Under the proposal, Beech also would modify Army's L-23F aircraft to bring them up to the Queen Air 80 configuration.
- ► Focke-Wulf is redesigning its VTOL close-support fighter project to incorporate Rolls-Royce lift engines instead of the originally planned Bristol Siddeley vectorable-thrust engine concept.
- ▶ General Electric lift-fan system for the Army's VZ-11 program was run to full power during its first test as a breadboard system recently. Test rig uses twin J85 turbojets complete with all ducting, two diverter valves, the pitch fan and one lift fan. Other lift fan is simulated by variation of back pressure on the jet exhaust, used to drive fan tip turbines. First flight of the VZ-11, now under construction by Ryan, is scheduled for July, 1963.
- ► Egypt's budding aircraft gas turbine industry reportedly is headed by a prominent Austrian engineer who worked in the Soviet Union after World War 2. Egyptians are ordering increasing amounts of compressor blade material from firms within the United Kingdom and Europe.
- ► Canadian de Havilland Otter, repowered for U.S. Army with two wingmounted Canadian P&W PT6 turboprops, is expected to fly by the end of this year. The STOL test aircraft also will be fitted with a fuselage-mounted General Electric J85 turbojet providing reverse thrust to permit extremely steep, nose-down approaches and to provide rapid braking.
- ► Watch for Navy to order six Nord CT-41 supersonic ramjet target drones from Bell Aerosystems Co., holder of U.S. sales and manufacturing rights for the French design, for evaluation at Pt. Mugu, Calif.
- ► Commercial development of the Robertson Skyshark STOL aircraft (AW May 28, p. 89) is under way, with certification planned within six months. Four-place aircraft will be powered by an engine in the 200 to 300 hp. range, and is expected to takeoff and land in less than 100 ft. with moderate loads. First flight is scheduled later this month.
- ➤ Rolls-Royce has developed an increased-thrust version of the Spey turbojet, designated RB.163-25. Specifications have been submitted to British Ministry of Aviation in request for funding support.



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Washington Roundup -

Air Force Space Plan

Air Force's comprehensive space plan, which was requested by Defense Secretary Robert McNamara (AW Aug. 27, p. 34), has been completed and will be sent to McNamara this week before Air Force Secretary Eugene Zuckert leaves for an extended trip to the Far East on Oct. 18. Requests embodied in the plan will stay within the spending ceiling set for Air Force by Defense Dept. for Fiscal 1964 but will recommend reorienting projects, putting greater emphasis on some and reducing others to development of the technology involved.

Drive to increase the role of international air transportation in the shaping of U.S. foreign policy is creating renewed pressure for the establishment of an undersecretaryship of state for civil aviation. Airlines have opposed such a move in the past on the grounds that it would increase governmental control over the industry. Now, however, some international carriers, led by Pan American World Airways, favor such a post to help gain top-level governmental backing in route negotiations with other nations.

Satellite Report

The Satellite Situation Report, published by National Aeronautics and Space Administration and containing tracking information on U. S. and Soviet satellites, was to resume publication late last week—with some changes—after missing two biweekly issues because of a dispute within the government on how much and what kind of information should be made public.

Ambassador Adlai Stevenson and Secretary of State Dean Rusk. NASA—which receives the detailed information for the reports from North American Air Defense Command (see p. 27)—would like to get rid of the responsibility for publishing and distributing the reports, but is especially anxious to avoid the burden of questions on data that are obviously omitted, such as code names of U. S. military satellites. Some Pentagon officials also favor inclusion of more information on U. S. satellites on the theory that Soviet Russia usually can deduce a satellite's mission from its own tracking.

Astronauts' Retreat

The Cape Colony Inn motel at Cocoa Beach, Fla., which is partly owned by the seven Mercury astronauts, is up for sale because of public criticism of their financial interest in it. National Aeronautics and Space Administration leased space there for its temporary news center for the Mercury-Atlas 8 flight, in spite of charges that this created a conflict of interest situation for the Mercury pilots. The money they invested in the motel—estimates range from \$5,000 each to a total of 30% of the \$1.6 million venture—came from a contract with Life magazine for the sale of their personal stories. Leo DeOrsey, Washington attorney and financial adviser to the astronauts (AW Apr. 9, p. 21, 28), said the asking price will be more than \$1.6 million but would not give a specific figure.

Because of Congress' haste to leave Washington and tend to re-election chores, the Senate agreed to let the communication satellite incorporators nominated by President Kennedy (see p. 37) serve under a recess appointment, rather than go through formal Senate confirmation.

Hardsite Experiment

Selection of four companies to conduct Hardsite ICBM defense studies without a formal competition (AW Oct. 1, p. 13) is an experiment by Defense Dept. to select contractors for low-cost, specialized studies based on company skills rather than on their ability to produce impressive brochures at considerable cost to all participants. Before selecting Douglas, Lockheed, Martin and North American, officials from Defense Dept. and Army Missile Command visited a large number of potential contractors and held detailed discussions with their engineers to evaluate their capabilities.

Col. Langdon F. Ayres, Air Force Systems Command's manager for development of large solid propellant rockets intended for both USAF and NASA use, will retire at the end of October. His replacement is Col. Harold W. Robbins, deputy commander of the 6593d Test Group (Development) at Edwards AFB, Calif.

Subsurface Motivation

For the second time in 27 submarines, the Navy pattern of naming Polaris-carrying nuclear subs for American statesmen, patriots and heroes has been broken. President Kennedy named the SSB(N)-663 the Casimir Pulaski in honor of the Polish general who served as a brigadier general in this country's Continental Army in the Revolutionary War. The only other break in the pattern came May 8, 1962, when the President's wife christened the Lafayette, and it was carefully pointed out that the French general had been an honorary citizen of Maryland and Virginia. Navy stoutly declines to comment on reports that the White House had in mind the Polish vote in a tough gubernatorial race in Michigan when it selected the name Pulaski.

-Washington Staff

Pentagon Civil-Military Friction Increases

Washington-Friction between civilian and military leaders in the Defense Dept. has been increased greatly by two recent incidents in which civilians in the Office of the Secretary of Defense took important preparedness actions without consulting the chiefs of the military services.

The most important was the ordering of a Navy fighter squadron to Key West, Fla., where it was put under Air Force operating control, to counter the threat of Russian-built MiG fighters in Cuba (AW Oct. 1, p. 20). This was done by Deputy Secretary Roswell Gilpatric, who did not consult beforehand with the Joint Chiefs of Staff as a group or with the Air Force chief of staff or the chief of naval operations.

The second action was an order to the Air Force, Navy and Marine Corps to stop current procurement of most conventional aircraft bombs and rockets in favor of more sophisticated and expensive weapons, and to eliminate the more conventional weapons from their Fiscal 1964 budget requests. Strong protests from the chiefs of these services were rejected.

These two incidents are only the most recent and striking examples of the growing gulf between Secretary of Defense's office and the military servby civilian budget and technical officials (AW Aug. 27, p. 19), and written orders on all types of matters from Defense Secretary Robert S. McNamara himself, which are so specific that the services say they leave no room for judgment by the military experts who must carry them out.

The services have responded to the McNamara orders by interpreting them strictly and following them to the letter, exercising even less judgment than the orders might permit. This "passive resistance" has been the cause of increasing frustration to Defense Dept. officials, particularly McNamara.

were designed for an earlier generation of jet fighters and were not stressed for the weight of the F-4B. The station also lacked any command and control installation for fighter ground control.

USAF's Tactical Air Command airlifted a portable command and control unit to Key West. The squadron was placed under control of the North American Air Defense Command, which will exercise the control through USAF's Air Defense Command. Protection of this area is referred to as Southern Tip, and the first operational squadron of Air Force F4Cs-the USAF version of the former F4-H-will replace Navy aircraft at Key West in 1964.

The station, located on Boca Chica key just east of the city of Key West, is 90 mi, from the nearest point of Cuba's north coast and 100 mi. from Havana. A portable command and control station was necessary because the southern approaches to the U.S. are not completely equipped to detect enemy air strikes or to direct U.S. fighters.

The order to the Air Force, Navy and Marines to concentrate on air-toground missiles of the Bullpup class was an abrupt reversal of the Administration's emphasis on relatively simple weapons and non-nuclear warfare techniques, particularly counter-insurgency warfare (AW Oct. 1, p. 37).

Recommendations for this action originated in the office of Alain Enthoven, director for systems analysis in the Defense Dept. comptroller's office.

Specific items cut from the buying programs are high explosive aircraft bombs of various sizes up to 1,000 lb., Zuni rockets and 2.75-in, rockets. The bombs eliminated included types that can destroy fortified positions and antipersonnel weapons, called Lazy Dogs, which scatter small pieces of shrapnel or shot over a wide area.

Substituted for these are several versions of the Martin Bullpup air-toground guided missile, which is already in the inventories of Air Force, Navy and the Marine Corps in both nuclear and non-nuclear versions. The basic Bullpup is sight-guided by the pilot of the launching aircraft. Another version, called Walleye, uses a television guidance system that permits launching from greater distances.

A variety of warheads is available for use with either guidance system. The conventional high explosive warhead has no special name. Sadeye warhead, like Lazy Dog, scatters fragments.

The orders were sent to the services without explanation. The unofficial reaction among working level officers has been far stronger than the opinions expressed in the official letters of protest.

Gilpatric telephoned his controversial order for Fighter Squadron 41, composed of 14 McDonnell F-4Bs (AW July 30, p. 38), to be transferred from Oceana Naval Air Station near Norfolk, Va., to the Naval Air Station at Key West, directly to Adm. Robert . Dennison, commander-in-chief, Atlantic, (CINCLANT) at Norfolk, on Oct. 6.

CINCLANT is a unified command. Although it is legal for the Secretary or Deputy Secretary of Defense to transmit orders directly to such a command, ices. Other areas of dispute involve operational orders normally are transwhat the services consider overcontrol mitted through the Joint Chiefs of Staff and the services provide support through their own control and logistics

> Bypassing of the heads of the two services involved and of the Joint Chiefs organization is expected to have widespread repercussions. It also created a number of immediate problems which the Navy and Air Force acted hurriedly to solve, once they were finally notified.

The most immediate problem was the inadequacy of the Key West air station. It is in the midst of a modernization program which includes new runways, hangars, housing accommodations and communications. Runways

Ranger 5 Ready for Launch

Washington-Fifth launch in the Ranger series is scheduled this week at the Atlantic Missile Range in the third U.S. attempt to take closeup photographs of the moon and to obtain detailed information on the composition of the lunar surface.

Ranger 5 is identical in appearance to Rangers 3 and 4, and has the same fundamental mission objectives as these earlier rough lunar landing spacecraft (AW Feb. 5, p. 30; Apr. 30, p. 35). Ranger 4 impacted the dark side of the moon and Ranger 3 went into a heliocentric orbit because its injection velocity was too high.

National Aeronauties and Space Administration last week reported that Mariner 3 gamma ray spectrometer has returned data indicating that gamma ray intensity in interplanetary space may be as much as 10 times greater than had been theorized. The instrument was carried on the payload to determine if potassium, uranium and thorium are present on the moon.

Gen. Gerhart Cites 'Urgent' Need For First-Pass Tracking Capability

By Larry Booda

Washington-U.S. sensing networks' capability to identify and track a satellite on its first pass "is limited and we have an urgent need for further expansion of our capability in this regard," USAF Gen. John K. Gerhart, commander-in-chief of North American Air Defense Command, said last week.

Gen. Gerhart was the second Air Force official to cite the lack of firstorbit tracking capability in recent weeks. Maj. Gen. C. H. Terhune, Jr., commander of Air Force Systems Command's Electronic Systems Division, told the Air Force Assn. convention that "we will need a surveillance system with a first-orbit capability for detecting, tracking, identifying and cataloging all objects. This function . . . will be particularly critical to military operations in space" (AW Sept. 24, p. 25).

Gen. Gerhart told the annual meeting of the Assn. of the United States Army here last week that Soviet Russia's Vostoks 3 and 4 passed over the U.S. many times. "There is no question that had the Soviets had a hostile intent during those orbits they could have posed a terrific threat to the U.S.," he said. "We must develop our own capability for responding militarily if Russia turns from peaceful uses in space."

Gerhart's vice commander, Canadian Air Marshal C. Roy Slemon, had told the AFA convention earlier that the Vostok flights "generated in many of us a strong feeling of uneasiness . . . They orbited in tandem and approximated a space rendezvous pattern. In due time they were brought back to earth with precision to predetermined landing sights. They crossed and recrossed America 70 times. I wonder if it's later than we think." NORAD is the command responsible for missile and satellite detection and warning.

Gen. Gerhart also noted that the Soviets now say they have missiles that

can reach the U.S. by way of the south polar regions. Since the BMEWS missile warning system covers only the northern reaches of North America, more sensors must be strategically placed to detect Soviet missiles, he said.

Gen. Gerhart's remarks were the only departure from the general theme of special warfare and counter-insurgency training, combat developments and equipment at the AUSA meeting. The emphasis was on mobility, communications and new weapons.

Commenting on Army's Tactical Mobility Requirements Board headed by Lt. Gen. Hamilton Howze, which has been studying Army air modernization (AW Oct. 8, p. 25), Gen. Barksdale Hamlett, Army vice chief of staff, said: "I want to make it clear that the Army is not proposing to take over any of the roles of the Air Force. We will continue to look to the Air Force for forms of support which it has been providing in the past-airlift, reconnaissance and close support."

Defense Secretary Robert S. Mc-Namara told the meeting that "continuing growth of Soviet nuclear force is the fundamental fact influencing all our military planning." He said the U.S. has a nuclear force strong enough to survive "any conceivable nuclear attack" and give the attacker "unacceptable damage . . . and we have increased the budget to assure that we shall have such a force in the future."

Soviet Russia prefers wars that it believes are "below the threshold of nuclear deterrence" but that threshold "is bound to rise" and "we require increasing capability to deter forms of political and military aggression against which the application of nuclear weapons may not be a credible response," McNamara said.

McNamara said the number of combat-ready Army divisions has increased by 45% in the past 14 months; 1963 procurement funds for airlift aircraft

are double that for 1961 and twice as many tactical fighters are being bought for USAF in Fiscal 1963 as in Fiscal 1961; Army's Special Forces now are at almost four times their strength at the beginning of 1961; and that while Army "has been absorbing these large increases of men and equipment and innovations in doctrine, it has been going through a major reorganization involving combat arms and technical services" that "has been the most comprehensive since Secretary Root created the General Staff system in 1903."

Army Gen. Paul D. Adams, commander in chief of the joint Army-USAF Strike Command, revealed that Strike Command is to develop new airto-ground support procedures involving field tests of tactics and material (AW Oct. 8, p. 25) and evaluation of USAF and Army aerial surveillance methods, or tactical aerial reconnaissance.

"In my judgment, neither the Army nor the Air Force has ever been completely satisfied with the present air-toground support system. Without any fuss or furor, or blood and guts on the floor, we have recommended a support system concurred in completely by the Air Force and the Army," Gen. Adams said. This system, he said, will be tested in Exercise Three Pairs late in October and other tests will continue until late next spring.

Surveillance test exercises will begin next January and last until May, he said.

Gen. Adams described what he refers to as contingency operations which take place outside the framework of the unified commands. If such an operation is ordered, Strike Command moves into an area with an advance echelon which receives the troops and aircraft.

The Strike Command has two Army corps, eight divisions, technical and administrative support for these, three numbered air forces and more than 40 squadrons of reconnaissance, tactical fighter, troop carrier and tanker aircraft. Gen. Adams did not describe any specific contingency operation, but said: "We have not conducted any that have developed into military action, but . . . some that I am not at liberty to de-

New Missile Competition

Requests for proposal for a new Guidance Evaluation Missile (GEM) to be used to evaluate stellar-inertial guidance systems of the type planned for the mobile medium-range ballistic missile are being issued by Air Force Missile Development Center, Holloman AFB, N.M. Rocket sled tests, previously used to check out all-inertial guidance systems, do not permit evaluation of star tracker performance under realistic space conditions because of atmospheric attenuation.

Keating Asks Facts on Cuban IRBMs

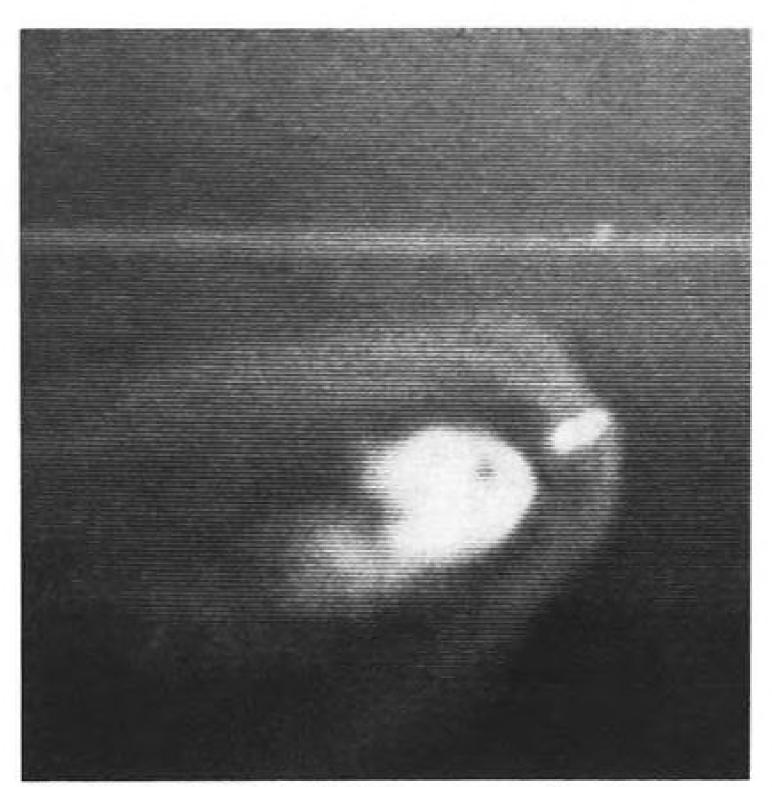
Washington-"Construction has begun on at least a half dozen launching sites for intermediate-range tactical missiles" in Cuba and the Kennedy Administration should give the public "all the facts about the military buildup" there, Sen. Kenneth B. Keating (R.-N. Y.) said last week.

Sen. Keating said his own sources, "which have been 100% reliable" on the Cuban situation, have substantiated published reports on the IRBM bases.

The first detailed, official report on the Cuban military buildup to be made public was given to the House Select Committee on Export Control on Oct. 3, by Under Secretary of State George W. Ball. It closely parallels a report made by Aviation Week & Space Technology on Oct. 1 (p. 20), but does not mention IRBM bases, which Pentagon strategists think will probably follow the present defense buildup.

Ball said there were 15 surface-to-air missile sites and it is estimated there will be 25 eventually. He said there are "three and possibly four missile sites . . . similar to known Soviet coastal defense missile sites . . .'

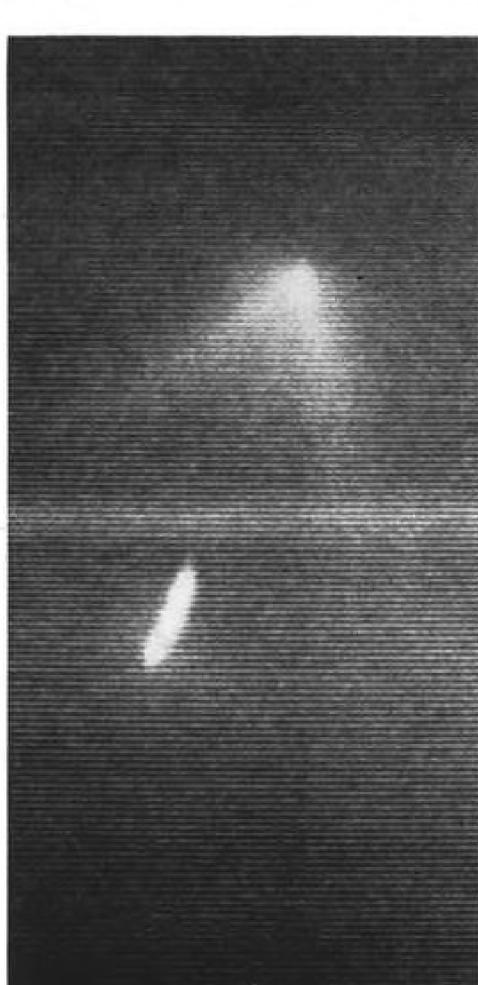
Cuba now has 60 older types of MiG jet fighter aircraft and "at least one advanced jet interceptor has recently been received, and probably several more are in the process of assembly," Ball said. "This type of advanced jet interceptor is usually equipped with infrared air-to-air missiles. We estimate that the total of these advanced interceptors in Cuba may eventually reach 25 to 30."





TWO MA-8 BOOSTER ENGINES were cut off and jettisoned approximately 2½ min. after liftoff, at an altitude of 201,000 ft. Sustainer engine continues to power the Atlas vehicle and its Mercury spacecraft into orbit. Photos were taken in rapid sequence. Note expanded boundary of the luminous exhaust plume in both photos. Flight lasted 9 hr. 14 min. (AW Oct. 8, p. 26).

MA-8 Provides Added Quantitative Data



PROPELLANT escape rocket, mounted in tower-like structure above the Mercury capsule, was jettisoned just prior to sustainer engine shutdown at altitude of about 284,000 ft.

By Erwin J. Bulban

Houston, Tex.-Collection of significant quantitative data on spacecraft operations and performance was made possible by Mercury MA-8 systems functioning flawlessly during six-orbit, 9-hr. 14-min. flight Oct. 3, Cdr. Walter Schirra noted in his initial pilot report here at Rice University Oct. 7.

Cdr. Schirra pointed out that although the systems he worked with in Sigma 7 differ somewhat from those that will be in Gemini and Apollo, he felt that he was able to prove the pilot's basic capability to use, control and evaluate the systems in far more detail than was possible in previous shorterduration missions in which Astronauts John Glenn and Scott Carpenter were further hampered by systems malfunctions and heavy work-load of experiments.

With systems working perfectly, Schirra said he was able to closely monitor the additional metering added to MA-8 to provide increased readouts on various equipments. These included meters to record temperatures of each of the low-thrusters he used for maneuvering, increased read-outs on the electrical systems and additional instrumentation providing more accurate presentations on suit temperature.

Schirra reported that he was particularly concerned with extending knowledge, in an engineering sense, of the varied controls and systems experience that Glenn and Carpenter had been

able to try out briefly in their flights. He also wanted to set the spacecraft up in one control mode and stay in one basic attitude for a long period to achieve what he termed its thermal balance, so that he could accumulate numerical data on how the system worked as an entity.

He also made a quantitative analysis on yaw determination, picking up from where earlier flights had left off in attempting to get longer periods of each of the successions they had performed.

Other points of the MA-8 flight cov-

Webb Retort

Houston-National Aeronautics and Space Administration Chief James E. Webb retorted strongly when asked to comment on an opinion expressed recently by former AEC Chairman Lewis Strauss that U.S. attempt to land a man on the moon is perilously like a stunt merely to impress others as a scientific achievement.

Webb noted that this is a step-by-step program in which this country is gaining experience as rapidly as it can without going into a crash program. For his part, he stated, he did not consider the Schirra flight, or those preceding it, as stunts. but as a serious program by a large number of people who have considered the scientific side, the technological side, the capability of the boosters within our control at the time, the lessons to be learned and the risks to the men involved.

USAF Explores Orca Missile Concepts

Air Force will begin an intensive series of studies on a new ballistic missile family which might be deployed at random over the earth's surface-in isolated wooded areas, arctic wastes and oceans and obscured waterways.

New missile concept, initially called Orca, for the killer whale of that name, would have the advantage of being launched from remote areas, mostly outside the continental United States, and would be relatively immune to retaliation. Unlike the Navy's submarine-launched Polaris, however, launching points probably would be unmanned and, in most cases at least, immobile.

USAF's Ballistic Systems Division will brief aerospace firms tomorrow on its requirements in connection with three proposal requests issued recently for the project. Proposals for the three studies, which involve 10 exploratory tasks, are due at

BSD on Jan. 2. USAF is understood to have several million dollars funded for the studies, expected to range in duration from 8-12 months.

Orca concept was proposed to the Air Force and Navy by General Dynamics/ Astronautics, which has been at work on the concept with its own funds for sometime (AW July 9, p. 15).

Essential idea is to encapsulate the missile so that it could be stored in firing condition under adverse environments, such as floating just below the ocean's surface, much like a naval mine. Navy was not interested in the concept because of its heavy commitment to the Polaris program.

Study task areas for the forthcoming BSD studies include:

- Encapsulation. This would cover methods to encapsulate the missile properly. Encapsulation is not regarded as a major problem area. Dollar value-\$225,000.
- Deployment. This would cover where to locate the missiles for strategic, political, and other reasons. \$225,000.
- Hardened mobility. \$300,000.
- Early warning, \$100,000,
- Payload. \$150,000.
- Global ranging. \$300,000.

Each of the six tasks is contained in a single proposal request.

One of the biggest problem areas will involve command and control of the missile. A single study, funded at about \$2 million, or perhaps two studies of about \$1 million each, will probe all types of command and control systems for the missile concept, which Air Force refers to as dormant, storable missiles. Proposals for this task will be made in response to RFP 04-(694)-63-118.

Third proposal request covers the second large problem area-guidance. Three types of potential guidance systems, including radio command and dormant inertial guidance, will be explored in three tasks.

ered by Schirra included the following: · During drift flight no axis motion exceeded approximately three-quarters of a degree per second. Schirra spent 118 min. in full drift flight, 18 min. in limited drift. Mercury capsule roll rate is approximately 1-2 deg. per sec.

duration flight yet made by a U.S. astronaut, was an experience about

Schirra Honors Due

Houston-Cdr. Walter Schirra, will be awarded the NASA distinguished service medal Oct. 15 at a ceremony in his home town, Oradell, N. J.

NASA's annual award ceremony, Oct. 25 in Washington, will honor four Mercury Project groups of the Manned Spacecraft Center-the Directorate for Engineering and Development, headed by Max Faget; the Mercury Project Office, headed by Kenneth Kleinknecht; Preflight Operations Division, headed by Merritt Preston and the Flight Operations Division, headed by Christopher Columbus Kraft.

which he said he had no recollection and he felt no fatigue, nor was there any break-off phenomena or queasiness.

• Fuel conservation program executed by Schirra resulted, he said, in sufficient fuel remaining for 12 more orbits, or a total of 18. At retrosequence, which · Weightlessness, during the longest- is just prior to retrofire, Schirra estimated he had 78% remaining in the automatic and manual system tanks; subsequent to retrofire he read approximately 55-58% on automatic and 78% on manual tank. He utilized the manual tank for re-entry, using the ratecommand system. He used the low thrusters for maneuvering, a switch having been added permitting fly-by-wire low thrust command. His concern with saving fuel extended to electing not to change capsule attitude in order to pick up the Echo balloon satellite visually, which had been a suggested experiment (AW Oct. 8, p. 26).

· Schirra saw the "firefly" phenomena earlier reported by Glenn and the white snow-like objects noted by Carpenter on his flight and his opinion is that they are a result of efflux from the spacecraft, Cdr. Schirra believes they

will be seen on future Mercury flights. • Improved HF antenna, which was attached to MA-8's retrorocket package, and deployed 14 ft. at three o'clock and nine o'clock positions, gave a "tremendous" increase in reception. Schirra said he raised stations earlier than he had

anticipated. Overcast prevented him from seeing the flare experiment performed on the ground at Woomera, but he stated that he did see lightning over the city, although the ground observers stated they saw no such phenomena.

 Schirra said that he took the 35-mm. camera along under duress, feeling that sufficiently good hand-held photographic coverage had been obtained on previous flights. He said he had very few opportunities to take pictures because of weather that blocked much of the view. Experiments included an attempt to photograph certain land masses to assist in analysis of the earth and possible extrapolation of the surface of other planets, which Schirra considered farfetched and an attempt to determine what type of filters would be best for future Tiros and Nimbus vehicle cameras.

• Radiation dosimeter carried on MA-8 was calibrated to finer degrees than on carlier missions, reading from zero to one Roentgen, but Schirra noted that on his mission the indicator never got up the scale as far as 0.1.

• Periscope was definitely established as being unnecessary on Mercury missions.

Schirra noted that MA-8 almost had the periscope deleted, before launch but it finally was included to be able to determine finally whether it was necessary to acquire attitudes or whether this could be done exclusively through the window. Periscope is being deleted from the next Mercury shot, MA-9, which is scheduled as a 24-hr. mission with a probable launch date of late February or early March, 1963.

ESD Studies

Air Force's Electronic Systems Division contemplates several additional planning studies (AW July 30, p. 16) in the current fiscal year to further examine future Air Force avionic requirements.

Planning studies for which industry proposals are expected to be requested include space-based command and control, aerospace environmental forecasting and prediction, and aerospace traffic control.

ESD recently selected Space Technology Laboratories and International Electric Corp., which placed first and second respectively in technical evaluation of industry proposals, in a competition for studies of global range instrumentation, 7990-23 (AW Aug. 13, p. 75). The three new studies will be in the 7990 series.

Active ECM to Be Tested for Missiles

Electronic countermeasures (ECM) flight test program aimed at exploring the feasibility and desirability of incorporating active ECM gear in Air Force ballistic missiles to confuse or jam enemy defenses will be conducted soon by USAF's Ballistic Systems Division. Plan calls for 25 test flights.

Program, known as ECM Feasibility Flight Test Program, is a follow-on to two competitive parallel studies completed earlier this year by Raytheon Co. and Sperry Rand Corp. It is not linked to any specific ballistic missile program, but its results presumably will be applicable to any of the newer re-entry vehicles, such as Mark 12 (Minuteman) and Mark 13 (Titan 2).

Proposal requests were sent to an extensive list of potential industry bidders last week. Companies solicited include Aeronutronic Division of Ford, Airborne Instruments Laboratory, Avco, Hallicrafters, Motorola, Raytheon and Sperry. Proposals are due Nov. 2.

Active ECM program is one of a number of efforts relating to ballistic missile penetration aids being conducted by the Re-entry Vehicle Technology Directorate of BSD. Others include a decoy program, under contract to Aeronutronic and the LORV (low observable re-entry vehicles) program (AW Apr. 16, p. 34) being conducted by Avco. The latter effort is an outgrowth of an earlier Avco study on reducing re-entry vehicle radar cross sections.

BSD also has an industry study on ballistic missile plume reduction. Aerospace Corp. is supplying technical direction for BSD's active ECM test program.

First Venus Data Still Assured Despite Wider Miss by Mariner

Washington-Mariner 2 spacecraft will miss the planet Venus by about 20,-900 mi, rather than 9,000 mi, as estimated earlier, but the new distance is close enough to assure first direct measurements of the planet's temperature and infrared radiation emissions.

The 447-lb. Mariner 2 payload was launched Aug. 27 from the Atlantic Missile Range (AW Sept. 3, p. 18), and a midcourse correction was applied to the trajectory Sept. 4 (AW Sept. 10, ing Oct. 8, p. 54) has a normal velocity p. 34). Shortly after the correction was of 850,000 to 1,550,000 mph., with made, National Aeronautics and Space Administration computed miss distance as 2.8 million mph., Dr. Neugebaur at 9,000 mi, based on one-way Doppler and brief tracking. The new estimate, which has a $\pm 3,000$ -mi. factor, was made last week after continued two-way Doppler tracking and 40 days of continuous tracking.

Meanwhile, the five science experiments on board the spacecraft (AW Dr. W. M. Alexander of NASA's God-Aug. 13, p. 68) are supplying a mass of dard Space Flight Center. This means new data concerning interplanetary space which, for the most part, is con- of cosmic dust particles near the earth, firming and extending information from earlier satellites and probes which carried magnetometers, solar plasma probes, ion traps and cosmic dust detectors.

and Jet Propulsion Laboratory last week scientific instruments which have been highlights:

• Solar plasma, although it varies in • Interplanetary magnetism is relatively

By Edward H. Kolcum time and velocity, is continuous and it moves fast enough to push the interplanetary magnetic field "around as it wishes," according to Dr. Marcia Neugebaur of JPL, co-sponsor of the solar plasma spectrometer experiment. This means that the solar wind is steady, and is much more than a breeze, sometimes reaching characteristies of a hurricane, according to Dr. Homer E. Newell, NASA space sciences director. The plasma flow (illustrated in an Aviation Week drawsome particles having a velocity as high said. These velocity numbers correspond respectively to energy ranges of 750 ev., 2,500 ev. and 8,000 ev.

 Cosmic dust is present in deep space, but the flux is at least 1,000 times less than the flux measured in the nearearth space environment, according to essentially that there is a concentration but it is not known why or how this concentration exists. The experiment, which is a flat magnesium sounding board, is sensitized to impacts ranging from a billionth to five trillionths of Mariner project officials from NASA a gram, and it can count them and measure momentum and distribution made their first report on findings of in mass. Counting will continue at the Venus encounter to determine whether in operation since Aug. 29. Among the a similar concentration of cosmic dust exists near Venus.

steady at a force of 5-10 gammas. During the flight of Pioneer 5, launched Mar. 11, 1960, increases up to 50 gammas were detected during periods when geomagnetic storms were measured on the earth. Mariner 2 has detected increases as high as 25 gammas during a storm Sept. 12. Dr. E. J. Smith of JPL said the magnetometer carried on board Mariner 2 has been measuring steady fields along the force lines around the sun and those perpendicular to the heliocentric lines, called the transverse component.

Dr. Newell pointed out that the transverse lines inhibit the free flow of solar particles into the earth's field, and Dr. Smith said it is the transverse component which is most disturbed during geomagnetic storms.

Although it had been theorized earlier that the direction of the transverse force lines would lie in the plane of the ecliptic, Dr. Smith said, Mariner 2 has found a substantial amount of magnetism perpendicular to this plane.

 Interplanetary high-energy radiation is constant, with a flux of 650 ion pairs per cm." per sec., according to Dr. H. R. Anderson of JPL. This is 100 times the cosmic ray intensity at the earth's surface. Variations that exist are in the order of 3 to 4%, he said. Mariner 2 recorded one sharp drop in high energy radiation, which may have resulted in a modulation in the interplanetary magnetic field, he said. Flux of low-energy radiation is about three times as great in interplanetary space as high-energy radiation, and increased by a factor as high as 10 at the times when highenergy radiation decreased.

J. N. James of JPL, Mariner project manager, cautioned that the Venus miss distance could change because of three uncertainties: the gravitational mass effect on the spacecraft, effect of solar pressure, and the precise measure of the astronomical unit. He said that at the time of the correction maneuver, total component velocity change along two axes should have been 69 mph., but actually was 72 mph. Total velocity increment added to the spacecraft was 47 mph., about 2 mph. faster than desired. Mariner velocity in relation to the sun, called absolute velocity, at the time of the midcourse correction was 60,117 mph., and after, was 60,164 mph.

"Bullseye" area in which the infrared and microwave radiometers can measure extends from 5,000 mi. to 40,000 mi. above the Venusian surface. Even though the midcourse maneuver resulted in a 2 mph. over-correction, Mariner 2 encounter date remains Dec. 14. Mariner 2 carried 4.75 lb. of attitude stabilization gas and uses it at an average daily rate of 0.022 lb. Solar ultraviolet radiation, expected to degrade the solar cells, has not done so,

Boeing, Dassault Forming V/STOL Team

Wichita, Kan.-Boeing Co. and Marcel Dassault have teamed formally to collaborate in technical and sales efforts on vertical and short takeoff and landing aircraft programs.

Three specific agreements have been signed by the two companies with the approval of the U.S. and French governments and direct liaison has been established between the two companies. Dassault's immediate line of contact with Boeing is the American company's Military Aircraft Systems Division (MASD), here.

Agreements, expected to be announced this week, basically cover these

 Technical evaluation of the V/STOL Dassault Mirage 3V by Boeing's MASD. This is planned to ensure that the program represents technologies that will not only fit North Atlantic Treaty Organization requirements in the NBMR-3 strike fighter competition-adding whatever Boeing knowledge may enhance the airplane's performance-but also to incorporate U.S. military system requirements that would make the Mirage 3V a potentially useful system to U.S. services with minimum modifications. This agreement also pledges Boeing to support the Mirage 3V fully in NATO and U.S. markets, and gives MASD the option of building the strike fighter in this country. Dassault has a similar agreement covering Britain with British Aircraft Corp. (AW July 30, p. 18).

 Similar understanding covering a V/STOL assault transport, proposed in the NATO NBMR-4 competition, is incorporated in a second Boeing-Dassault agreement.

 Rights to Dassault-developed V/STOL thrust control system, covering sales and production in the United States by MASD, are included in the third agreement.

Under the technical collaboration agreement, MASD will tap its own engineering resources at Wichita. It also will be able to call for assistance on any of Boeing's other divisions which it feels have specialized knowledge and equipment fitting any portion of the 3V's needs.

Interchange will provide free passage of unclassified data. Classified material will have to be approved for transmission between the two companies by their respective governments.

Initial contributions by Boeing to the Mirage 3V include advice regarding fuel systems design technology, data on the effects of sonic fatigue on structure and personnel-a vital area due to the large number of engines in the airplane which develop high noise levels-and information on long-life, fail-safe structures.

Dassault liaison with Boeing is directly with MASD. Boeing vice president and division general manager, Edward C. Wells, is the key man, with authority to make decisions reflecting Boeing policy.

MASD Exploratory Studies Manager Donald D. Hufford will coordinate and implement the agreements in Wichita. Herbert S. Clayman, recently assigned by MASD as European manager with offices in Paris, will manage the program at its source. T. E. Lollar, a division aerodynamics and dynamics stability specialist, is being moved to the Paris office to act as liaison during the tethered and flight test program, being carried out by Dassault on the Mirage 3V Balzac, approximately a half-scale testbed of the Mirage 3V.

Boeing collaboration with Dassault on the new program actually is a followon to the U.S. company's earlier working arrangements with the French manufacturer. The arrangements involved an unsuccessful attempt to fulfill an informal Dept. of Defense requirement for a lightweight, simplified fighter-Northrop N-156 and Lockheed F-104 also participated

Boeing and Dassault, working together on a general policy basis and operating

Hawker-Fiat Pact

Fiat is negotiating for a licensed production agreement with Hawker Siddeley Aviation for possible manufacture of the Mach 2.5 P.1154 VTOL strike fighter and will drop its own project in this area, the G.95/6.

In a parallel move, Fiat also is negotiating for license rights to the 32,000lb.-thrust Bristol Siddeley BS.100/9 vectored thrust engine which will power the P.1154.

Move gives impetus to an envisioned multi-nation program for the P.1154 and, for all practical purposes, throws Italian support behind the aircraft in the nowshaky North Atlantic Treaty Organization competition for a V/STOL closesupport fighter.

In discussing the negotiations, an Italian spokesman pointed out last week that the G.95/6, if continued, would have been in all probability a single-nation program, with Italy absorbing all the costs. With the P.1154, a large share of its development costs have been or will be paid by Great Britain, and other nations may yet participate. Republic Aviation and Fokker also have been discussing possible participation in the P.1154 program with Hawker Siddeley (AW Sept. 10, p. 30).

agreements never made formal, jointly entered the Dassault Mirage 3W, which actually was a Mirage 3C modified to meet DOD desires for an airplane that would be able to operate out of relatively unprepared fields, have relatively unsophisticated fire control and electronics equipment and feature some degree of self-sufficiency in combat.

The 3W was fitted with larger tires, its rocket pack was deleted, simpler Aida radar replaced the more complex Cyrano equipment, and a self-contained starting system was incorporated in the

Proposal by the two companies last March contemplated manufacture of the prime equipment by the U.S. companies under license to satisfy DOD's reluctance to rely on foreign supply sources. For example, Pratt & Whitney would be assigned the manufacture of the 3W's Snecma turbojet engine and Hughes Aircraft would provide the Aida

This earlier collaboration provided Boeing management with insight into Dassault capabilities. With growing inbomber, a competition in which the terest in V/STOL programs evidenced by NATO and the U.S. indicating a firm market developing in the near future, the American company decided to leap-frog its own research and development programs by utilizing what appeared to be a definite lead by European designers in actual V/STOL hardware.

> Other agreements by U.S. and European companies-Pratt & Whitney and Bristol Siddeley, Rolls-Royce and Allison, Ling-Temco-Vought and Short Bros. & Harland (AW Sept. 10, p. 30)also influenced the Boeing decision.

Boeing probably sees the agreement with Dassault as providing considerable benefits in developing its own technologies and considers the Mirage 3V as not merely the means to an end, but as providing invaluable broad-based additional V/STOL technology which can be applied to future programs.

MASD engineers appear to have developed considerable respect for the French company's attitude and ability to make decisions to build hardware to flight-test concepts at an earlier stage than is prevalent in U.S.-where the design constantly is refined on the drawing board and in the wind tunnel until it is in danger of being obsolete before being built.

The Boeing engineers point out that as a result of the 3V Balzac testbed program, Dassault expects to roll out and start flight tests on the full-scale Mirage 3V strike fighter in late 1963 and believes it can have the airplane operational with the French air force in quantity by 1966.

Military Space Spending to Rise Slightly

Washington—Defense Dept. funding programs of military space programs is expected to be higher in Fiscal 1964 than the \$1.5 billion allocated in Fiscal 1963, "but not very much larger," Asst. Secretary of Defense John H. Rubel, deputy director of defense research and engineering, said last week.

Defense Dept, expenditures for space developments "have been remarkably high in relation to viable concepts for military applications in space," Rubel told the Washington Aerospace Luncheon Club.

Funding of military space programs has tripled in the last three years, Rubel said.

Half of the department's efforts are directed at meeting well-defined military needs, but the other half represent "a very extensive program of technological insurance against an uncertain future," Rubel said.

Midas Problems

In the category of projects aimed at identifiable military needs, the Defense Dept. has spent \$300 million on the Midas early warning satellite and will spend up to \$100 million more this fiscal year, "despite great technical difficulties and disappointments" with the

USAF Gemini Role

Far broader participation in Project Gemini, including tests of military hardware in low earth orbit and the training of USAF technicians, is being asked by Air Force in the comprehensive space plan that currently is being prepared for Secretary of Defense Robert S. McNamara.

Prime goal of USAF is to accumulate knowledge, especially on the mechanics and problems of in-space rendezvous, so that it can respond rapidly if the Soviet Union threatens to move offensive weapons into space.

Sensors and so-called "negation devices," which could deactivate a potentially hostile satellite, are among the types of equipment Air Force wants to test.

However, it does not now intend to request funds for the purchase of Gemini spacecraft.

Officers responsible for USAF's space program feel that maximum military benefit would follow from intimate Air Force collaboration in the earth orbit rendezvous phase of Gemini. Rather than seek authorization for a similar development program of its own, Air Force prefers to work with Gemini, which is entirely under National Aeronautics and Space Administration.

program, Rubel said (AW Aug. 6, p. 26, Sept. 24, p. 54).

The department has spent nearly \$200 million on development of a military communication satellite system and plans to spend \$100 million more this year.

Funding for development of the Transit navigation satellite now totals \$100 million, with another \$50 million planned for Fiscal 1963, Rubel said.

In the second category—developing technology and systems where the military requirement is not well defined—Rubel cited the Titan 3, which is expected to cost nearly \$1 billion to develop. More than \$250 million of this will be spent this fiscal year.

Titan 3, expected to be a standard launch vehicle useful for nearly a decade, "is not being developed to fill a specific military mission requirement that adequately justified its development.

"No such requirement presently exists," Rubel said.

Defense Dept. will spend another \$300 million in the current fiscal year for bioastronautics, development of advanced sensors, the evolution of advanced propulsion systems and power supplies, developments in materials and a multitude of exploration and research efforts aimed at learning more about space flight and the space environment, Rubel said.

Large Percentage

The \$1.5 billion earmarked for military space development this year represents more than 20% of the department's total research, development, test and evaluation budget of \$7.1 billion and "is greater than the entire Army RDT&E budget and greater than the entire Navy RDT&E budget, including Nike Zeus and Polaris," Rubel pointed out.

Military space funding "is very large in relation to the funds and the efforts we are expending in research and development . . . of new systems . . . of demonstrable military value and effectiveness," Rubel said, "It competes with these, and as it grows, becomes a correspondingly larger and more important factor in decisions affecting the total Defense Dept. research and development program."

Rubel said the Office of the Director of Defense Research and Engineering is "particularly concerned with the effective utilization of our precious scientific and engineering manpower resources, for the bulk of the funds for research and development . . . determine the areas toward which their efforts . . . will be directed."

Citing extensive Air Force and Defense Dept. studies of possible military uses of space dating back to 1946 at the Rand Corp., Rubel said that despite many thousands of man-years of effort, "no really new ideas for the military utilization of space have been evolved. New techniques have been evolved or postulated, but the list of system proposals under active consideration shortly after Sputnik 1 is remarkably similar to today's list."

Sufficient Study

Many of these are being heavily supported, he said, but others are not. "This does not prove that new ideas will not be forthcoming. It does not prove that all the decisions to proceed or not to proceed have been correct. Nor does it prove that we have studied the problem sufficiently. We are still studying it.

"But it does suggest that our development efforts are not lagging behind the good ideas," Rubel said.

Rubel conceded that "there are a multitude of fascinating and potentially useful projects that one might undertake in this new field, but unless we can satisfy ourselves that these efforts contribute to our military mission, or are likely to, we are not justified in supporting them. . . . Naturally, space efforts which are often very costly and which may not contribute heavily or directly to [military capability] . . . must compete for support with others that do."

Marquardt Merger Study

Los Angeles—Marquardt Corp. and Packard Bell Electronics Corp. last week were in the midst of what Roy E. Marquardt described as "preliminary investigation" of a possible merger.

Marquardt is interested in Packard Bell as another step in its efforts to diversify into the electronics field (AW Aug. 13, p. 115). The particular attraction of the local electronics company for Marquardt is believed to be its digital computer capability.

Packard Bell, which has annual sales of about \$20 million, reported a sizable financial loss last year and another loss in its most recent quarterly report after two favorable quarters.

Industry reports over the past year or more have linked a number of large avionics companies to possible acquisition of Packard Bell.

A well-known Southern California avionics company is known to have held financial discussions with the company late last summer.



Russian V-8 24-place helicopter, credited to Mikhail Mil's design office, is now powered by paired turboprop engines instead of the single unit of the prototype (AW Feb. 12, p. 65). Wheel pants have been removed from this version.

Soviet V-8 Helicopter Now Powered by Paired Turboprops



Two small gas turbines, credited to Soviet Designer Isotov, power the V-2 helicopter. This six- to eight-place design also is credited to Mil's office and apparently is a conversion of the piston-engined Mi-1 to turbine power.

Congress Showed Firm Support For Accelerated Space Program

By George C. Wilson

Washington-Eighty-seventh Congress gave general approval of an accelerated national space program and set the stage for a debate next year on such specific questions as the roles the Pentagon and space agency should play in the effort.

In a second State of the Union message May 25, 1961, President Kennedy presented the challenge to Congress by declaring: "Now it is time to take longer strides-time for a great new American enterprise-time for this nation to take a clearly leading role in space achievement . . . I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to earth. . . ."

Congress responded to this request by voting overwhelmingly almost all the money requested for space. The lopsided voting in 1961 and 1962 for civilian and military space appropriations indicated that few lawmakers felt reluctant to commit the nation to such an expensive enterprise.

President Kennedy, in his May 25 message, warned: "Let it be clear that I am asking the Congress and the country to accept a firm commitment to a new course of action-a course which will last for many years and carry very heavy costs-an estimated \$7-\$9 billion additional over the next five years. If we were to go only half way, or reduce our sights in the face of difficulty, it would be better not to go at all."

Last year, Congress appropriated \$1,-671,750,000 for Fiscal 1962 for the National Aeronautics and Space Administration-\$562 million more than President Eisenhower requested in his final budget recommendation and \$112 million less than President Kennedy requested after reviewing that budget. This year, for Fiscal 1963, Congress

appropriated \$3,674,115,000 for NASA -only \$113,161,000 less than President Kennedy requested.

Not all this support was generated by President Kennedy, of course, A good deal came from spending space dollars where they could do political good. For example, Chairman Albert Thomas (D.-Tex.) of the powerful House appropriations subcommittee which handles the NASA budget, benefited from NASA's decision to place the Manned Spaceflight Center in Houston near his congressional district. Also, the growing volume of space contracts going to private firms in various areas helped broaden congressional support for space spending.

But more responsible for congressional support than anything else is the conviction that the national space program is an important event in the U.S. vs. Russia contest. Such Russian achievements as the flights of Vostoks 3 and 4 are causing a growing number of lawmakers to go beyond appropriating the money and question whether the billions for space are being spent in the most effective way.

Chairman Melvin Price (D.-Ill.) of the Joint Congressional Atomic Energy Research Subcommittee, is one lawmaker who feels the national space program must undergo a change of emphasis to surpass the Russian effort. He told Aviation Week he will press harder next year than ever before for more emphasis on nuclear space pro-

Chairman Richard B. Russell (D.-Ga.) of the House Armed Services Committee is among those who contend military space projects were taken away from the armed services too soon and transfered to NASA. He will go into the question of whether NASA is adequately fulfilling military space requirements during Defense Department and NASA budget hearings next year

New Radiation Levels

Washington-Peak intensity of highenergy electrons produced by the July 9 Starfish high-altitude nuclear test is 100 to 1,000 times the pre-blast levels found in the Van Allen radiation belt at altitudes above 1,000 mi., according to measurements reported by Air Force satel-

The new man-made radiation is not found below 400 mi. altitude at the geomagnetic equator, but penetrates as low as 200 mi. off the coast of Brazil at 30 deg. south latitude, 45 deg. west longitude due to the dip in the earth's magnetic field at that point.

It therefore does not pose a hazard for manned space flight missions planned for the near future.

before both his armed services committee and the Senate Aeronautical and Space Sciences Committee, where he is second ranking Democrat.

Similarly, Chairman George H. Mahon (D.-Tex.) of the House Appropriations Defense Subcommittee will take a hard look at the military space program of the Defense Dept. and NASA during hearings early next year. Until now, the majority of the subcommittee has felt that much of NASA's research work has direct military space application. Rep. Mahon said this is why he and others on the committee have not pressed for a larger military space role. Next year's hearings will determine whether that viewpoint still

Chairman George P. Miller (D-Calif.) of the House Science and Astronautics Committee is a leading advocate of continuing the present military-civilian mix in the national space program. He took issue recently with Sens. Barry Goldwater (R-Ariz.) and Howard W. Cannon (D-Nev.) who contended in Senate speeches that the Kennedy Administration was endangering the national security by not placing more emphasis on the military space role (AW Aug. 20, p. 31).

Rep. Miller said \$4.8 billion has been spent to date on military space activities compared with \$6.4 billion for NASA through Fiscal 1963. He said: "I find it difficult to view this record as flagrant disregard for the military's interests" (AW Sept. 3, p. 22). This type of debate over the military's role will intensify next year as Congress takes the closest look yet at military and civilian space budgets.

Debate on the specifics of the national space program is bound to get off to an early start next year because NASA will ask for supplemental funds for this fiscal year shortly after Congress returns in January (AW Sept. 3,

To give a boost to booster rocket production, specialists at Lukens "spin" heads in the widest range of sizes, shapes and materials available anywhere. Important uses for these versatile metal domes range from rocket end-closures to missile nose cones . . . from cryogenic storage tanks to huge industrial boilers. Lukens heads are produced in diameters up to 211/2 feet; in thicknesses up to 71/2 inches. Technical assistance on materials selection and design is always available. Write or phone collect: Manager, Application Engineering, Lukens Steel Company, Coatesville, Pennsylvania. Telephone: DUdley 4-6200.

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NASA FY 1963 Budget

Authorization

	Request	House	Final
Research, development, operation Construction of facilities	\$2,968,278,000 818,998,000	\$2,934,961,750 736,200,250	\$2,957,878,000 786,237,250
Total	\$3,787,276,000	\$3,671,162,000	\$3,744,115,250
	A	Appropriatio	on

	House	Senate	Final
Research, development, operation Construction of facilities		\$2,917,878,000 786,237,000	\$2,897,878,000 776,237,000
Total	\$3 644 115 000	\$3 704 115 000	\$3 474 115 000



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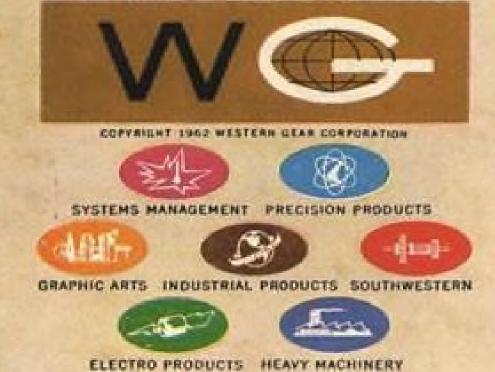
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West Coast Contract Negotiations Continue

Contract negotiations between four West Coast aerospace companies and the International Assn. of Machinists continued through late last week with little likelihood of any further immediate strike action.

Aerojet-General and IAM representatives met with Federal Mediation and Sept Conciliation Service and Labor Dept. officials in Washington, resuming negotiations following a 2½-day IAM strike which Aerojet-General said was caused by "misunderstandings" for which it [Aerojet-General] "was responsible." UAV An IAM spokesman said primary issues involved in the strike were non-economic and included seniority and company policies on subcontracting unit work.

The company said all schedules were met during the strike with aid of supervisory and technical personnel.

An early settlement between Aerojet-General and the union seemed possible, but there was little indication of an immediate settlement in the IAM's disputes with Lockheed, Boeing and Rohr. The union shop figured prominently in these disagreements (AW Oct. 8, p. 41).

A three-man fact-finding board appointed by President Kennedy had been scheduled to make its recommendation in the Boeing-IAM controversy today but asked and received permission from the President to delay its report until Nov. 5 because of the complexity of the issues involved.

Following completion of the factfinding board's hearings in Washington, Boeing and IAM representatives continued negotiations in Seattle at the board's request. Lockheed and IAM negotiators met in Los Angeles and Rohr-IAM representatives in Riverside, Calif. Federal mediators attended the Lockheed-IAM and Rohr-IAM meetings

Elections to decide whether employes desire a union shop are scheduled at North American Aviation Fri-

RF-110 Radar Proposals

Industry proposals for the forward looking, or search, radar to be installed on Air Force/McDonnell RF-110 reconnaissance version of the Navy F4H, are due today at McDonnell Aircraft Corp., St. Louis, Mo.

Companies expected to submit proposals include Autonetics, General Dynamics/Electronics, Emerson Electric, Texas Instruments and Westinghouse. The latter supplies the APQ-72 mission control radar for the F4H.

Goodyear Aircraft is developing a side-looking radar slated for the RF-110.

day, at General Dynamics West Coast facilities Oct. 23 and Ryan Aeronautical Co. Nov. 1. These companies reluctantly agreed to employes' elections on the union shop issue in compliance with recommendations of a fact-finding board appointed by the President to help resolve labor difficulties at these companies and at Lockheed.

United Automobile Workers ratified a new three-year contract with Ryan Sept. 28 and with NAA Sept. 30. IAM employes of General Dynamics West Coast facilities ratified a three-year contract with the company last week.

Douglas Aircraft Co., which reached agreement on new contracts with the UAW and IAM in July, announced last week a 5% pay raise and extension of fringe benefits for approximately 8,000 salaried employes not in any bargaining unit.

Southern California Professional Engineering Assn., representing 4,600 professional people at Douglas, has endorsed company offers of similar salary and fringe benefits. The organization is conducting a mail ballot election among its members, with votes to be counted Saturday.

Comsat Corporation Directors Are Named

Washington—President Kennedy has nominated thirteen incorporators to serve as the initial board of directors of Communications Satellite Corp., authorized by Congress to develop and operate a communications satellite system.

These are the designees, who would serve no more than one year: Edgar F. Kaiser, president, Kaiser Industries; David M. Kennedy, board chairman, National Bank and Trust Co., Chicago; Philip L. Graham, publisher, Washington Post; Sidney J. Weinberg, partner, Goldman, Sachs and Co.; Bruce G. Sundlun, partner, Amram, Hahn and Sundlun, Washington law firm; A. Byrne L. Litschgi, Partner, Coles, Himes and Litschgi, Tampa law firm; Beardsley Graham, president, Spindletop Research, Inc.; Leonard Woodcock, vice president, United Auto Workers; Sam Harris, member, Strasser, Speigelberg, Fried and Frank, New York law firm; George J. Feldman, vice president, Mastan Co.; Leonard H. Marks, partner, Cohn and Marks, Washington law firm; John T. Connor, president, Merck and Co.; George L. Killion, president, American President Lines.

A major task of the incorporators will be to arrange for the financing of the corporation. Fifty per cent of the stock will be offered to the public at not more than \$100 a share and 50% is earmarked for sale to communications common carriers.

Transport Concept

USAF is advancing the concept of a 500,000-lb. gross weight, 175-ft.-long transport, to be designated CX-4, as a Specific Operational Requirement (SOR).

Projected program, which apparently has the approval of the Secretary of the Air Force, is being considered for inclusion in Fiscal 1964 funding to the extent of \$60 to \$80 million for initial effort. Estimate is that total program would run about \$1.2 billion.

News Digest

First full duration (7 min.) static test firing of the six clustered RL-10 engines for the S-4 upper stage of the Saturn C-1 booster has been conducted at Douglas Missile and Space Systems Division, Sacramento, Calif.

X-15 research vehicle last week made its third in a series of flights that tested stability with the ventral fin removed. National Aeronautics and Space Administration Pilot Jack McKay flew the No. 2 X-15 to a maximum altitude of 129,000 ft. Top speed was 3,716 mph., achieved at 107,000 ft. Engine burn time was 81 sec., and the flight lasted 11 min.

South African government last week ordered Blackburn Buccaneer Mark 2 naval strike fighters to bolster Cape of Good Hope shipping lane defenses. Order probably is for at least two landbased squadrons, consisting of 20 aircraft.

Rocketdyne J-2 engine has successfully completed first full thrust, long duration (4 min.) static test at the Santa Susana test facility near Canoga Park, Calif. The liquid hydrogen/oxygen-fueled 200,000 lb.-thrust engine will power top stages of both Saturn C-1B intermediate vehicle and Saturn C-5 Apollo vehicle as well as second stage of C-5 as a cluster of five.

Kaman Aircraft has been selected by Lockheed-Georgia Co. to manufacture tail cones for the USAF C-141 turbofan transport, due to fly next year. Kaman has received a contract for tail cones for the first five aircraft and expects follow-on orders when the aircraft goes into full production. Kaman said contract dollar value was relatively low.

De Havilland is starting a new production batch of Comet 4C aircraft at its Chester, England, plant to meet recent orders for four airplanes and an undetermined number on speculation. Orders are from Sudan Airways, Kuwait Airways and United Arab Airlines.

AIR TRANSPORT

BOAC Reports \$140-Million 1961-62 Loss

State-owned airline hints it will ask for government support; \$88-million capital costs to be written down.

By Herbert J. Coleman

London-British Overseas Airways Corp., citing a bad year for world airlines, last week said it lost \$140 million in 1961-62 and hinted it would turn to the government for future support or re-evaluation of its financial structure.

Included in the deficit reported by Sir Matthew Slattery, BOAC board chairman, is an \$88-million write-down of equipment capital cost, primarily Bristol Britannia turboprop transports and the short-range de Havilland Comet 4s in BOAC's fleet that also includes the longer-range Comet 4C. Also part of the total deficit is BOAC's \$40-million operating loss, which includes BOAC's own operation and interest charges and those of its subsidiary and associated companies (see box p. 39).

Slattery, in a reference to BOAC's operation as a state-owned airline, contended there "is every chance that BOAC can operate on a reasonable basis" if the government would allow it to write off the airplanes, instead of writest payments, amounting to nearly \$17 million last year. Then he added:

"I have taken the opportunity at the end of my first full year as chairman of the corporation to point out that think the financial structure of the corporation and the way it is expected to operate is bloody crazy."

So far this year, BOAC's traffic and revenue position "is not as bad as last year's," according to Slattery, but still is far from encouraging. He said fare discounting and various excursion plans seriously diluted the airline's revenues.

There has been virtually no capacity increase this year.

The BOAC chief called for a "slight increase" in fares, in a reference to the present International Air Transport Assn. fares conference at Chandler, Ariz. (AW Sept. 24, p. 43). Airline's official position is that if fares on the ing down, in order to reduce the inter- North Atlantic had been reduced by 20%, BOAC would have had to find at least 100,000 more passengers to improve the inadequate revenue it earned from existing fares.

> Slattery emphasized that BOAC, under its enabling act, has been a chosen instrument of national policy and prestige and has been charged with pioneering of new routes and technological advances-the latter a reference to British aircraft.

His report continued:

"Just as it [BOAC] has modernized its aircraft fleet, so it is now faced with the necessity to rationalize its financial structure. BOAC's present capital position is largely the result of policies that followed a concept of the corporation's role that has now been changed."

Other points raised by the chairman included:

 Airline's fleet of Comet 4 jets will be retired in about three years when the Vickers VC.10 four-jet transports begin coming into service (see p. 54). Cost of phasing the VC.10 into service will be \$9 million. BOAC plans to ask for government aid in this area.

• BOAC is negotiating for sale of the Britannia fleet, but the chairman declined to give any details of prices or airlines involved. Most discussions are being held with British United Airways,

the largest independent.

 BOAC is "not too worried" about the ability of the VC.10 to compete on the London-Los Angeles route with the Boeing 320B. Slattery said the VC.10 can fly the route nonstop with extra fuel, but noted Vickers now is evaluating this possibility in the light of current flight testing.

 Airline has not yet reached any final conclusions about establishing a new cargo fleet made up of Canadair CL-44 swingtail turboprops. BOAC has Ministry of Aviation approval to lease at least two CL-44s which would operate with its two Douglas DC-7C pistonengine cargo planes.

 It is hoped that a supersonic transport will not be brought into service before the early 1970s and then only on "very

restricted routes." Question as to eventual merger of BOAC and British European Airways, the other state-owned airline, was

brushed off by Slattery as "I hear there is a rumor about a rumor."

Despite the chairman's comment, there will be considerable parliamentary pressure toward this end, in view of the fact that BEA also lost money last year. Initial reaction last week came from John Cronin, the opposition Labor Party's spokesman on civil aviation in the House of Commons. He said he intended to inquire into the "extraordinary re-evaluation of capital assets" when the House reconvenes, and this probably will lead to a full-scale debate on BOAC's and BEA's future.

BOAC's policy has been to amortize the cost of aircraft over seven years to their estimated residual value at the end of that period, or 25% of the original

tired this year after less than five years'

However, the 12 Britannia 102s and four Douglas DC-7Cs (other than two freighter versions) will have to be re-

BOAC Deficit

The following table is a detailed breakdown of BOAC's 1961/62 fiscal year deficit. The figures, in dollars, may not total precisely due to rounding in conversion from pounds to dollars.

Operating deficit \$14,000,000 Interest on capital . . . 16,739,000 Associated and Subsidiary Companies Operating loss allocated to

Interest on capital.... 1,130,000 Capital loss on equipment disposal 4,110,000 Total 40,258,000 Capital Adjustments

BOAC shareholdings 4,200,000

Additional obsolescence and amortization charges: BOAC\$88,807,000* 2,800,000 Assoc. companies Normal adjustments... 3,640,000 Transfer to fleet insurance reserve 2,810,000

Penalty on amendment to VC.10 contract 1,890,00 Total 99,940,000 Less profit on redemption of

British Overseas Airways 1,020,000 Total 98,800,000 Total 1961/62 deficit. \$139,176,000

Previous accumulated deficit 41,580,000

Total accumulated

deficit \$180,880,000 *Includes Britannia write-down of \$61, 600,000 and Comet 4 write-down of

\$21,840,000.

service. The airline also said the decline of longer-range Britannia 312s' competitive strength will sharply curtail their working life on BOAC routes. The Comet 4 jets, of which BOAC owns 19, will be phased out after four years, instead of seven, as originally planned.

Slattery pointed out that BOAC, and the British aircraft industry had gone through two costly, intermediate phases -the first big medium-range jet, the Comet 1 series, and subsequently, the big turboprop. First era ended tragically with the Comet metal fatigue problems, and the second was too late to realize a prolonged earning life.

It also was noted that cancellation charges assessed when BOAC revised its VC.10 order for 30 Super VC.10 and 12 standard versions amounted to about \$2 million charged to last year's total deficit.

In computing its losses, BOAC calculated that a strike by its mechanics also cost it, directly and indirectly, nearly \$9 million.

BOAC's Atlantic link with Cunard Eagle Airways, which has consistently

lost money on its operations, will also come up in the House, spurred by Labor Party members who are still rankled over the deal. In the airline's annual report, BOAC contended that its interests on the North Atlantic, as far as British competition was concerned, were safeguarded in the short term when former Minister of Aviation Peter Thornevcroft revoked a London-New York route granted Cunard Eagle by the Air Transport Licensing Board.

The report said BOAC and Cunard Eagle, which had planned to reapply after putting its two Boeing 707s on a London-Miami route, began to consider together how they might in a limited way extract at least some positive benefits from the negative situation ". . . as talks proceeded it became clear that a full alliance of two great British enterprises and two names embodying outstanding prestige and reputation would constitute the most formidable British attack there had ever been made on the Atlantic travel mar-

According to Slattery, another major factor in BOAC's poor showing last year was that London no longer is the main gateway to Europe, since competing airlines can serve European capital cities from New York, where BOAC is limited to a London destination.

To combat this trend, the airline currently is discussing sales campaigns and advantageous scheduling with BEA, to provide expedient connections from London to the important European business and tourist centers.

Slattery also pointed out that BOAC's 28% expansion of passenger capacity, based on predictions of a growing market that did not materialize, brought less than a 6% increase in business. The passenger load factor fell more than 10 points to 49.6%.

Slattery contended that BOAC's main problem lay in traffic growth, not economics, since the airline, through cost improvements, brought down its breakeven load factor in 1961-62 from 55.9% to 52.4%.

The airline's report also stressed that the prime necessity at this time is to establish whether the trends of last year are a temporary distortion of a familiar pattern, or the beginning of a new one that could have far-reaching consequences for the entire industry.

In an explicit warning, the report continued: "In short, this is not the time to turn back. To do so would not only mean a drastic reduction in the size and world-wide image of the corporation and in the contribution it can make to the nation's overseas earnings, it would mean abandoning many routes on which heavy past expenditure is beginning to show a return; it would mean canceling many British aircraft now on order, at an incalculable cost

to the industry and the country, and it would mean dismissing very large numbers of staff.

"These immense penalties, with their grave economic and social implications, would produce no compensating financial advantages for many years, and indeed, the short-term position would be immeasurably worsened by the large capital losses that would inevitably be entailed.'

Part of BOAC's total loss-\$9 million-came from its associated companies, although during the year the airline disposed of its interests in Middle East Airlines and British West Indian Airways. Only associated airlines to show profits were Borneo Airways, Cathay Pacific Airways, Fiji Airways, Gulf Aviation and Malayan Airways. BOAC owns 61% of Turk Hava Yollari, the Turkish airline, but results were not available.

BOAC lost \$160,000 with Aden Airways, largely due to maintenance costs on its Argonaut fleet; \$1.5 million with Bahamas Airways, due to costs of domestic operations; \$2.3 million with British West Indian Airways, of which it now owns 10% without responsibility for losses, and \$417,000 with Kuwait Airways, due primarily to intensified quantity and quality of competition from other carriers. Balance of the total \$9 million lost came from what BOAC described as capital losses in disposing of investments.

In referring to Kuwait Airways, the report predicted that because jet operations began only last February, losses to be borne by BOAC will be greater for the 1962-63 financial year. Current agreement between the two airlines ends in May, 1963, and the Kuwait government has confirmed that it will not be renewed.

BOAC also is allocating a sum of \$2.8 million toward the write-down costs of aircraft it has leased to associates and other companies.

London Rerouting

London-Closing of London Airport's Runway No. 5 last week for maintenance and repairs will mean increased use of the Shannon, Ireland, airport by long-range westbound flights for balance of October, when the runway will be reopened.

Runway No. 9 at London is open, but is 9,700 ft. long compared with 11,000 ft. for Runway 5, which it parallels, and is not considered long enough for the high gross weight takeoffs necessary for many westbound jet flights. Trans World Airlines and British Overseas Airways Corp. have set a 50% load factor as the dividing line, and for load factors over 50% are making an unscheduled stop at Shannon for fueling. Other airlines are expected to follow this system.

 Acceptance of passengers at student fares to which they are not entitled. Provisions of free hotel accommodations at attractive stopover points, along with

low load factors, have used these inducements to entice passengers away:

its revenue picture in the East and at Central European points.

unrecorded cash refunds.

BOAC Fare Discount Objections

London-Highly concerned over fare discounting, British Overseas Airways Corp.

BOAC claimed that certain operators who are desperate to force up miserably

last week outlined the manifestations of what it calls a further factor in worsening

Commission splitting and bribery of travel agents.

Turning a blind eye to excess baggage charges.

• Flouting of currency regulations in countries where exchange is controlled, even to the point of illegally providing foreign currency to the passenger for use on his journey.

BOAC charges that these practices make airlines buy business without appreciably extending the market. In most cases, the methods involved are especially vicious in that they tend to corrupt by providing large funds to staff members who are not required to account for them.

BOAC has asked for IATA intervention and has alluded to the possibility of government action, undoubtedly in the area of bilateral agreements.

Backers to Reshape Legislation Founding Federal Aviation Service

ice bill establishing a corps of traffic controllers who could be militarized during national emergencies will be one casualty of the 87th Congress, but no one in government-not even its sponsor-appears openly sorrowful.

Prepared by Federal Aviation Agency and introduced last fall by Sen. A. S. Mike Monroney (D.-Okla.), the bill has drawn sharp criticism from the agency's 18,000-man controller force. Air Force, in addition, has been reluctant to yield any authority over air traffic activities, even at air bases with little secret activity.

In the months since the bill's drafting, FAA has taken a closer look at some of the arguments in favor of a Federal Aviation Service and concluded an FAS would cost substantially more than was first estimated. The service also would require a greater number of controllers than originally estimated, for it was found that the military ATC technician and the civilian controller are almost equally adept at moving a given volume of air traffic. Previously, FAA had thought that two civilian controllers could do the work of three military controllers.

Air Force sources note that the military controller is usually an enlisted man and that his salary as such is about half that paid civilian counterparts by FAA. Even the extensive fringe benefits accorded military personnel do not cancel out this pay gap.

Essentially, the FAS was to assure uninterrupted ATC service to military and civil aircraft during a defense emergency. At such time, the President could shift the civilian corps to military status. The FAA administrator also would be empowered to activate certain elements of the service during lesser crises, on the Defense Secretary's recommendation. A controller, under the bill, could elect whether to join FAS or not. But membership would be mandatory if he sought certain jobs within the agency.

Most common complaint voiced by controllers last year was that membership in FAS could disrupt the stability of their families. It was said that because the controllers could be pressed into military service and transferred to another location on short notice, any FAS legislation should afford compensatory benefits.

One such benefit provided in Sen. Monroney's bill was retirement at age 50 for controllers with 20 years of FAS service. But this plan was complicated during the last session by Sen. George Port Authority has maintained exemp- council.

Washington-Federal Aviation Serv- Smathers (D.-Fla.), who introduced a bill that offered the controllers similar retirement with or without FAS participation. As a result, one big incentive for joining the service lost much of its appeal

The form of future FAS legislation,

if it is ever introduced, probably will depend on the report being written by a joint committee of FAA, Defense Dept. and Budget Bureau representatives (AW Oct. 8, p. 45). Sources close to this committee say that it will endorse the quality of the FAS concept, which won Defense Dept. approval last year, but not the reasoning advanced by FAA to justify creation of the service. Committee's final report is due before the new Congress reconvenes in

State Court Committees to Seek Idlewild Noise Problem Solutions

New York-Hearings before committees of the New York state courts are expected in a search for legal procedures to cope with jet noise problems over communities near New York International Airport (Idlewild).

Paul Windels, Jr., appointed by State Attorney General Louis Lefkowitz to study possible legal action in the noise matter, told AVIATION WEEK that it appears the problem will rest ultimately with the courts.

"We will have to hold hearings to establish the state courts' jurisdiction in noise complaints," Windels said.

The attorney is former counsel to the Aircraft Noise Control Council of Nassau County, L. I., N. Y., and was once regional administrator here for the Securities and Exchange Commission.

He was appointed by Lefkowitz after the attorney general received an antinoise petition signed by Nassau County Executive Eugene H. Nickerson, the county's Board of Supervisors and the mayors of nine communities near Idle-

Windels said there is little doubt that many complaints are justified regarding damaging effects of jet noise on property values and personal comfort.

"But on the other hand, we can't simply ask the courts to tell the airlines to stop making noise," he said. "As a New Yorker interested in commerce, I'm for keeping these airports in the metropolitan area rather than placing them 60 mi, out in the country.

Windels said that since the noise problem became acute, searches for corrective measures have been thwarted simply because it has never been determined who is responsible.

Although the airlines create the noise, and the Federal Aviation Agency determines routes the planes must follow, Windels believes the burden rests primarily with the Port of New York-New Jersey Authority, which locates and operates the airports.

However, as a bi-state agency, the

tion from federal regulation. This has led to the problem now before the

"Our job, basically, is to find a solution that will satisfy the complaints, but in such a way as to affect air commerce to a minimum," Windels said.

Windels said he feels the ultimate solution of the noise problem will come through cooperative concessions by everyone involved, including the airlines. The courts perhaps could establish a schedule of corrective measures, he said, which might include a reduction of night operations, relocation of runways, or new traffic patterns directed away from residential areas.

"The attorney general's interest arose largely from concern over no one being willing to assume responsibility for this problem," Windels said. "Many of the people voicing complaints have lost faith in the governmental agencies simply because of inaction."

Gen. Kuter Is Elected Pan American Officer

Gen. Laurence S. Kuter, USAF (ret.), has been elected a vice president of Pan American World Airways and will serve in the company's operations activi-

Gen. Kuter, who retired last July 31 as commander of North American Air Defense Command and USAF's Air Defense Command, had been offered several other major positions including top-level posts at both the Air Transport Assn. and the Aerospace Industries Assn. A graduate of the U.S. Military Academy, he was assigned the task of organizing and commanding the Military Transport Service in 1948 and continued this duty during the Berlin and Korean airlifts.

In 1946-48, he was senior representative of the U.S. delegation to the International Civil Aviation Organization and served as a member of the ICAO

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TWA Shows International Operation Profit

London-International operations of Trans World Airlines in the past eight months have shown a profit of \$8.9 million, compared with a loss of \$4.9 million in a similar period a year ago, Floyd D. Hall, senior vice president, said here last week.

Factors contributing to the profits, he explained, were high transatlantic reliability rate, in which TWA jets completed 99.6% of scheduled mileage, and success of the Royal Ambassador first-class service which includes in-flight motion pictures.

Domestic loss for the eight-month period, according to Hall, is about \$20.5 million. Airline's total operating revenues for the first eight-month period amounted to \$259.5 million, against \$238.3 million in 1961. Important reason for domestic losses were U.S. strikes, which did not affect the international operation.

Other points raised by Hall included:

- Potential merger with Pan American could be realized within six months if a number of factors, including stockholder acceptance and final decision on merged airlines' identity, are determined.
- TWA has a definite need for a short-medium range jet transport such as the BAC 111 (the airline has ordered the Boeing 727 three-jet transport, AW Sept. 10, p. 19) but no decision on re-equipment has been made. Airline has completed study of BAC 111 operating characteristics and economics, however.
- · Airline, along with British Overseas Airways Corp., has found illegal price cutting in Europe and the Middle East has put it at a sharp competitive disadvantage. TWA has met with heads of airlines involved and has protested to International Air Transport Assn.
- Supersonic transport will become an eventual reality and a vital competitive weapon, but Hall said TWA technical personnel consider the proposed Anglo-French Mach 2.2 transport (AW Sept. 17, p. 34) an interim airplane that will be superseded by a Mach 3.5 version. Consensus is that TWA would prefer to wait for the latter, but would have to be guided by competitive aspects if Mach 2.2 airplane was introduced earlier.

CAB Implements New Legislation; Rejects Eight Supplemental Bids

By Robert H. Cook

Washington—Supplemental ranks were reduced to only 14 carriers last week in a series of Civil Aeronautics Board orders tightening control over the industry and limiting its competitive impact against scheduled carriers for the next two years (AW Aug. 27,

Eight other supplementals were denied renewal of their temporary operating rights, primarily due to strong objections by CAB Bureau of Economic Regulations attorneys, who based their opposition on the carriers' operational histories.

The attorneys recommended against renewing the authorities of 10 of the 22 supplementals, but two of the airlines-United States Overseas Airlines and Standard Airways-later won approval of their applications in separate 3-2 decisions before the five-member

In addition to these two carriers, the Board approved renewal applications for AAXICO Airlines, American Flyers Airline, Capitol Airways, Johnson Flying Service, Modern Air Transport, Overseas National Airways, Purdue Aeronautics, Saturn Airways, Southern Air Transport, Trans International Airlines, World Airways and Zantop Air Transport.

Supplementals denied interim authorization, pending future Board hearings on applications for permanent operational authority, included Air Cargo Express, Airline Transport Carriers, Associated Air Transport, Blatz Airlines, Paramount Airlines, Quaker City Airways, Sourdough Air Transport and World Wide Airlines.

Details of the revised authority granted the 14 carriers indicates how far CAB has gone in complying with a congressional mandate to strengthen control over the supplemental airlines, within 90 days of passage of the legis-

All of the carriers retain their domestic charter rights, but only six are permitted to conduct individually ticketed flights under a strict formula that limits their service to no more than 10 round trips a month and revenues from the flights to no more than the average revenue attained from this business over the past three years.

Only five of the fourteen airlines were granted the right to conduct overseas or foreign charters for passengers or property. Of this group, only U.S. O. A. was given authority to conduct unlimited overseas passenger charters,

irregular foreign cargo flights, plus cargo charters on the return leg of one way military contracts. Three other carriers were also limited to irregular schedules for the carriage of foreign cargo, and only one-Trans International-was granted authority to conduct both passenger and cargo charters on the return trip of military one-way charters. Southern Air Transport was the only one of the fourteen supplementals to win the right to operate individually billed overseas and foreign cargo flights, under a prior Board approval.

Each of the approved certificates also carries a warning from the Board that they can be immediately suspended for an initial period of 30 days, if the airline fails to comply with CAB's new regulations on insurance coverage, ticket refunds to passengers or the retention of company records.

Granting of the interim rights to U.S.O.A. and Standard brought dissenting votes from Members Chan Gurney and Whitney Gillilland on grounds that neither carrier has shown an adequate financial ability or a willingness to comply with CAB regulations in the

The two members conceded that U.S.O.A. has been re-accepted for Military Air Transport Service contracts after being suspended because of faulty maintenance and service, but they pointed out that the carrier reported a deficit of \$1.1 million last June. Loss of the MATS business cut the airline's total revenues by one third for the first half of this year and U.S.O.A. may be unable to offset this loss in the future, they said.

The minority members took issue particularly with a majority finding that while the carrier's record of violations show "glaring deficiencies, it is nevertheless not so bad" as to cause a rejection of their application.

Standard Airways application also should have been rejected, the dissenters said, because of the airline's poor financial record and past record of violations. The majority conceded that the airline will lose much of its income because the Board has restricted its revenue from individually ticketed flights to only \$581,088 a year, as compared with \$1.5 million earned from this service last year, primarily in the California-Hawaii market. The Board noted that although it could not minimize the financial dilemma Standard will face because of the cutback, the problem should not require a denial of its interim operating authority. The airline has never been subject to a cease and desist order from the Board in its 17 years of existence, and the violations cited by BER attorneys did not involve any intentional attempts to disregard or evade Board orders or regulations, the majority said.

Study Shows Problem of Midair Collisions Is Far From Solved

By David H. Hoffman

Washington-Final Project Scan report, published unexpectedly by Federal Aviation Agency, shows the problem of midair collisions is far from being solved despite a sharp decrease in the number of actual impacts reported thus far this year.

In all, 3,126 incidents involving some risk of midair collision were reported by pilots and air traffic controllers during Fiscal 1962. Of these, 2,577 went directly to the Flight Safety Foundation under Project Scan and as such are categorized but not investigated.

The remainder, 549, were from pilots who elected to report directly to FAA and this category was subjected to thorough investigation by the agency. As a result, ATC error was found at fault in 52 cases. Pilots' failure to follow ATC procedures or to keep vigilant in the cockpit was held to be a factor in 119 others, and violation reports were filed against 32 pilots in this category.

FAA's decision to withhold no data on the midair collision hazard, made by Administrator N. E. Halaby after months of discussion, is without precedent in recent years. But the U.S. scheduled airline industry, as of late last week, was accepting the policy change calmly, and, in some quarters, even endorsing it as a means of putting the complex problem in perspective.

According to FAA and the Flight Safety Foundation, a near midair collision is a flight situation in which the reporting pilot judges the actual impact was avoided by either chance or evasive action. However, at least 70% of the 549 incidents reported to FAA in Fiscal 1962 involved "no hazard" situations, in which direction of flight alone would have assured separation between the aircraft.

midair collisions, which claimed 21 lives in 1961, numbered 22. In 1960, there were 24. But thus far this year there have been only 12, of which seven were fatal. None of the 1962 collisions involved airline transports. Military aircraft were involved in two, and the balance is attributable to general aviation flying, according to FAA.

Of the 2.577 FSF incidents, 50% occurred in the afternoon and one-third in the morning daylight hours. Slightly less than half of those reported took place en route, rather than in terminal areas. "Those in the terminal area," the report said, "were divided into in-bound and out-bound operations in a ratio of two to one."

The reporting aircraft was following provement.

Visual Flight Rules (VFR) in 56% of the FSF incidents and Instrument Flight Rules (IFR) in 44%. The reporting pilot, in 40% of these incidents, was talking to or under the control of an ATC facility when the near miss occurred.

Largest percentage, about 35%, involved single-engine piston aircraft. Nearly half the total aircraft were flying at speeds less than 150 mph., while more than one third were flying at 150 to 300 mph. In 60% of the reports, both aircraft were at the same altitude and a majority took place when both were in level flight. VFR weather prevailed in 88% of the incidents.

The altitude stratum from the ground to 500 ft. accounted for 11% of the FSF incidents; from 500 to 3,000 ft., 37%; from 3,000 to 14,500 ft., 36%; from 14,500 to 24,000 ft., 5%; from 24,000 to 29,000 ft., 4% and above 29,000 ft., 7%.

On the basis of this data, Flight Safety Foundation drew conclusions, several of which probably will be disputed by organized aviation groups. For example, it said that "a very large number of people are being exposed to a potentially hazardous situation" because of the "high involvement" of airline aircraft in altitudes above 24,000 ft.

"At these altitudes," the report said, "conflicts between military and airline aircraft are in the majority." Of these, most occur while at least one aircraft is on an IFR flight plan. "In 60% of the incidents, radar advisories were being used, particularly by the airline aircraft," the report said.

To minimize the possibility of midair collisions, Flight Safety Foundation recommended that FAA take the following steps:

- Prepare and distribute to pilots a booklet discussing the role and limitations of radar in the U. S. ATC system. Pilot training curricula also should be revised to give students a better understanding of ATC procedures and collision-avoidance responsibility.
- Examine the compatibility of Strategic Air Command missions with the ATC system and review current channels of liaison between military and first-class and day coach travel, to apply civilian aircraft operators.
- Continue collecting anonymous near collision reports. Meanwhile, the agency should form an independent group of operational and equipment experts to on the two days before or the two days periodically review ATC procedures with users of the system, pinpoint current problem areas and make recommendations for their immediate im-

In releasing the Scan report, Administrator Halaby outlined familiar FAA programs now under way in all these problem areas to lessen the midair collision hazard. He intimated, however, that the Scan project will not be continued, holding that it has served its purpose and that there is no point in re-confirming data that has already been

The number of reports filed monthly under Scan dropped sharply as the program evolved. During July, 1961, the first reporting month, a high of 506 were received. In June, 1962, the program's final month, this figure had dropped to 102.

According to Halaby, to say this downward trend means that the midair collision problem is disappearing "would be absolutely misleading." The volume of reports was also high during the early months of former FAA and Civil Aeronautics Board programs, he explained.

Eastern Submits New Four-Point Fare Plan

Washington-Eastern Air Lines last week filed a four-point tariff with the Civil Aeronautics Board which, the carrier said, will help halt the diversion of first-class traffic to coach and open new travel markets. These are the key pro-

- Basic jet coach fares would be increased approximately 43% beginning Nov. 16. On this day, the federal transportation tax will be reduced from 10% to 5% so that the fare increase, in effect, would merely keep jet coach rates -fare plus tax-at their present levels. All jet and propeller first-class fares and all propeller coach rates would remain unchanged. As a result, total amounts for fare and tax now paid for passengers using these services would be reduced by the 5% transportation tax reduction. Total amounts paid by Air Shuttle passengers, including tax, would be reduced by \$1 between New York and Washington and New York and Boston.
- and Boston would be reduced by \$2. All long-haul propeller Air-Bus fares would be raised so that the new rate, with the reduced tax, will be equal to the present rate.

Air-Shuttle rate between Washington

 Round-trip discount of 20% would be established for all jet and propeller only if the return portion is used not less than seven days after the trip started. In addition, such tickets could not be used on Fridays or Sundays or after certain legal holidays, although they could be used on the holiday itself. It would also not apply on trips to and from Florida during peak months of the season there.

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Patterson Urges Adoption of New Single-Class Service; Hits 'Experts'

By Ward Wright

New York-United Air Lines' President W. A. Patterson last week urged combining of airline passenger firstclass and economy class services into a single class both for economy and safety

Speaking at a meeting of the Passenger Traffic Assn. of New York, Patterson told listeners he would downgrade first-class service and upgrade coach service to provide service more suitable to passenger and airlines' present needs.

Patterson also urged the airline industry to throw off the influence of "so-called transportation experts . . . giving well meaning but erroneous advice." He described the present state of the airline industry as one of "confusion" and "frustration" for having "succumbed" to the advice of transportation economists.

For 10 years, Patterson said, on the recommendation of these "experts," the industry has been trying all manner of fare "gimmicks" contrary to the experience and judgment of management with disastrous results.

"We've got to stop thinking that everyone should fly," Patterson said, adding that some think all cargo should also be flown. "Its unfair to try to meet [fares of] ground transportation when the economics won't justify it. It costs more to lift something than to pull it."

Patterson also hit indirectly at 25% coach fare reductions, conceived by Continental and now being tried by other carriers until the end of the year between Los Angeles, Denver and Chicago (AW Aug. 27, p. 47).

United's experience shows that a 50% reduction in fares will increase traffic volume 3%. Patterson said. And a 25% reduction in some coach fares will require a 30% increase in volume to break even.

The United president said he wouldn't try to prejudge the outcome of this latest fare experiment but "I can tell vou after six weeks there has been a 1½% new volume in over-all patronage." He conceded that "in a few isolated cases" such as seasonal promotional fares to Miami, reduced fares have helped the industry smooth out annual traffic fluctuations.

Real key to promoting air transportation, Patterson said, "is fear, not fare. Fear shows up in every survey made as the number one retardant to growth."

Airline management must solve this problem before there will be any great jump in traffic, Patterson indicated.

In calling for a one-class service, Patterson said United could save about \$4.7 million annually by eliminating costs connected with two-class service. United spends about \$3.3 million for liquor, \$500,000 for personnel, \$300,-000 for ticketing, \$300,000 for accounting, \$300,000 for reservations and about \$100,000 for stores connected with first-class service.

Dramatizing the growth of coach service, Patterson said, "I see my friends in coach seats who could buy a DC-8." With thousands of corporate executives telling their personnel to fly coach, and the U.S. government telling military and government contractors that it will allow only coach fare as a justifiable travel expense, Patterson said, the airline industry will have to revise its current concept of two-class service.

"People aren't interested in that gourmet stuff that is advertised," Patterson said, and suggested one standard of service coast-to-coast at \$10 above existing coach fares. This would include a meal and a drink,

Patterson also answered critics who say the industry is buying too many aircraft. Based on piston experience, Patterson said. United expected that a DC-8 in 105-seat configuration would need 40% first-class and 60% coach seating. Actual jet experience, however, is running closer to an 80% coach and 20% first-class seating configuration.

Based on this unexpected split between first-class and coach configuration, United bought eight DC-8s too many, Patterson said. The industry misjudged this trend and would have to admit it, he added.

In reference to the Eastern jet coach fare increases filed earlier this week (see p. 42), Patterson said United would not go along."

FAA, Airlines Seek to Improve Cockpit Regulation Enforcement

Agency is searching for a means of improving "cockpit vigilance" as a result of nationwide publicity over a series of photos of alleged cockpit violations taken by Eastern Air Lines and Trans World Airlines flight engineers (AW Oct. 8, p. 43).

Last week, the agency officials, and representatives of Eastern, TWA and Pan American World Airways and the Air Line Pilots Assn. discussed the problem during a two-day session, but did not announce their conclusions.

However, it is considered likely that Administrator N. E. Halaby will recall the Project Tightrope task force—an independent group that recommended a major overhaul of FAA's rulemaking and enforcement procedures-to gain advice on how to collect what he has publicly termed "evidence of misconduct in the air."

Halaby first indicated he would take this course in a recent press conference, during which he said that FAA had "prima facie" evidence that at least three Eastern captains had been "inattentive" to their flight duties. He was referring to a series of photos allegedly taken on 18 Eastern flights by a striking Flight Engineers International Assn. member, D. K. Carson.

Eastern continued to question the validity of the photos last week in a statement which contended that several pictures of a stewardess in the cockpit seat were taken on the ground, as far as the company could determine. Four and creating a very misleading picture."

Washington-Federal Aviation of the 14 individuals photographed have been tentatively identified, but deny that they violated any inflight safety regulations, the company said.

Robert L. Turner, senior vice president of Eastern, said that the company has tightened its rules and regulations and instituted frequent reviews of Civil Air Regulations for all flight crew members, to "insure against even circumstantial inferences which could reflect on the conduct of its flight personnel."

Ron Brown, FEIA president, replied that it was "incredible" that Eastern would attempt to deny that the pictures were taken in flight, since Carson supplied the pictures to FAA, along with dates, times, trip numbers and crew names. In addition, Carson testified under oath before both the FAA and the government operations subcommittee, and even offered to take a lie detector test, Brown said.

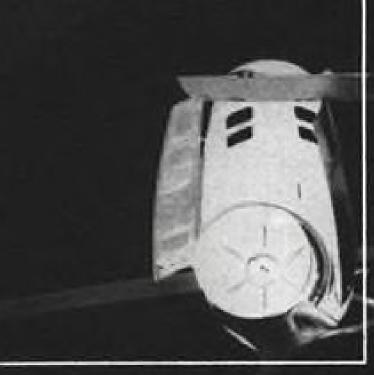
"Obviously this is just an attempt to try and sweep the whole matter under the cockpit rug," Brown said. "Eastern, after consultation with the FAA administrator, has now made a choice. It, like the FAA administrator, has chosen to ignore the situation which the pictures bear out and attack the man reporting the situation."

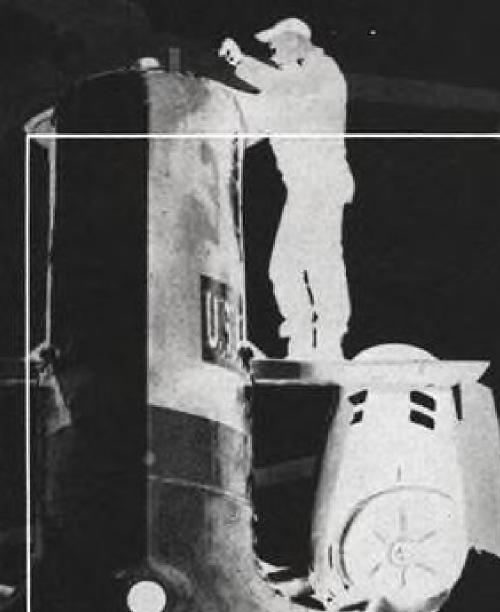
ALPA President C. H. Ruby, defended the safety record and practices of the pilots and their union in a statement criticizing the "sensational publicity obscuring non-sensational facts necessary to an objective judgment

THE CHINOOK'S EASY MAINTENANCE IS BASED ON NEGATIVE THINKING!

In creating a heavy-duty transport helicopter that can really live with the troops in the field, the designers of the Boeing-Vertol HC-1B Chinook probed deeply into the negative aspects... the problems and headaches encountered under rugged conditions, far from ground support facilities. By overcoming these factors one by one, they have arrived at a positive ease of maintainability. Thus, the HC-1B, already recognized for what it can do, also merits consideration for what it doesn't need. For instance...

- No requirement for daily rotor or other greasing.
- No need to operate rotors or turbines for system checkouts—internal APU suffices.
- No need to stock left and right engines, main landing gear and fuel cells—they can be installed on either side.





- No need for checking dip sticks—fluid levels appear on sight gauges.
- No workstands or ladders needed for inspections integral steps, walkways, etc., are provided.
- No worries about lost cowlings or access panels they're hinged to the aircraft.
- No need for vehicular crane to change major components —provisions are included for portable, hand-operated hoisting davit.

- No supplemental power unit needed, even at —65°F... internal APU is provided. Main engine starting is accomplished hydraulically from the APU.
- No special tools or ground equipment needed for organizational maintenance.
- No need to unload cargo or dismantle interior finish for inspection or servicing there are no systems under the floor or behind the blankets.



All in all, the HC-1B is just about the most self-sufficient helicopter conceivable... as well as possessing outstanding payload and performance capabilities.



U.S. Cargo Route, Rate Changes Urged

By L. L. Doty

Washington—Drastic changes in overseas all-cargo route and rate structures, as a means of developing the airfreight market to its maximum, will be proposed in the White House study aimed at formulating a new U. S. international air transport policy.

In addition, the study will suggest three alternative policies the U. S. could adopt to define the airlines' role in the nation's military airlift requirements. Recommendations based on the study, first disclosed by Aviation Week (AW Oct. 1, p. 28, Sept. 10, p. 53), are to go to President Kennedy on Dec. 1.

This is also the date that the President is to receive Budget Bureau recommendations on proposed organizational changes of such government agencies as the Civil Aeronautics Board, Federal Aviation Agency and State Dept.'s Office of Transport and Communications.

The study will recommend that allcargo services be conducted on a multilateral regional basis rather than on a bilateral point-to-point basis. To achieve this, the study recommends that allcargo services be treated as a category entirely separate from passenger or combined passenger-cargo operations.

The study group has reasoned that the unique character of aircargo operations calls for schedule flexibility and that all-freight services should follow the natural flow of cargo and not be confined to fixed points. Passenger services would be held to high density markets such as Paris, London and Rome, under the study's recommendations.

The regional concept of cargo operations has long been supported by Seaboard World Airlines, only U.S. all-cargo transatlantic scheduled carrier. Under this plan, Seaboard would be permitted to conduct its scheduled flights from the U.S. to any European ports and as many as the destination of the freight required.

With respect to the handling of military airlift in overseas operations, the study proposes these three alternatives:

• Military Air Transport Service be allowed to carry virtually all military traffic. This would permit MATS to maintain the readiness and training level it says it needs. This proposal poses severe political problems since it would renew protests that the government is

Airlines be allowed to handle all the military traffic they can with their present equipment and that which they will acquire in the normal process of growth and development. This appears to be a compromise solution most likely to be adopted.

• Furnish airlines with as much traffic as they can handle with an expanded fleet of aircraft, subsidizing the purchase of new all-cargo aircraft if necessary to maintain a high traffic density operation. Defense Dept. would rigidly oppose this suggestion.

The study concludes that larger aircraft will be required by the airlines if they are to play an expanded role in the U.S. defense effort. This would mean carriers would use such aircraft as the Lockheed C-141 turbofan all-cargo transport that can handle "outsize" cargo or freight which, because of its size, cannot be accommodated on standard aircraft.

Whether the airlines can fulfill urgent military needs with such a fleet while still maintaining civil transport requirements is a point raised but not entirely answered by the study.

On the subject of cargo rates, the study proposes revised tariffs that reflect lower ton-mile costs resulting from the introduction of turbine-powered aircraft. The study suggests that rates are a shipper's chief concern and that the cargo market can best be expanded by lowering rates to conform more closely with new low operating costs.

Principal problem in this connection is the rate-making machinery of the International Air Transport Assn. traffic conferences. Attainment of the rate structure the White House study recommends and a flexibility in pricing that will attract shippers to air transportation may not be entirely possible, since IATA tariffs are subject to the approval of all governments involved.

Governments differ widely on the subject of cargo rates and no nation is likely to approve rates on traffic moving to and from its territory that could be harmful to its own flag carriers. In addi-

tion IATA is still split over whether emphasis should be placed on the specific commodity tariff or the weight-break tariff.

On this subject, the study avoids any detailed discussion of the Bermuda principles of bilateral air transport agreements. However, if the multilateral regional concept for aircargo is adopted, a reinterpretation of Bermuda principles and renegotiations of bilateral agreements will be required. Underlying the study's recommendations is the principle that the U. S. should no longer attempt to coerce other nations to conform to its interpretation of the Bermuda principles. The study recommends that the U. S. apply persuasion rather than compulsion.

The study's discussion of mergers, affiliations and pooling establishes no criteria for carriers interested in entering into such agreements. It proposes no mergers, but it raises no objections to mergers.

On the matter of pooling, the study is ambiguous. Both advocates and opponents of the pooling principle should be satisfied with the findings, since each can interpret them to his own satisfaction.

The study suggests that the use of multiple-designation of airlines should be determined by the routes involved. It specifically names several points where multiple designation can be eliminated but generally proposes that each case should be decided on its own merits.

The study takes note of the formula developed by a 1960 United Research study, commonly called the Cherington Report, which would allow traffic volume on a given route to determine the number of carriers that would serve that



727 Fuselage Sections Mated

Forward fuselage of the first Boeing 727 short-to-medium range jet transport is lowered by overhead cranes into position for mating with the aft body section at Boeing's Transport Division, Renton, Wash. Wing and aft fuselage were joined last month (AW Sept. 17, p. 45). Rollout of first 727 will be in November, with first flight scheduled for next January.



Twice the load . . . half the seat-mile cost

Sikorsky's twin-turbine S-61 carries twice the payload of its piston-powered predecessor, the S-58.

Even better, it cuts seat-mile cost by half. (Seat-mile costs have been halved with each new Sikorsky design from the S-51 through the S-55, S-58, and S-61). To date, operating costs for the 28-passenger S-61

have averaged only 8c per seat mile. Sikorsky is currently designing advanced helicopters that will reduce this figure even further.

This emphasis on engineering progress has always characterized Sikorsky design. It is one of the many reasons for Sikorsky leadership in vertical flight.

Sikorsky Aircraft DIVISION OF UNITED AIRCRAFT CORPORATION





Soviet II-62 Transport Has Sawtooth Leading Edge

Sawtooth leading edge is featured on the wing of the Russian Ilyushin-62 jet transport (AW Oct. 8, p. 43). Plane seats 182 passengers, is powered by four 23,000-lb. thrust turbofan engines designed by N. D. Kuznetsov. Backgrounds of both photos have been retouched to eliminate area around the airport.



AVIATION WEEK and SPACE TECHNOLOGY, October 15, 1962



"Beats me how you guys who fly Western always make it to the cab line first!"

It's the net result of a lot of things, Mac.

Speed, for instance. Only Western flies 720B Fan/Jets along the Pacific Coast, as well as to Phoenix and Mexico City. These babies cruise at nearly 9/10ths the speed of sound...deliver the fastest nonstops between California and the Pacific Northwest-Mexico City, too! And those Fan / Jet engines have lots of reserve power . . . power that's always there to help us put our passengers down on time.

And we don't waste the time we save. Our ground crews really scramble. Western's passengers are usually the first to get away from the luggage rack.

Next time you spend time with an airline in the West, make it count. Make it fast. Make it Western. As they say, it's the o-n-l-y way to fly!

WESTERN AIRLINES

CL-44 Use Doubles Flying Tiger Income

By James R. Ashlock

New York-Flying Tiger Line has almost doubled its monthly gross revenue since it began service with 10 Canadair CL-44 turboprop freighters in the second quarter this year, Robert W. Prescott, president of the carrier, said recently.

Speaking before the New York Society of Security Analysts, Prescott said total monthly gross has averaged \$5,500,000, compared with \$2,800,000 per month last year when the airline was using only piston equipment.

"Our pre-tax net profit with the CL-44s has averaged \$600,000 per month, compared with a loss of \$1,500 a month in the same period last year," Prescott said. "We have cash balances now of \$9 million." However, Prescott said Flying Tiger's improved position is not expected to produce any immediate cash dividends for its stockholders. Expected revenue return for 1962 is \$1.75-2.00 per share.

"We need about \$5 million more in earnings before we can make dividend payments," he said, "and we cannot foresee any until our debt position is substantially improved. But we are considering a stock dividend."

Prescott said Flying Tiger paid \$52 million for its 10 CL-44s, spare engines and parts, with 10% down payment and seven-year pay-out. The fleet has been depreciated to \$44.5 million. Present balance on the debt is \$39.6 million, with payments, including interest, amounting to \$8,220,000 annually.

Besides the CL-44s, Flying Tiger also operates nine Constellation freighters. Prescott said the Constellations, which are on the airline's books for \$2.5 million but have an estimated market value of \$6.5 million, will be disposed of when business growth justifies purchase of additional CL-44s.

Prescott said that in his estimation, no freighter available is more suitable to Flying Tiger's needs than the CL-44.

"Any equipment additions we would make would be CL-44s," he said. "We are studying now the feasibility of addition of two or more CL-44s to our fleet. but have made no final decision."

He feels the aircraft will meet Flying Tiger's needs for 15-20 years.

Asked about the C-141 jet freighter now under development by Lockheed, Prescott said that in Flying Tiger's estimation it will not be an acceptable commercial cargo airplane.

He said the I3-ft. high cargo section of the C-141, while useful for military operations, is too tall for practical commercial schedules, hindering the shallow stacking necessary for rapid load-

ing and unloading of freight. The 7-ft. height of the CL-44's interior was the more ideal design, he said.

Prescott said the Tyne turboprop engines of the CL-44 cost \$25,000 to overhaul. Its time-between-overhaul is up to 1,400 hr., and Rolls-Royce feels the TBO can be advanced to 3,000 hr., he said. Calculating that overhaul costs per engine will not exceed \$30,000, Prescott said a 3,000-hr. TBO would require only a \$10 per hour overhaul reserve on each engine, or \$15 less than when service with the Tyne powerplants began. Annual savings would be \$2,-160,000 on engines alone.

He also said that because of the Tyne's newness, it has been operated at lower rpm. and temperature than it was designed for originally. As reliability justifies increases in rpm, and temperature, Prescott said, the CL-44's speed will be increased about 40 mph., representing a 10% rise in efficiency.

Prescott said the CL-44s each average 300 hr. of utilization a month, with fixed costs per hour of \$325. The carrier is striving to attract enough additional business to fly each airplane 400 hr. a month, thus reducing hourly costs to \$244. This would result in a \$3.9 million annual saving on the fleet's operation, he said.

Flying Tiger is also modifying its CL-44s to increase gross takeoff weight from 205,000 to 210,000 lb. and is also applying to the FAA for a 5% increase in zero fuel weight and landing weight. Such improvements would increase maximum payload from 65,000 lb. to 73,000 lb., raising the CL-44's earning capacity by 13%.

Prescott said approximately 60% of Flying Tiger's business is with the Military Air Transport Service. Its three-year MATS contract for Atlantic and Pacific operations amounts to a

Air France Volume

New York-Air France figures show 30,089 passengers carried eastbound over the North Atlantic during the third quarter of 1962, a 38% increase over the 21,792 passengers carried in the comparable period last year.

Eastbound traffic for the first nine months of the year totaled 77,346-a 36% increase over the same period in 1961. Air France says it flew 3,231 more eastbound passengers during the first nine months of 1962 than during all of 1961.

Highest rate of increase was reached in August with a 46% eastbound traffic gain over the same month last year. Highest traffic volume was in July when 12,566 passengers were carried-a 40% increase over July, 1961.

total of \$18 million a year," he said. "So far we have operated for MATS

this year an average monthly amount of \$3.4 million," he said, "which is an annual basis of \$40.8 million. We were informally told by MATS that next year, this tonnage will very likely increase, since the Army is being encouraged to use more air transport in its logistics."

Approximately 5% of Flying Tiger's business this year has been charter passenger transportation on the North Atlantic. A CAB examiner has recommended a permanent charter certificate for Flying Tiger on the Atlantic, and the airline has also been granted domestic charter rights by an act of Con-

Prescott said Flying Tiger is also changing its sales technique in its efforts to expand business. The carrier is attempting to overcome established opinions about surface transportation, the low rates of which, he said, will never be matched by a cargo aircraft.

"Unfortunately, most American business firms have an organizational structure that does not lend itself to an unbiased analysis of the full cost of distributing material." he said.

Traffic managers cling to surface transportation because of the low rates, disregarding the higher over-all distribution costs created by warehousing and inventories, he said. Sales managers are interested only in customer service, and ignore warehousing and inventories.

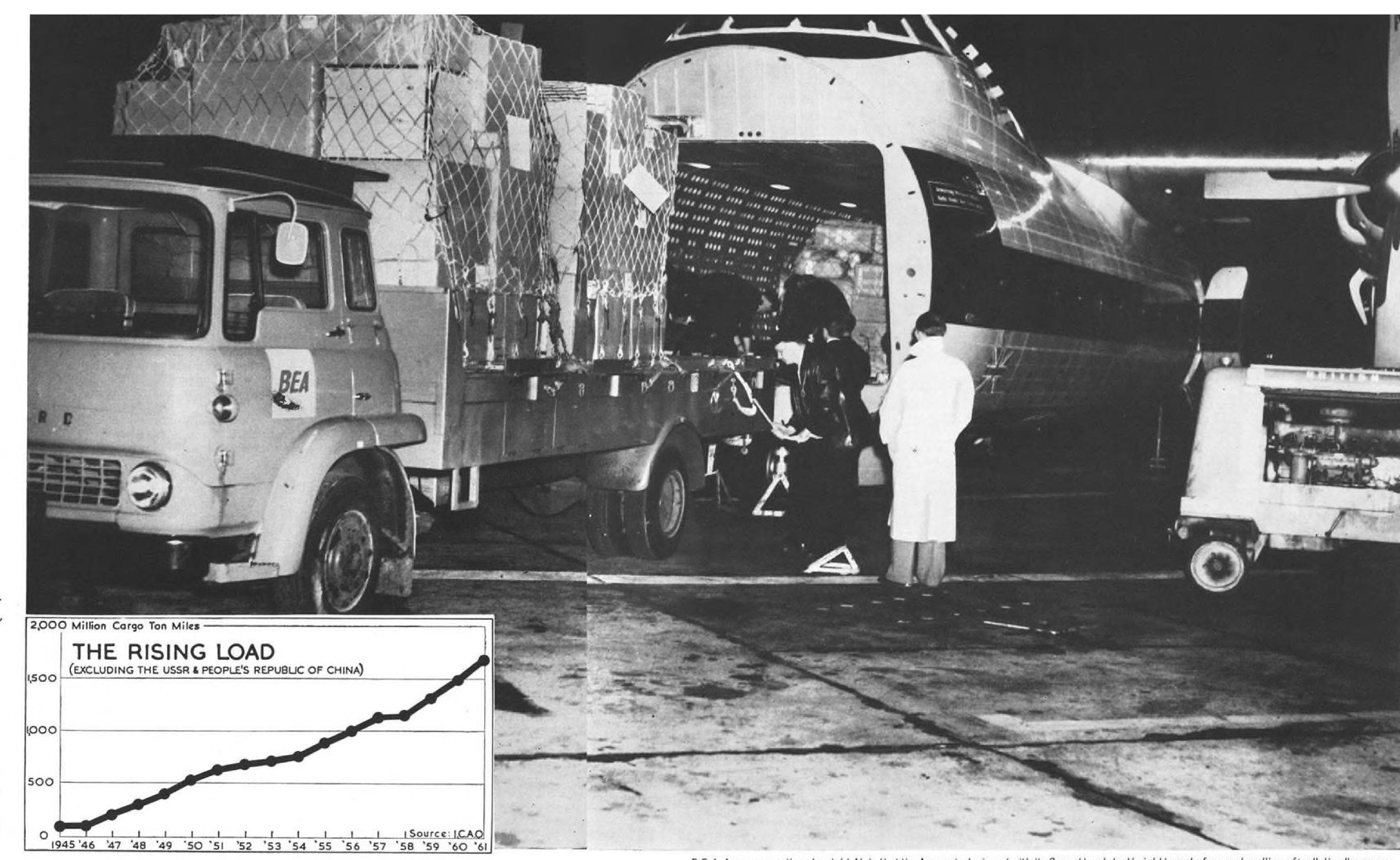
"We have now changed our selling technique from traffic-manager selling to executive selling," Prescott said, "highlighting and comparing to top management of industrial shippers the over-all costs of materials flown by airfreight versus other means. . . . We have met with good success in this technique." Prescott said Flying Tiger still favors a simplified rate structure involving promotional rates and differentials, even though opposition from competing carriers blocked approval of such a system by the CAB last year.

"It is unfortunate that our principal revenue source is the passenger carriers' byproduct," he said, "and that they can be a bit more flippant about rates than we can."

He said he believes air cargo's ultimate success rests in integrated package deals involving both air and ground transportation. Flying Tiger is arranging cooperative services with both sea and trucking firms, and is also planning a joint program with railroads.

"It is most logical that a combination of more than one form of transportation will result in a compromise form of transportation at lower costs and faster movement of goods," he said.

Who'll take most of the growing airfreight business?



Airfreight business is going one way-UP!

ARGOSY OPERATORS-LIKE 137



B.E.A. Argosy operations by night. Note that the Argosy is designed with its floor at truck-bed height to make for easy handling of 'palletised' cargoes.

With the rate of growth of passenger traffic slackening off, freight offers the big opportunities. The rewards will go only to those whose courage and foresight prompt them to invest in the right aircraft now. The Argosy—unlike converted passenger aircraft—is built for the job. That's why it can do it so much better. B.E.A., for example, are operating Argosies (often more than 12 hours a day on one aircraft) on scheduled services on European routes and achieving high load factors (e.g. 85% on the six-times-a-week round trips between U.K. and Germany). And B.E.A. are uncovering a whole new market in outsize freight, because the Argosy's full-width doors and unobstructed fuselage mean that all its cargo space is completely accessible. In addition, the new Argosy 200 series is in production, offering the same 30,000 hours guaranteed life, with bigger payload and better economics. Yes, freight operators who are going places must, repeat must, have Argosies!

HAWKER SIDDELEY AVIATION

2 Duke Street, St. James's, London, S.W.1

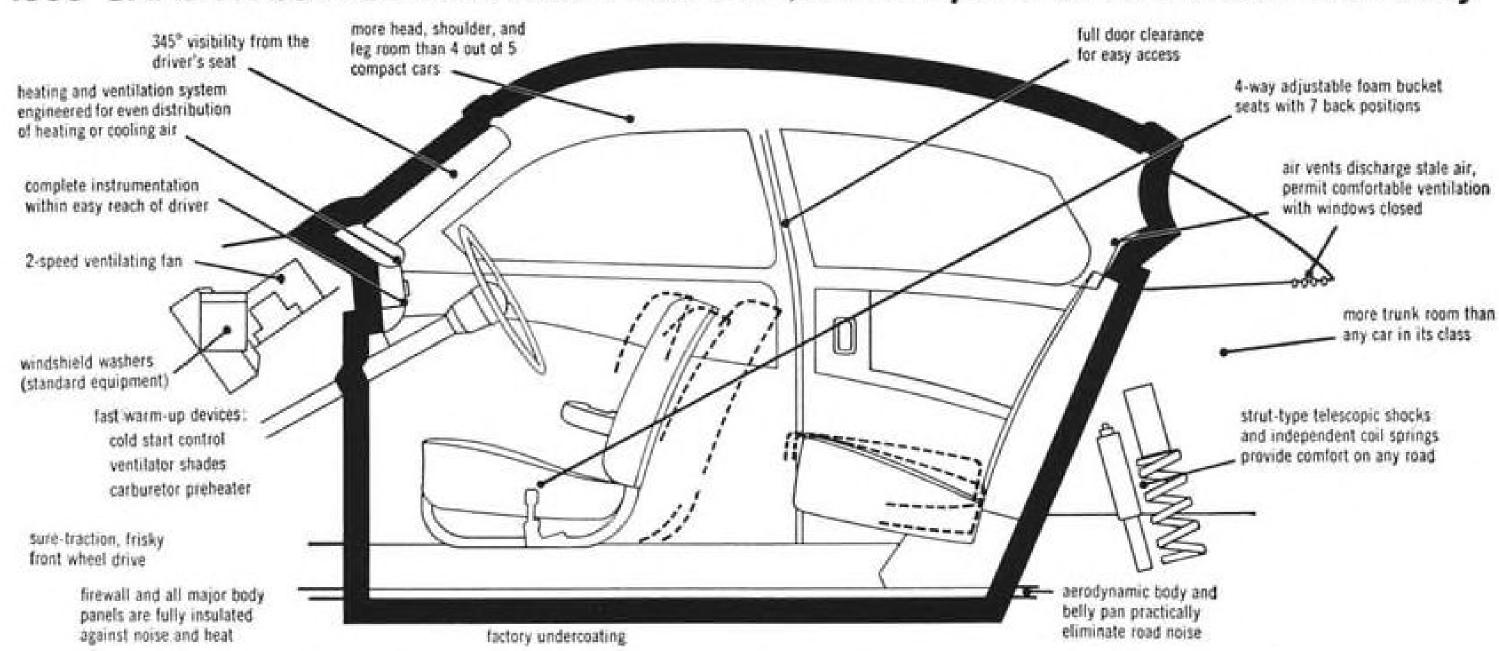
AIRLINE OBSERVER

- ▶ U. S. attempts to persuade Alitalia to provide traffic statistics to the U. S. in exchange for traffic rights in Los Angeles have hit another snag. Originally, Italians agreed in principle to provide such statistics within three years but objected to the wording of the formal agreement. Negotiations on this point have adjourned.
- ▶ U. S. Chamber of Commerce pamphlet issued last July, calling on the federal government to take action against the decline in U. S. carriers' share of North Atlantic traffic, has stirred serious foreign repercussions. Alitalia resigned from the organization and British Overseas Airways Corp. threatened to do so. Lufthansa's deputy general manager came to Washington to protest. SAS and the Scandinavian Chambers of Commerce wrote stiff letters in objection to the pamphlet.
- ▶ Boeing engineers are nearing agreement that their company's entry in the undeclared competition among U. S. aerospace industries to build an economic, civil supersonic transport should incorporate variable sweep wings. Marginal handling qualities inherent in a tailless delta or canard-delta configuration are the prime reason. As one Boeing engineer puts it, "We would much rather tackle the structural and mechanical problems of building the variable sweep airplane than try to teach 2,000 or 3,000 pilots how to land a machine having the characteristics, say, of the F-102, blown up to 400,000 or 500,000 lb. gross weight."
- ► Trans World Airlines has studied and rejected the mobile lounge concept as one way to increase the number of gate spaces available to it at Idlewild Airport. TWA concluded that while the lounge would prove cheaper during the first few years of operation, in the long run a second satellite terminal would save far more money.
- ▶ Airline Mechanics Fraternal Assn. has been formed to strengthen the bargaining power of mechanics who object to contract negotiations covering other ground service personnel. AMFA consists of individual chapters representing mechanics of all airlines at specific airports. Major chapters now include New York, Boston and Los Angeles.
- ▶ U. S. trunkline and all-cargo airlines flew 47.7 million ton miles of air freight in domestic operations in August, a 19.3% increase over the 40 million ton miles handled in the same period last year. For the first eight months of the year, cargo ton miles increased 22% over the same period last year. Freight handled in 1961 increased 12.9% over the volume handled the previous year.
- Domestic trunkline industry showed a net loss of \$10.4 million for the first eight months of 1962, approximately the same as last year's period. Net profit for August was \$3.2 million. Although Eastern Air Lines operated reduced schedules for the month, the industry reported operating revenues of \$194.2 million, compared with \$184.3 million in August, 1961. During the first eight months, the trunklines showed an operating profit of \$41.4 million.
- Pacific Air Travel Assn. has estimated that the number of visitors to the Pacific area will increase 16-18% this year over 1961. During the first six months, traffic to Tahiti has increased 40% over the same 1961 period. Burma, Fiji, Hawaii and New Caledonia have recorded increases of 15%. U. S. citizens account for about 50% of all travelers to Japan, Taiwan, the Philippines, Thailand, Indonesia and Tahiti, and 25% to Fiji, 22% to India and 35% to Hong Kong.
- ▶ Supreme Court last week agreed to rule on whether a state anti-discrimination agency may require an interstate airline to hire a Negro. Case was brought by the Colorado Anti-Discrimination Commission and by Marlon D. Green, a Negro who was turned down as a pilot by Continental Air Lines. Colorado Supreme Court earlier this year ruled by a 4-3 vote that states may not concern themselves with racial discrimination practiced by employers in interstate commerce.

SHORTLINES

- ► All Nippon Airways, Japan's domestic airline, has ordered four additional Fokker F-27 Mark 200 Friendship turboprop transports to bring its fleet of this model to 14. Planes will have a 40-passenger configuration and will be powered by two Rolls-Royce RDa.7 Mk. 528-7E engines.
- FAA will publish in the Federal Register notices canceling proposed rules on which the agency plans no action. Under its new policy, the agency will cancel rulemaking proposals six months after the deadline for public comment, but FAA department directors can extend this by three months.
- ▶ Intra-European passenger traffic on scheduled airlines increased 13.8% in the second quarter of 1962 compared with the same period last year, according to the International Air Transport Assn. Load factor for the period was 57.2%, a 2% increase over the second quarter of 1961.
- ▶ Japan Air Lines has opened a new route between Tokyo and Calcutta, Karachi, Kuwait, Cairo, Rome, Frankfurt and London. Route will be operated with Convair 880M turbofan transports.
- ► Mohawk Airlines has protested the industry's recent decision to extend the no-show penalty plan (AW Oct. 8, p. 52). In announcing its refusal to subscribe to the plan, Mohawk said its objective is "to make it easier to travel by air, not more difficult."
- ► National Airlines has reported a 45% increase in revenue passenger miles for the first quarter of the fiscal year, ending Sept. 30, compared with the same period last year. During the period, load factor rose to 61% compared with 53.5% for the 1961 quarter.
- ▶ Piloted jet transports were used for first time by FAA last week in operational tests of arresting gear designed by All American Engineering Co. under an agency contract (AW July 9, p. 59). Aircraft involved are a Boeing 720 and a Convair C-131 fitted with specially designed tail hooks. Total of 45 engagements will be attempted before Nov. 15.
- ► Trans-Texas Airways has reported a 30% increase in passenger traffic during September compared with the same month last year. Load factor was 38.7%, an 11% increase over Sept., 1961.

1963 SAAB... built so well that it has a 24,000-mile/24-month written warranty*



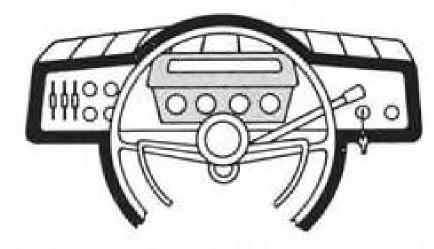
Take a critical look at SAAB comfort and convenience

Aircraft reliability and performance standards are blended with an entirely new approach to over-all automotive design in the Swedish SAAB 96. This car was built to be better and more comfortable, not different... built by one of Europe's leading aircraft man-

Aircraft reliability and performance standards are blended with an entirely new approach to over-all automotive design in extraordinary craftsmanship.

A critical look at *all* the facts and specifications will prove that SAAB is unquestionably one of the world's best engineered cars.

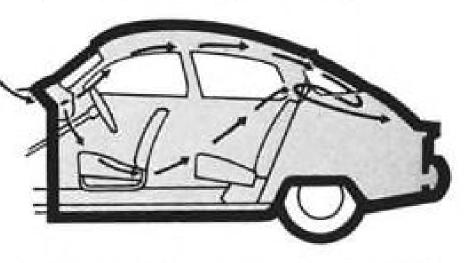
*Engine, transmission (3-or 4-speed gear box available), and differential have a written warranty for 2 years or 24,000 miles.



saab standard extras place complete comfort and convenience within easy reach of its driver. At no extra cost, SAAB provides: electric clock, temperature and fuel gauges, ammeter, on easy-to-read instrument panel; heater and defroster to warm or cool car interior as required and keep all windows fog-free; dual padded sun visors; cold start control, ventilator shades, and carburetor preheater for instant starts in any weather; wind-shield washers, lockable glove compartment; safety belt fittings; factory undercoating—all standard equipment!



saab riding comfort is based on front wheel drive, which eliminates driveshaft, makes all floor space flat and usable, permits quick conversion of SAAB interior to a bedroom big enough for two. Front wheel drive, combined with carefully calculated understeering, low center of gravity, and advanced suspension design, provides swayless directional stability for relaxed driving. The sure-footed traction of front wheel drive pulls the rest of the car firmly and easily around sharp curves and corners, through mud, ice, and snow.



provides draft-free, year-round comfort. Fresh air is circulated and discharged through ducts below the rear window and vents behind the side windows. Removable ventilation lids help keep engine compartment and car interior cool in summer, warm in winter. New ultra-efficient hot water heating system eliminates hot spots and danger of exhaust fumes... provides even heat to front and back seats. Strategically-positioned air jet holes keep front and side windows clear and defrosted for fog-free vision.



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Vickers VC.10 transport makes final approach (right to left) after flight at Farnborough. Fowler-flap sections and leading edge slats

VC.10 Approach, Landing Configuration Shown



Three spoilers installed in each wing assist in braking the VC.10. During the Farnborough flights (AW Sept. 10, p. 26), made with the first production model, pilot actuated thrust reversers immediately prior to touchdown. VC.10 has completed 44 flights, totaling 56 hr. 50 min. Highest takeoff weight has been 250,000 lb.; top speed reached was Mach .84 at 35,000 ft.





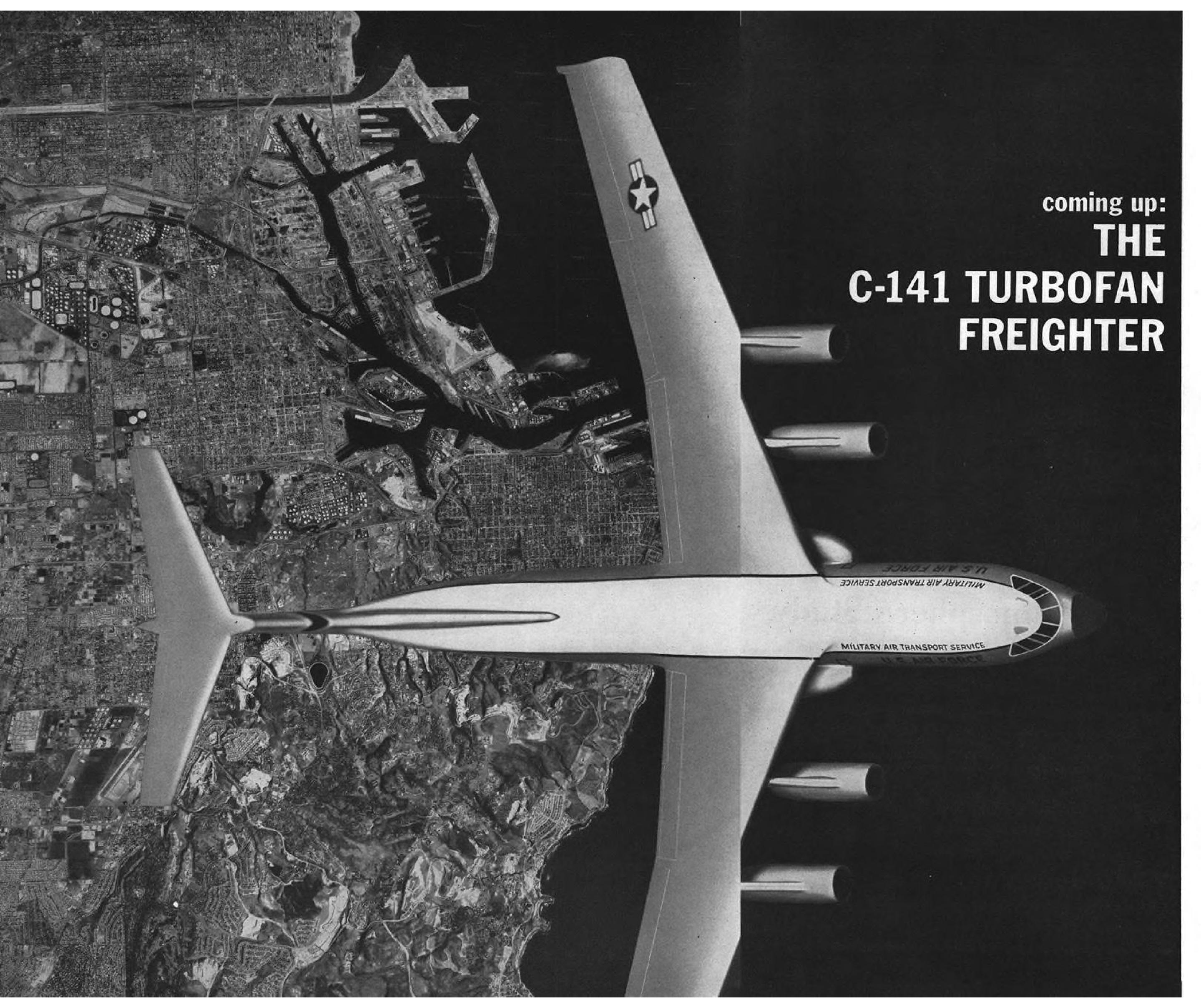
are operated hydraulically. Flaps are fully extended to 45 deg. Leading edge slats are operated on both takeoff and landing.



VC.10 display at Farnborough drew crowds of visitors. During demonstrations, aircraft was operated at maximum landing weight of 206,-000 lb. Maximum takeoff weight is 310,000 lb. Original VC.10 model and stretched version, Super VC.10, have 4,000-mi. ranges. Vickers also plans a third model with 6,000-mi. range. The company currently is attempting to determine the feasibility of the VC.10 transport for London-Los Angeles service.







Soon the new Lockheed C-141 will extend the basic virtues of the true airlifter into the realm of huge, high-speed jet transports. It is designed for truck-bed-height, straight-in, rear loading, which eliminates jockeying cargo up and around corners. Fast, efficient loading systems will make elaborate support equipment unnecessary. And the C-141 is compatible with and complementary to the C-130, which will be in production and service for many years.

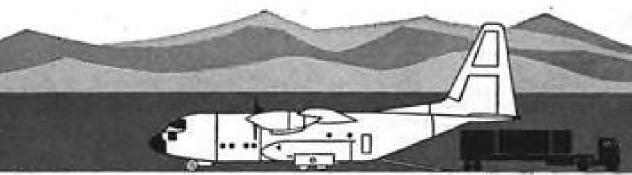
The C-141 will be powered by four 21,000-pound-thrust Pratt & Whitney turbofan engines. It will be able to carry up to 82,000 pounds on transoceanic flights at speeds up to 480 knots. Yet the big turbofan bird can slow to 115 knots, open its giant rear doors, and make airdrops of huge bulldozers and other heavy equipment.

The C-141 is the first transport airplane designed to meet both military specifications and civil air regulations. First military version will fly next year.

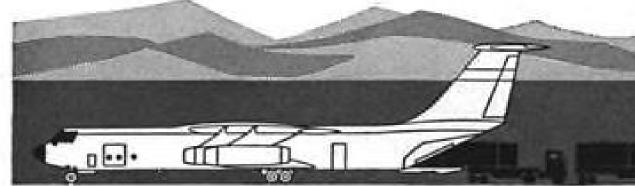
Lockheed-Georgia is prime contractor for the C-141, and is subcontracting 60% of the airframe to firms, large and small, throughout the United States.

LOCKHEED GEORGIA COMPANY

MARIETTA, GA. - A DIVISION OF LOCKHEED AIRCRAFT CORP.

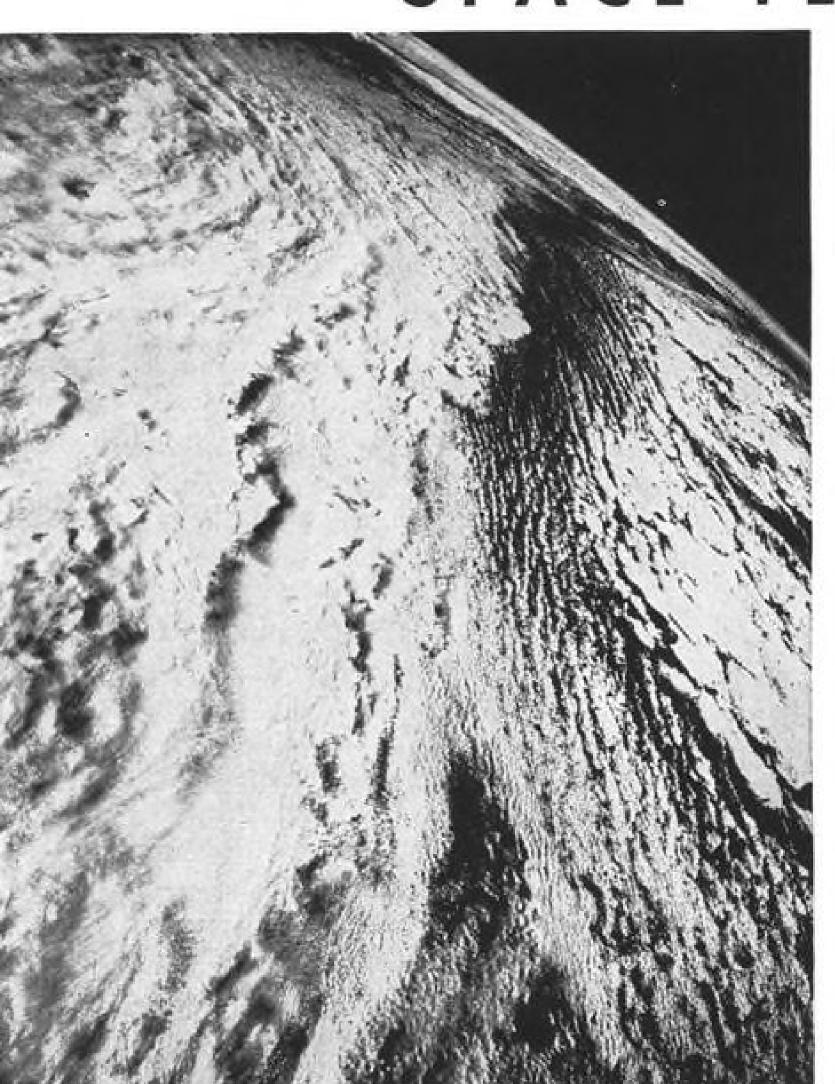


C-130 Hercules: still the best in its class



C-141 StarLifter: tomorrow's turbofan giant

SPACE TECHNOLOGY





INFRARED PHOTO, left, taken from Aerobee, shows area around Ft. Churchill. Aerobee photo, right, shows cloud cover over same area.

Space Sciences Expansion—Part 2:

Space Tools Advance Atmosphere Study

By Edward H. Kolcum

Washington - Scientists have long known that the atmospheric gas cloud which surrounds the earth greatly influences weather and the quality of longrange radio communications, but the means to determine why and how have become available only recently with the development of rockets and satellites.

These tools of space science effectively eliminate the distortion of the gas cloud by providing the means for directly measuring and sampling the dense layers close to earth, the rarefied region thousands of miles above, and the ionized area between.

Classical scientific interest has been focused on the region of electricallycharged gases-the ionosphere-because layers in this region, which begin at an altitude of 35 mi., can be observed by radio techniques and act as mirrors in reflecting radio waves.

58

tend to the far reaches where even traces of particles have a bearing on his life. With rockets and satellites, he now has a way to determine more precisely what that bearing is.

The science of the earth's atmosphere is closely related to the sciences of solar physics and space radiation (AW Oct. 8, p. 55), since all three deal with research into the particles which stream from the sun and stars. Some of the high-energy emissions, measured in the millions and billions of electron volts, are trapped in the Van Allen radiation belt; some are neutral, and others have low energies and velocities. Particles which make up the ionosphere are measured in tenths of electron volts.

With rockets, man has been given the opportunity for the first time to send instruments directly through the atmospheric structure for brief studies. With satellites, he can make long-duration surveys of the composition of the

density, day-night variations and seasonal and geographic differences.

National Aeronautics and Space Administration has given its Goddard Space Flight Center responsibility for atmospheric physics research as part of the center's space sciences program. Much of the Goddard staff engaged in atmospheric research came to NASA from the Naval Research Laboratory, which in the early years of rocketry conducted the most active U.S. work in this phase of space research.

The NRL core has been augmented by civilian scientists and engineers from Air Force, Army and universities, Initially, the discipline was divided between branches called planetary ionospheres and planetary atmospheres. The branches are now called ionospheres and aeronomy.

The early history of upper-atmosphere research actually is the early history of the U.S. space program. It But man's curiosity and interest ex- gas cloud, its pressure, temperature, began in 1946 with the launch of the

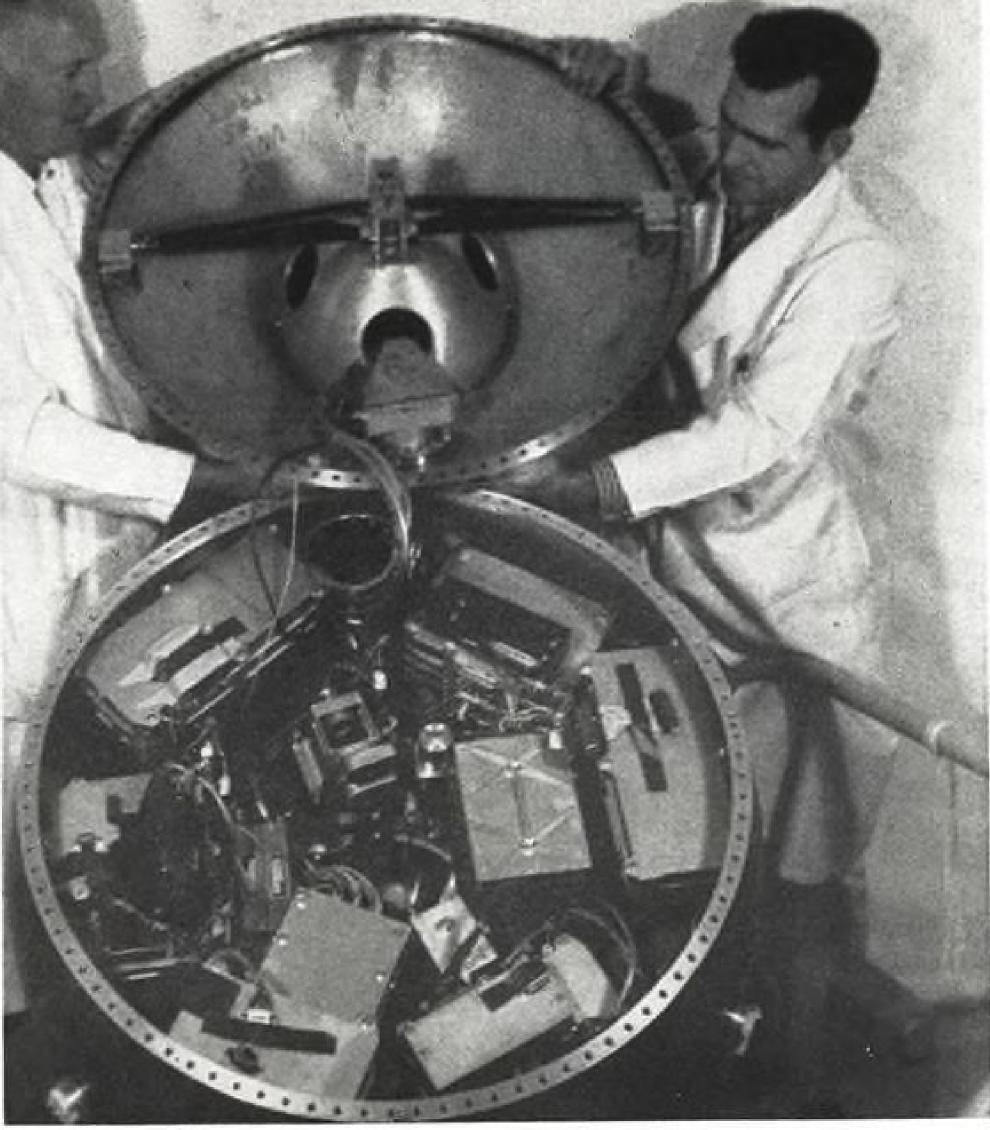
first of 64 captured German V-2 rockets. In addition to revealing some of the fundamental behavior of the atmosphere, these launches taught U.S. scientists how to do things in space-how to design and calibrate instruments and telemetry systems, and how to analyze the data these instruments supplied.

The V-2 Panel formed in January, 1946, to advise the Army Ordnance Corps on what scientific experiments to attempt with the captured German rockets recommended that payload responsibility be spread among the scien-tific elements of Navy, USAF and the Army Signal Corps. As the program developed, NRL became the largest user, initially providing all nose cones and telemetry systems.

The V-2 could reach an altitude of about 80 mi., and during its lifetime it carried just about every appropriate scientific instrument available in the U.S. The full payload capacity of 3,000 lb. was never attained, and as a result, all payloads included concrete or other ballast material.

But it was on these V-2 flights that Dr. James A. Van Allen developed the technique for launching Geiger counters to measure cosmic and geomagnetically trapped radiation; that ion and pressure gages for space measurements were developed; and that electrostatic probes, first used by the University of Michigan, measured electron temperatures.

The V-2 program lasted until the late 1940s, when development of the Venus rocket began. Venus was the forerunner of the early Aerojet Aerobee, the work-horse rocket of the atmospheric sounding program. When the supply of V-2 rockets was exhausted, the V-2 Panel evolved into the U.S. Upper Atmospheric Rocket Research Panel, and this group was the center of virtually all U.S. space research activ-



GODDARD TECHNICIANS assemble the prototype of the S-6 atmospheric structures satellite to be launched this winter.

ity from 1949 until the International Geophysical Year in 1958.

During the decade starting in 1949, 174 Aerobee rockets were launched and they returned excellent data on atmospheric pressure, temperature and density up to altitudes of 100 km. (62 mi.). This data became the basis for the Panel Reference Atmosphere, named after the research panel.

This reference atmosphere extended

and advanced the National Advisory Committee for Aeronautics (NACA) Standard Atmosphere, which was based on ground-based meteor observations made by Dr. Fred Whipple.

Before the year's end, U. S. will publish a 1962 Standard Atmosphere. It will advance the 1956 and 1959 reference atmospheres prepared by Air Research and Development Command, and similar references of the International Civil Aeronautical Organization and Committee on Outer Space Research.

In the study of the physics of the ionosphere, the U.S. has launched about 35 sounding rockets, a satellite and two probes since 1946 to obtain data on ion composition and temperatures of electrons. The fundamental objective, according to Goddard's Robert E. Bourdeau, is to establish a physical model which describes the characteristies of ionized constituents at any altitude.

Ionospheric characteristics depend on the balance of the charged particles produced by the sun from neutral gas, plus charged particles lost through recombination processes. Rocket and satellite experiments are supplying the numbers for this equation.

Space experimentation in the atmosphere began in 1946 when NRL packed a dispersive Doppler transmitter

Major Experiments

	Major	Experiments
Payload	Launch	Significance
1. IONOSPHERE		
Explorer 8	Nov. 3, 1960	First direct evidence of helium band around the earth; first satellite to measure electron temperature; deter- mined that ionospheric electron temperature varies by time of day.
Ariel	Apr. 26, 1962	Found electron temperatures to be greater at the higher latitudes.
P-21 probe	Oct. 19, 1961	Verified existence of helium ions.
P-21A probe	Mar. 29, 1962	Same as P-21.
Scout TV-2	Oct. 4, 1960	Same as P-21.
Rocket payloads		Calibration of ionosondes; precise plots of ionospheric profile layers; found polar and mid-latitude ionospheres the same during quiet sun, and increase in D-layer electrons during solar activity; found large number of nitric oxide ions between 60–120 mi. altitude.
2. ATMOSPHERE		
Rocket payloads	••••••	First measured electron temperatures; measured atmospheric pressure, density and temperature to altitude of 100 km. to establish basis for Panel Reference Atmosphere; expanded this data for 1956 and 1959 ARDC reference atmospheres; established techniques

for satellite measurements.

AVIATION WEEK and SPACE TECHNOLOGY, October 15, 1962



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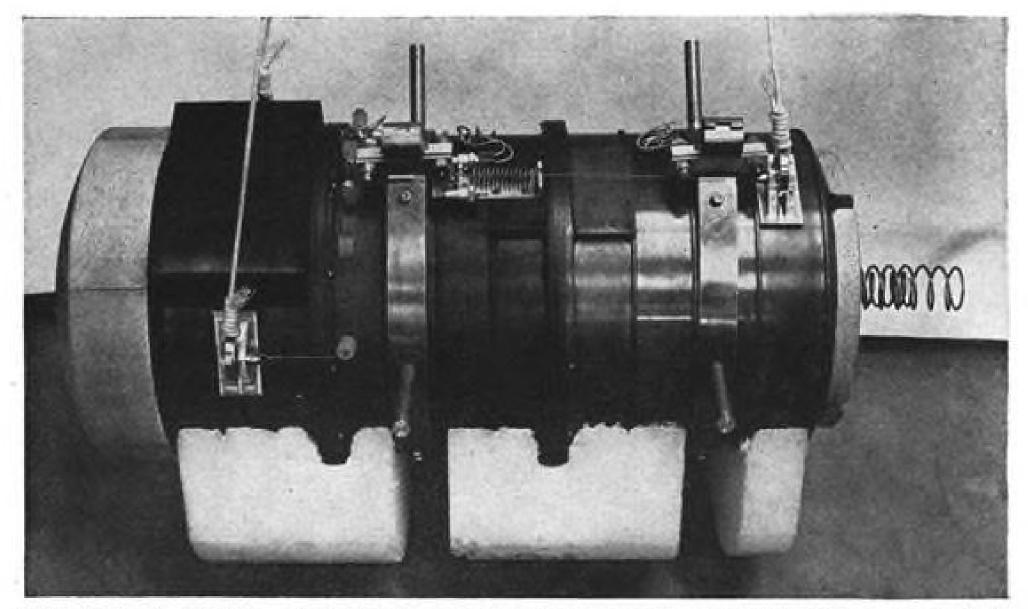
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MOCKUP of Martian atmospheric measurements capsule, presently being studied by NASA's Goddard Space Flight Center

into a payload launched from White Sands, N. M., by a V-2 rocket. Between this launch and 1951, when first results of ionospheric soundings were published, about a dozen successful rocket probes were launched specifically to study the ionosphere.

These flights gave the opportunity to learn what ions exist in the ionosphere. develop techniques and instruments for direct measurements in space. Most notable scientific contributions were the first precise calibration of groundbased ionosondes, or radio sounding instruments, and accurate plots of the profiles of ionospheric lavers.

Before the availability of rockets, scientists were limited to ground observation of the upper atmosphere, and had to infer the physical properties of this region. Rocket flights gave direct evidence that the altitudes of the ionosphere lavers, as measured by groundbased ionosondes, were too high.

Ionosondes indicated that the daytime ionosphere consists of four distinct layers, each acting as a screen which filters some radio waves through and reflects others.

Lowest is the D-layer. It begins at an altitude of 35 mi. and passes all radio waves through. The E-laver at 60 mi. reflects commercially-transmitted waves (below 3 mc.); the F-laver, at 120 mi. and 180 mi., reflects short waves (3-30 mc.), and FM, VHF and UHF (above 30 mc.) waves pass through the ionosphere.

During nighttime, the F₁ and F₂ lavers merge into a single region at an altitude of 180 mi., and the D-laver essentially disappears.

Data from ionosonde measurements indicated the possibility that sharp vallevs existed between lavers. When rocket payloads were fired into the layers, they returned data showing the boundaries are smooth bends, and that no deep valley separates E and F

Several ionospheric rocket flights between 1951 and 1955 confirmed these findings. Research was accelerated during the IGY, when the U.S. program included several Aerobee launches to determine the characteristics of the auroral ionosphere, and to attempt to

These Aerobees were launched from Ft. Churchill, Canada, in the polar region, and resulted in two significant

· Auroral ionosphere and the ionosphere above the middle lattitudes are essentially the same when the sun is

• Electrons in the D-layer are greatly increased in number during auroral displays. Quality of radio wave propagation is degraded considerably during these displays.

The IGY ionospheric survey concentrated on the area between 60 mi. and 120 mi., and Bourdeau said a major finding of the flights was the large amount of nitric oxide ions that exists in this region. Nitric oxide constitutes about half of the ionized atmosphere between 60 and 120 mi. Molecular oxygen ions make up most of the remainder. Above 120 mi., ions of atomic oxygen rapidly become predominant.

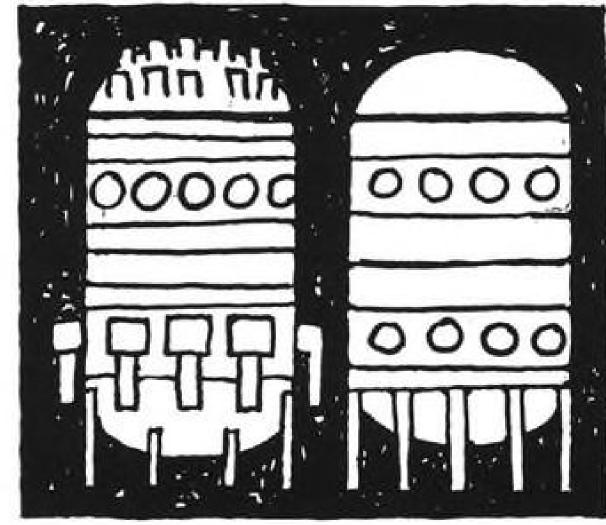
Below 60 mi., the atmosphere consists of 78% nitrogen, 20% oxygen, 1% water vapor and traces of argon, carbon dioxide and ozone.

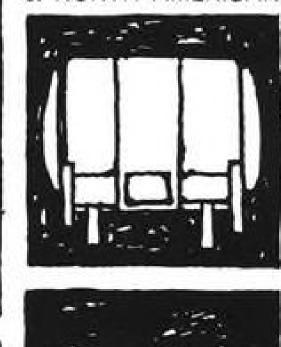
Aeronomy

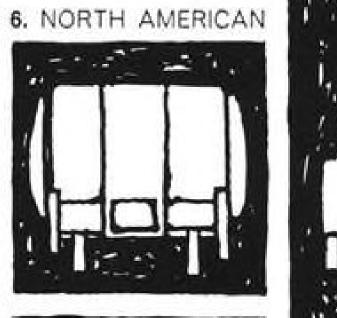
AVIATION WEEK and SPACE TECHNOLOGY, October 15, 1952

Composition, temperature, pressure and density of the upper atmosphere had been only a topic for physical theory before the availability of rockets. Most theory was based on telescopic observations of meteorites and auroras. With rockets and satellites, atmospheric characteristics summarized by the classical hydrostatic equation now can be studied in greater detail to establish a continuity equation quite similar to the

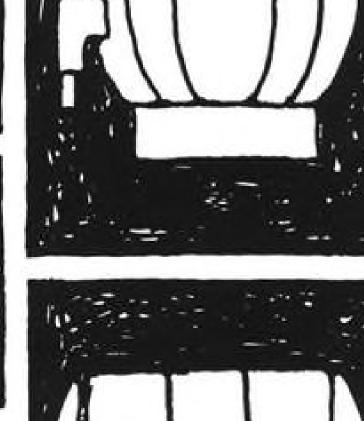
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- 2. Satellite Development Chamber, 32'φ x 54', for General Electric's Missile and Space Vehicle Department, Valley Forge, Pa.
- 3. Space Simulator Facility, 27'φ x 53', for NASA's Jet Propulsion Laboratory, Pasa-

dena, Calif.-through Consolidated Vacuum Corporation.

- 4. Space Environment Simulator Chamber and Dynamic Test Chamber, each 33'-6" x 58', for NASA's Goddard Space Flight Center, Greenbelt, Md.-through Minneapolis-Honeywell Regulator Company.
- 5. Centrifuge Facility, 58' x 55', for NASA's Langley Research Center, Hampton, Va.
- 6. Space Hardware Development Chamber, 15'φ x 22' (Apollo), for North American Aviation, El Segundo, Calif.
- 7. Space Engine Test Facility, 13' x 24', for PD-41046

Republic Aviation, Inc., Farmingdale, Long Island, N.Y.

- 8. Space Simulation Chamber, 38'-6"φ, for Douglas Aircraft Company, Inc.-through F. J. Stokes Corporation.
- 9. Space Hardware Development Chamber, 18' φ x 30' (Gemini), for McDonnell Aircraft Corporation, St. Louis, Mo.

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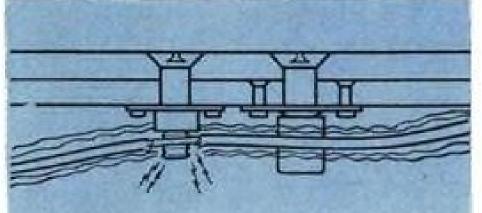
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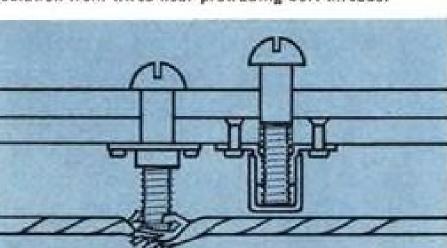
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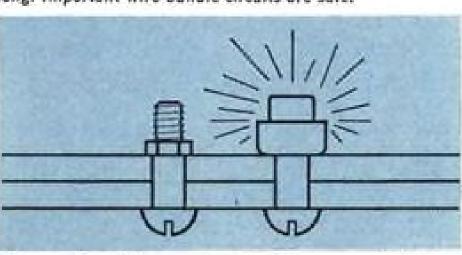
Protect Vital Assemblies, Assure Safe, Trouble-Free Operation



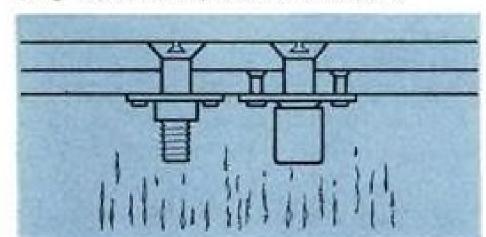
Under conditions of vibration, capped locknuts increase assembly reliability by preventing the abrasive removal of insulation from wires near protruding bolt threads.



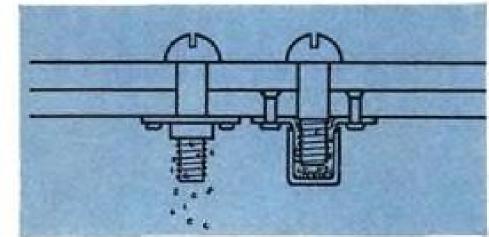
Automatic quality control—capped locknut prevents damage to internal and hidden assembly from screw that is too long. Important wire bundle circuits are safe.



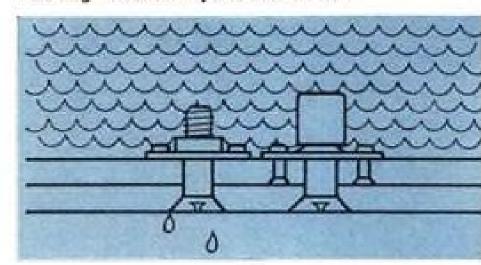
Neat, workmanlike appearance is always a product plus— capped locknuts show extra care in design and manufacturing-experienced buyers look for these extras.



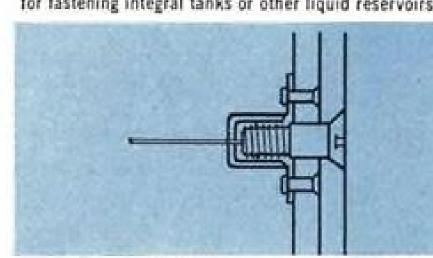
Protection from galling of screw threads in high tempera-ture and corrosive atmospheres. Capped nut protects threads and permits easy subsequent removal of screw-fast replacement of sub-assemblies.



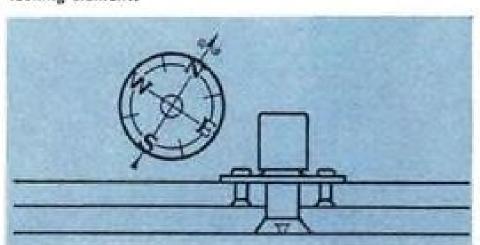
Increased reliability and protection for delicate exposed circuits-cap effectively traps metallic flakes or other fallout resulting from assembly of screw and nut.



Used in conjunction with liquid sealing "gunk," capped lock-nuts provide one of the lightest weight integral seals possible for fastening integral tanks or other liquid reservoirs.



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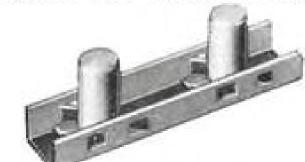


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Nelson W. Spencer of Goddard defines the equation this way: the change in electron concentrations as functions of time is equal to the recombination and diffusion of neutral and charged particles.

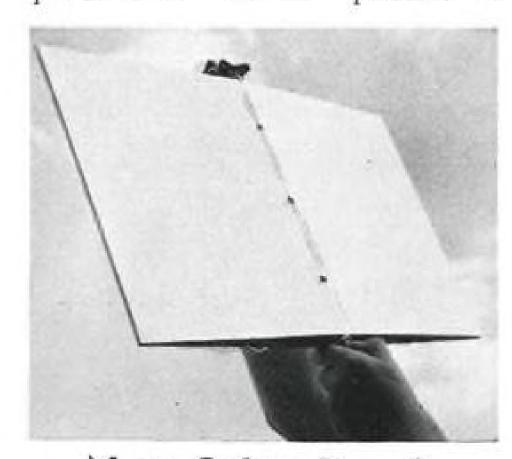
In fitting numbers to this equation, scientists will learn to understand the physical processes inherent in such questions as why the relationships of electron and neutral particle temperatures vary, and how heat generated at high altitude descends to low altitude.

In aeronomy, Spencer said, Goddard depends on four principal measuring

• Neutral mass spectrometer, a device which counts neutral particles in space. This instrument is a good example of how complex space measurement has become. Technique it uses is to ionize neutral particles, and then separate them by focusing each element on an electrode.

S-6 satellite, to be launched this winter, is the first aeronomy orbiter. It will contain a neutral mass spectrometer with electrodes that will attract the characteristic electrical currents of oxygen, nitrogen, helium and water vapor. The instrument cannot be satisfactorily calibrated before flight. Therefore, scientists will attempt to determine the extent to which constituents measured are influenced by the hot filament in the spectrometer, and how much of the atomic oxygen detected is dissociated from water vapor and molecular oxygen. This should provide a basis for preflight calibration of instruments for future flights.

• Ion mass spectrometer, designed to count charged particles. Technique is similar to that used in the neutral mass spectrometer. Because particles it



New Solar Panels

Fairchild Stratos Corp. has delivered four new jewel-like solar panels for an Explorertype satellite to NASA's Goddard Space Flight Center. Satellite will investigate artificial radiation belt created by recent nuclear blast. Aluminum panels have .008-in.-thick skins bonded with epoxy resin to .0007-in.-thick foil honeycomb core.



Space Control System

Tiny "cap pistol" space vehicle control system, developed by Curtiss-Wright Corp. for USAF, contains tape in which are imbedded tiny bits of solid propellant which, when ignited individually, make possible precise control of pitch, roll and yaw. Outer housing is shown above.

counts are already ionized, the hot filament is eliminated.

- Electrostatic probe, an instrument which measures electron temperatures and the density of positive ions by applying a voltage between the payload electrode and the launching rocket.
- Neutral pressure gage, an instrument which collects, ionizes and determines the amount of neutral particle pressure. The S-6 atmospheric structures satellite (AW Jan. 1, p. 56) represents a significant advance in the art of measuring atmospheric density because it will count the number of particles. Earlier measurements have been made by observing satellite drag.

Of the U.S. rockets flown, Spencer said, four V-2s and about 20 Aerobees have been devoted specifically to the study of the atmosphere and its structure. They have been supplemented by rocket grenade and sodium flare flights, which provide data on upper atmosphere temperature, density and wind shear.

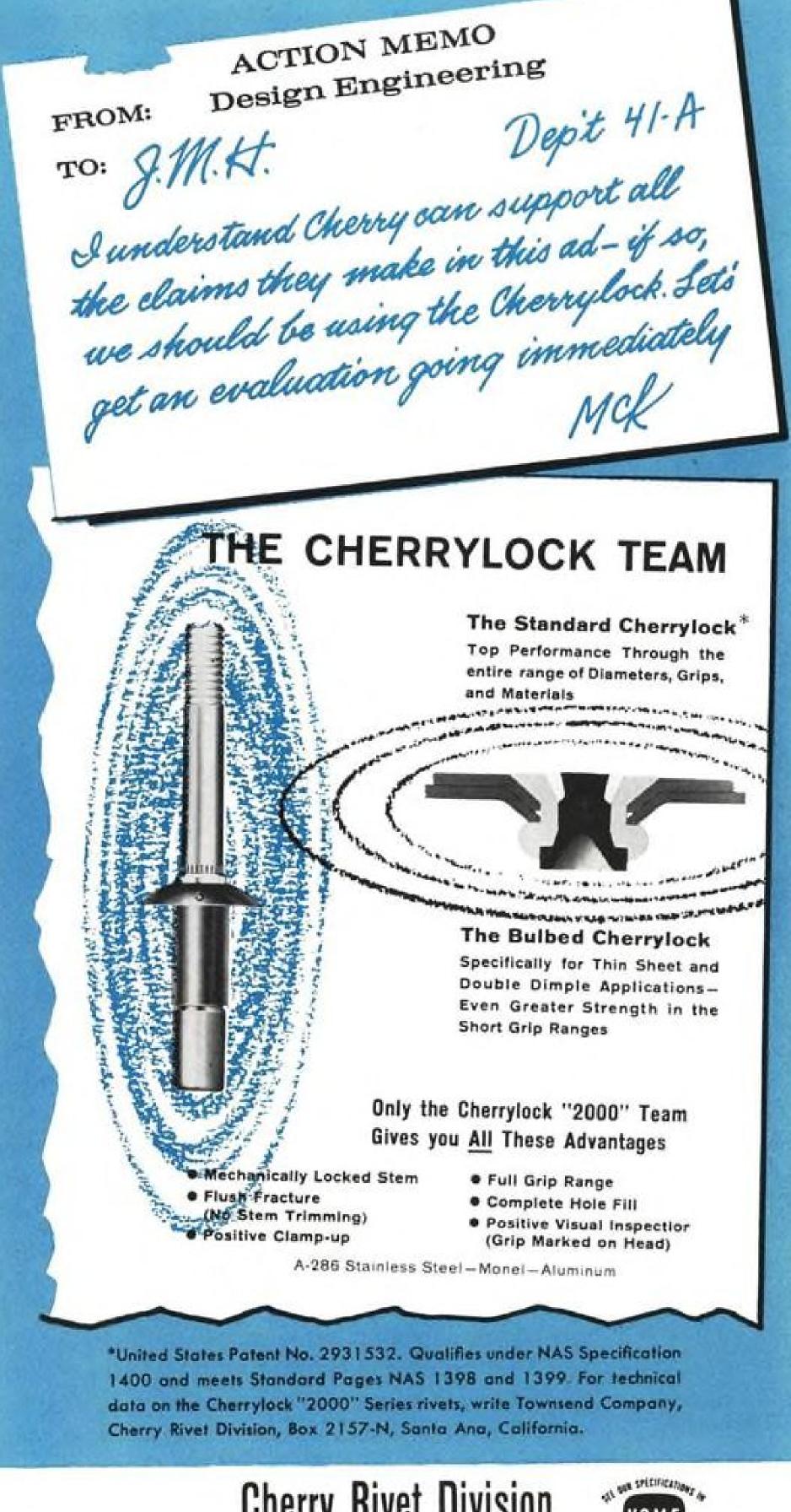
Rocket grenade technique involves launching several grenades which are detonated at different altitudes. By measuring the differences in arrival times of the resulting sound, scientists can compute temperatures and densi-

Wind direction also can be ascertained by determining the angle at which sound arrives.

Sodium flare experiments involve ejecting a trail of sodium as the rocket ascends. The resulting luminous cloud provides a profile of wind force and direction.

These rocket flights have returned data which shows:

- Atmospheric temperature varies considerably from summer to winter at altitudes below 50 mi., and is warmer in winter than in summer.
- Electron temperature varies with the state of the ionosphere. Temperatures



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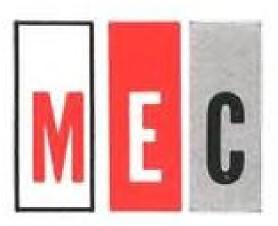
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are higher and more variable when the ionosphere is disturbed.

• Atmospheric constituents are mixed below 65 mi. altitude, and are separated above this altitude.

NASA Programs

With the establishment of NASA and the development of a coordinated U. S. space science program, long-range objectives for ionospheric and atmospheric measurements were developed.

In the NASA program, the first ionospheric satellite was Explorer 8, which carried an ion trap conceived at NRL, developed at Goddard and tested as an Aerobee payload launched from Ft. Churchill.

Launched Nov. 3, 1960, Explorer 8 provided direct evidence of one of the most important phenomena of the atmosphere—a belt of ionized helium in the upper atmosphere which lies between the two regions where oxygen ions and hydrogen ions predominate.

Prof. Marcel Nicolet of Belgium had theorized earlier that such a belt existed, but first direct measurements came from Explorer 8, with additional measurements made by the second Scout rocket test vehicle, launched Oct. 4, 1960, and the Goddard P-21 and P-21A ionospheric probes. These payloads, plus the joint U. S.-British Ariel satellite, have been the most ambitious ionospheric experiments conducted by the U. S.

From experimental data, together with theoretical reasoning, a concept has evolved which Goddard's Dr. Siegfried J. Bauer calls the "case of the disappearing helium belt." This concept holds that this belt varies considerably with temperature and will be very thick during solar maximum and quite thin when the sun is quiet, and that it shrinks during the night and expands during the day.

During the solar minimum in 1964, Dr. Bauer said, the belt will be on the order of 100 to 200 mi. thick, with its lower boundary at an altitude of about 400 mi. above the earth. During solar maximum, it will be more than 1,500 mi. thick, with its lower boundary at about 1,000 mi. altitude.

In addition to satisfying fundamental curiosity, the importance of knowing of the presence of helium ions is that the type of ion determines the number of electrons present, which in turn determines the characteristics of radio wave propagation.

In addition to detecting the presence of helium ions around the earth, Explorer 8 substantiated earlier rocket data by providing the first satellite data on ionospheric temperatures. The satellite also determined that electron temperature in the ionosphere varies with the time of day.

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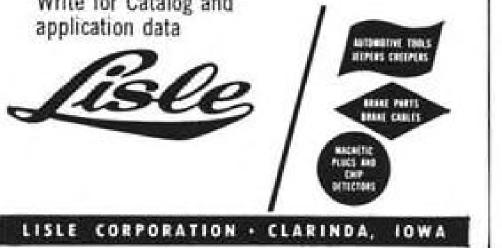


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Early detection means constant protection against in-flight failure.

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phere temperature: satellite drag and direct sampling by rockets. Although assumptions enter into the formula for drag computations, satellite instruments for measuring such things as particle density can be calibrated fairly precisely by first flying them as rocket payloads.

A primary finding of the Ariel satellite, launched last Apr. 26, was that electron temperatures are greater at the higher latitudes, a finding which is at variance with those of previous satellites, which found no significant temperature variation with latitude.

Bourdeau feels that considerable new information has been obtained about the F2 layer as the result of several flights into this region by Argo D-4 rockets. The same is not true for the D-region, which Bourdeau said is less known than any area of the upper atmosphere. The D-region extends from 35 to 53 mi., and according to existing theory, is ionized in the upper layer by Lyman-alpha radiation, and in the lower layer by cosmic rays.

With this theory as a starting point, the U. S. and Norway will make joint studies of the middle and auroral, or polar, D-regions from Wallops Island, Va., and Andoya, Norway. Rocketlaunched payloads will measure Lymanalpha radiation simultaneously with electron density and ion constituents.

The U.S. will measure electron density in two ways: by the amount of detuning in a radio frequency probe, and by using the Faraday effect, measuring the shift of signal polarization from a transmitter on the ground and a receiver in the rocket.

Basic Norwegian payload is designed to measure differential absorption by determining the amount of radio energy removed as a function of altitude.

Bourdeau identified other future U.S. ionosphere program projects:

 Geoprobes – Rocket-launched ionosphere and aeronomy payloads to altitudes of about 400 mi. to determine why E- and F-layers exist. Argo D-4 rockets will be used to boost sensors designed to measure the parameters of neutral gas; simultaneously, Aerobee rocket payloads will measure in the ultraviolet and X-ray spectral bands.

Program calls for three such simultaneous launches each year for the next two years. It will permit coordinated measurements of electron and ion densities and temperatures, ion compositions, densities of neutral gases, chemistry of the gases, and direct spectral analysis of solar emissions.

 Topside sounders—actually ionosondes which measure from above the ionosphere. U. S. will launch the S-48 which will transmit radio waves on six frequencies. Canadian Alouette, launched Sept. 29 (AW Oct. 8, p. 34), contains a transmitter which sweeps from 2 to 12 mc.

 Polar beacon, the S-66 satellite, which will permit measurements of the number of electrons between the satellite and ground receivers. This satellite will transmit on 20, 40, 41 and 360 mc., and Goddard is encouraging anyone with an appropriate receiver to participate in the experiments. With enough receivers, this polar-orbiting satellite could develop a worldwide map of the ionosphere. Bourdeau said that about 100 representatives from 20 foreign countries have said they will make measurements.

Several ionospheric experiments are being planned during the International Year of the Quiet Sun in 1964 which will coordinate the direct measurements made by topside sounders and the beacon experiments. Synoptic measurements of the ionosphere during the full 11-year solar cycle also are in the planning phase. One objective will be to place a payload into a 1,200-mi. polar orbit to monitor behavior of the upper ionosphere as functions of both solar cycle and latitude, measuring hydrogen and helium ions and investigating the relationship between energetic particles and the ionosphere.

When vehicles become available to launch them, ionospheric payloads will be sent to Mars and Venus to determine if these planets have ionospheres and of what these ionospheres are composed. Instruments to make these determinations will use the same radio sounding techniques developed for rocket and satellite payloads which measure the earth's ionosphere.

Similarly, the long-range aeronomy plan, Spencer said, includes development of capsules to be dropped into the Martian and Venusian atmospheres to determine the pressures, temperatures and constituents of the gas clouds around these planets.

The S-6 atmospheric structures satellite, to be launched this winter, will be followed by satellites launched into polar orbits and containing more versatile and more advanced instruments. Complementing the horizontal measurements made by satellites will be rocketlaunched payloads which make vertical cuts into the region above the lower atmosphere, but below the region where satellites operate. Spencer identified this rocket program as "TP," for thermoprobe. Experiments will be carried aloft and then ejected so that they will not be influenced by the launching rocket in measurements of ions, neutral gas and neutral particles.

Satellite and rocket experiments now under way are creating the framework for these coming experiments, which will contribute to the detailed chart of the solar system being developed by the tools made available to space science. (Part 3 of this series will discuss astrophysics and cosmic dust.)



HE'S REDUCING THE COST OF AN ENGINE OVERHAUL

It is customary for overhaul shops to use a vapor blast to clean the baked-on carbon from turbine engine blades and discs. This is a slow process. The material to be removed resembles a very tough varnish. Every bit must be removed from the surface of the metal so any cracks present will be easily visible. But slurry covers up the work; the operator works blind; the danger of eroding the metal beyond maximum limits is great.

Airwork looked for a better way—and found it in the dry honer used in an allied industry. This proved to be not only faster —but gave the operator a constant, unobstructed view of the work. The result: less chance of metal erosion—and a better inspectable surface that makes metal flaws easier to spot.

This is one result of our constant effort to reduce costs while increasing reliability. It saves many labor dollars on a Dart engine overhaul...and will soon be saving money on piston engine overhauls, too.

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KNOW YOUR ALLOY STEELS . . .

This is one of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may 4nd it useful to review fundamentals from time to time.

Cold-Finishing of Alloy Steel Bars: Grinding and Polishing

Grinding and polishing of cold-drawn or turned alloy steel bars is the concluding discussion on the subject of cold-finishing. In the processes of turning and polishing, and grinding and polishing (both of which require removal of surface metal), the surface finish of the bars, as well as their dimensional accuracy and alignment, are improved. But the ultimate in quality of bright, smooth surface finish and accuracy is produced by grinding and polishing of either cold-drawn bars or turned bars up to 4-in. diam, inclusive.

GRINDING AND POLISHING

Sizes up to and including 4-in. diam, are generally confined to centerless cylindrical grinders. Larger sizes are ground on centers. A centerless grinder includes a grinding wheel, a regulating wheel for applying pressure against the bar, and a work-rest blade which both supports the bar and guides it between the wheel spacing. Automatic feed of the whole length of the bar is accomplished because the regulating wheel is set at an angle of inclination with respect to the grinding wheel, and thus within this system the bar rotates and feeds during grinding. The bar is then polished to a mirror-like finish by passing through straightening rolls.

Both processes of turning and polishing, and grinding and polishing, are applicable to normalized, annealed, or heat-treated carbon and alloy bars. These operations do not materially affect the mechanical properties. For this reason, the end product can be machined unsymmetrically, with little or no tendency to warp.

Technical Service. Bethlehem metallurgists have given long study to specifications with respect to chemical composition, grain size, hardenability, and the machinability of cold-drawn alloy steel bars. If you would like additional information on cold-drawn products, or alloy steels, our metallurgists will gladly give you all possible help, without cost or obligation.

When you need alloy steels, remember that Bethlehem offers the full range of AISI standard grades, as well as tool steels, special-analysis steels, and all hotrolled carbon grades.

Don't miss our exhibit (Booth 2130) at the ASM World Metal Show in New York, Oct. 29-Nov. 2. It shows how Bethlehem's research program is providing better products for steel users.

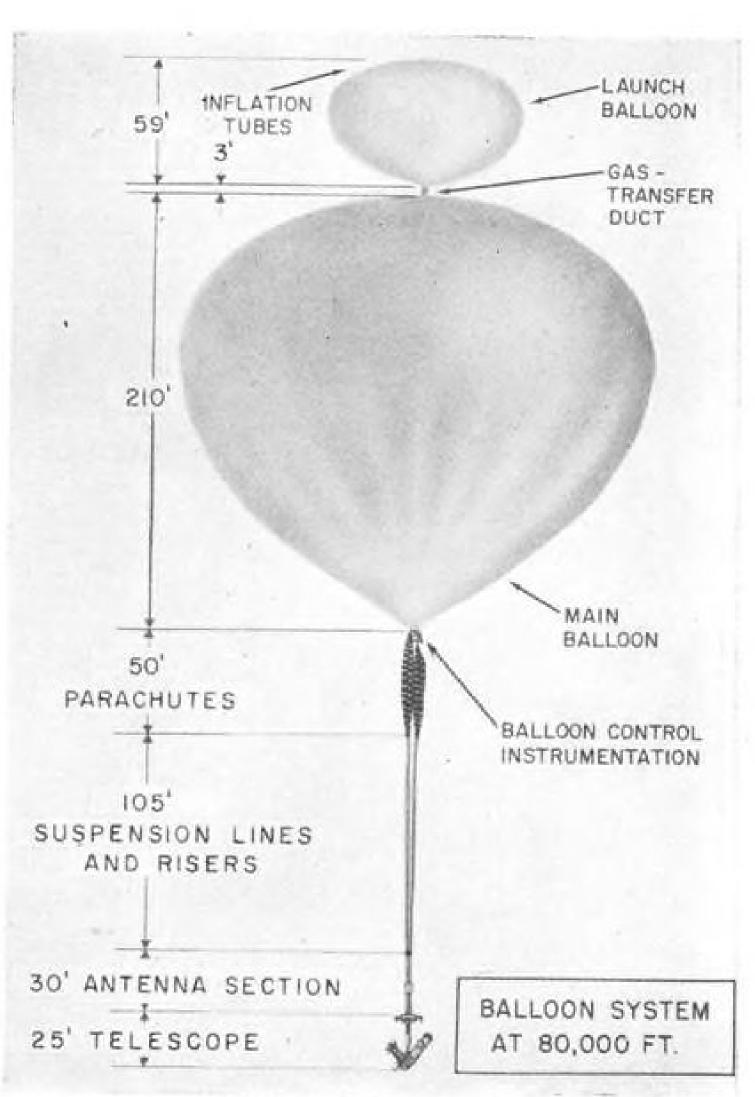
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TECHNICIAN of Perkin-Elmer checks out the Stratoscope 2 telescope system in photo at left. Initial flight, aimed at infrared studies of Mars, is scheduled for early next year. Drawing at right details balloon system's over-all characteristics.

Stratoscope Aims at High-Altitude Photos

By C. M. Plattner

Norwalk, Conn.—Perkin-Elmer Corp. 36-in. aperture telescope for Project Stratoscope 2 will provide photographic and spectroscopic resolution at its altitude of 80,000 ft. three times greater than resolution of telescopes on the earth's surface.

The 300-ft. effective focal length balloon-borne telescope will operate above 96% of the earth's optically-distorting atmosphere, providing resolution of .1 sec. of arc. This is equivalent to distinguishing two objects 30 in. apart at a distance of 1,000 mi.

Project Stratoscope 2, scheduled for its first flight early next year, is an outgrowth of Stratoscope 1, a 12-in. balloon-borne telescope used for photographing the sun in 1957 and 1959. The project is headed by Dr. Martin Schwarzschild, Princeton University professor, who also directed Stratoscope 1.

Stratoscope 2 is sponsored jointly by National Science Foundation, Office of Naval Research and National Aeronautics and Space Administration Approximately \$5 million has been spent on Stratoscope 2 development to date.

First flight of the high resolution optical system in February or March, 1963, will be used to obtain an infrared spectrum analysis of the surface of Mars. NASA has requested modification of the photographic system to include this new mission, since Mars will not be in good opposition to the earth again, after next April, until 1965.

NASA will use the infrared analysis of Mars to plan instrumentation for the Mariner B observation satellite scheduled for Mars flyby in 1964 (AW Feb. 5, p. 57).

Mars infrared spectrum analysis conducted in the 1-7 micron region should provide information on the organic makeup of the planet's surface as well as an indication of the amount of water vapor in its atmosphere. No reliable information on the water vapor content of Mars' atmosphere exists, according to NASA.

Stratoscope 2 spectral analysis flight may include observations of the moon and Venus if time and conditions permit. Although the optical system has the ability to provide a clear definition of objects on the lunar surface down to 500 ft. wide, it is not planned to use the system to study the moon's surface.

Observations of the moon and its arid, tenuous atmosphere will be made only to check the amount of water vapor in the earth's atmosphere above the operating altitude of the telescope. This will ensure the accuracy of the Mars observations. Infrared observations of Venus may also be made.

University of California, Berkeley, has been awarded a \$336,318 contract by NASA to manage the spectral analysis flight. The project will be administered through the university's Space Sciences Laboratory.

Modification of the telescope includes installation of a prism to spread the light gathered by the optical system into a spectral band. A narrow slit moving across the spectrum will permit passage of light from each "color" segment into a radiation detector, which will replace the 70 mm. camera used on photographic flights.

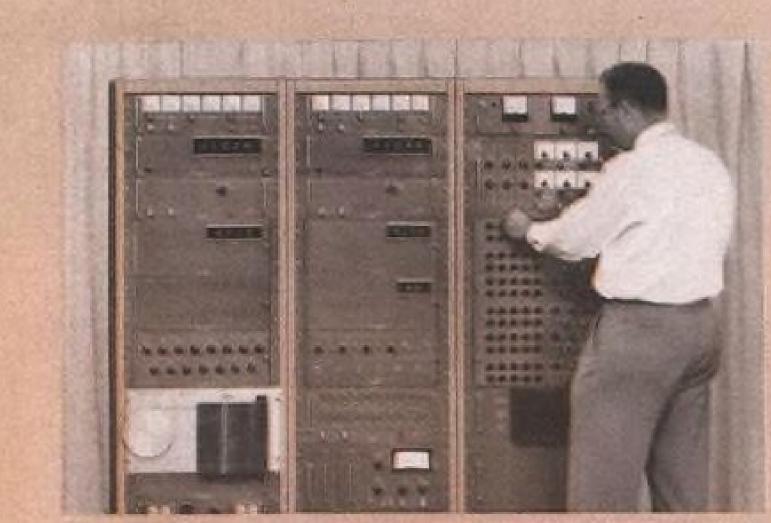
Naval Research and National Aeronau- and Venus if time and conditions pertics and Space Administration. Approx- mit. Although the optical system has will be telemetered to the ground as

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The all new 20 to 100 amplifier 0.01% Donner 3200 is the first analog computer designed from the ground up to use the new iterative technique



This digital data acquisition system built for North American Aviation is an example of Systron systems capability. It measures up to 140 temperatures and 60 strain or motion inputs every few seconds and records them for computer analysis on perforated tape. A built-in design feature is the system's ability to troubleshoot its own faults.



Systron Model 1038 transistorized 25 megacycle counter-timer represents an important advance in the state of the art.



Providing the best price/perform-ance ratio ever offered, the Donner 4310 0.1% linear force balance servo accelerometer has played important roles in virtually every mis-sile program including Project Mercury. It is also an important part of the Donner ignition programmer, a critical element in the Polaris missile.



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In the final analysis, the ability to solve tomorrow's problems evolves from today's capability. And the most tangible evidence of capability is in your hardware.

Systron-Donner hardware includes accelerometers, gyroscopes, analog computers, test and measurement instrumentation, flight control and programming devices, and data handling systems.

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well as recorded on tape. In addition to indicating the presence of water vapor (which absorbs infrared radiation in 1-7 micron region) in Mars' atmosphere, the data should show the presence of the following gases:

· Carbon dioxide, produced by fermentation, bacteria or plants.

· Carbon monoxide, produced by the photodissociation of carbon dioxide.

• Methane, one of the earth's primeval gases, which, together with water, ammonia, hydrogen and energy, can produce amino acids, the basic building blocks of organic matter.

Armed with the knowledge of the identity and amount of the gases in Mars' atmosphere, scientists will be better able to resolve the controversial question of what type of life exists on that planet. It will also be possible to plan more effectively the instrumentation of Mariner B, which should vield much more information about Mars.

Another aspect of Stratoscope 2 which interests NASA is proving equipment and control techniques which will be useful in developing the Orbiting Astronomical Observatory. The fields of guidance, star field recognition and data acquisition are of interest to NASA.

Basic Mission

Primary mission of Stratoscope 2-to photograph stars, planets, nebulae and galaxies-will not start until late next summer. Determination of which celestial bodies will be photographed will not be made until system performance has been evaluated after the first flight.

The 6,300-lb. telescope employs a Gregorian optical system with a 36-in. fused quartz primary mirror. The mirror is polished to a wavelength error tolerance of .4 x 10⁻⁶ in.

Small error of the f/4 paraboloid primary mirror is directly responsible for the total system error. The error introduced by the guidance and control system, which ordinarily is the dominating error in ground-based telescopes, is five times smaller than the optical error in Stratoscope 2. During the average exposure time of 1 hr., the guidance and control system can hold a target in the image plane within .02 sec. of arc.

General telescope configuration is an L-shaped structure formed by an 18-ft. main tube which houses the basic telescope and an 11-ft. side arm which contains the fine television, guidance and camera equipments.

Positioning the telescope to obtain photographs will be done manually by ground controllers using television displays. Three S-in, screens are provided in a mobile van which will follow the course of Stratoscope 2 from the ground during the night-long observations.

Initially, the telescope will be positioned using a television camera located on the end of the main tube with a Top balloon, known as the launch min.

10-deg. viewing field. More accurate positioning is then accomplished with the aid of a 1-deg.-field fine television camera. The fine television camera looks directly at the image inside the telescope. This permits ground controllers to command corrections which must be made to lock the system onto the two stars used for guidance.

Once the guide stars are in the right position, the automatic tracking system is cut in. It is capable of maintaining the image at the film plane for periods up to 1 hr, while the film is being exposed. Exposure time for both spectrum analysis and photography is approximately 1 hr., depending on the light source.

Television cameras employ image orthicon pickup tubes capable of detecting stars of the ninth magnitude. They are made by Radio Corp. of America. RCA also furnished the mobile ground monitoring systems for controlling the telescope as well as the balloon.

High degree of accuracy with which the guidance and control system maintains lock-on depends on the unvielding suspension system. The lack of play in the five-axis suspension system is attained by using three fine primary bearings in addition to two coarse bearings for large movements of the telescope. Rotation is on an insulated mercury bearing, which is one of the three fine bearings. It is a thin film of mercury between two semicircular metal surfaces, one connected to the telescope, the other to the balloon's undercarriage.

Other two fine bearings, used during lock-on, are flexure bearings which permit either movement of the telescope with respect to the frame or movement of the frame with respect to the telescope. Freedom of movement about the flexure bearing axis is limited to ±5 deg. Therefore, two coarse ball bearing axes are installed to permit large roll and elevation movements.

Launch site chosen for the Stratoscope 2 shots was the Scientific Balloon Flight Station located at Palestine, Tex. The station is administered by the National Center for Atmospheric Research –a 14-university, non-profit corporation.

Total of three launchings are planned through next summer. The first ascent is scheduled early this December and will be a final checkout of the balloon system carrying a dummy payload. The Mars' spectroscopic flight is scheduled for February or March, 1963, followed late next summer by the first photographic flight.

Two-balloon configuration will be used to carry the telescope to the operating altitude of 80,000 ft. The two balloons are connected by a 3-ft.-dia. annular ring through which the helium gas can flow freely during ascent and descent.

balloon, is made of a laminate of dacron scrim bonded to a .5 mil Mylar film, called S-12. It carries all the helium necessary to lift the system. The lift provided by the helium in the 75-ft.dia. launch balloon is 14,575 lb. The total system weight, including weight of balloons is 13,250 lb.

The 230-ft.-dia, main balloon starts to fill with helium from the launch balloon at an altitude of 4,000 ft. as the atmospheric density decreases. It continues to fill until completely inflated near the peak of the ascent. Material used in the main balloon is a laminate of .35 mil Mylar and dacron scrim (4 x 6 strands per inch) called S-11. Both balloons are manufactured by G. T. Schjeldahl Company, Northfield, Minn.

Wind problems, which have plagued balloon shots in the past by limiting launch periods to calm days, have been overcome with Stratoscope 2. Vitro Laboratories of Silver Spring, Md., program manager for balloon system development and flight operations, has designed the system so that launch can be accomplished in 15-kt, surface winds and 20-kt. winds at 500 ft.

Launch balloon, after being filled, is played out by a cable attached to a mobile winch upwind of the launch site. As the balloon ascends, it carries aloft the main balloon, which is enclosed in a 3-ft.-dia. Mylar sheath. "Sailing" in the wind is thus effectively eliminated. The sheath is partially ripped before final launch, and the expansion of the gas rips the sheath the rest of the way during ascent.

System is 660-ft, tall in launch configuration. This includes two 100-ft. standard nylon cargo parachutes for emergency descent. Altitude control and descent are accomplished by valving off gas and releasing ballast.

Balloon Tracking

After launch in the early evening, the balloon is tracked by aircraft and mobile ground units. Two airborne control units, a twin-engine Piper Aztec and a Brantly B-2 helicopter, will be utilized.

At dawn, the balloon will be valved down to 2,000 ft., where the helicopter will take control for the final phase of the descent. The helicopter will be carried on a flatbed truck during the night-long flight, following the balloon's

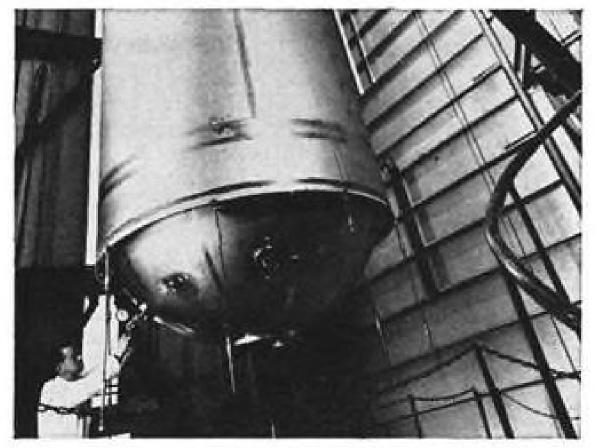
Balloon will be valved down theoretically in a flat, clear area where least damage will be done to the telescope.

At the moment of contact, it is planned to jettison the balloon. The balloon will then be collapsed by exploding a cap off the top of the sphere to deflate it. Rate of descent during the final phase will be 500-600 ft. per

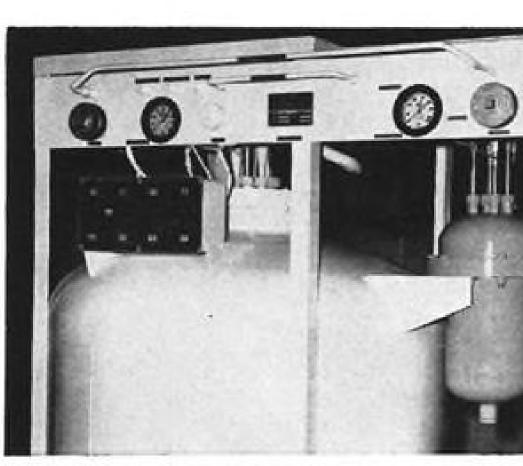
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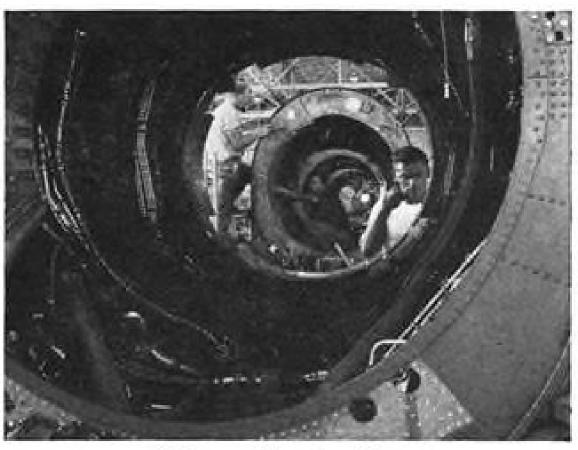
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Beech helps space vehicles get better mileage by turning "hot" fuel into icy slush

Slush hydrogen experiment shows vital facet of Beech's comprehensive systems management capability

At the heart of this experiment at Beech's Boulder, Colorado, space center are three double-walled vac-uum jars, each inside the other. Inside the inner jar is liquid hydrogen, while the center jar contains liquid helium. The outer jar is filled with liquid nitrogen. The idea is to further reduce hydrogen temperature until it turns to icy slush.

The purpose of this experiment is to explore the feasibility of reducing hydrogen volume in order to increase space vehicle fuel loads without increasing tankage size or weight.

Applied research projects like this are common at

Beech. In the past they have included valuable work on cryogenic problems, space environment, and countless other projects that have measurably advanced the state of the art.

Basic research and development is but one of an ever-expanding group of Beech space-age capabilities. Within the last year alone, the size and function of Beech space facilities has more than doubled. This constantly expanding capability complex, coupled with a highly trained and experienced staff, makes Beech a natural choice for systems management projects. Besides the experiment shown here How may we help you? To discover how the unique facilities and expert personnel of Beech can be quickly and efficiently put to work on your project, write, wire, or phone Contract Administrator,

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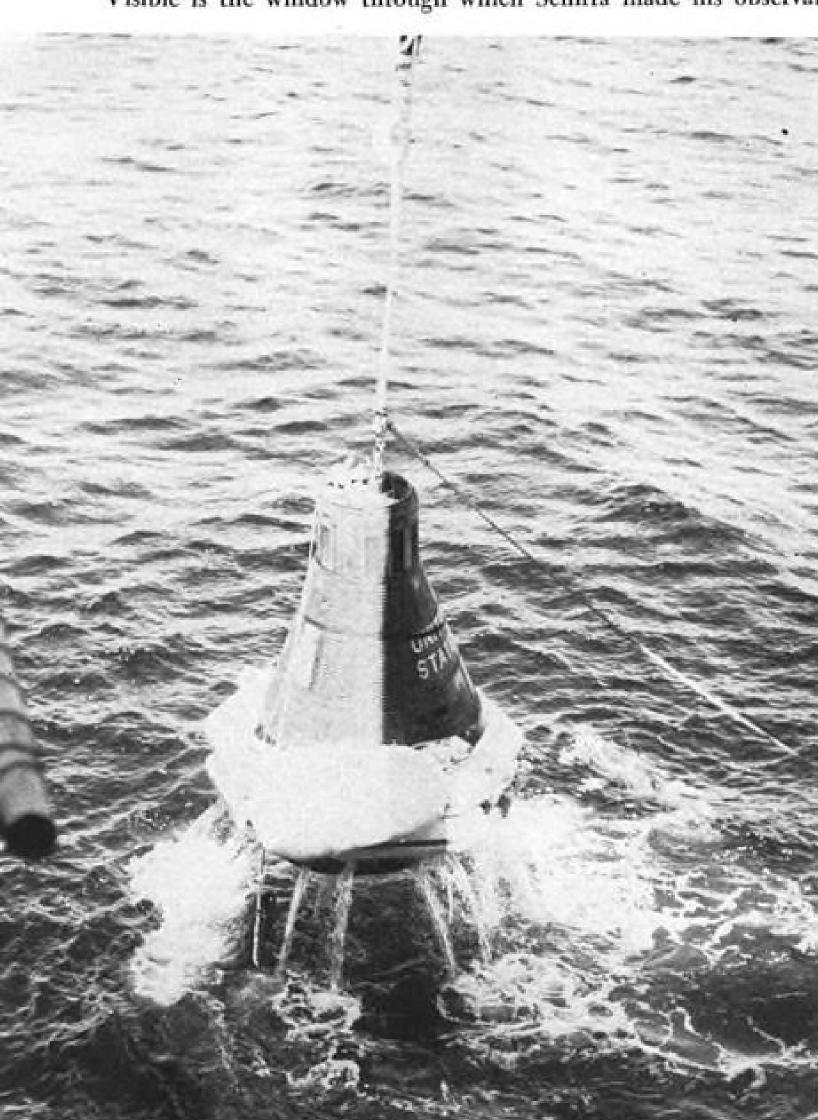


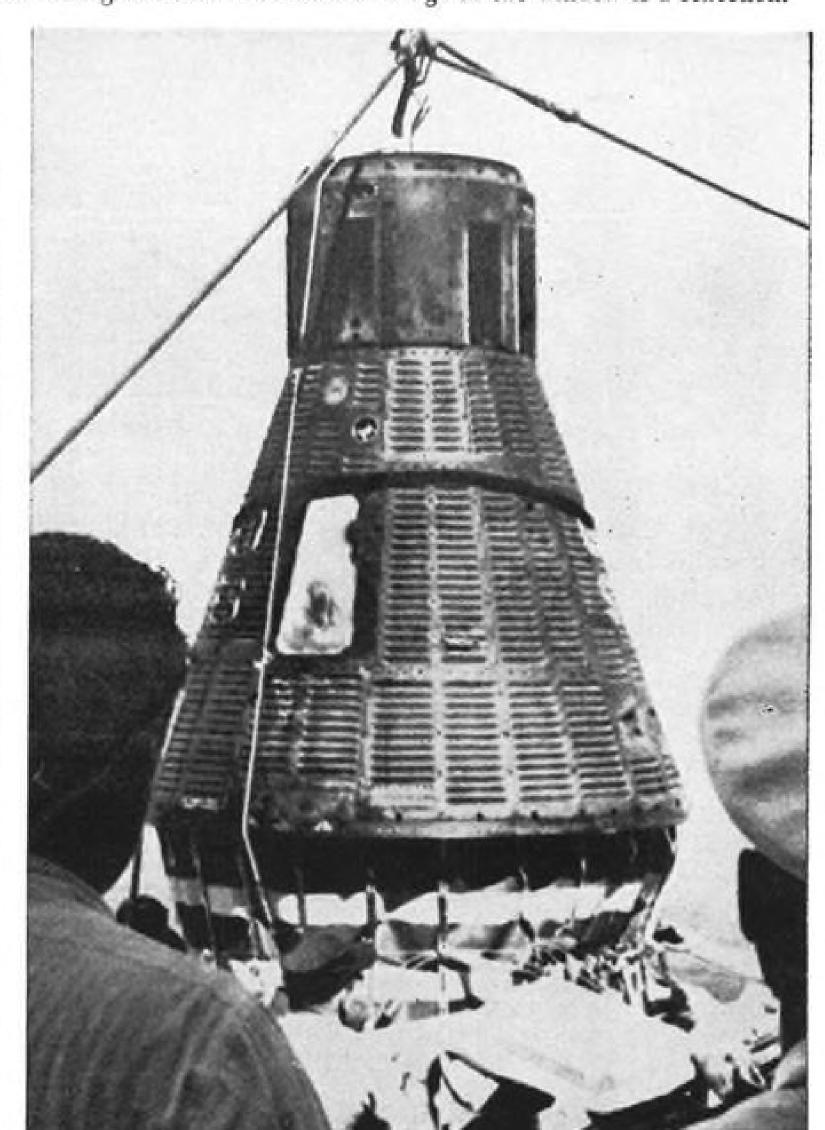


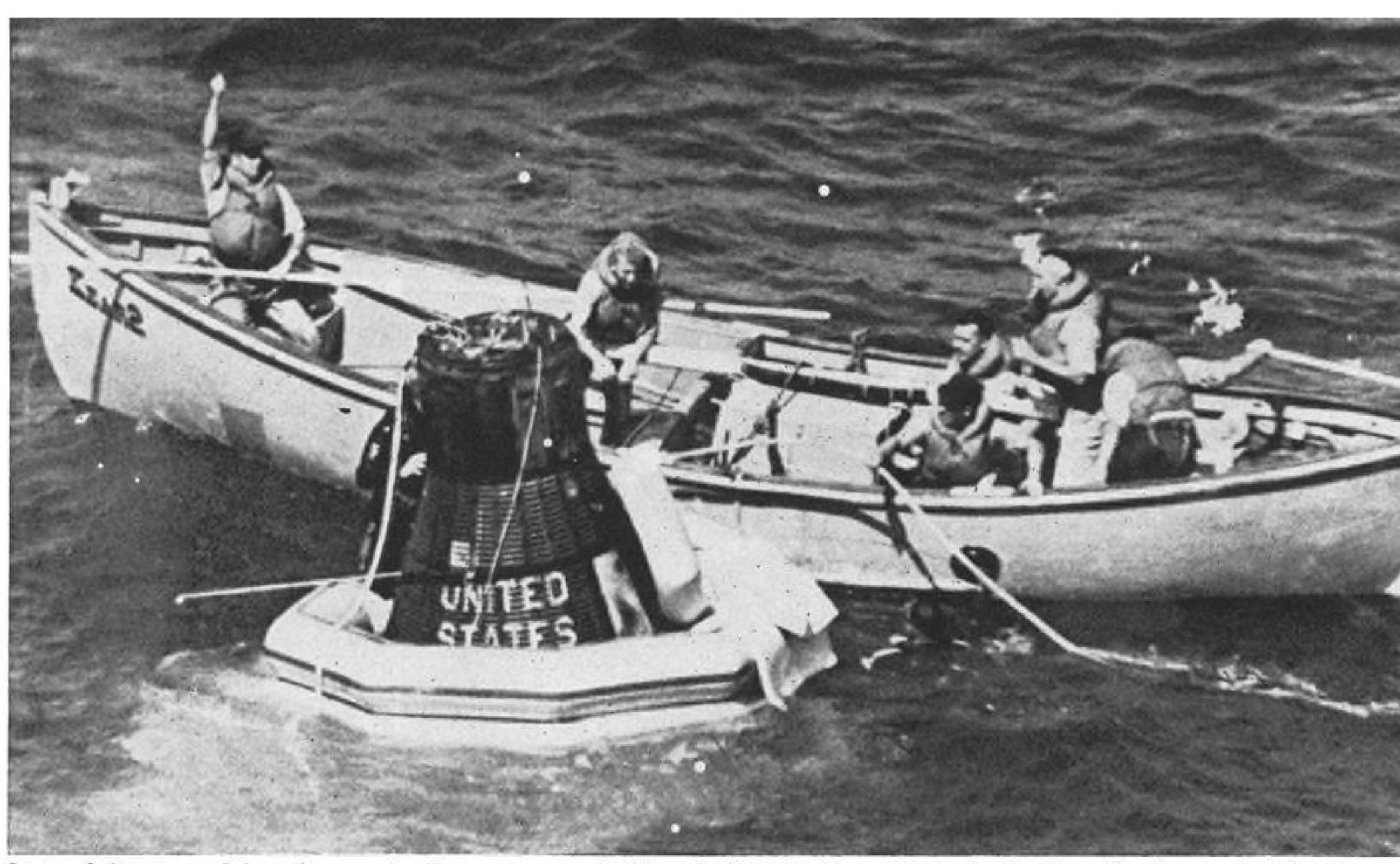
Photo sequence shows landing and recovery of Navy Cdr. Walter Schirra's Sigma-7 space capsule 330 mi. northeast of Midway Island after his successful six-orbit MA-8 flight Oct. 3. Left, capsule drifts under parachute toward Pacific Ocean.

Schirra, Sigma-7 Capsule Recovered in Pacific,

Capsule is winched out of water in photo at left. Mercury spacecraft is lowered by aircraft winch (right) to the deck of the Kearsarge. Visible is the window through which Schirra made his observations during course of the mission. Image in the window is a reflection.



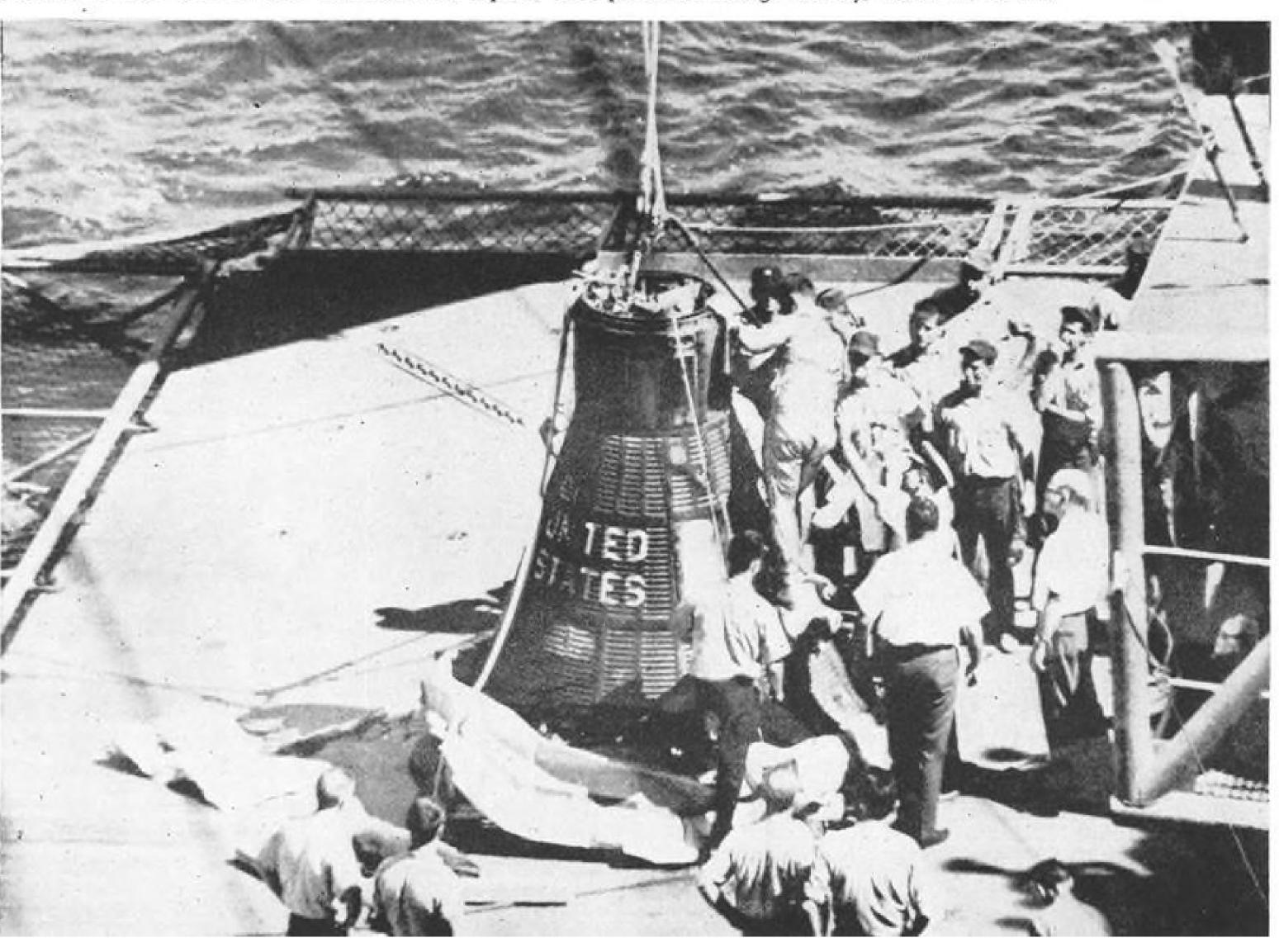




Center, helicopter and boat from carrier Kearsarge approach Sigma-7. Right, boat crew attaches hauling lines after frogmen had placed flotation gear around spacecraft. Schirra remained inside his capsule throughout the recovery operation and return to the carrier.

Returned to Carrier after Perfect MA-8 Flight

Schirra climbs down to the carrier deck after emerging through Sigma-7 escape hatch. Hatch (side) was blown after the capsule came to rest on the deck. Schirra's total time inside the capsule, from pre-launch through recovery, was 12 hr. 26 min.



Ionosphere Probes Set for Solar Eclipse

the July 20, 1963, solar eclipse at the Ft. Churchill, Canada, launch site will provide a simultaneous measurement of electron density and ultraviolet and X-ray radiation under conditions of varying solar radiation for the first time.

Geophysics Corp. of America, Bedford, Mass., will conduct the experiments using Nike-Apache sounding rockets to probe the D, E and F, lavers of the ionosphere. Geophysics Corp. was recently awarded a \$250,000 contract by National Aeronautics and Space Administration to conduct the experiment.

At present, this is the only NASA contract relating to next year's solar eclipse. NASA, however, will provide ionosonde (ionospheric sweep-frequency sounder) ground measurements at the site as a correlation to the data obtained with rockets.

Experiment is based on a study completed by Geophysics Corp. in 1961 which was submitted to NASA. The study was approved by NASA as submitted, subject only to a program re- study, and nine of the two-stage, solid-

Ionosphere rocket soundings during evaluation by Geophysics Corp., which is taking place at the present time.

> Nike-Apache rocket booster chosen by the company will provide greater altitude capability than the Nike-Cajun which has been used extensively for past rocket sounding programs. The 154-in. Army M5-EL Nike first stage generates 42,500 lb. of thrust for 3½ sec. The second stage, 107-in. Thiokol TE-307 Apache provides an additional 5,000 lb. of thrust for 6 sec. This will boost a 70-lb, payload to a peak apogee of 106-112 mi. in 3 min.

> The Apache booster, with an improved polyurethene propellant, will carry the 70-lb, payload 30 mi, higher than the Cajun with its 8,000-lb. thrust for 3 sec. Nike-Apache rockets have attained altitudes up to 128 mi. with a 60-lb. payload in test firings. With the added 10 lb. and addition of telemetry antennas, maximum altitude expected during the eclipse shots will be 112 mi.

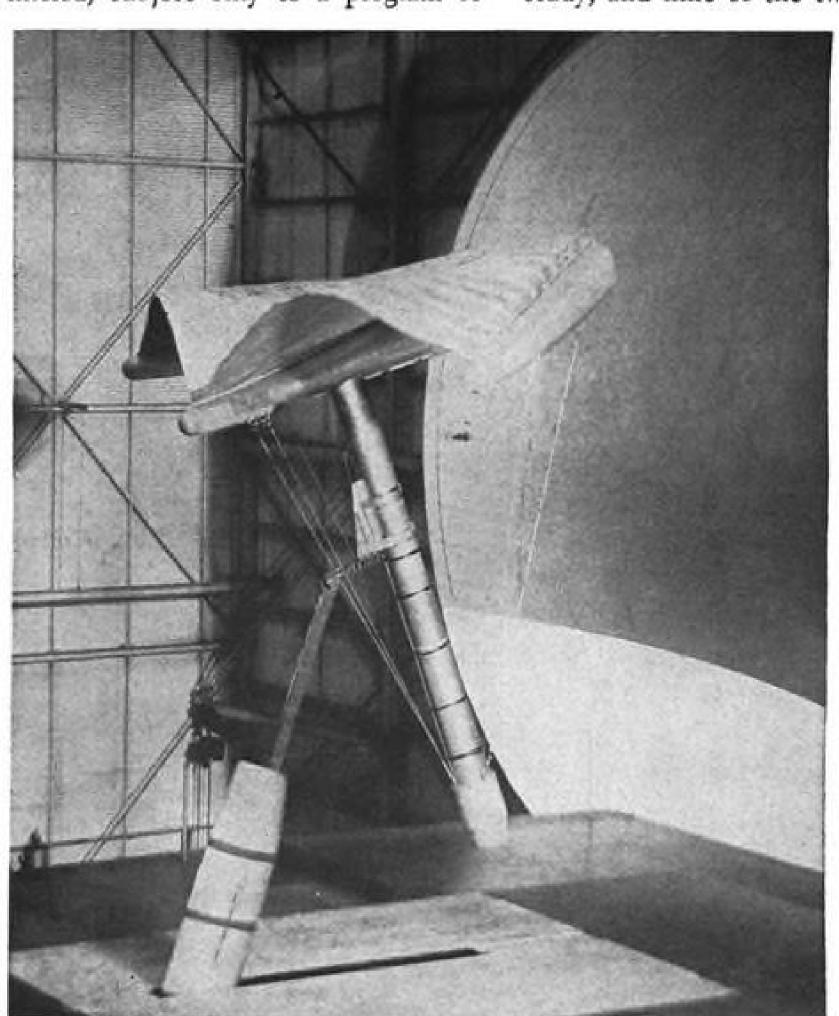
> High reliability of the Nike-Apache has been established in past test firings, according to the Geophysics Corp.

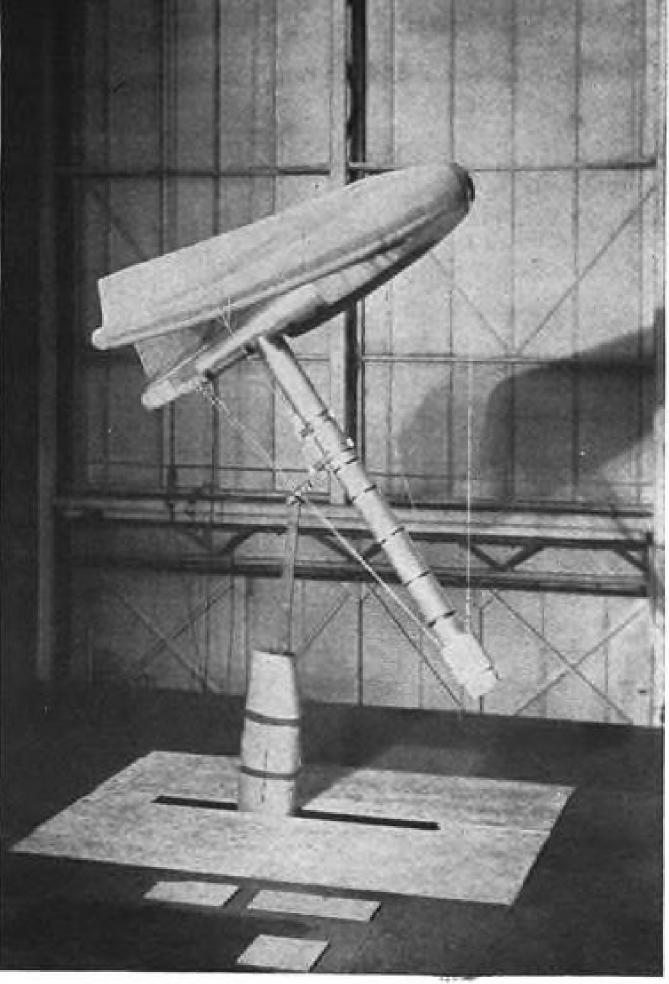
propellant vehicles will be used in both preliminary and operational firings. Two vehicles will be fired in January, 1963, from Wallops Island, Va., to flight-test the nose cones.

One rocket will be fired from Ft. Churchill three days prior to the eclipse to provide background data on atmospheric conditions at the test site and serve as an integrated test of launch facilities. The remaining six rockets will be launched at varying intervals over a 1 hr. 53 min. period during the 2 hr. 12 min. eclipse.

During the period of maximum coverage of the solar disk, the sun will be 94% obscured at the Ft. Churchill range and 90% obscured at the rocket's apogee. The launch site, 160 mi. northeast of the path of total eclipse, is preferred by Geophysics Corp. over water launchings during other eclipses. The Ft. Churchill range is a permanent facility and provides logistic advantages of a well-established launch site.

During rocket ascent, information will be telemetered to ground receivers over a single RF/RF channel. Two dif-





Inflatable Paraglider Models Tested in Wind Tunnel

NASA's Langley Research Center is studying stability characteristics of an inflatable paraglider in tests in the center's full-scale wind tunnel. Tests are leading to development of an operational vehicle to obtain information on frequency and size of micrometeoroid particles in space and allow post-flight study of craters formed by the impact of such particles (AW Oct. 8, p. 32). Space-General Corp., El Monte, Calif., is developing two paragliders to undergo earth re-entry testing.

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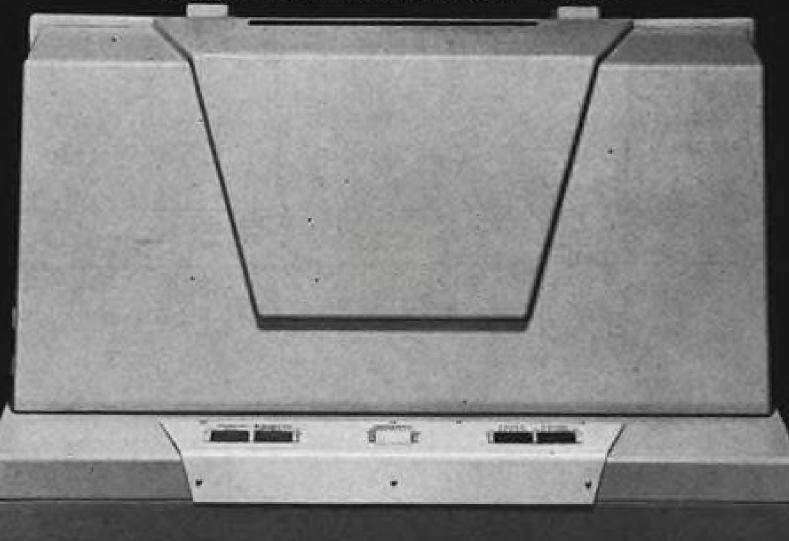
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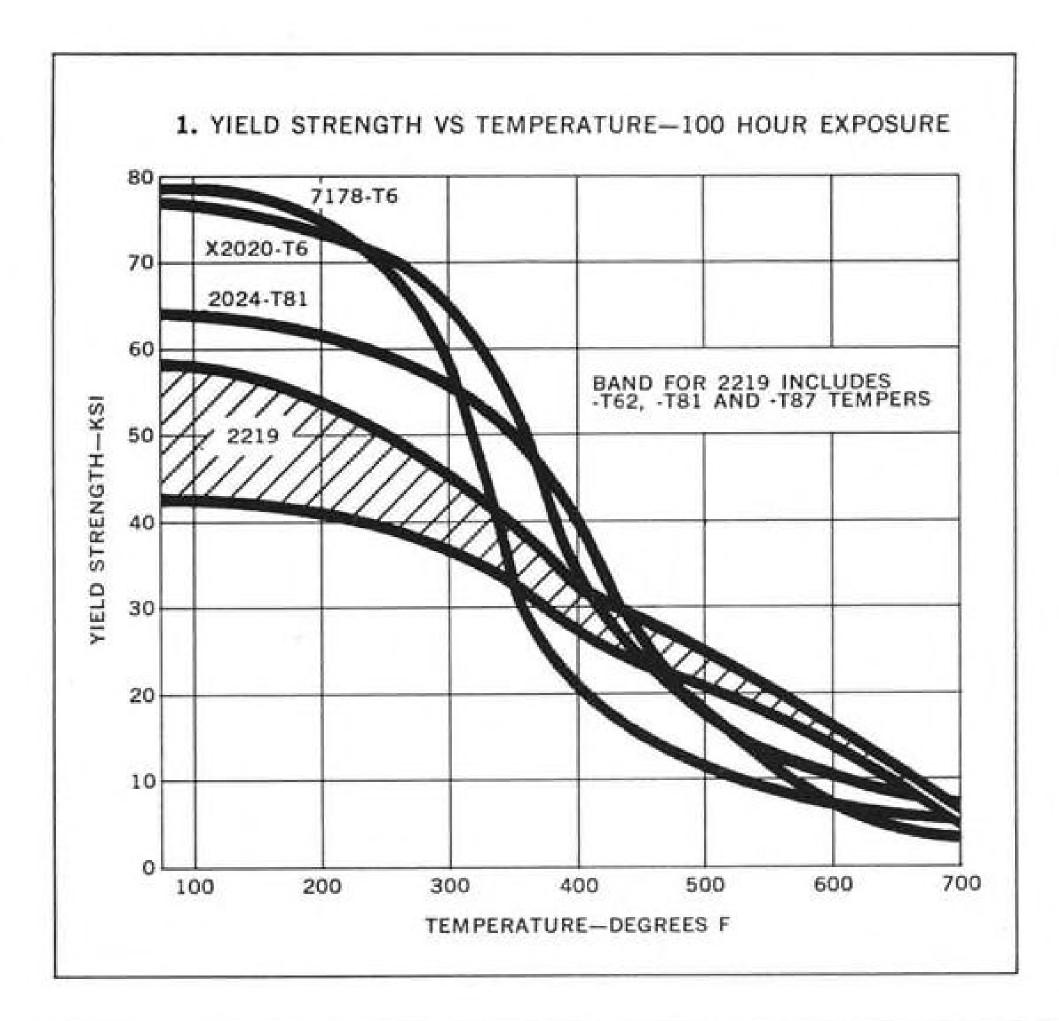
Military Electronics Division

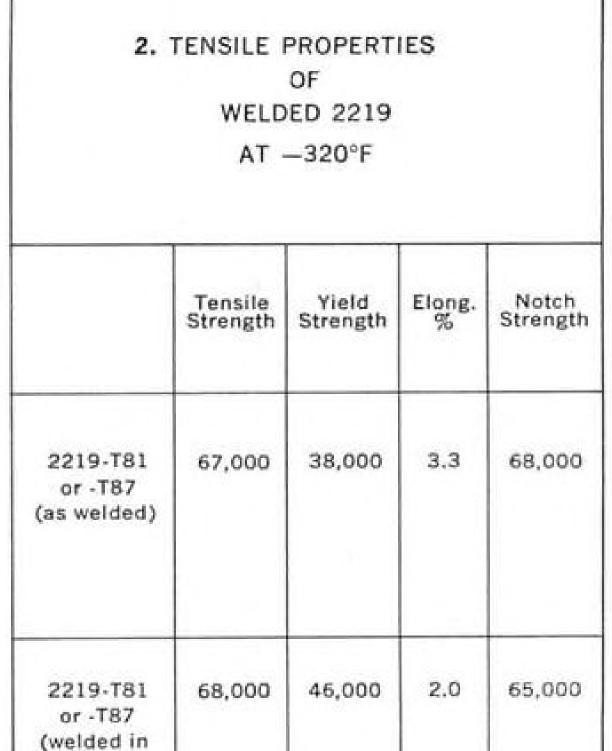


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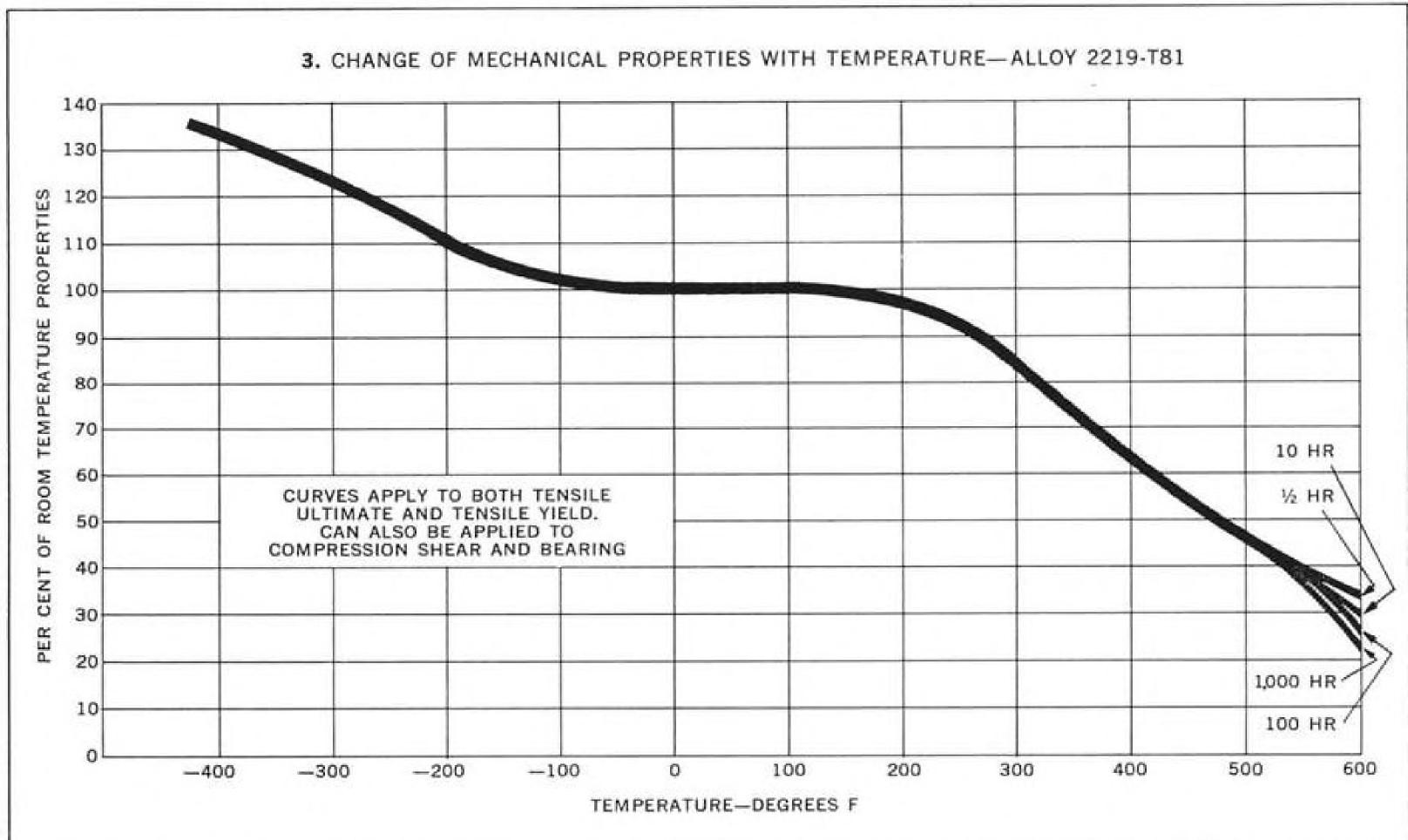




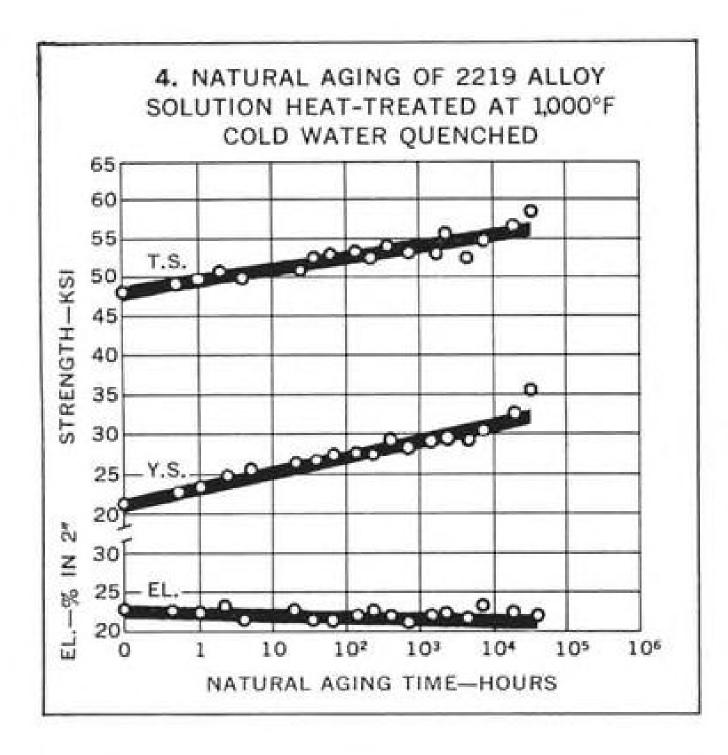
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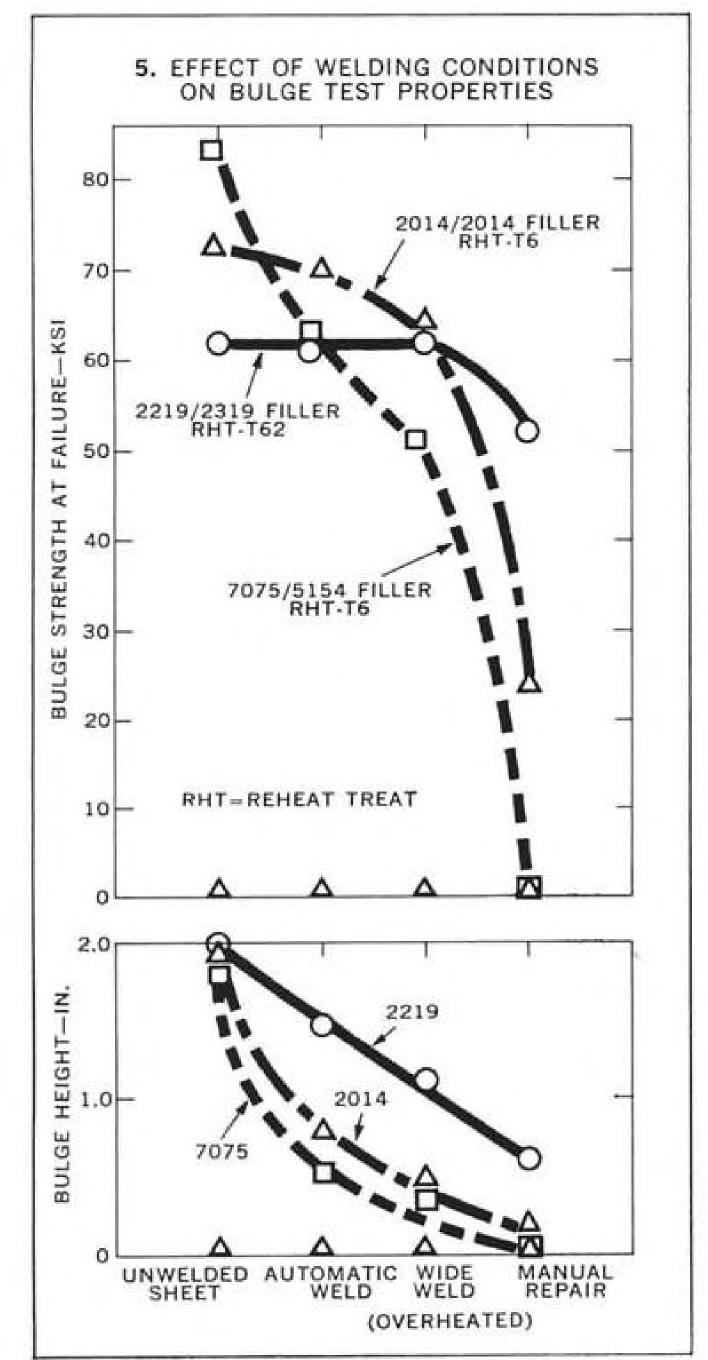
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Alcoa capability at work... gifted newcomer promises out-of-this-world performance on Saturn

The designers of the proposed Saturn C-5 rocket needed a metal loaded with talent for the first-stage fuel tank (33-ft dia). Steel? Out of the question—too heavy for the role. The designers picked a gifted, new aluminum alloy from Alcoa: 2219.*

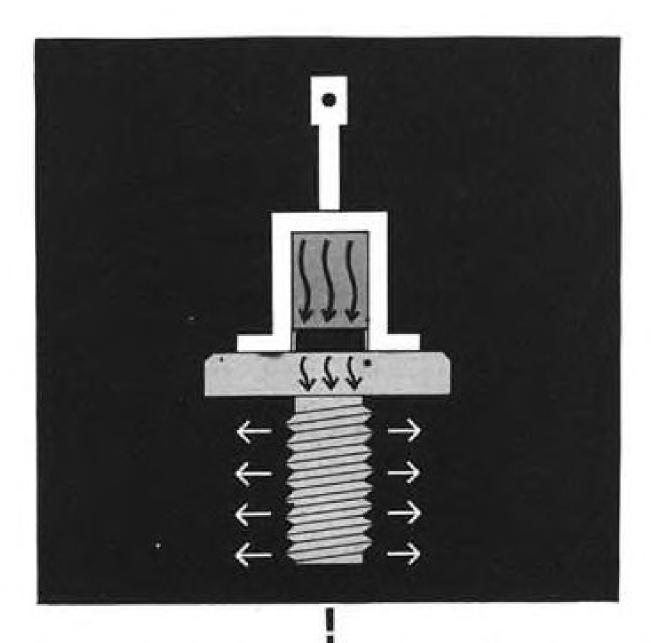
Here's how alloy 2219 performs: It's the strongest conventional aluminum alloy in the 500-600°F heat range. At temperatures as low as -423°F, it has a tensile strength of 92,000 psi. It resists stress corrosion and cracking and it gets along nicely with current fuels and oxidizers. It has good ballistic characteristics. Alcoa® Alloy 2219 is easy to work. Easier to weld. Fusion-welds without harmful strength defects. 2219 weldments also give good performances at sub-zero and elevated temperatures.

World's biggest light-metals workshop. It's Alcoa's. No other basic producer can match our facilities or knowledge. We can fabricate aluminum by any known method—rolling, casting, forging, impact, extrusion—we're not married to a single process. Alcoa's strong on research, development engineering and testing. Can you use our capabilities? Write Aluminum Company of America, 1865-J Alcoa Building, Pittsburgh 19, Pa.

*U.S. Patent No. 2,706,680

- 1. Yield strength vs temperature-100-hr exposure
- 2. Tensile properties of welded 2219 at −320°F
- 3. Change of mechanical properties with temperature 3.(a) Typical room temperature mechanical properties
- 4. Natural aging
- 5. Effect of welding conditions on bulge test properties





Another hot job for Mallory materials...

thermally tailored bases for semiconductors

Keeping a semiconductor cool gets to be a complicated problem in materials. The base, or back-up disc, that serves as a heat sink for a rectifier or power transistor, has to have good thermal conductivity . . . must have a coefficient of expansion that matches the semiconductor . . . and should be readily produced to close dimensional tolerances.

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wide range . . . from 6.9 to 12.1 x 10⁻⁶/°C for standard silver Elkonites . . . from 7.5 to 14.2 x 10⁻⁶/°C for standard copper Elkonites. Thermal conductivity is good, ranging from about 0.45 to 0.8 gm. cal./sq.cm./°C/cm.

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High density metals • refractory materials • special alloys

ferent frequencies, one for odd-numbered launch vehicles and another for even-numbered vehicles, will be used. This will prevent instrumentation of individual rockets from interfering with each other during checkout.

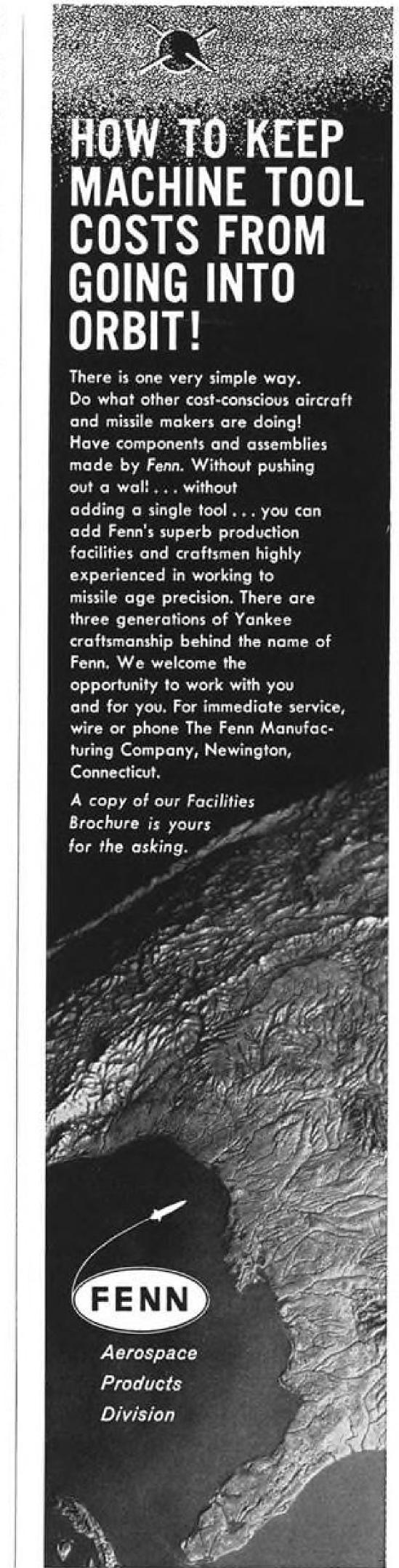
Stabilization will be achieved by presetting the fins of the instrumentation section to spin the second stage at 5 rps. about its longitudinal axis, which will avoid the problem of pitch-roll coupling. Total length of the payload section will probably be 65 in. The 6\frac{2}{5}-in.-dia. body is capped with an 18\frac{1}{2}-in., 20-deg.-included-angle nose cone. The top five inches of the nose cone contain the probe for measuring electron density and positive ions.

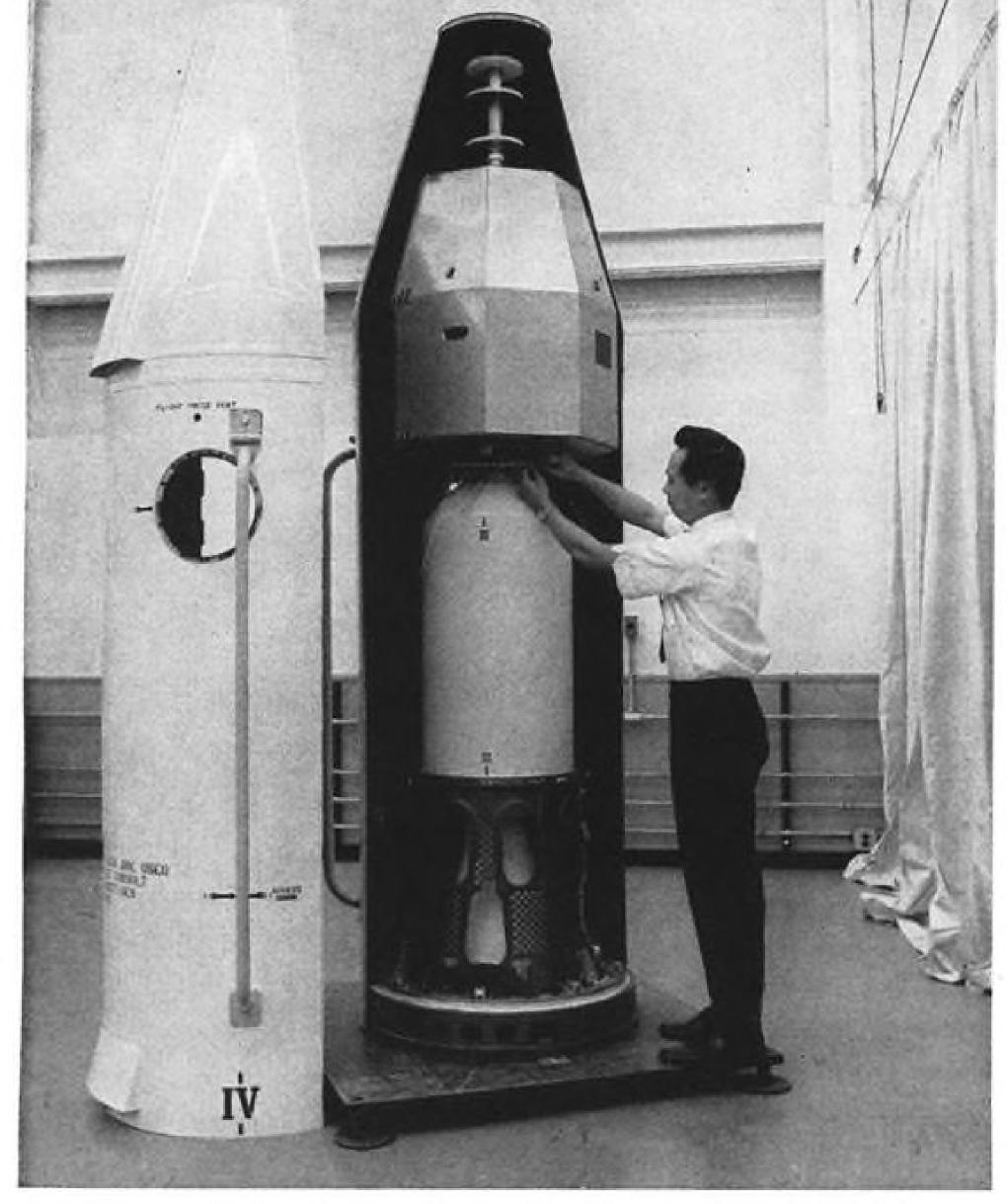
Primary instrumentation in the payload section includes:

• Langmuir probe. The instrument which serves as a Langmuir probe is a

5-in. stainless steel head on the nose cone and is insulated from the rest of the cone by a ceramic insulator. A sweeping voltage of ±3 v. will be applied to the probe. The resulting current from the probe, amplified by electrons or positive ions, passes through an electrometer and into one of the subcarrier oscillators of the telemetry equipment. The instrument acts as a Langmuir probe above 40 mi., measuring electron density, but serves as a positive ion conductor in regions of higher density below 40 mi.

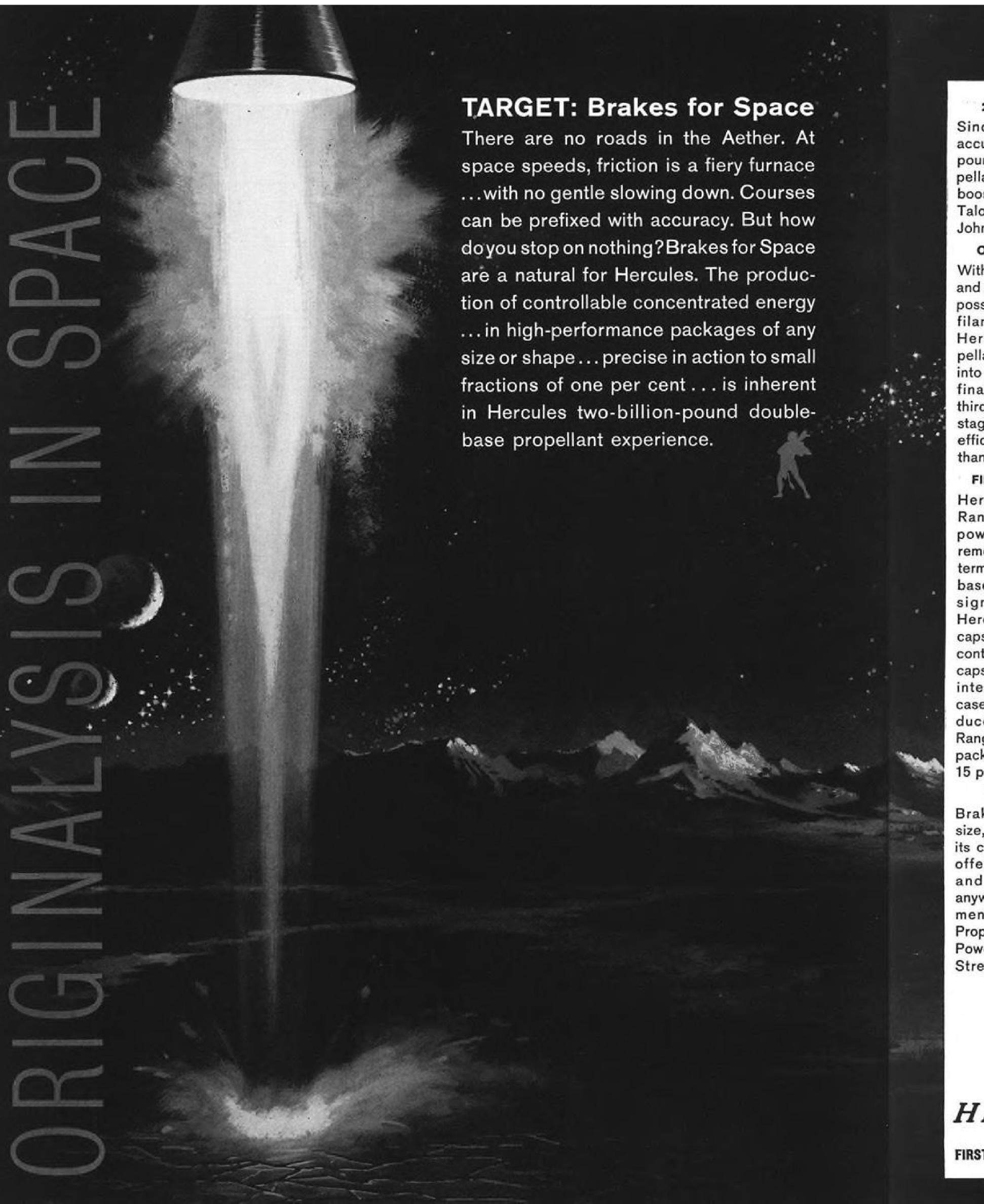
• Lyman-Alpha ion chambers. Four ion chambers sensitive to radiation between 1,040 and 1,340 angstroms will be mounted in parallel-connected pairs diametrically opposing one another to compensate for abnormal rocket motion. Each consists of a ceramic shell, 13 in. in dia. and 1½ in. long, gold plated on





Glass Fiber Shrouds to Shield Relay Satellite

Test model of Project Relay active repeater communications satellite has been used at Douglas Aircraft Co.'s Missile and Space Systems Division to check compatibility of spacecraft and Delta launch vehicle third stage with glass fiber shrouds. Two 10½-ft.-high shrouds will be used to shield the satellite during launch and injection into orbit. Radio Corp. of America is spacecraft contractor.



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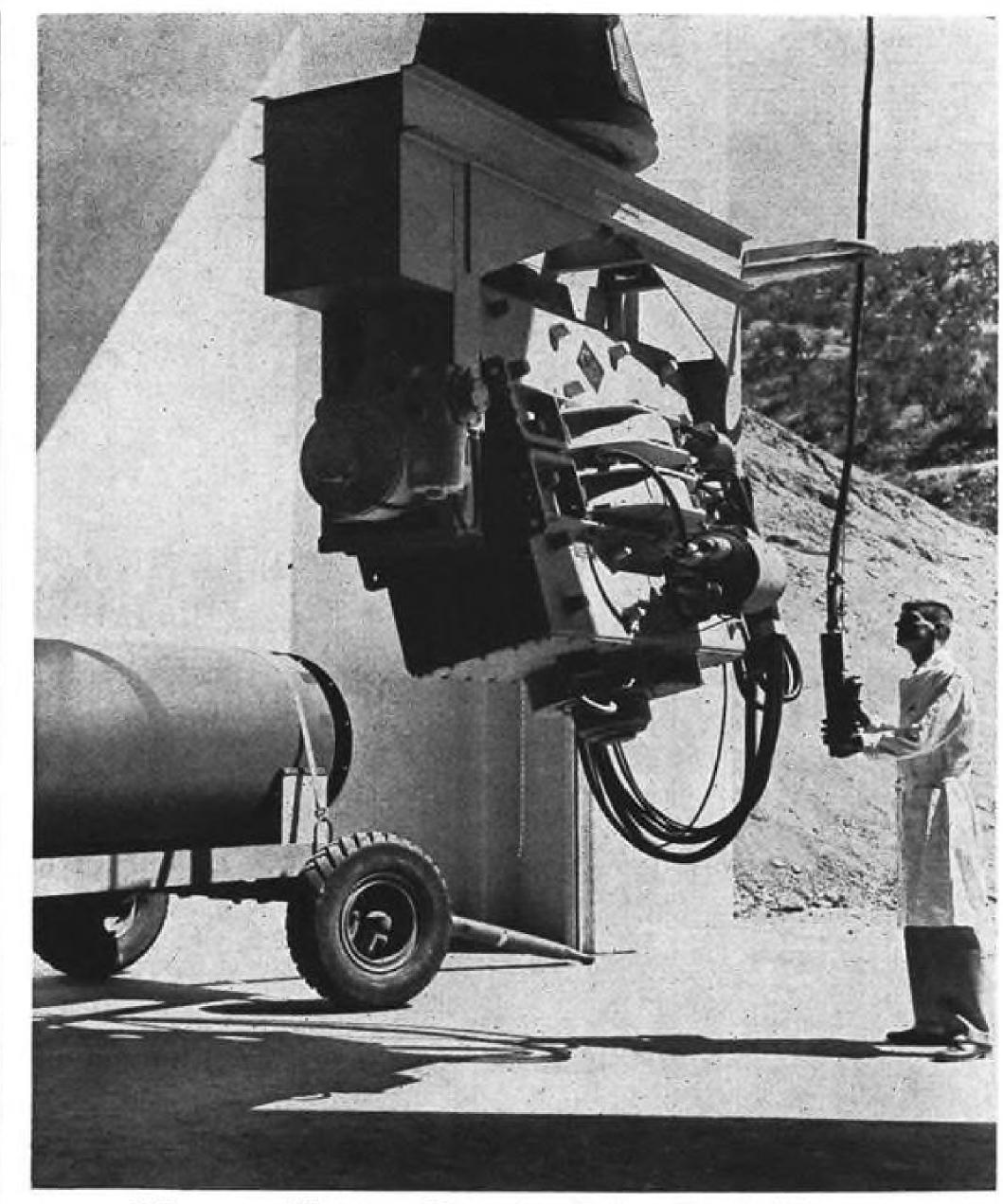
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FIRST IN CHEMICAL PROPULSION





25-mev. X-Ray Checks Solid Fuel Motors

New 25-mev. X-ray machine is being used by Lockheed Propulsion Co. to inspect solidpropellant rocket motors at the firm's Potrero facility near Beaumont, Calif. Device can inspect 156-in.-dia. motor segments, detecting flaws in seconds. Company says lowerenergy X-ray techniques would require up to two days to perform the same task. Lockheed Propulsion plans to offer the equipment for use by industry, military and government agencies in checking solid rocket motors and other jobs.

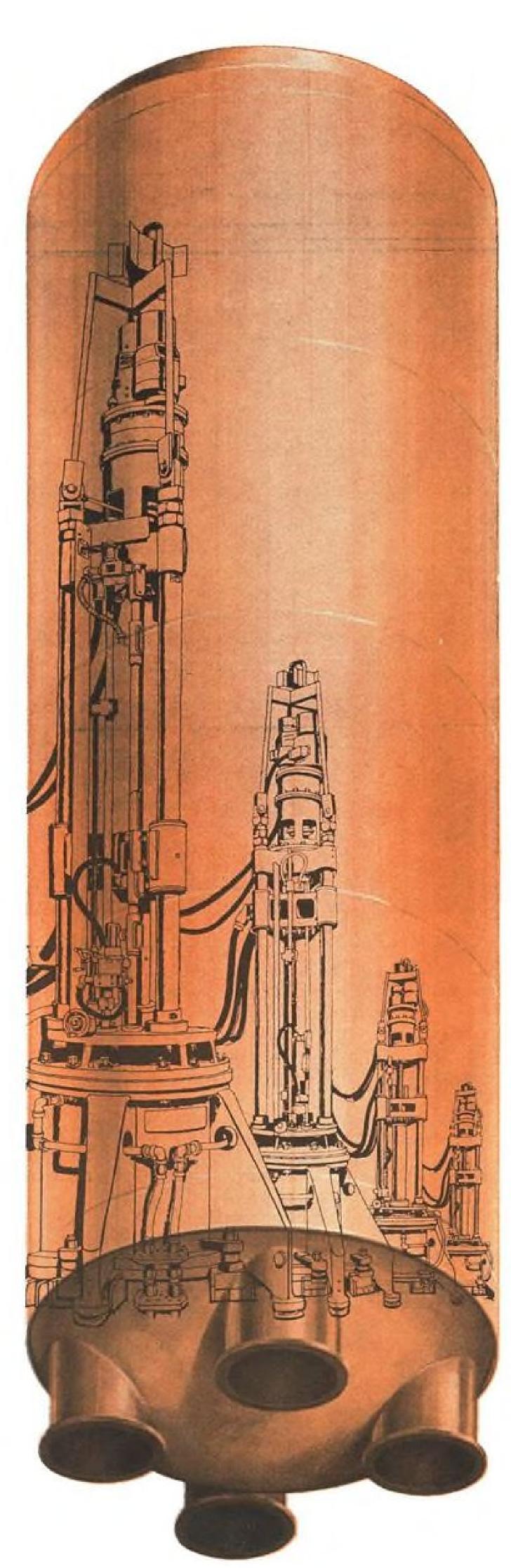
the inside, with a central wire anode. Window material is lithium fluoride, which provides the short wavelength limits. The chamber is filled with nitric oxide at a pressure of 15 mm. Hg. The photoionization onset of the nitric oxide provides the upper limit of wavelength detection. Lyman-alpha rays (solar hydrogen) are 1,216 angstrom units and in the lower part of the ultraviolet spectrum. The ion chambers are currently manufactured by Geophysics Corp. for NASA for other satellite and rocket programs.

• Photon counters. Pending complete re-evaluation of its proposal, Geophysics Corp. has not decided which wavelengths to monitor. They will be one of three spans in the soft X-ray region:

hardware which has a proven reliability will be used. Four counters will be mounted in the payload section in the same manner as the ion chambers, providing reliable information even in the event of unexpected abnormal rocket

Dr. Leslie Smith of Geophysics Corp., who is in charge of the eclipse shots, feels one of the main benefits of the experiment will be a better theoretical understanding of the upper atmosphere.

Oversimplified assumptions and lack of experimental data have often led to discrepancies between predicted and observed values in ionospheric behavior, Dr. Smith pointed out. A re-combination coefficient for free electrons in the 2-8, 8-20 or 44-60 angstroms. Only ionosphere, for example, is known only



HAND IN HAND

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... New MARVAC (Maraging) steels by Latrobe. Failure of a component in a missile or jet aircraft can mean failure for the entire system. That's why optimum performance in high strength structural applications and critical tooling calls for alloys possessing the ultimate in quality.

The newest concept in ultra high strength metals is the maraging steels developed by International Nickel and being produced by Latrobe Steel under the tradenames Marvac-18, Marvac-18A, and Marvac-20. These low carbon iron base alloys contain 18 to 20 percent nickel plus important alloying additions. Besides their unusually high strength and toughness they show remarkable ductility under extremely high stress concentration, far superior to H-11 and 4340 types.

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approximately, despite its fundamental role in ionospheric theories, he said.

Observing the change in ionizing ultraviolet and X-ray radiation from the sun along with the electron density should yield data from which a re-combination coefficient may be more accurately computed. Determining such a coefficient, which will establish the extent to which electrons attach themselves to positive ions or neutral molecules or atoms, will be one of the primary objectives of the eclipse experiment, Dr. Smith said.

In addition, Dr. Smith indicated, the eclipse studies should help clarify the following uncertainties which now exist in ionospheric studies:

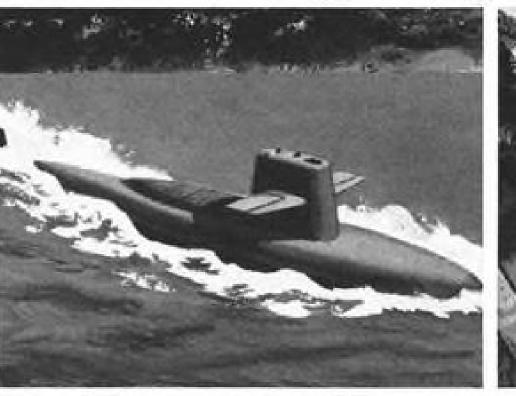
• Vertical ionospheric movements. Hypothetical movements of the ionosphere during an eclipse should be readilv detected through measurements of the electron density. The effects due to theoretical vertical movements of the ionosphere have never been evaluated, according to Geophysics Corp.

- Radiation distribution of the solar disk. Measurements of solar radiation concurrently with electron density should help pinpoint the source of the radiation from the solar disk and check the theory that 10% of the ionizing radiation comes from the sun's corona.
- Temperature effect. One explanation of the inconsistency between theory and past experimental data on variation of ionospheric layers is that the temperatures of free electrons vary with incident solar radiation. The Langmuir probe technique measures electron temperature (energy) and may help resolve this inconsistency.
- · Shape of ionospheric layers. Theoretical analysis of shape of ionospheric layers, particularly the E Region (70-80 mi.) can be checked as well as its maximum height verified.
- D region has received little study during an eclipse. Its ion density will be studied along with the short wavelength radiation responsible for ionizing this region.
- Anomalous behavior of F, laver. Past observations have shown that a decrease in solar radiation during an eclipse makes the difference between the F₁ (135-145 mi.) layer and F2 (190-230 mi.) layer more pronounced compared with normal days, when the two layers appear to merge into a single F layer as the sun goes down.

Further analysis of detailed data from the proposed rocket sounding program should shed some light on this.

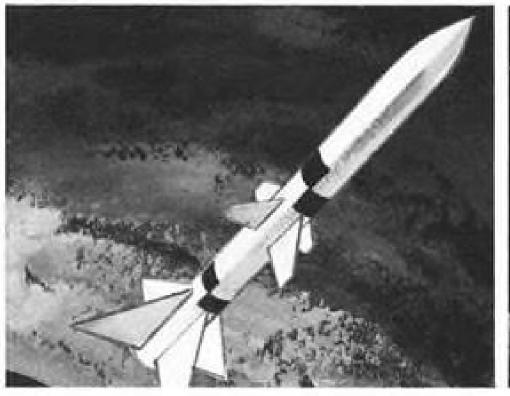
During both checkout and eclipse firings, NASA will furnish the operating equipment and personnel for launching, telemetering and tracking the rockets. NASA will also furnish the Nike-Apache rockets. Geophysics Corp. will provide instrumentation and personnel to check out the payloads.

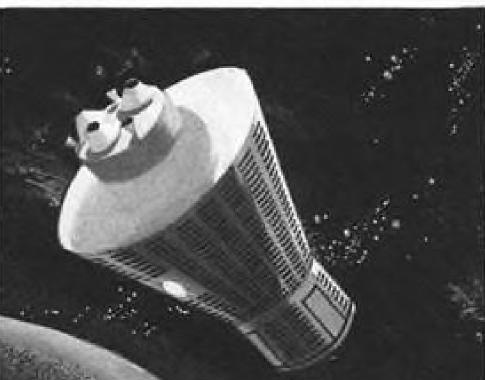
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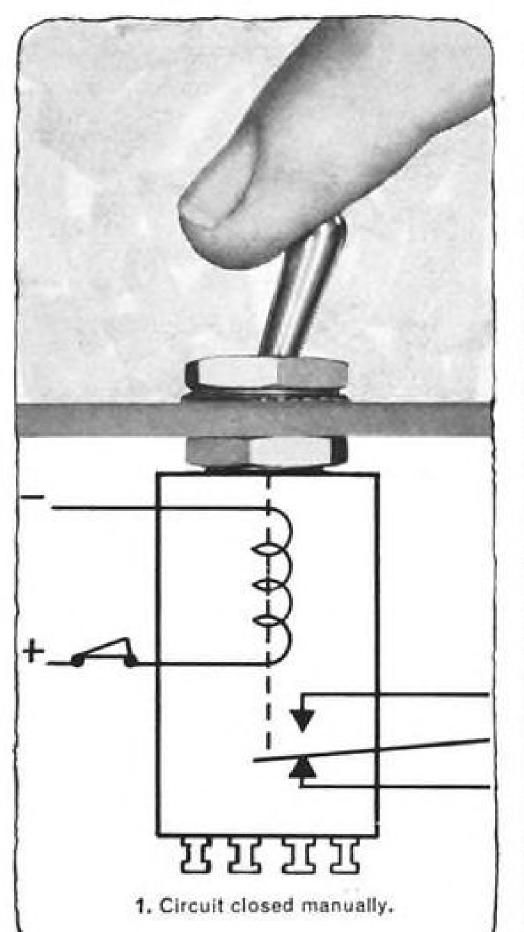
For more information write to Minneapolis-Honeywell, Dept. AW-10-86, Military Products Group, 600 Second Street North, Hopkins, Minnesota.

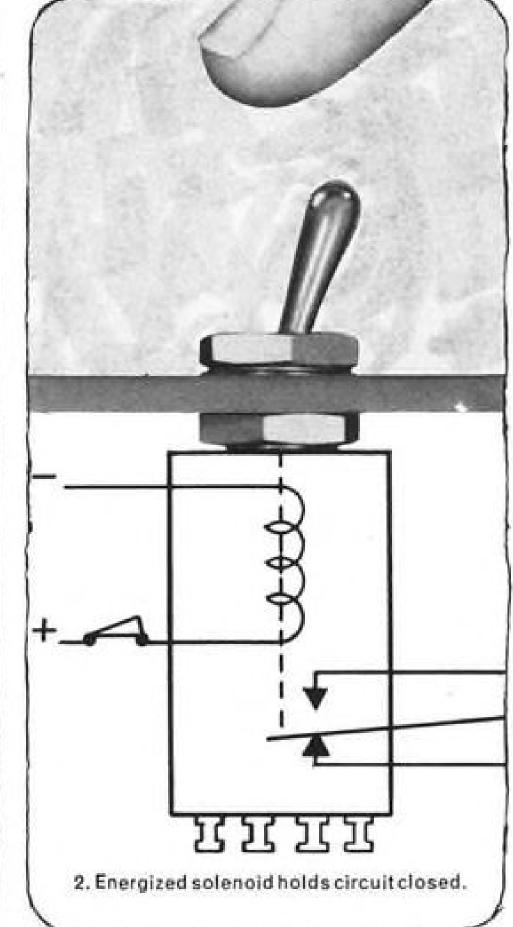
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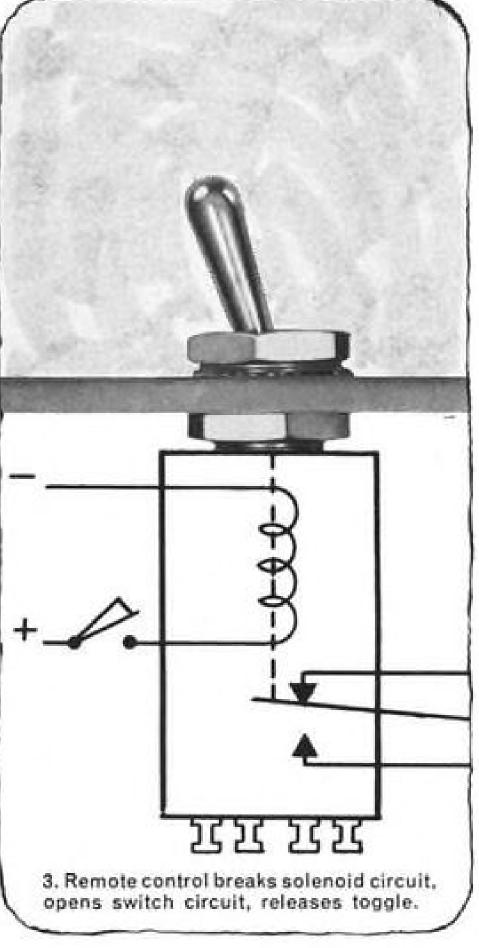


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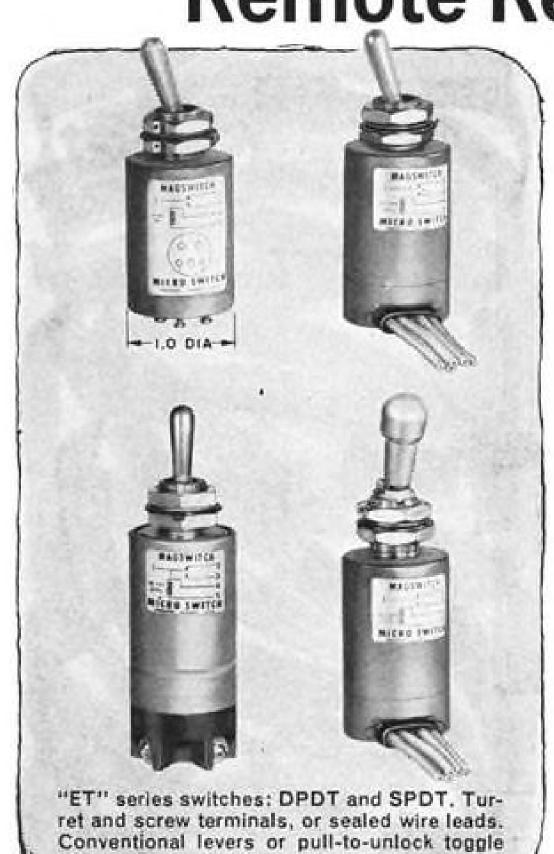
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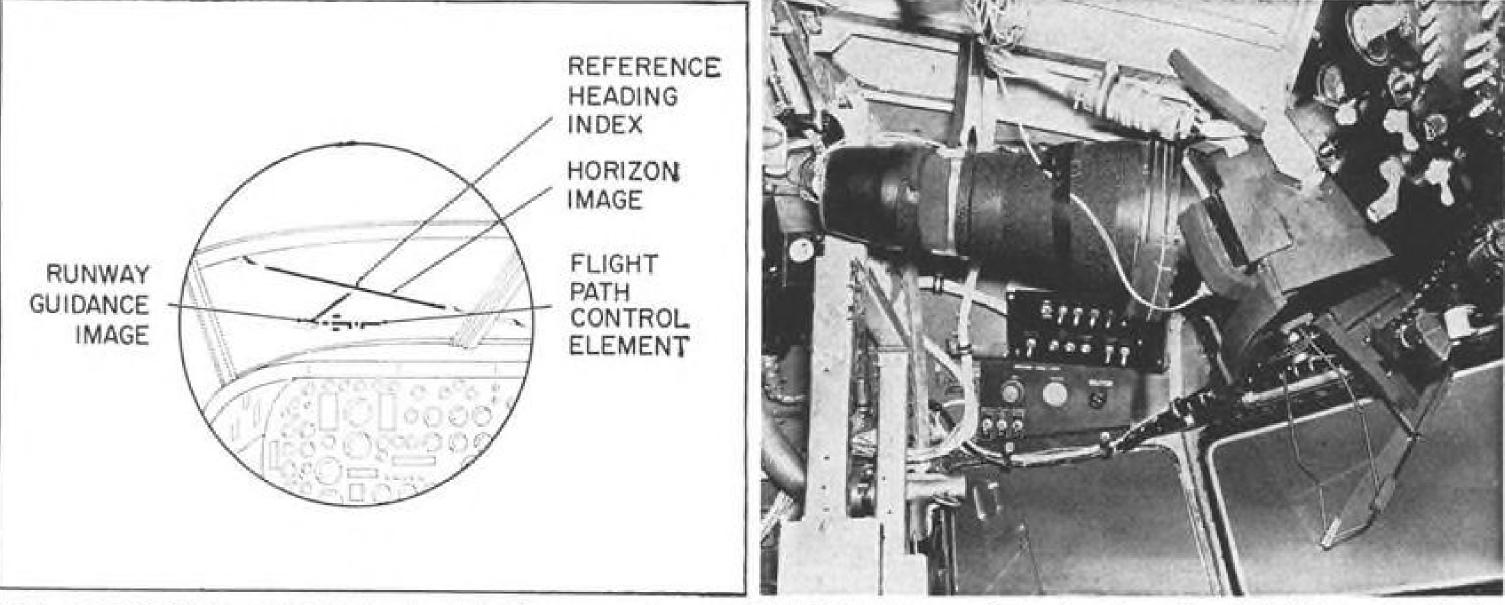
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AVIONICS



NEW ALL-WEATHER DISPLAY developed by Sperry superimposes vital flight data on pilot's view through windshield to give illusion of contact flight (left). Experimental installation (right) in DC-3 uses overhead projection onto transparent glass.

Flight Path Sight Gives Cues for Landing

By Philip J. Klass

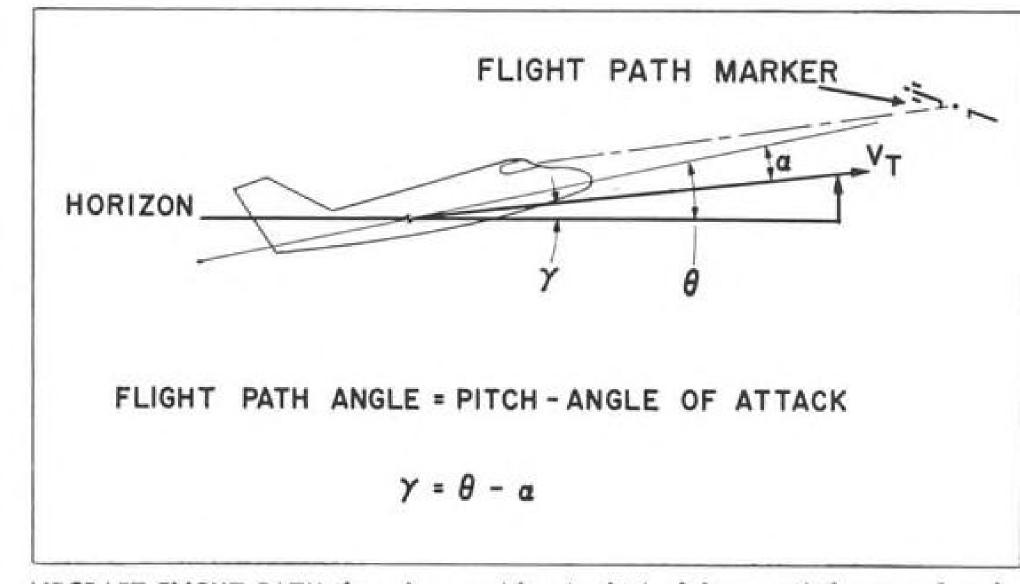
First details on a new Sperry Gyroscope windshield display technique de-signed to ease the transition from instruments to visual contact during bad weather approaches, as well as for making VFR landings and takeoffs, were disclosed at the recent Society of Experimental Test Pilots Symposium in Beverly Hills, Calif.

The Flight Path Sight, as the technique is called, projects vital flight information on aircraft attitude, speed, path and position relative to the run-way so that the horizon and runway replica will be superimposed on the actual horizon and runway when the aircraft breaks through the overcast.

The basic concept has been under investigation by Sperry Cyroscope for several years, according to R. P. Snodgrass, who delivered the report to the test pilots. Original work was carried on with company funds, but Air Force and Navy recently have undertaken sponsorship of portions of the program.

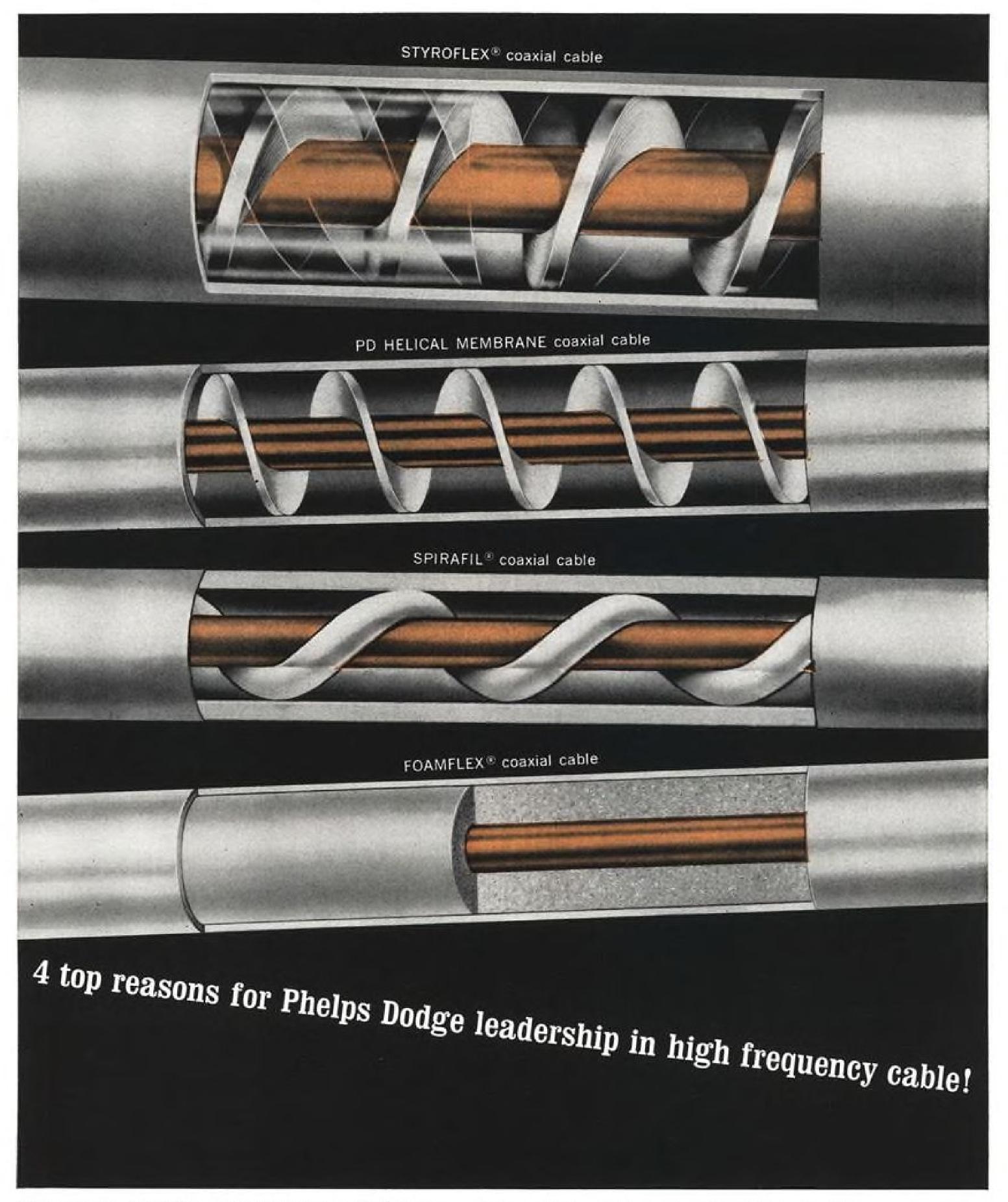
Sperry has accumulated more than 250 hr. of flight test time on early experimental hardware in aircraft ranging from a Navion to military jets. A more advanced all-weather prototype system, now under construction, will be installed in a company DC-3, with initial flight tests scheduled for early next

Basic Flight Path Sight concept stems from the experience of Sperry and other companies which manufacture automatic approach couplers. Although autopilot approach couplers have been on the market for 15 years and have been installed on many airliners for at



AIRCRAFT FLIGHT PATH through space (above), obtained from vertical gyro and angleof-attack sensors, is used to position marker to show where present path intersects earth. Gunsight technique (below) would be used in making VFR takeoffs and approaches. USAF and Navy see military applications.





These semi-flexible, air dielectric coaxial cables have demonstrated their superiority as electronic transmission links in a number of advanced communications projects in space research, national defense and industry.

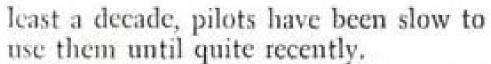
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Because the approach couplers did not always function properly, pilots lost confidence and used them only infrequently. Without use, the manufacturer failed to get feedback on performance so it could take corrective action, and the equipment did not receive adequate airline maintenance. This, in turn, further degraded performance and reliability on those occasions when pilots did try the coupler, which caused a further drop in pilot confidence.

Snodgrass sees an important principle here for industry as it seeks a solution to achieve lower weather minimums and all-weather landing. That is, the instruments and procedures which a pilot uses to make a difficult bad weather landing should be essentially the same as those he normally uses for the far more frequent VFR landings. Otherwise, the pilot can not maintain proficiency in the use of bad weather techniques and have confidence in them when needed.

Clear Weather Accidents

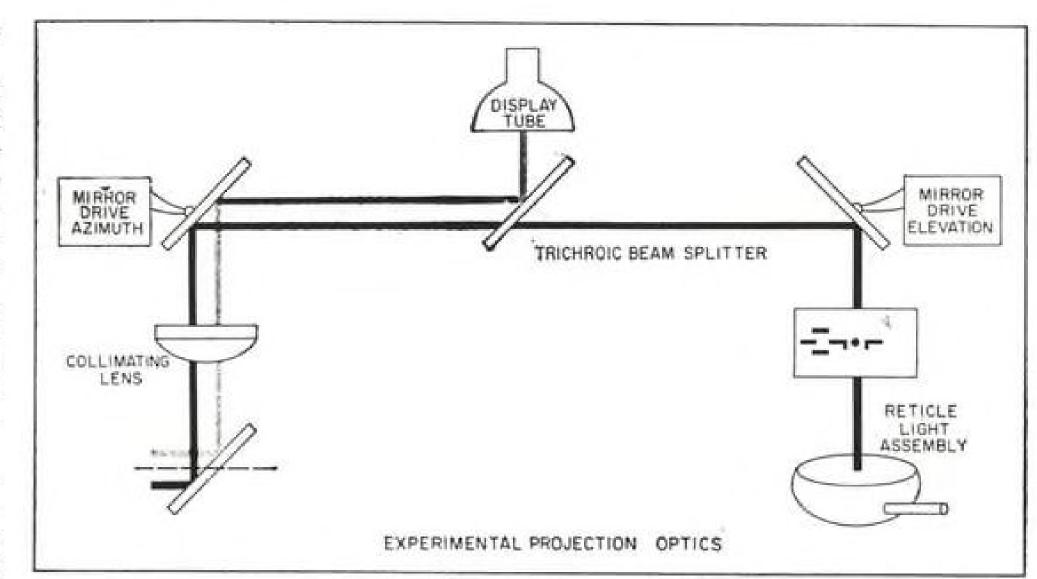
Snodgrass, an experienced pilot, points out that a number of landing accidents occur in clear weather. In many instances the men in the cockpit are experienced military or civil pilots. Relying on a case history analysis of clear weather landing accidents, plus Sperry's own experience in instrument approach development, Snodgrass concludes that the basic cause is difficulty in assessing correctly the direction of the aircraft flight path during the final phases of the approach.

Characteristics of high-speed jet aircraft at extremely low altitudes aggravate the problem. He believes that a suitably designed display can be of value to a pilot for both VFR and IFR landings.

Another problem which has guided the Sperry concept is the difficult transition from cockpit instruments to visual flight during low weather approaches, where the pilot has only a few seconds to recognize and interpret the external visual scene while continuing to scan the cockpit instruments.

To meet these problems, Sperry proposes to lift vital flight information which the pilot needs for an approach out of the cockpit panel and superimpose it on the view he sees through his windshield, without obscuring his view of the outside. During VFR conditions, the display would show only the aircraft's flight path aiming point, or essentially where the airplane would intersect the ground if it continued on the same path.

During IFR conditions, replicas of the runway and horizon, plus indications of the aircraft heading and its



PROJECTION SYSTEM for experimental Flight Path Sight combines orange path-marker with green replicas of runway, horizon and heading into single display.

speed relative to a preselected value, would be displayed in the same fashion.

By itself, this would not be too difficult to accomplish, but Sperry has a more ambitious goal. This is to display the horizon and runway replicas in the same relationship to the aircraft centerline as they would appear to the pilot under visual contact conditions. The replicas will be essentially superimposed on the real world horizon and runway when the airplane breaks through.

This is a more challenging problem, particularly if the runway and horizon replicas are to move with the same sensitivity and scale factor as those in the real world. Snodgrass says this aspect has not been completely solved, but sees no insurmountable problems.

To superimpose landing cues on the pilot's view of the outside, Sperry has borrowed a technique used in military gunsights to superimpose aiming instructions on the pilot's view of his target. Early company experiments were conducted using a modified military gunsight, originally designed to project a collimated image of a crosshair on an inclined glass located between the pilot and the windshield. The collimated image appears to be coming from far out in front of the aircraft and does not shift position when the pilot moves his head.

To assist the pilot under VFR conditions, Sperry proposes to give him a new piece of information not previously available—a visual indication of his aircraft's velocity vector. This is an indication of both direction of aircraft movement and its velocity with respect to the runway.

Basic input for this display comes either from an angle-of-attack indicator or an angle-of-attack computer. While angle-of-attack has been used before, to show whether the aircraft is at a safe approach speed, Sperry uses it to show the pilot where his present flight path is taking him.

Path-marker displayed for the pilot consists of two orange-colored horizontal bars with short vertical feet and dots between them to show the aircraft flight path projection. The marker position is determined by the difference between aircraft pitch angle, obtained from the airplane's vertical gyro, and angle-of-attack, obtained from an external sensor or a computer.

When the aircraft is on a level flight path, the projected path-marker will coincide with the natural horizon, regardless of the aircraft pitch attitude. If the
path-marker appears below the horizon,
the aircraft is descending. Despite
changes in aircraft pitch attitude or
angle-of-attack, the marker shows a projection of the direction in which it is
moving through space.

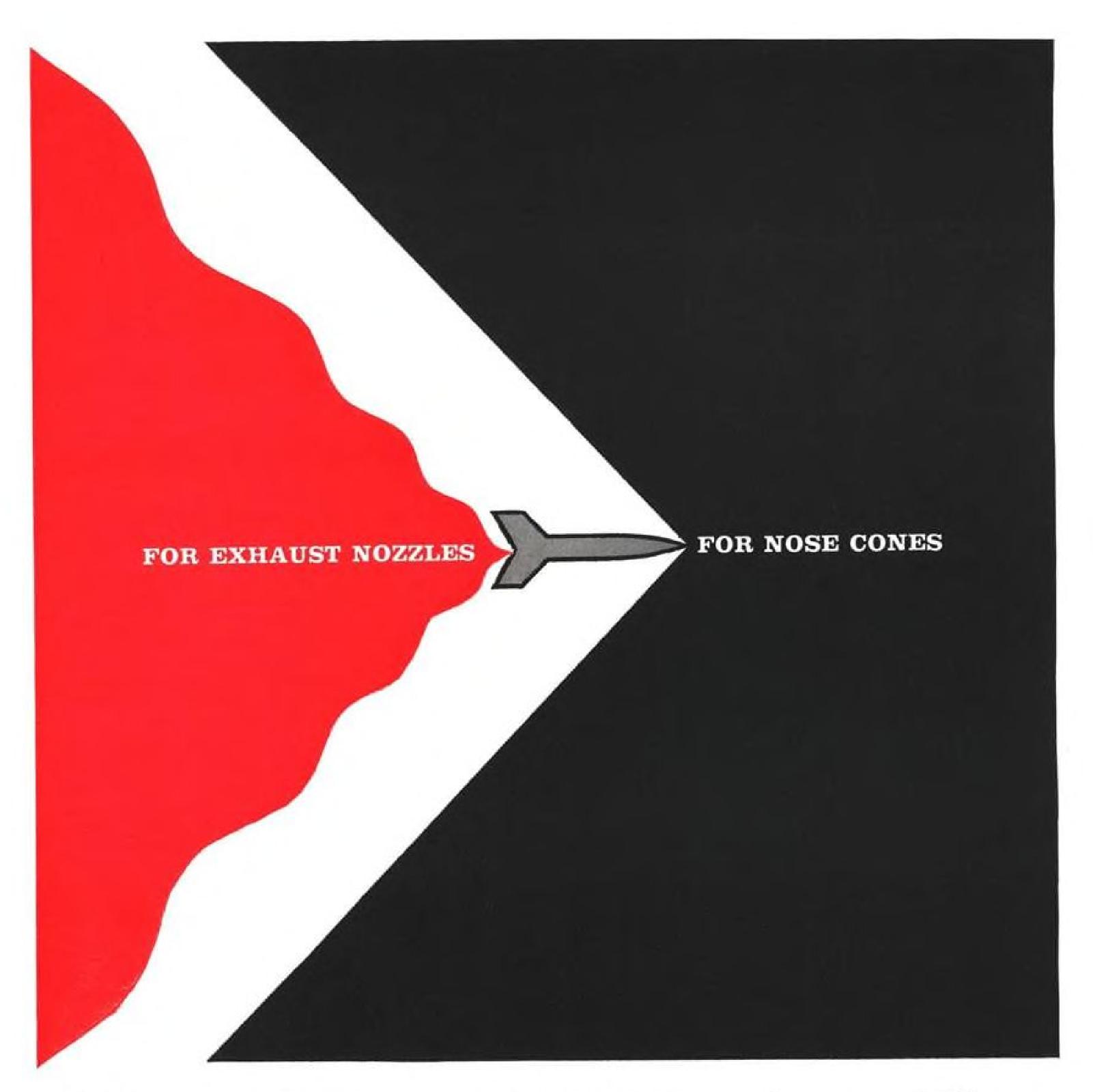
VFR Approach

During an approach under VFR conditions, a 3-deg. down bias signal (or other desired value of glide slope) is introduced, and the pilot then need only aim his aircraft so that the pathmarker lies on the end of the runway. When the aircraft reaches flare-out altitude, the gyro signal is removed and the path-marker operates entirely from angle-of-attack data. The pilot now merely aims the marker at a point farther down the runway to achieve the desired flare.

If desired, the display also can give the pilot an indication of his approach speed by means of a small marker alongside one wingtip of the marker symbol (see photo). Operating from an air speed sensor or the angle-of-attack sensor, the velocity marker will be aligned with the path-marker horizontal bar when the aircraft is at the preselected speed, shifting up or down to show variations from that speed.

Use of this simple path-marker for VFR approaches and landings during Sperry flight tests revealed that it greatly increased the consistency with which

P ELECTRONICS D



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pilots were able to fly good approach paths, according to Snodgrass. It is this aspect of the Sperry development which has aroused Air Force and Navy interest and which they are now funding.

These tests also showed that the technique is useful in takeoffs to help the pilot determine the proper amount of rotation during the crucial phase of jet lift-off.

However, the tests also disclosed system design problems. For example, it requires the use of a high-quality vertical gyro or stabilized platform reference to prevent errors due to aircraft acceleration/deceleration. Also, considerable damping of the angle-of-attack signal is needed. Existing angle-of-attack sensors and computers do not have the characteristics required, Snodgrass indicates.

Same path-marker used for VFR operations forms the heart of the Sperry IFR display, with these additions:

 Artificial horizon, a horizontal green bar positioned through signals obtained from the aircraft vertical gyro.

 Reference heading, based on runway heading set in by the pilot, appears as a small vertical green bar atop the horizon bar. Position of the heading bar depends upon aircraft heading with respect to desired heading.

• Runway replica, an inverted, green T-shaped symbol which resembles the runway's horizontal threshold and longitudinal centerline viewed in perspective.

Position of the runway replica and its perspective angle are computed, using signals obtained from the regular glide slope and localizer receivers which indicate aircraft position with respect to the runway.

Size of the runway replica should change automatically as the aircraft approaches the runway. This can be accomplished using signals from a distance measuring equipment (DME) receiver if the airport has a DME installation. Otherwise, the signal can be obtained from a barometric device or radar altimeter to vary runway replica size as a function of aircraft altitude.

If the runway, horizon and heading reference replicas are properly reproduced, the pilot gains the illusion of making a VFR approach. Under these conditions, the pilot automatically introduces "path softening." That is, he instinctively knows whether he should correct a small deviation or ignore it as inconsequential, much as during a VFR landing, Sperry's flight tests indicated.

As the runway lights begin to break through the overcast, they should roughly coincide with the position of the runway replica, and the latter gradually merges into the actual runway, Snodgrass says. This, he says, should "fuse the pilot's visual and instrument flight control techniques into a single skill."

But achieving a display which has the 24, 1961, p. 77).

same linearity and sensitivity as the real world is not easy, Snodgrass emphasizes. For example, the dot in the center of the path-marker symbol subtends an angle of 0.1 deg., and the apparent motion of the horizon bar on the windshield is roughly 15 times more sensitive than the artificial horizon on the panel to which pilots are accustomed.

Display which Sperry currently has mounted in its DC-3, and the improved version which will replace it, require the installation of a rather large projection system, containing a cathode ray tube, the path-marker reticle and associated optics

Snodgrass admits that it would be difficult to add such a display to existing aircraft where this overhead space already is used, but he believes a feasible installation could be worked out if done during the early design phase of a new airplane.

FILTER CENTER

➤ Speech Operated Typewriter—Rome Air Development Center is sponsoring development of a device capable of converting spoken words into signals suitable for operating an electric typewriter to provide automatic speech to hard copy conversion. Initially, at least, the typed copy will necessarily use phonetic spelling.

► Electrostatic Reaction Sphere—Eight companies have been invited to submit proposals for an electrically suspended reaction sphere for space vehicle attitude control by the Goddard Space Flight Center, with bids due Oct. 22. Companies are: Bendix Systems Division, General Electric, General Precision, Inc., Minneapolis-Honeywell, North American Autonetics Division, Space Craft, Inc., Sperry Rand and Telecomputing Corp.'s Whitaker Gyro Division.

► Semiconductor Shakeout Takes Another Victim—Continuing shakeout in semiconductor business (AW, June 12, 1961, p. 73, Mar. 19, p. 57) claimed another victim recently as public auction was held in Gardena, Calif., on Sept. 8 to dispose of properties of Western Transistor Corp.

► Tactical Atomic Clock—Lightweight atomic frequency standard, suitable for tactical use by the Army, is being developed for the Signal Corps by General Technology Corp., formerly Clauser Technology, of Torrance, Calif. The atomic clock employs rubidium as an active medium and is a modified version of an earlier atomic standard developed by the company (AW July 24, 1961, p. 77).

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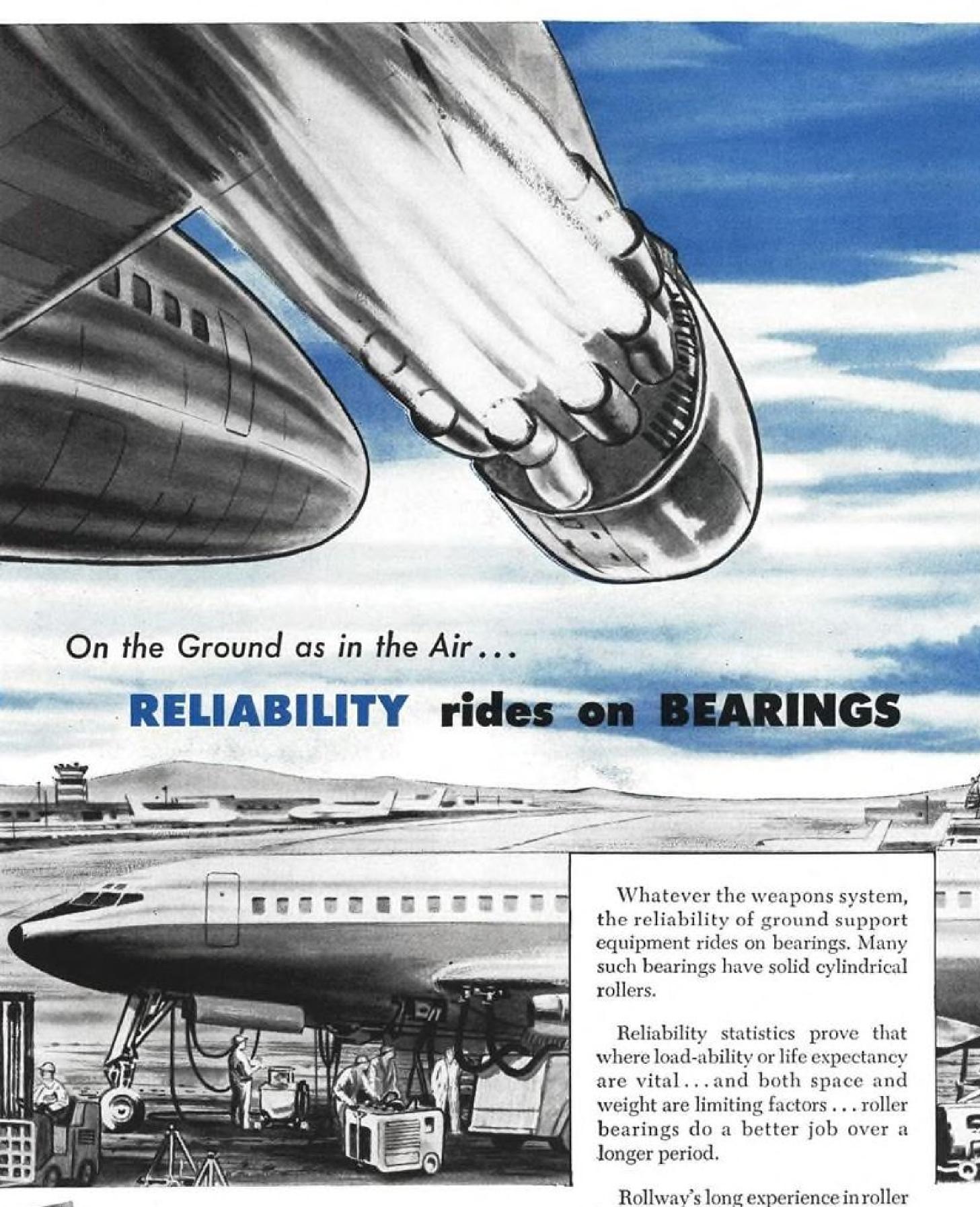


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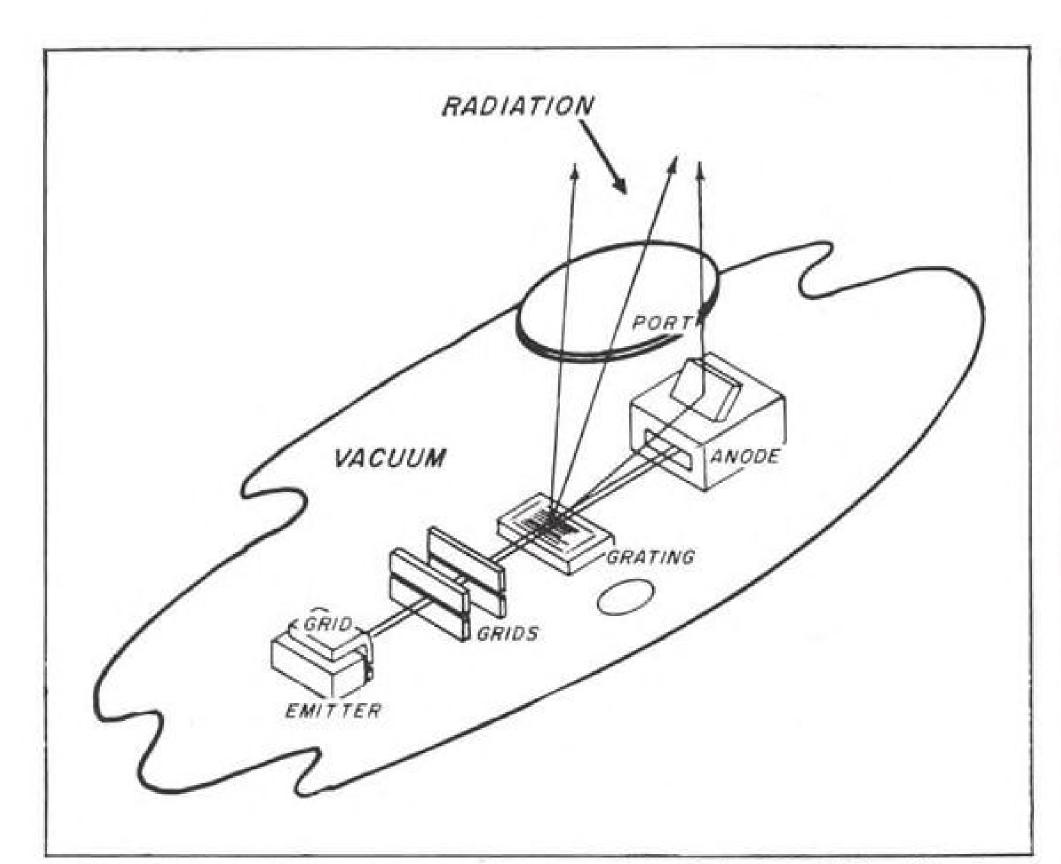
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VAROTRON, new device, generates electromagnetic radiation in visible, infrared and ultraviolet region which can be frequency or amplitude modulated, using interaction between electron beam and grating. Uses may include communications and exotic weapons.

New Radiation Generator Permits Electrical Wavelength Selection

New device which generates electromagnetic radiation in the infrared, visible and ultraviolet region, whose wavelength can be electrically selected and which can be either amplitude or frequency modulated, has been developed by Varo, Inc., Garland, Tex.

The new device, called a "Varotron," was described by its inventor, Dr. W. W. Salisbury, of Varo, in a report delivered at the recent American Optical Society meeting in Rochester, N. Y.

The Varotron appears to have application to communications and possibly exotic weapons, similar to optical masers (lasers). Although the tunability and modulation capabilities of the Varotron may give it advantages over the laser for certain uses, the question of whether its output radiation is coherent like that of the laser is not yet resolved.

Varo says that "experimental tests have not been completed to determine to what degree the radiation is coherent [but] indications are that the device may be directly suitable for special purpose applications which are feasible only with coherent radiation."

The principles of the Varotron are covered by U. S. Patent No. 2,634,372, issued to Dr. Salisbury in 1953. The new device uses some of the techniques employed in the klystron and traveling wave tube.

A high-velocity electron beam, formed by conventional techniques, is passed directly over a metallic diffraction grating in a direction parallel to its surface and at right angles to the engraved lines in the grating.

The undulations of the grating surface interrupt the electric flux lines produced by electrons in the beam at an extremely high frequency, producing visual radiation at a vertical angle with respect to the grating surface.

Frequency Change

The wavelength of the radiation depends upon the vertical angle of observation with respect to the grating surface. For instance, the radiation wavelength seen at one angle is red, at another angle is green, and at still another angle is blue. The radiated wavelength at any particular angle depends upon the spacing between adjacent grooves in the grating and upon the velocity of the electron beam.

This means that from any given observation angle, it is possible to change the frequency (color) of the radiation merely by changing the voltage applied to the accelerating grid. Frequency modulation with a very high modulation index can be obtained by this method.

An experimental Varotron using a grating with 45,000 lines per in. pro-

high temperature valve OPERATES AT. 1500°F

(- and modified, up to 2200° F.)

for handling metal vapors, molten metals, hot gases and fuels—

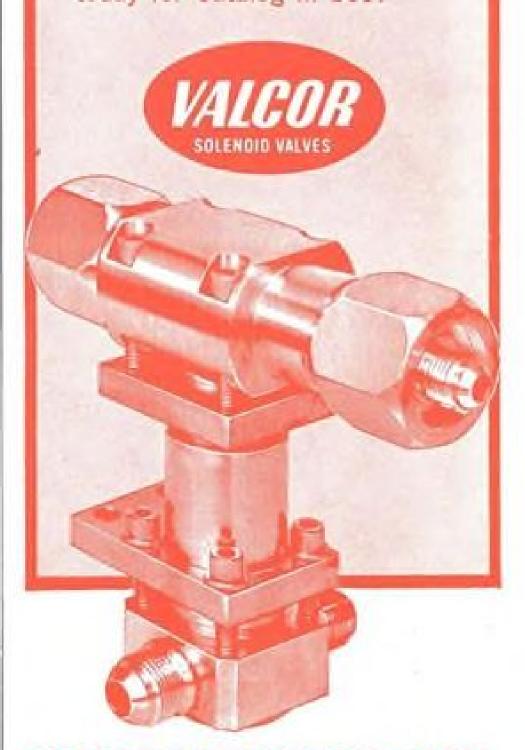
A few short years ago 900° F. was considered "high" temperature. Since then the needs of the aero-space and nuclear industries have pushed the "limits" steadily upwards.

Valcor's technological growth, over the years, has allowed it to transcend these frontiers.

Series 420 is the result. This is not a theoretical or "paper" design. These are production valves. As illustrated, it is used by industry for 1500° F. applications. In a modified form it is being used for 2200° F. service.

Series 420 can be actuated directly or remotely—pneumatically, electrically or manually. It is, a floating shear seal type of valve with straight through flow which can be modulated.

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duces visual radiation in the fundamental mode at an observation angle of 20 deg. when electrons have energies ranging from 65 kv. to 155 kv., Dr. Salisbury reported.

Observation from a lower angle of 10 deg, permits using of a lower energy electron beam.

The Varotron is based upon an electrostatic image theory first proposed by James C. Maxwell, 19th century Scottish physicist. This theory says that a small spherical charge near a metal surface will induce a charge of opposite sign on the surface which behaves in the manner of a visual image with respect to a conventional mirror. The height of the actual charge above the surface will determine the apparent depth of the image charge inside the metal surface.

In the Varotron, as electrons in the beam skim along the surface of the metallic diffraction grating, each electron produces an equivalent charge below the grating surface which travels along parallel with it.

Because of the groove undulations in the grating, each electron image moves toward and then away from its electron in the beam in a periodic manner so that the two jointly behave like an oscillating electric dipole. Such an oscillating dipole is an ideal radiator of electromagnetic waves at the frequency at which the dipoles are oscillating, according to Salisbury.

The radiated frequency as observed in the laboratory is subject to a Doppler shift due to the motion of the electron and its image.

For this reason, the particular frequency (color) observed depends upon the angle of observation as well as the line spacing of the grating and the velocity of the electrons.

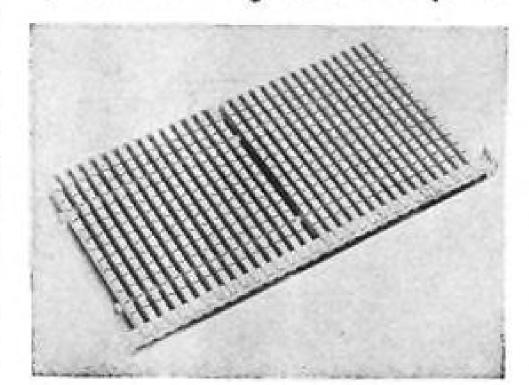
Original work on the Varotron was carried out using company funds. More recently the Air Force Systems Command has provided funding.



EXPERIMENTAL VAROTRON, shown with its inventor, Dr. W. W. Salisbury, chief scientist of Varo, Inc.

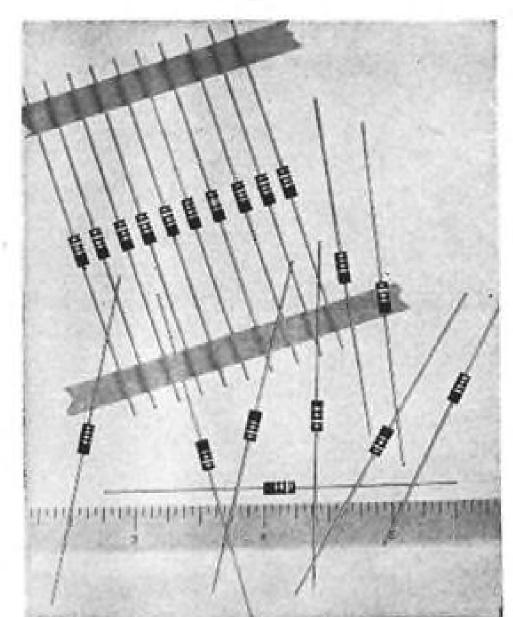
NEW AVIONIC PRODUCTS

• Two dimensional slot array antenna, suitable for simultaneous transmission and reception at frequency of 9,375 mc. ± 180 mc. The model X988 dual array consists of two 14 x 14 in. slot arrays mounted side-by-side, each using 15 resonant waveguide slot arrays fed



by a single waveguide with total of 195 slots per array. Antennas have a VSWR less than 1.3:1 and 20 db. sidelobes. Antenna radiates pencil beam patterns perpendicular to the array, with half power beam width of 6 deg. Isolation between transmit and receive antennas is quoted at 50 db. minimum. Manufacturer: TRG, Inc., 400 Border St., East Boston, Mass.

 Subminiature tubular ceramic capacitors, Style 390, designed to meet or exceed MIL-C-11015, measure 0.250 in.

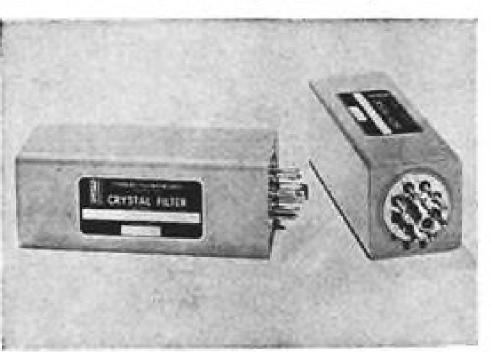


long x 0.095 in. dia., with axial leads, are available in capacitance range of 5.6 to 1,200 picofarad. Working voltage is 100 vdc. at 85C, 50 vdc. at 125C. Bulletin 522 gives specifications. Manufacturer: Erie Resistor Corp., Erie, Pa.

 Low-frequency tunable magnetron, type ZM-6068, for operation in the 250 to 500-mc. range with minimum power output of 0.5 watt. Tube can be voltage tuned over part or all of its operating

range with power variation across any octave being less than 3 db. The new magnetron weighs 3.6 lb., measures 3 x 4.9 x 5.3 in., is priced at \$1,500 in small quantities. Manufacturer: General Electric Co., Power Tube Dept., Schenectady, N. Y.

- Long ruby laser crystals, up to 12 in. in length, with dopings of 0.02% and 0.04% chrome by weight, with diameters up to 0.650 in., 90-deg. oriented, are optically corrected with end surfaces flat to 1/20th wavelength and optically parallel to within 2-4 sec. of arc. Manufacturer: Adolf Meller Co., Box 6001, Providence, R. I.
- Matched pair of crystal filters, for single sideband use, have center frequency of 1,750 kc. Filters have a 3 db. bandwidth of 2.5 kc., carrier rejection of

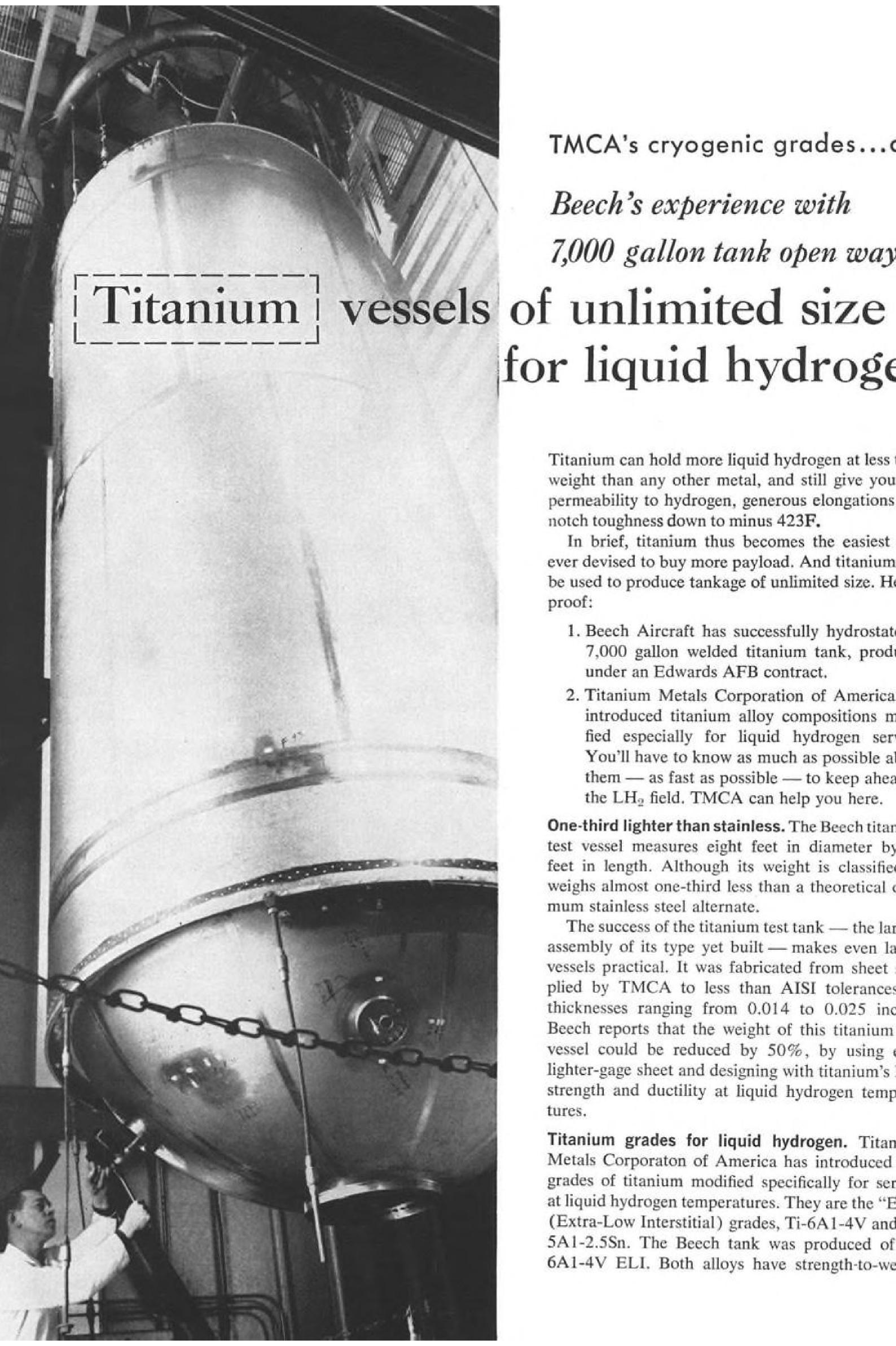


20 db. with at least 50 db. rejection of unwanted sideband. Ripple is less than 3 db. with insertion loss under 6 db., according to manufacturer. The filters, identified as Models USB and LSB 1750-2.5, measure 1½ x 1½ x 4 in. with octal plug-in base and are priced at \$125 per unit in lots of 10. Manufacturer: Systems Incorporated, 2400 Diversified Way, Orlando, Fla.

• Miniature tuning fork, Design 256, occupies only \(\frac{1}{2}\) cu. in. and weighs less than 1 oz., is available in frequencies ranging from 360 to 4,000 cps., accurate to within 0.005\%, and calibrated over



temperature range from —55C to 100C. Dimensions are § in. dia. x 2§ in. long. Device is hermetically sealed. Manufacturer: Gyrex Corp., 3003 Pennsylvania Ave., Santa Monica, Calif.



TMCA's cryogenic grades...and

Beech's experience with 7,000 gallon tank open way to for liquid hydrogen

> Titanium can hold more liquid hydrogen at less tank weight than any other metal, and still give you impermeability to hydrogen, generous elongations and notch toughness down to minus 423F.

> In brief, titanium thus becomes the easiest way ever devised to buy more payload. And titanium can be used to produce tankage of unlimited size. Here's proof:

- 1. Beech Aircraft has successfully hydrostated a 7,000 gallon welded titanium tank, produced under an Edwards AFB contract.
- 2. Titanium Metals Corporation of America has introduced titanium alloy compositions modified especially for liquid hydrogen service. You'll have to know as much as possible about them — as fast as possible — to keep ahead of the LH2 field. TMCA can help you here.

One-third lighter than stainless. The Beech titanium test vessel measures eight feet in diameter by 24 feet in length. Although its weight is classified, it weighs almost one-third less than a theoretical optimum stainless steel alternate.

The success of the titanium test tank — the largest assembly of its type yet built - makes even larger vessels practical. It was fabricated from sheet supplied by TMCA to less than AISI tolerances, in thicknesses ranging from 0.014 to 0.025 inches. Beech reports that the weight of this titanium test vessel could be reduced by 50%, by using even lighter-gage sheet and designing with titanium's high strength and ductility at liquid hydrogen temperatures.

Titanium grades for liquid hydrogen. Titanium Metals Corporaton of America has introduced two grades of titanium modified specifically for service at liquid hydrogen temperatures. They are the "ELI" (Extra-Low Interstitial) grades, Ti-6A1-4V and Ti-5A1-2.5Sn. The Beech tank was produced of Ti-6A1-4V ELI. Both alloys have strength-to-weight

Table I — Typical Tensile Properties of Ti-5Al-2.5Sn ELI Test Temperature

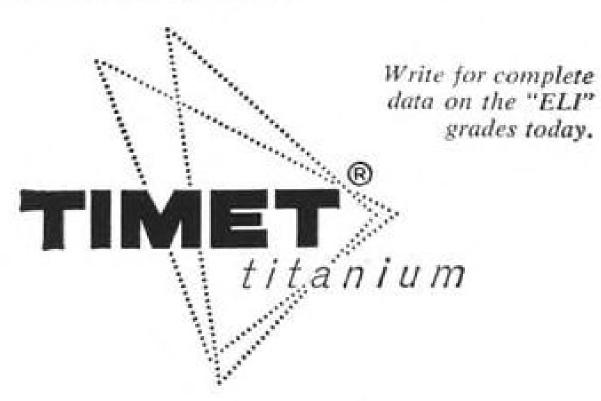
	rest remperature		
	70 F	—320 F	-423 F
Yield Strength, psi	102,000	168,000	206,000
Tensile Strength, psi	117,000	181,000	229,000
Elongation, %	16.5	16.0	15.0
Notched Tensile Strength, psi	155,000	228,000	233,000
Notched/Unnotched Ratio	1.38	1.26	1.03
K. — 6.3			

Table II — Typical Tensile Properties of Ti-6AI-4V ELI

	Test Temperature		
	70 F	—320 F	-423 F
Yield Strength, psi	127,000	202,000	248,000
Tensile Strength, psi	135,000	218,000	263,000
Elongation, %	14.0	13.0	7.0
Notched Tensile Strength, psi	165,000	206,000	211,000
Notched/Unnotched Ratio	1.22	0.94	0.80
$K_{\tau} = 6.3$			

ratios at cryogenic temperatures that are superior to stainless steel and aluminum (see Figure 1). At the same time they retain toughness — a feat that few materials can approach. Control of interstitials also enhances the rolling characteristics of the grades in production of wide, thin sheets needed for LH2 programs. For example, material is now available in such representative sizes as 0.014 x 36 in. x coil and 0.020 x 40 x 120 in.

TMCA your best bet in titanium. The best bet today for cryogenic vessels in high-energy missiles is titanium. Its successful fabrication in large tankage, such as the Beech unit, underscores the fact that thingage titanium sheet is here. And if your best bet is titanium, then TMCA is your best bet in titanium. TMCA is the nation's only company devoted exclusively to titanium and is the only organization with the experience provided by an unbroken history of full-time technical assistance.



TITANIUM METALS CORPORATION OF AMERICA

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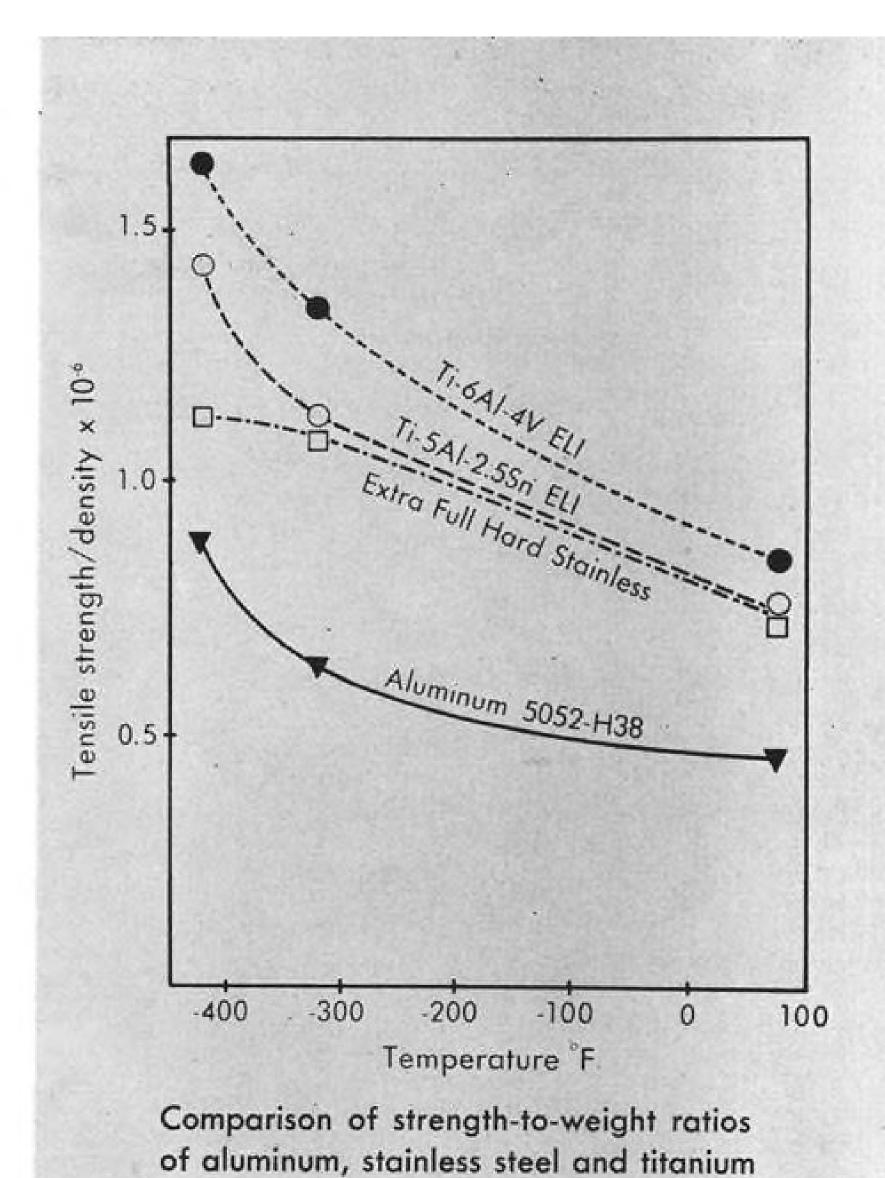
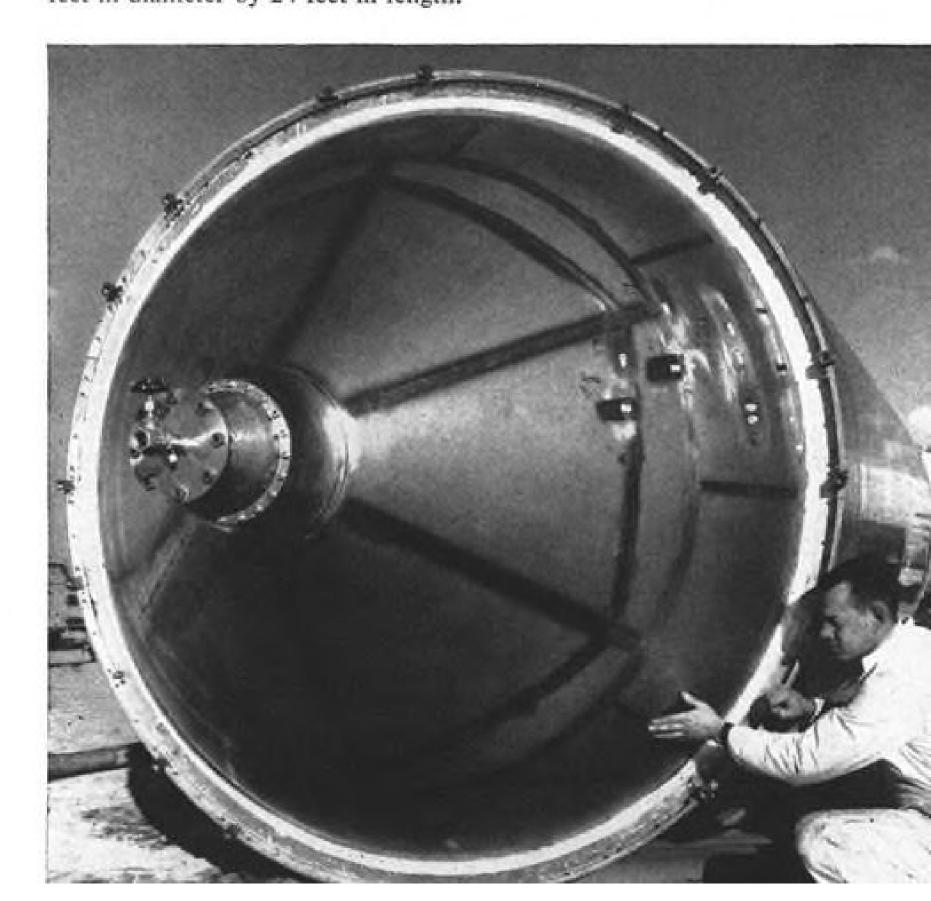


Figure 1. Curves show superiority of new ELI grades of titanium to stainless steel and aluminum, on a strength-to-weight basis. Called Ti-5A1-2.5Sn ELI and Ti-6A1-4V ELI (for extra-low

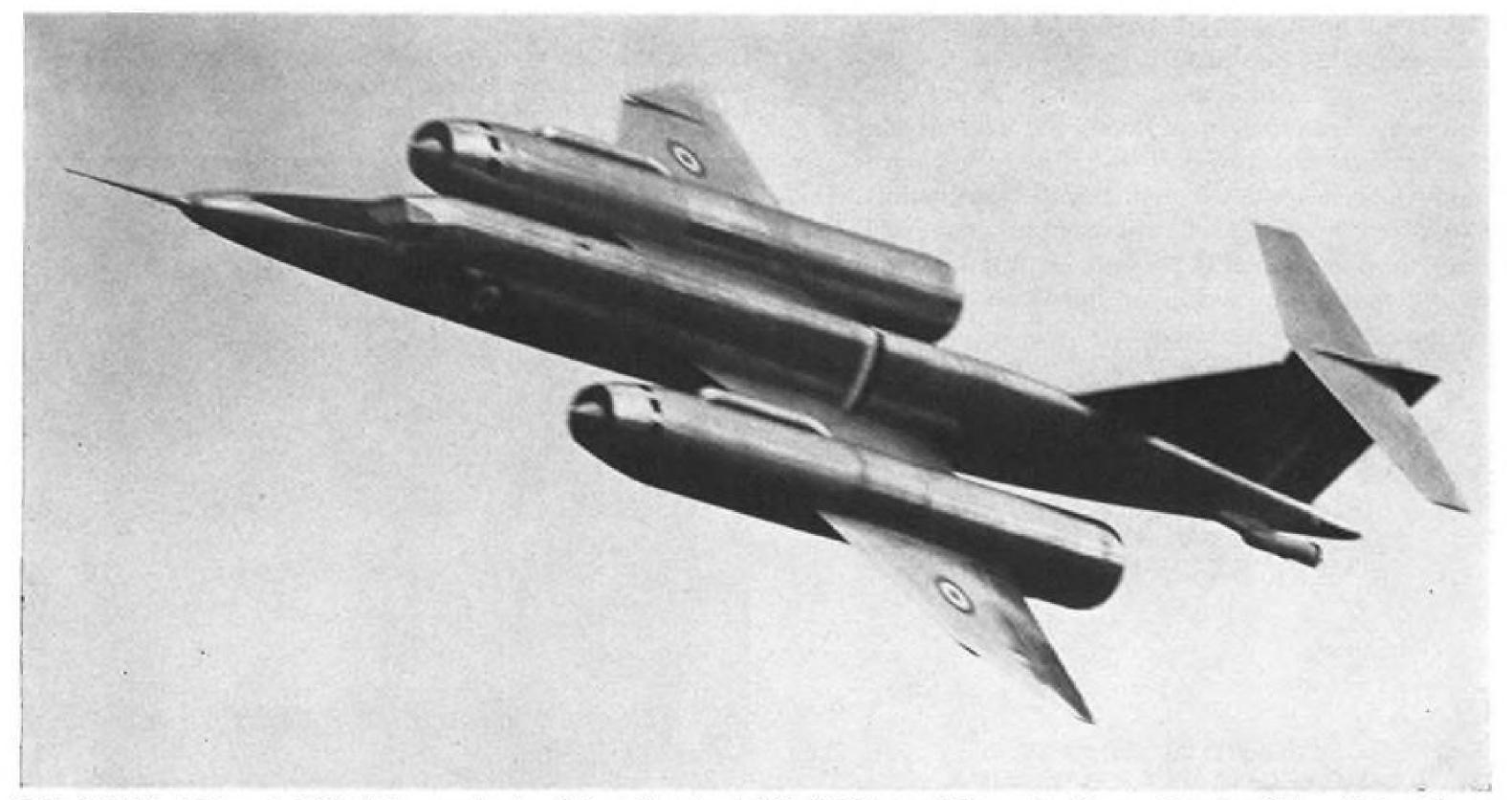
interstitials) the new cryogenic titanium grades also retain tough-

ness at low temperatures and impermeability to hydrogen.

Largest titanium assembly ever made, the 7,000 gallon test vessel designed and produced by Beech Aircraft, measures 8 feet in diameter by 24 feet in length.

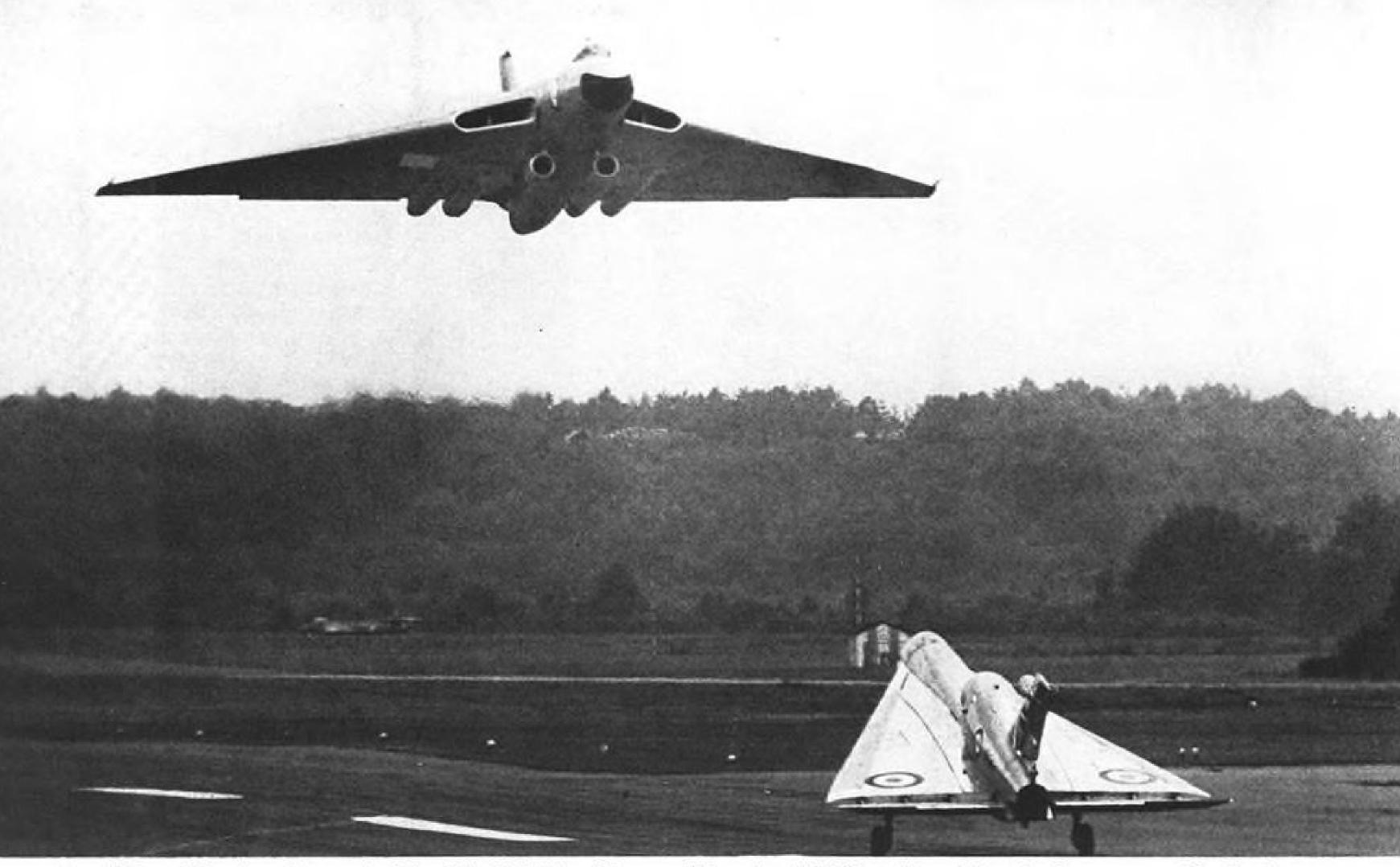


Model of Bristol Type 221 supersonic research aircraft, above, is a follow-on to the Fairey FD.2 (AW Sept. 17, p. 34). Major changes include new ogee wing and elongated nose section. Area-rule bulges below wing house air intakes. Aircraft is scheduled to fly next summer.



Bristol T.188 stainless steel Mach 3 research aircraft is undergoing initial flight tests at Boscombe Down. Aircraft will investigate airframe heating in Mach 2 regimes. Pods on nacelles are fire extinguishers. Tail extension houses parachute.

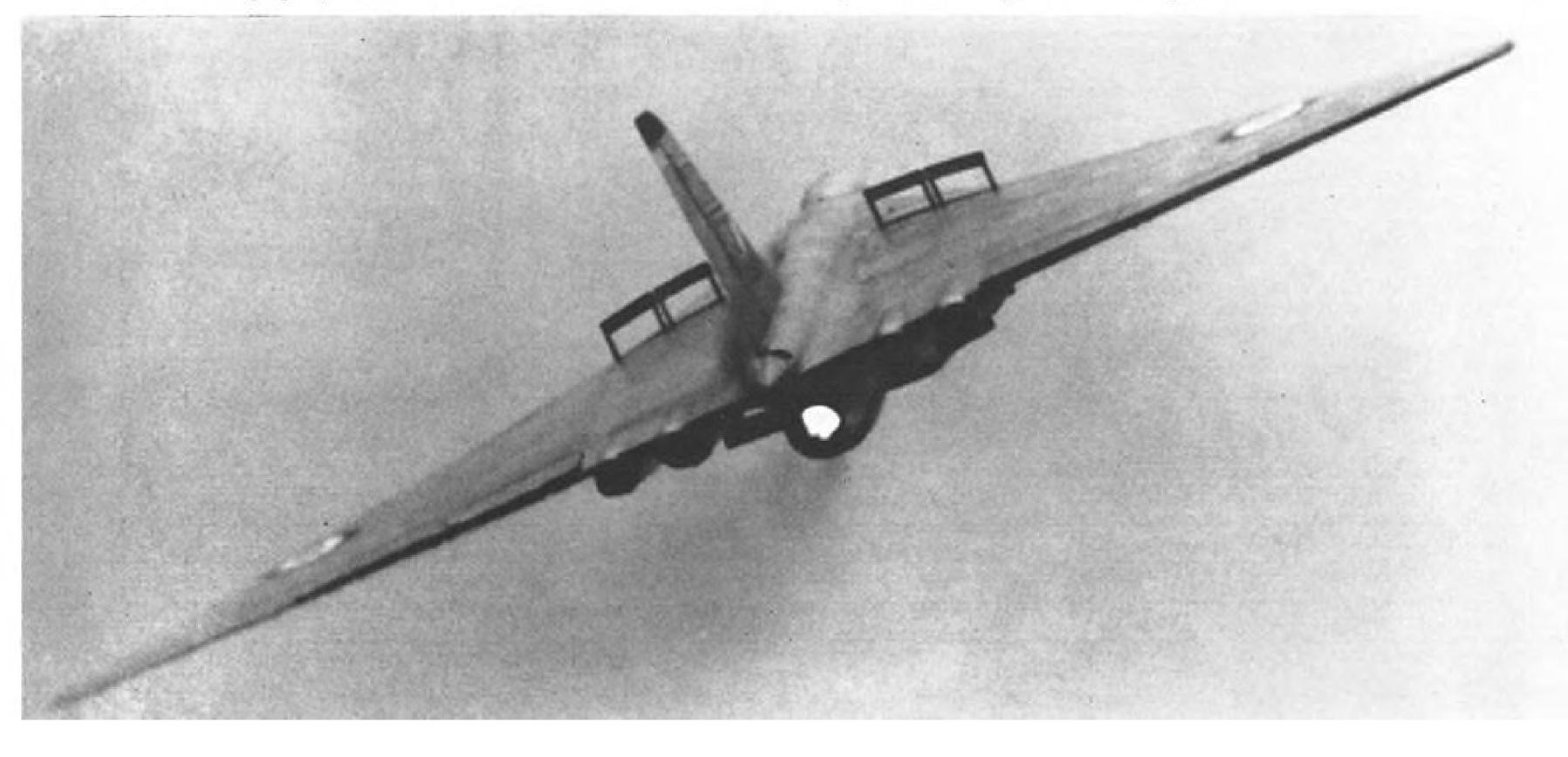
AERONAUTICAL ENGINEERING



Avro Vulcan V-bomber flying testbed for Bristol Siddeley Olympus 593 engine (AW Sept. 10, p. 26) makes low pass over Handley Page HP-115 on runway. Note twin air intakes for the podded Olympus. Supersonic transport would have four Olympus 593s paired in pods.

British Push High-Speed Engine, Airframe Studies

Rearview of Olympus-powered Vulcan shows flame in afterburner built by Solar, San Diego, Calif. Note speed brakes.



ELECTRO-PNEUMATIC AIR TEMPERATURE CONTROL SYSTEM



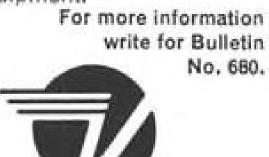
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PRODUCTION BRIEFING

Polytechnic Institute of Brooklyn will study the flow pattern, chemical behavior and radiation effects around very high-speed spacecraft re-entering the earth's atmosphere, to determine best design for hypersonic vehicles. Studies, financed by an \$83,300 Navy contract, will be conducted in the Institute's aerodynamics shock tunnel, now under construction.

Martin-Marietta Corp. has received an \$11,792,252 contract from Army to continue research and development of the Pershing missile. Contract brings total amount allocated for development of Pershing to \$435 million.

General Dynamics/Convair, San Diego, has been awarded a \$74,500 Navy contract to continue study of ground effect takeoff and landing (GETOL) airplane designs. Study is part of program aimed at determining effectiveness and economy of GETOL principles in an anti-submarine warfare seaplane.

Garrett Corp.'s AiResearch Division has been awarded a \$225,000 contract to develop a closed-loop cryogenic cooling system, utilizing the non-reciprocating technique.

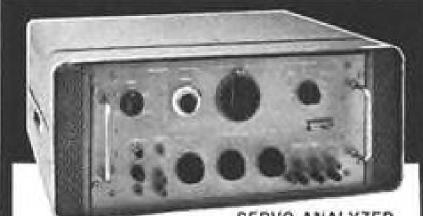
Arthur D. Little, Inc., Cambridge, Mass., will build two multi-component thrust-measuring systems for the Minuteman ICBM static test program under a subcontract from Thiokol Chemical Corp. Systems will be capable of measuring 250,000 lb. thrust, using a fluid-bearing concept which will provide low friction resolution of forces during test firings.

General Electric Co. has received a \$201,545 research and development contract from Air Force's Aeronautical Systems Division to study electrolytic machining techniques, define their operating parameters and prepare design and process specifications.

Martin Co.'s Orlando Division has been awarded Navy contracts totaling \$1,576,845 for equipment which will make the Bullpup air-to-surface missile quickly adaptable to more aircraft. Équipment includes a new guidance system transmitter in a smaller package and Type S launcher which fits any aircraft equipped with standard military bomb racks.

Sylvania's Electronic Systems Division, Waltham, Mass., has received a \$16,050,000 Air Force contract for continued development of ground electronic systems for the Minuteman ICBM. Sylvania was awarded a \$2million initial work contract in July.





SERVO ANALYZER

The TEMCO 100/200 Series Servo Analyzer is an allelectronic instrument capable of performing phase and gain response measurements on servo systems and compo-nents. This electronic formulation of the modulation frequency precludes the troublesome maintenance requirements of mechanical multipliers and allows for modulation rates over the dynamic frequency range of .005 to 1000 cycles. All circuit connections are fail-proof — soldered with ERSIN Multicore 5-Core Solder—assuring high performance and dependability.

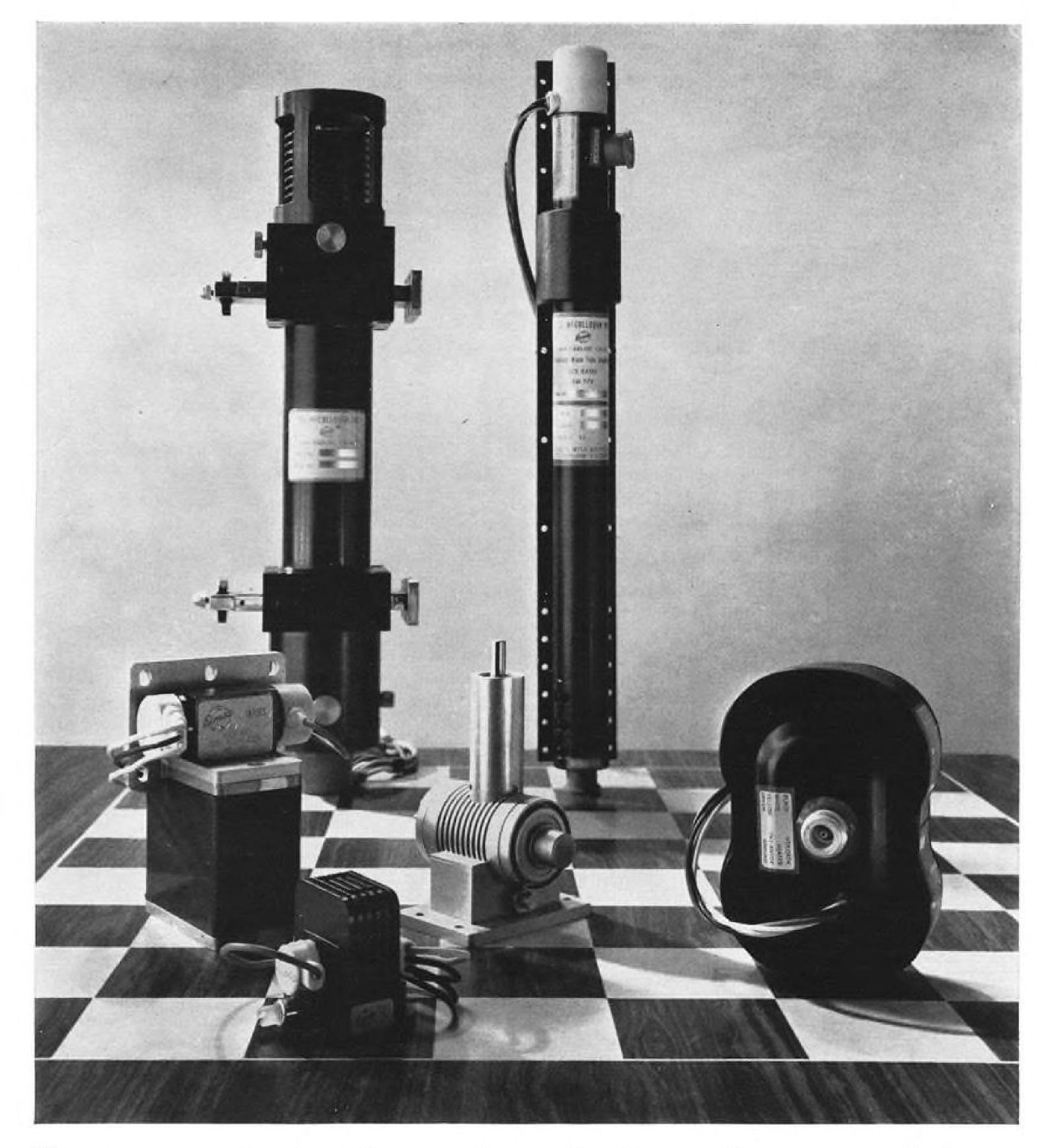


ERSIN Multicore 5-Core Solder costs TEMCO a trifle more than ordinary solders - but this is more than compensated for by the vital savings realized through more joints-per-pound, and virtually no costly rejects due to cold or H/R joints. For production efficiency, guaranteed by 5 cores of exclusive ERSIN flux and fast melting thin-wall construction, quality manufacturers have come to rely on ERSIN Multicore, the world's finest cored solder.

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Eimac can supply microwave tube types on fast delivery schedules: (front row) reflex klystron; (second row) iso-klystron-factory matched reflex klystron and isolator, reflex klystron, VTM; (back row) TWT's-the one on left interchanges in a PPM array.

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World leader for 15 years in the design, development and large-scale production of Doppler navigators, versatile, fastmoving Ryan is also making significant contributions in other space age areas.

For example, Ryan is building the newest concepts in vertical take-off aircraft. And today, as for years past, Ryan is the major supplier of advanced jet target drones for all the Armed Services. Among other Ryan activities are Flex Wing applications, electronic systems for lunar landings, and structures for space vehicles.

Your inquiry is invited concerning these and other capabilities of Ryan Electronics and Ryan Aerospace in the design, development and fabrication of space age products.

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plication of Doppler to be successfully achieved ment for both rotary and zero speed to 2000 knots



BUSINESS FLYING



BEECH MODEL 120 turboprop executive transport will be powered by two Turbomeca Bastan 6 engines. Market potential of 500 is seen.

Beech Plans Tight Cost Controls for 120

By Erwin J. Bulban

Wichita, Kan.-Beech Aircraft Corp. will emphasize fabrication techniques permitting a high manufacturing rate and reduction of factory manhours in building its Model 120 twin-turboprop business transport. The company is aiming for sales of 400 to 500 units within the next 10 years.

Major goal of the streamlined Model 120 production program will be to hold the aircraft unit price under \$500,000, fully equipped, to achieve the company's planned market penetration.

In addition to maintaining rigid control of in-house fabrication costs, Beech expects many of the program's subcontractors, who will be awarded fixed-fee contracts, to consider using their own funds to conduct research, development and fabrication of components.

Initial design details of the new eightplace transport have already been provided with the unveiling here recently of a highly-detailed full-scale mockup (AW Oct. 1, p. 18).

Concurrently with development of the Model 120, Beech has arranged to

acquire the second of two Model 18 testbeds equipped with the same Turbomeca Bastan 6 engines that will be installed in its new executive transport. This Model 18 will be used by Beech to develop the Model 120 engine installation and for engineering development work, service tests and pilot checkout.

Testbed will also be used in developing many of Model 120 major components and acquiring service experience through flight testing, including propeller controls, lubrication and fuel control system to contribute to reliability in the production model.

Model 120 will have flush riveting throughout with butt joints on skins to provide far more structural smoothness than any of the company's current models. As a result, company engineers say, their estimated performance data is heavily on the conservative side. Basic intent is to provide a structure of extremely long life, not incorporating any structural components that will require replacement at a specified number of hours.

Model 120 wing typifies the com-

pany's philosophy of aiming for rugged structures geared toward keeping manufacturing costs down. The wing will be constructed of two panels jointed under the fuselage to a short center-section essentially as a permanent splice. Wing panels will consist of seven spanwise spars fabricated of sheet aluminum allov 7075ST with lightening holes and riveted stiffeners.

Upper spar cap will be an extruded component, and the lower cap will be formed on a spar web. Two spars, located at 20% and 60% of the wing chord, will form the main wing box and also the vertical walls for the continuous, root-to-tip integral fuel tanks. As now planned, each wing panel will contain only two ribs, one at the root and one at the tip, also acting to contain

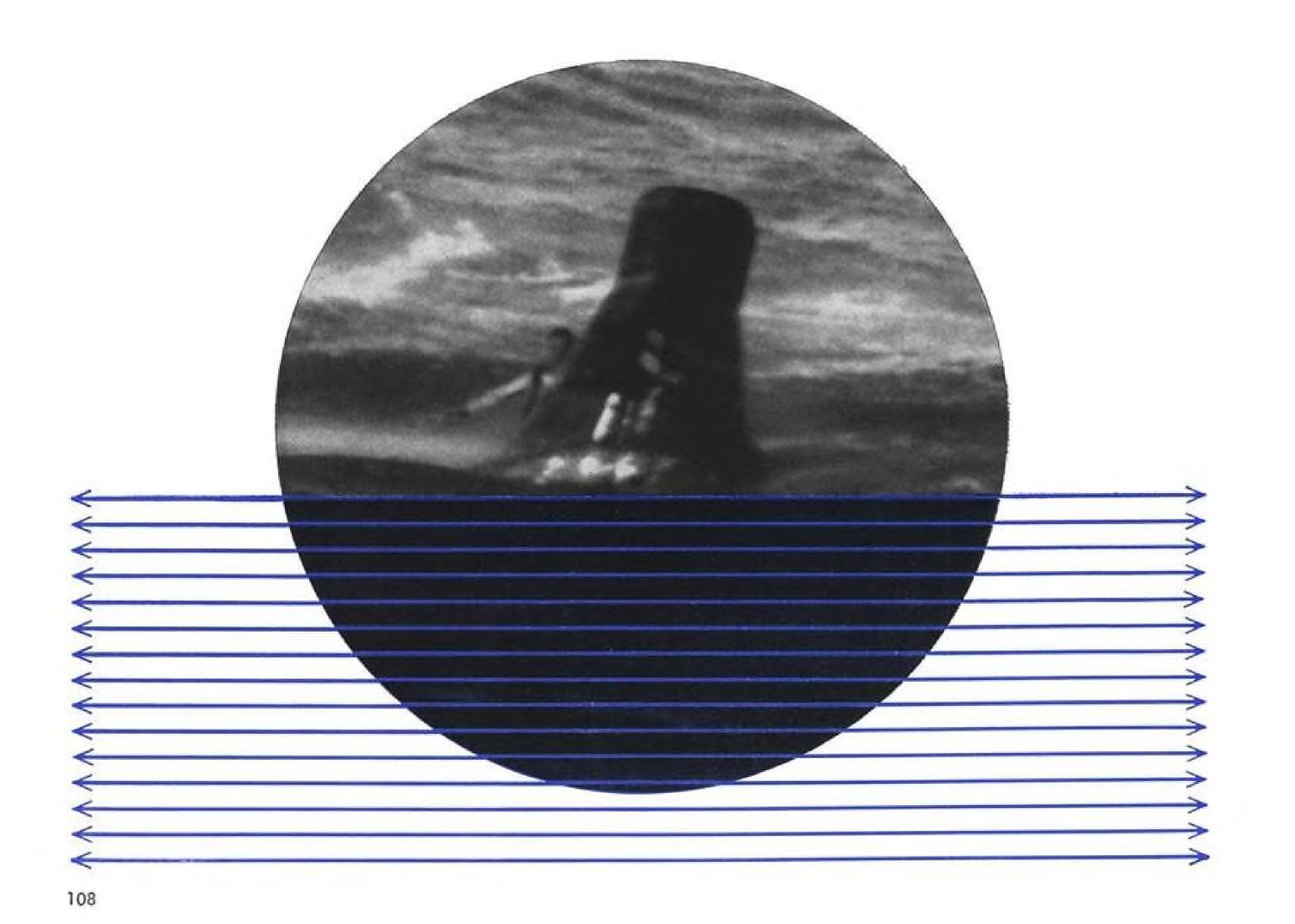
Beech engineers say that another rib may be added between the tips and engine nacelle area. These main ribs will be supplemented by ribs external to the main wing box for attaching the engine mount structure and landing gear units. Assembly process will attach spars directly to wing skins by automatic rivet-

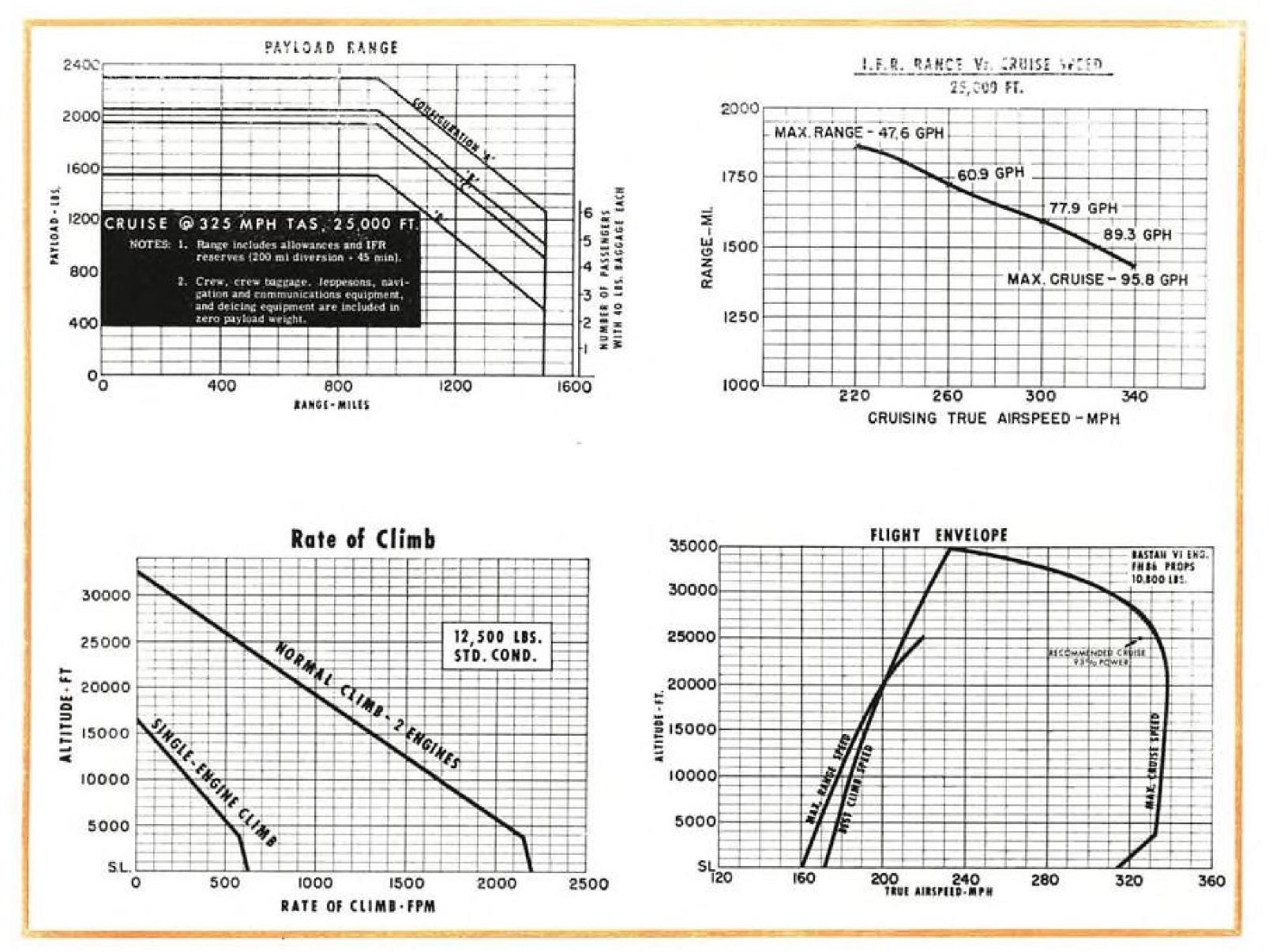
Kel-O-Rad -communications where it counts

A ten foot space craft bobbing in the vast Pacific Ocean makes a very small ripple. But when that space craft contains Astronaut Walter M. Schirra, Jr., the ripple laps the shores of the world. From countdown to splashdown a vast communications network links Astronaut Schirra with his earthbound colleagues. A unique Kel-O-Rad Radio Transceiver installed in the Astronaut's survival kit was available to keep him in constant voice communication with nearby rescue aircraft if he elected to leave the space craft. The microminiaturized Kel-O-Rad unit permits hands free communications in a host of operations—flight line maintenance, warehouse areas and special test and fire fighting teams—where people work in hazardous or extremely noisy surroundings. Kel-O-Rad's two basic units—the portable transceiver and base station—are compact battery-powered packages. The 12-ounce transceiver contains a crystal controlled transmitter and receiver powered by two rechargeable batteries. Two base stations are available—a small unit operating from an internal battery pack and a slightly larger unit powered by a battery or an AC power supply. With a wide selection of operating frequencies, Kel-O-Rad puts reliable voice communications where they count—in any military or industrial environment.

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ing. Some tooling holes will be provided in the skins to locate the spar caps for the riveting process. Upper skins will be made of 7075ST aluminum alloy to assist spars in carrying bending loads. Lower skins will be composed of 24ST. The wing skin will taper from 0.20 in. at the root to 0.40 in. at the tips.

The 15%-thickness wing will utilize a 63A215 airfoil section from root to tip and will be a high aspect ratio planform of approximately 10.7. The wing will have 3.5-deg, washout and dihedral of 7 deg. Pneumatic de-icer boots will be fitted and fuel filler caps will be at the wing tips.

Circular cross-section fuselage will be 75 in. outside diameter of conventional frame-and-stringer makeup using bonded crack-stoppers to provide longfatique life and fail-safe construction. Bulkheads will be formed of sheet aluminum alloy, and the plan calls for using no chemical-milled or machinemilled members.

Cabin section will be 160 in. long. Entire occupied area of the airplane from Station 84 to Station 372, will be pressurized to the fuselage skin, capped at the forward station by a flat, reinforced bulkhead and capped at the aft end by a domed pressure bulkhead.

Pressurization will be to 5.5 psi., pro- one unit, hydraulically actuated.

viding the equivalent of 8,000-ft. altitude while flying at 25,000 ft. The structure is designed to hold leakage to a minimum of 3 lb./min. Nose and tail cones will be made of laminated glass fiber, with the nose cap capable of accommodating an 18-in. radar dish. Fuselage skin covering will be constructed of relatively small panels to provide maximum stiffness and reduce noise transmission.

Tail unit will have conventional makeup, with spars, stringers and ribs and wrap-around skins. Wing flaps, of similar construction, will include two segments on each wing panel and will have double-slotted design, with the slot maintaining a fixed position during travel. Flap travel will be on tracks, utilizing screw-jack actuators off an electric drive system.

Flight controls will utilize manual trim-tabs throughout. Ailerons, rudder and elevators will be directly operated by the pilot through cable-connected systems.

Landing gear will have 650 x 8 tires, with dual wheels on the main legs. The nose gear will have a single wheel. Landing gear structure and cylinder will be one-piece aluminum forgings. Drag links and actuating cylinder will be

All three landing gear will retract forward, to provide positive airstream pressure in emergency free-fall. A back-up air bottle will ensure that the gear goes down and locks.

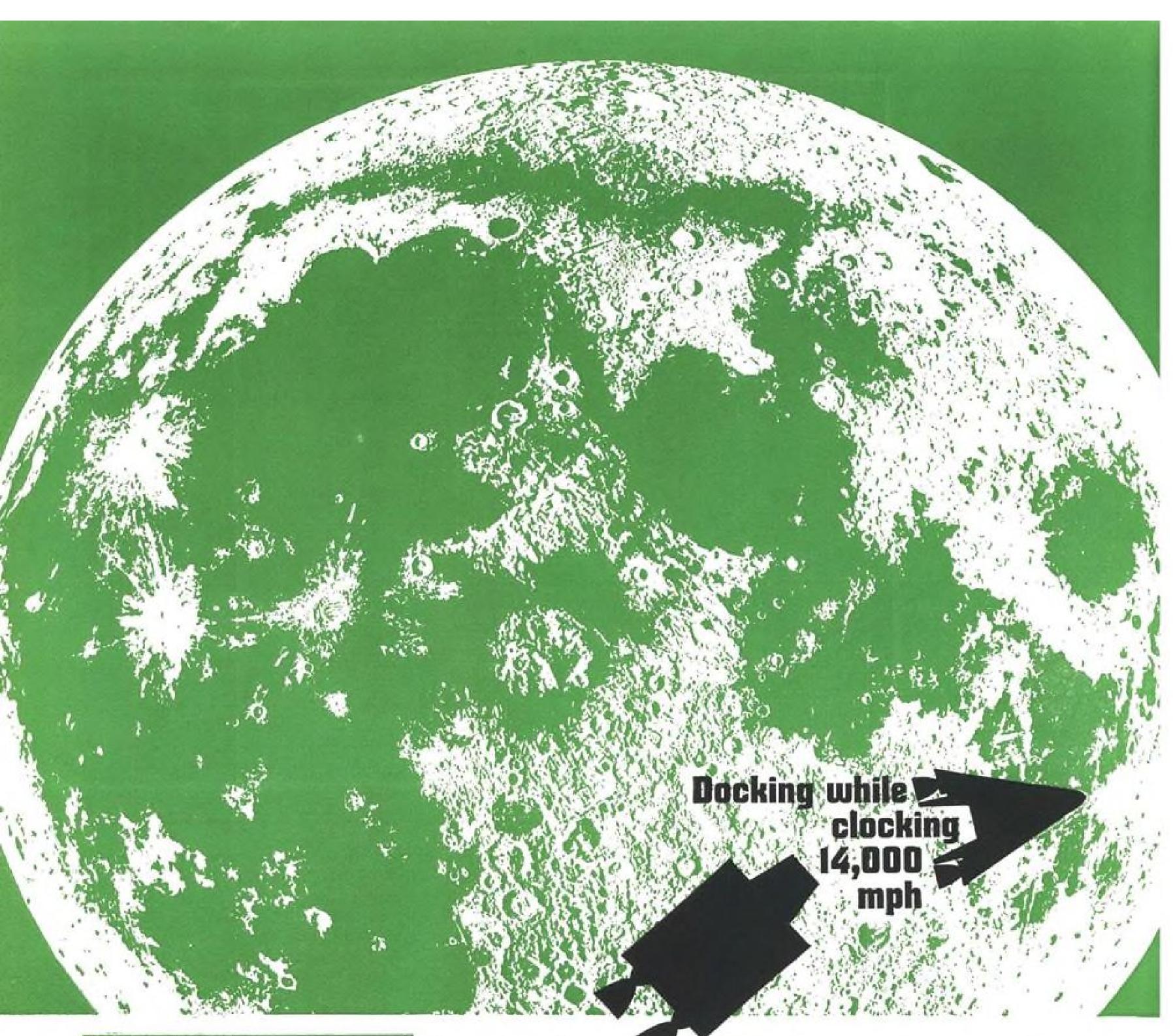
Systems include utilization of bleed air from the Bastan engine for air conditioning and pressurization, with an air-cycle refrigeration system providing ground and flight cooling.

Fuel system will hold 544 gal. of JP-1. JP-4 may also be used, although it is pointed out that JP-4 takes 3-4% more space for the same amount of fivel

A common sump for each engine will be located in the wing root section. Fuel will be fed from this point to each engine by independent systems, with a pump in each sump to assure flow. Crossfeed will make all fuel usable in either engine. Future growth versions will probably incorporate wingtip tanks for additional capacity.

v.d.c. Where required, 115-v. 400-cycle a.c. power will be supplied by inverters, and each engine will be fitted with a 200 amp. generator supplying power at 28 v. Hydraulic system for landing gear, power brakes and power steering will be 1,500 psi. capacity.

To assure service back-up to future



COPTICAL ELECTRONICS Space rendezvous problem: how to align for physical coupling of vehicles orbiting at predicted speeds of 14,000 miles per hour? Answer: Kollsman power optics guidance systems with accuracy potential of one part in 100,000 miles.

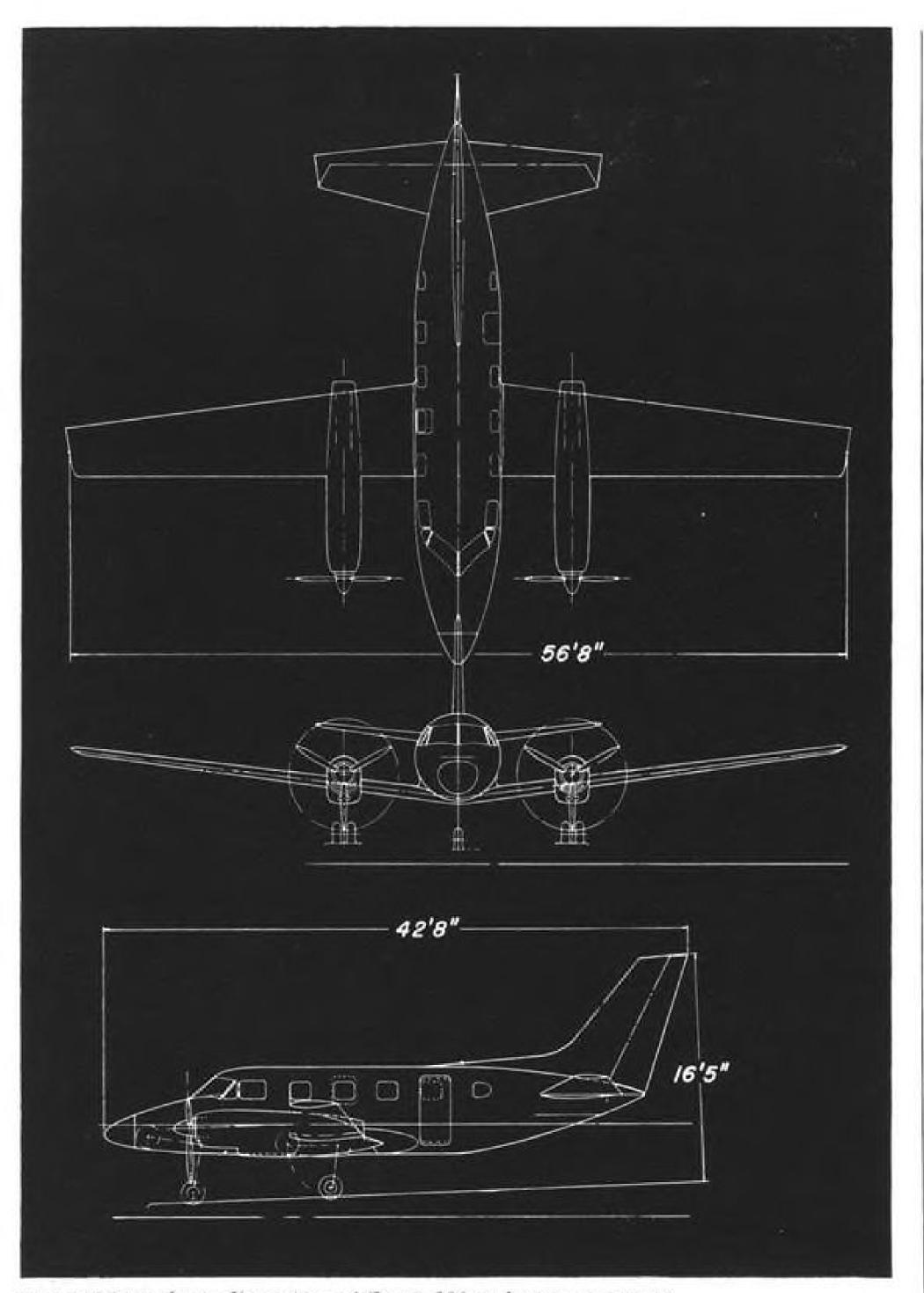
Other Kollsman optical electronic programs currently in progress include improved integration of celestial navigation systems with pilot controls in manned space vehicles . . . athermal optics for orbiting solar observatories . . . and approach-pattern recognition techniques for vehicle guidance to planetary landings or space rendezvous.

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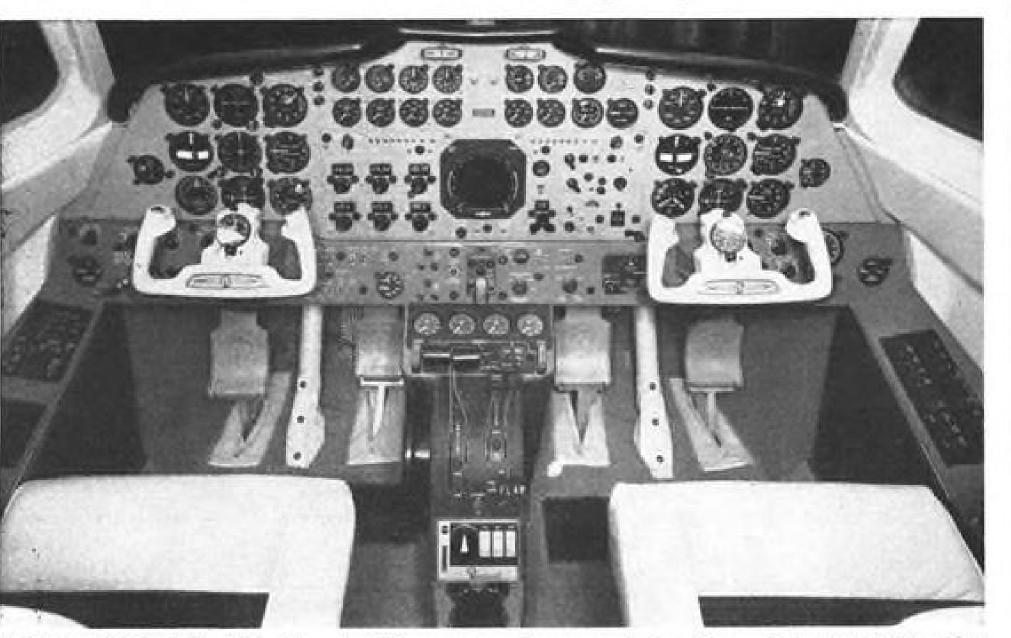


Kollsman Instrument Corporation



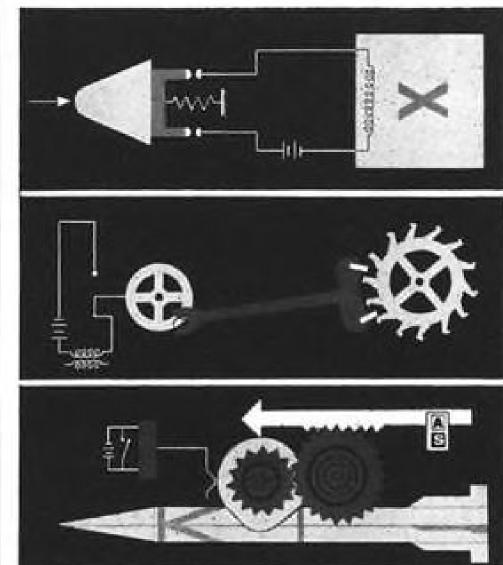


THREE-VIEW shows dimensions of Beech 120 turboprop transport.



ROOMY COCKPIT of the Beech 120 mockup shows uncluttered panel layout with radarscope centered and dual flight instruments in front of each pilot.

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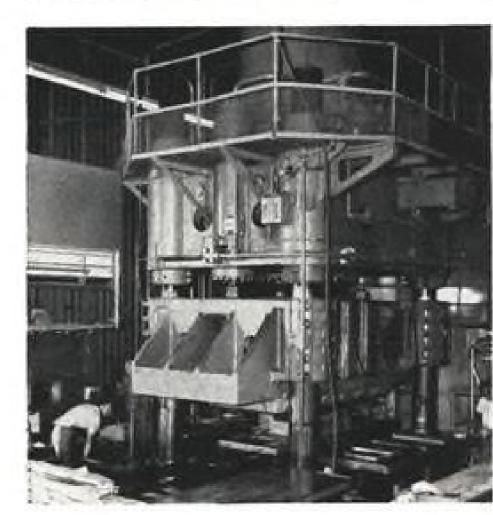




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Model 120 operators, Beech will assume full service obligations. A supply of new, overhauled or re-manufactured powerplants will be available through Beech at Wichita and other distribution points under Beech cognizance.

Beech will obtain engines for production airplanes from Turbonieca as complete units-including the 917 eshp. Bastan 6, propeller control and governor, cowling, oil radiator, fuel system control and related components.

Turbomeca has approximately 16,000 hr. running time on the Bastan 6, including 5,000 hr. flight time. The engine is going into Max Holste Super Broussard production series, which should increase its service time considerably by the time it begins operations on the Beech Model 120. It probably will start with time-betweenoverhaul of 750 to 1,000 hr. In several years, TBO should be more than 2,000

Propellers are 100-in.-dia. Ratier-Figeac (affiliate of Hamilton Standard) full-feathering, three-blade type.

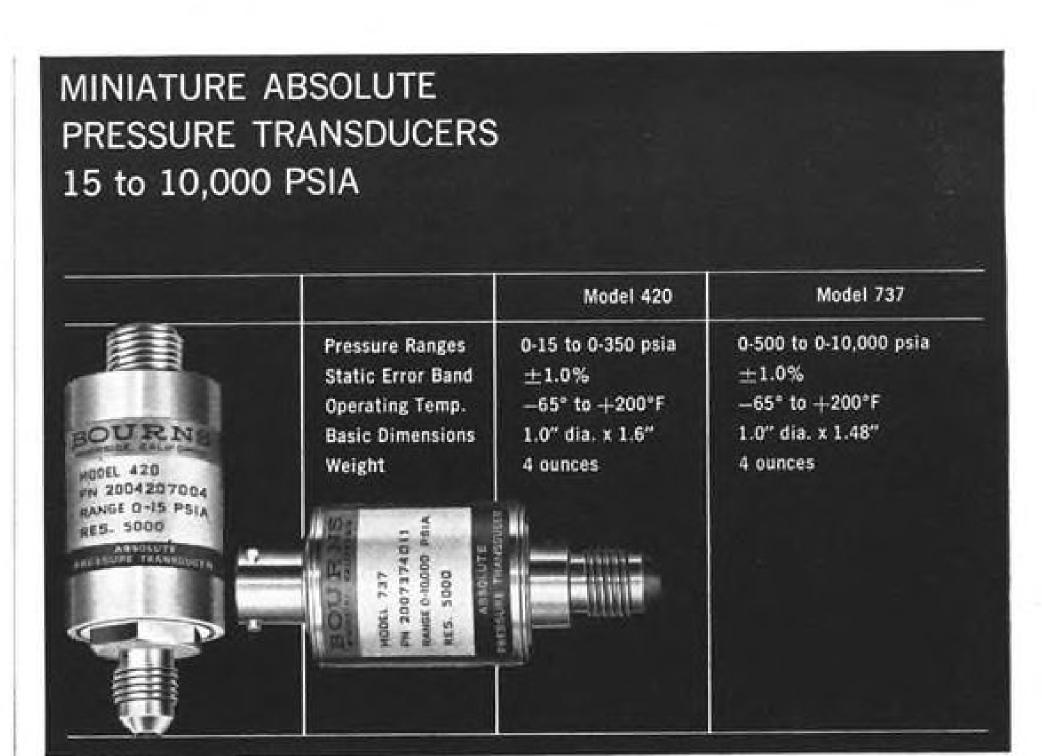
Standard equipment for the engine will include provisions for a watermenthanol injection system, although Beech currently does not plan to equip the powerplant with water injection.

In comparing the new Model 120 with the largest airplane in the present Beech line-the Model H18-the cockpit of the turboprop transport will be 40% larger, the cabin is 80% larger, and the baggage and lavatory section is 40% larger. Increased capacity was provided in a fuselage which is only 20% longer than that of the H18.

Beech Model 120

the control of the co
Gross weight 12,500 lb.
Design takeoff weight12,000 lb.
Design landing weight11,400 lb.
Empty weight
Span
Over-all length
Height to tip of fin 16 ft. 5 in.
Fuselage outside diameter75 in.
Wing area300 sq. ft.
Horizontal tail area83.7 sq. ft.
Vertical tail area58.3 sq. ft.
Main wheel tread
Wheel base
Wing loading (takeoff) 41.8 lb./sq. ft.
Power loading (takeoff)6.8 lb./shp.
Specific fuel consump-
tion
Normal cruise speed325 mph.
Range with IFR reserve,
325 mph. at 25,000 ft1,500 mi.
Twin-engine rate of climb,
5,000 ft2,000 fpmplus
Single-engine rate of climb,
5,000 ft
Takeoff over 50-ft. obstacle2,700 ft.
SR422B field length, sea level 3,700 ft.
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Landing over 50-ft obstacle....2,770 ft.



At 35 G vibration, these two miniature Bourns transducers deliver a high-level, low-error signal in ranges from 0-15 to 0-10,000 PSIA. Their performance and reliability are outstanding and typify the entire Bourns line of compact, high-performance Potentio-

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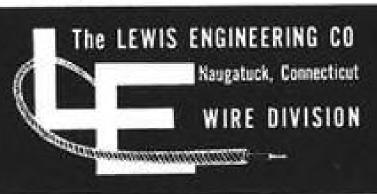
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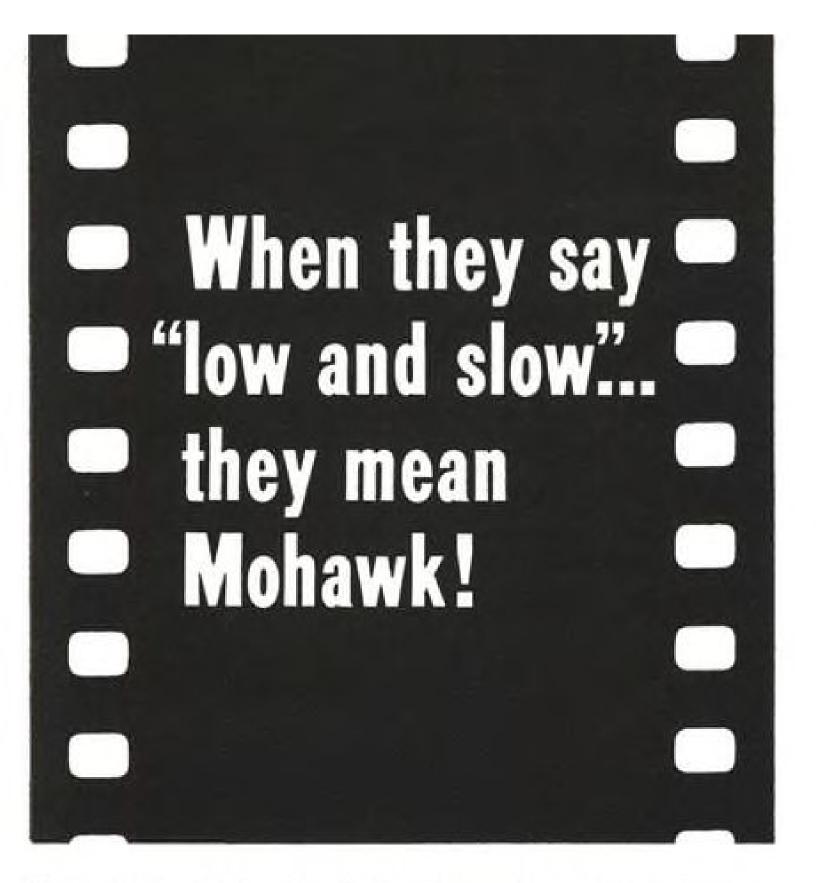
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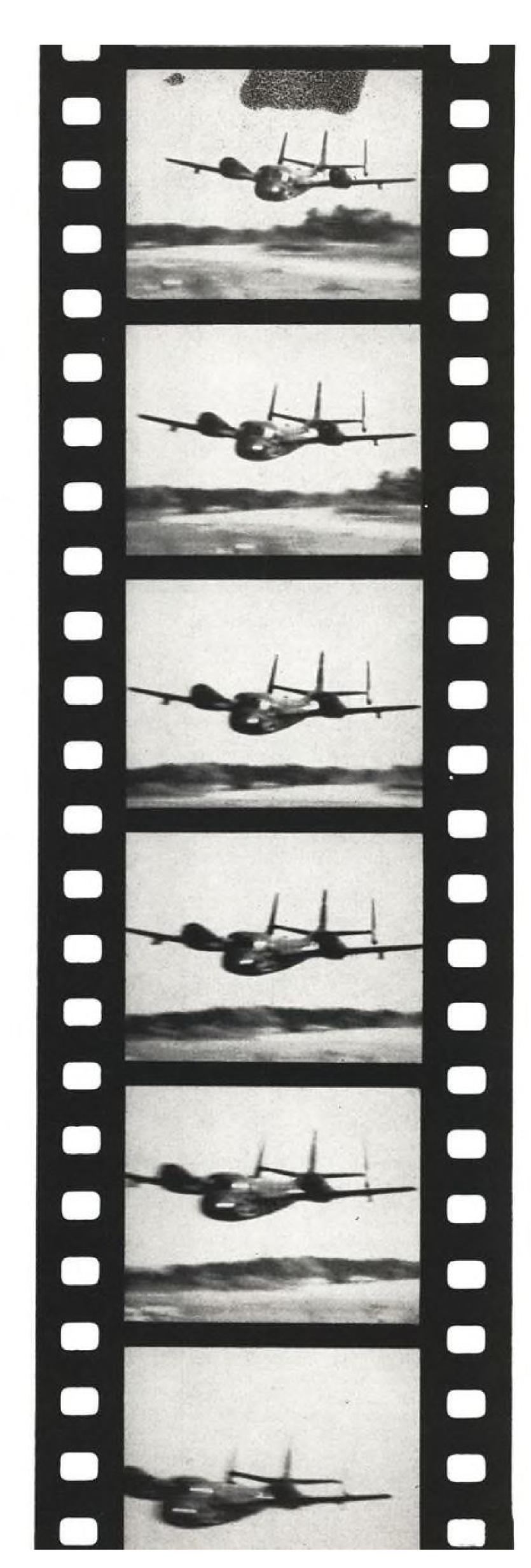


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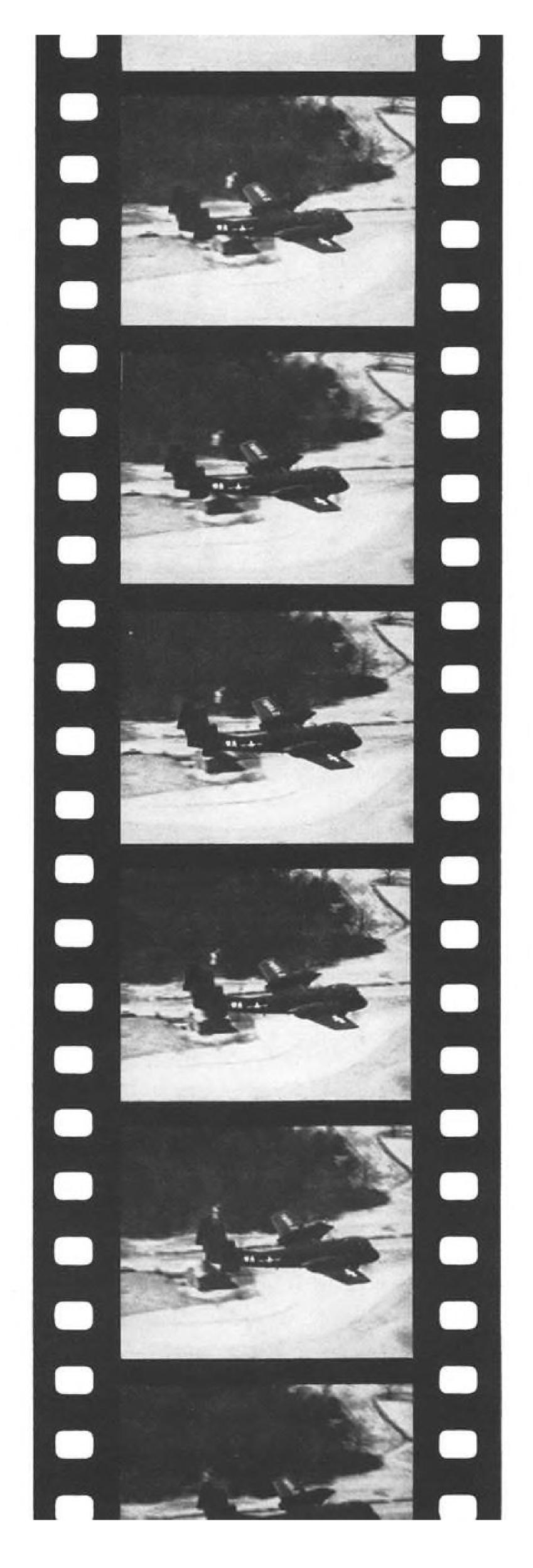
A stall speed of only 55 knots gives the Mohawk enormous short-take-off-and-landing capabilities. And yet it's beefy enough for rough field, and any weather.

Mohawk's maneuverability at low altitudes means shortening the time ground fire can be brought to bear and, when the looking job is over, the airplane's two Lycoming engines lift it at the rate of 3000 feet per minute. Mohawk's speed in level flight is 275 knots. Serviceability in the field? Grumman made left- and right-hand components on the Mohawk interchangeable, including engines, tail surfaces, and undercarriage. Virtually all components are interchangeable between aircraft. Engines and many accessories can be changed with a minimum of special tools. More than 75% of the airplane opens up for maintenance in seconds—entirely by hand. That's Mohawk . . . bugeyed and bustling.











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FAA Prepares Initial Suggestions For Light Aircraft Simplification

By David A. Brown

Pittsburgh, Pa.—Project Little Guy— Federal Aviation Agency's program to simplify light aircraft and relieve their pilots of much of the physical and mental strain of flying, especially in controlled or high density airspace—will have its first recommended cockpit revisions ready in December or January.

Simulator to evaluate proposed cockpit equipment also is expected to be in operation in three or four months, and industry-developed flight hardware may be available by early 1964.

Project Goal

Project Little Guy is attempting to develop light aircraft controls, cockpit layouts and cockpit systems which will make both instrument and visual flight less demanding on the non-professional pilot and, as well, reduce training time.

At present, the program has been divided into four categories:

Turbine Conversions

Pittsburgh—Variety of conversions of piston-engine business aircraft to turbo-prop configuration as well as new engines to power the aircraft highlighted the 15th annual National Business Aircraft Assn. convention here last week.

In addition to a de Havilland Dove conversion announced by Riley Aeronautics (AW Oct. 8, p. 30), at least two companies, including Riley, are planning to convert the Beech 18 to turboprop power, both using the Canadian Pratt & Whitney PT6A. Riley's Beech conversion is about a year away, mostly because of engine availability.

Another firm is planning to install PT6As in the Beech 18 and probably will replace the traditional double tail with a swept single tail and add a tricycle landing gear.

Service experienced gained by the Canadian company's flight test program using a modified Beech 18 has increased interest in the use of the PT6 in fixedwing business aircraft.

General Electric also is planning to enter this power class and has been running a new 500-eshp. turboprop engine on the test stand. Engine, designated the X388, is designed to be rugged, easy to maintain and have low-cost components. Fuel pump, for example, will cost about \$150, and the oil pump even less. The X388 already has undergone two 50-hr. unofficial bench trials and is soon to undergo an official 50-hr. test.

 Development of flight controls which are less demanding on the pilot and which achieve coordination normally provided by the pilot without losing the flexibility of manually coordinated controls.

• Integration of secondary flight controls (flaps, engine and propeller controls, etc.) to provide easy, rapid and thorough change from one flight configuration of the aircraft to another.

 Construction of a navigation system which will place less demand on both the time and attention of the pilot.
 A pictorial display system is considered almost essential at this time.

• Development of a simple, low-cost method of information presentation and communication which will be compatible with Project Beacon requirements and which, hopefully, will be available within five years. A study of avionic equipment and techniques, developed and in use by the military, is planned to see which can be adapted to civil use.

First cockpit design, which may be a physical mockup or a drawing, will be used mainly to draw comment from industry sources, according to Colin G. Simpson of FAA's Aircraft Development Service.

FAA's plan now is simply to develop workable ideas and general ways of solving problems. Then, the aircraft and associated equipment industry will probably supply the actual hardware and the techniques which will make possible the accomplishment of the program's goals.

Flight Controls

Primary flight controls, for instance, might be changed from the traditional stick-and-rudder arrangement to a system which would include a climb and descend control, turn control and others to perform all functions necessary to accomplish a certain maneuver.

Such a system might even take the form of a simple autopilot.

Idea behind this radical change would be to take much of the minute-to-minute load of simply flying the airplane off the pilot and allow him correspondingly more time to navigate, communicate or perform other necessary functions.

Revised system also might reduce the time needed to train a pilot, by lessening the number and degree of difficulty of the tasks he would have to master.

While Project Little Guy is not primarily a safety program, Simpson pointed out, it is expected to make flying safer by making it simpler.

An attempt will be made to integrate

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Note: Deliveries through May totaled 2,970 units having a factory net billing value of approximately \$60,190,000.

which compares with 2,999 units valued at approximately \$55,754,000 in the same period last year. Retail value of these shipments would be approximately 25% higher, and installation of additional equipment in the field would

U. S. Business & Utility Aircraft Shipments

secondary controls into only one or two units rather than leaving them as at present, with each individual mechanism having a separate control.

further boost these values.

For instance, a pilot using the new system could place his secondary control unit in a "take off" position, which would automatically lower the flaps, set the engine and propeller for takeoff, set the trim and perform other operations.

Later, this control could be changed to climb, cruise, descend or land modes and in each would automatically set up the aircraft for that particular portion of the flight.

As in the development of primary

flight controls, a study will be made into possible loss of flexibility by the use of integrated secondary controls.

Pictorial navigation systems now are regarded as the "natural" if not the only way of easing light aircraft navigation problems. Main stumbling block presently is price. Navigation systems have traditionally tended to be costly.

Cost of communication and information presentation equipment also is a problem foreseen by Simpson in planning Project Little Guy. He feels that electronic techniques of communications (micromodules, solid state devices, etc.) can reduce the cost of such equip-



B-377PG Designed as Space Vehicle Carrier

B-377PG, modification of Boeing 377 Stratocruiser, recently made its first flight at Van Nuys, Calif., airport. Aircraft was altered by Aero Spacelines, Inc., of Van Nuys, which plans to offer it as a transport for extremely large U.S. space vehicles, such as the Saturn booster. Special midsection adds 16 ft. 8 in. to length.

AVIATION WEEK and SPACE TECHNOLOGY, October 15, 1962





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ment to smaller civil aircraft, but that development of civil communication equipment is being retarded because it is not supported by military research.

Achievements of Project Little Guy in the communications and information presentation field must be integrated with the requirements of FAA's Project Beacon. As a result, there probably will be considerable cross-flow of data between the two projects.

Industry's attitude toward the objectives of the project has been largely wait-and-see. Cost aspects have caused concern among airframe and equipment manufacturers, who have openly wondered if the simplified system can be produced as economically as present, traditional control systems. FAA hopes that by keeping the system simple, cost can be held to present standards.

Lack of funds has prevented FAA from negotiating development contracts with industry, but Fiscal 1963 funds, amounting to less than \$1 million, will be available within a few months. Contracts for flight hardware may then be signed. FAA plans to have hardware in flight test in nine months to a year after signing of development contracts.

Prior to the flight test, simulator tests will be conducted. FAA hopes to begin simulator tests in three or four months, after first modifying an existing light aircraft simulator. Work may be carried on at the National Aviation Facilities Experimental Center in Atlantic City, N. J., the FAA center in Oklahoma City, Okla., or a privatelyowned simulator facility.

As a final step in the project, Simpson said, FAA will conduct a broad sales program to urge adoption of whatever system is finally devised. Advantages of the new system will be presented to both manufacturers and users.

Simpson noted that relatively little of the total IFR flying now recorded is done by general aviation pilots and that a great many non-professional general aviation pilots seem "scared" of the air traffic control system. Only about 30% of civil flights now file even VFR flight plans, Simpson said.

Sales efforts will be directed to these pilots and to manufacturers, who possibly would be able to sell more aircraft if they were simpler to fly, he said.

Further sales effort will be to point out that training time will be cut by simpler aircraft.

Total development program originally was scheduled to be completed in three years, but now may run longer.

There are no plans to force adoption of the system by regulation. Simpson said he hoped the new system would be accepted on its merit.

An industry committee "undoubtedly" will be formed, Simpson said, to facilitate liaison between industry and

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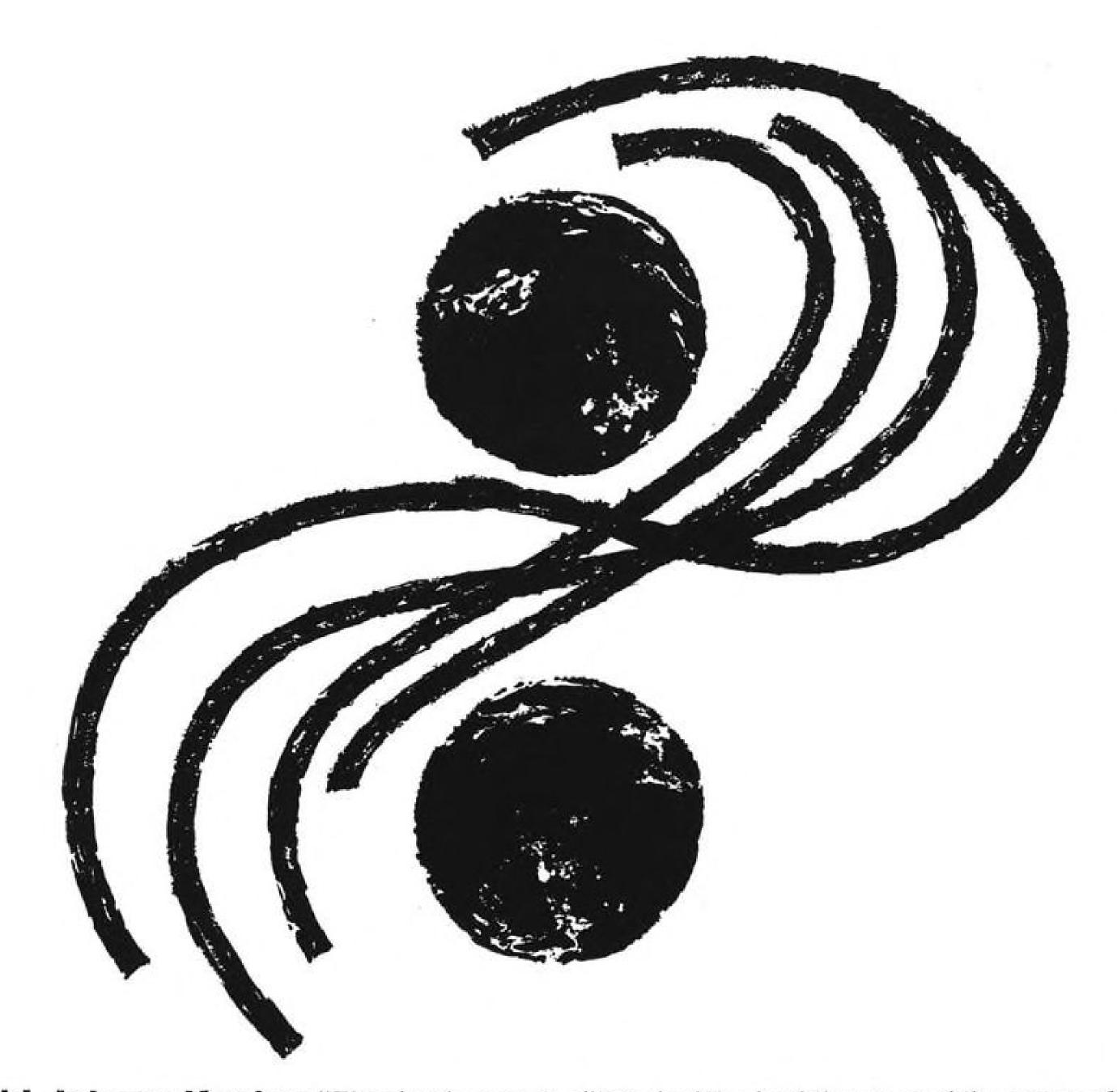
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PUBLISHED: MID-DECEMBER





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PRIVATE LINES

Potez 840 prototype 02, which drew large crowds at the National Business Aircraft Association meeting in Pittsburgh, will be taken on a "selective sales tour" of North America. Aircraft will be shown only on request by a qualified prospective purchaser. Turbo-Flight, Inc., of Chicago is U.S. sales agent for the French four-engine, execu-tive-feeder aircraft. Canadian Pratt & Whitney is making a strong effort to sell its PT6A 525-shp. turboprop engine to the manufacturer and distributor of the Potez 840, especially for aircraft sold to Western Hemisphere operators. Attempt is being made to take the prototype to Montreal for demonstrations.

Small market potential is foreseen for the North American Aviation Sabreliner, but large volume military production has allowed the manufacturer to write off most development costs, reduce the learning curve in manufacturing and offer the civilian version at a relatively low price (AW Oct. 8, p. 30). Commercial sales may not exceed 25 units.

Name of the Swiss-American Aircraft Corp. and designation SAAC-23 apparently have been dropped from the new Lear-Jet executive turbojet promotion. Aircraft, displayed in partial mockup form at Pittsburgh, was referred to exclusively at the Lear-Jet. Aircraft will not be offered with optional instrument and cabin arrangements. Both are being standardized to keep price down. All of 1963 production is sold out and orders are being taken for 1964 delivery.

Single-tail Beech 18 modification, developed by Pacific Airmotive Corp., Burbank, Calif., features a single tail swept vertical rudder and stabilizer replacing the conventional twin tail. Termed the Beech Tradewind, it is designed for gross weight up to 10,200 lb., also has tricycle landing gear, completely faired by retractable doors and 100-gal, wing tanks replacing auxiliary nose tank, freeing nose for electronics installations and baggage. Complete airplane will be priced at approximately \$155,000-if customer supplies a Beech 18, price would be about \$75,000. Indications are that the Tradewind experienced some tail flutter in initial test flight, requiring re-skinning.

Fairchild has delivered a total of 34 F-27 turboprop-powered transports to the corporate market, including one it uses as a company demonstrator, and is scheduling a new production block of 12 F-27F versions, of which three or four will be delivered to corporate customers.



Industry requirements for a small, rugged, yet inexpensive float switch for a wide variety of applications is met by the Aerotec F203 series. Suitable for top, bottom or side mounting, the unit is fully qualified to MIL-S-23980 and has been in volume production for more than a year. Variations in a duel level sensing version are also available.

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The broad acceptance attained by this design permits stocking of standard parts, prompt delivery, and a reasonable pricing structure.

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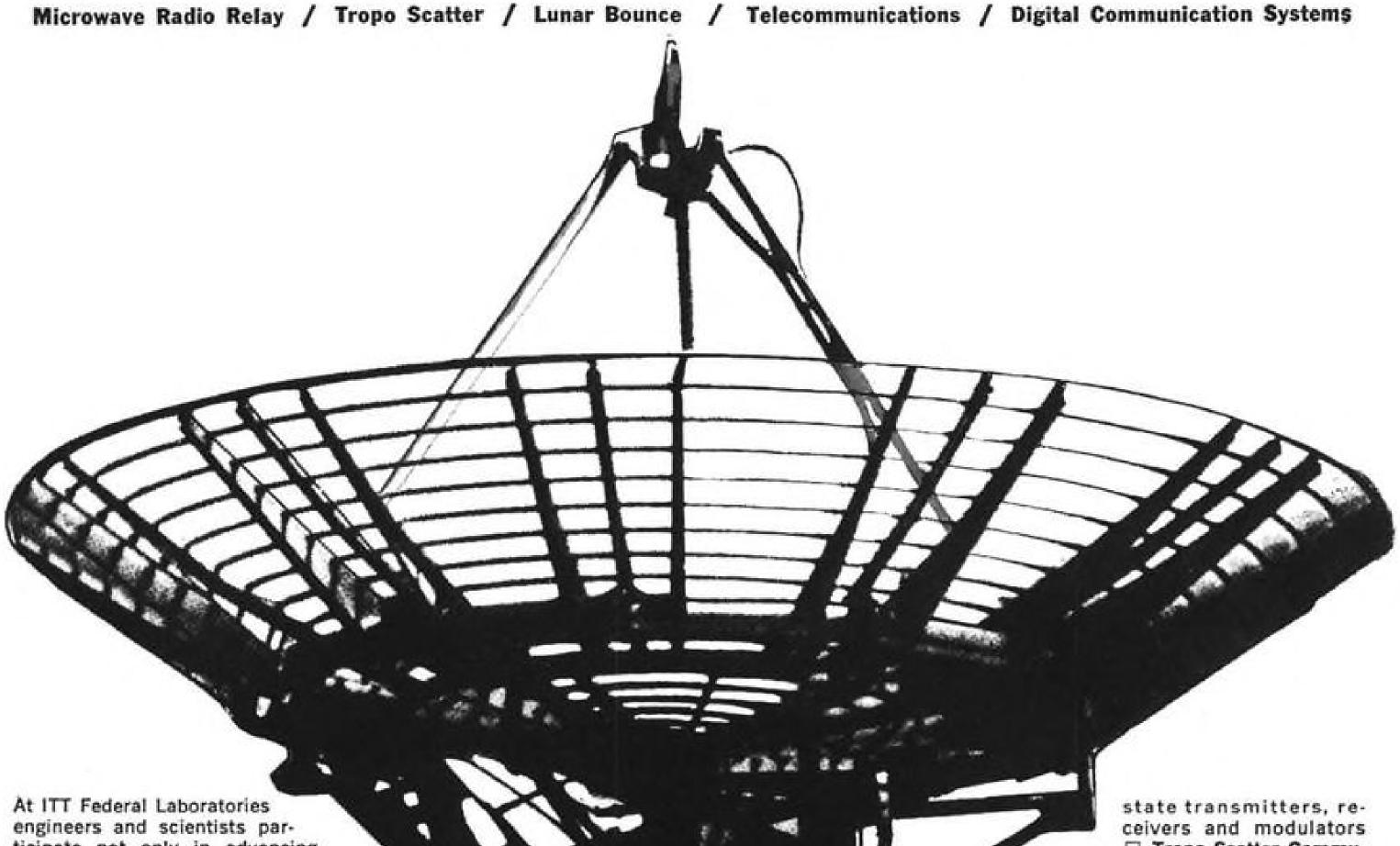


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ticipate not only in advancing communications theory and technology but also in the applications of these new techniques to systems of large scope and major importance. To cite a few instances: ACE HIGH - the command communication network of tropospheric and line-ofsight radio stations linking NATO countries

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UNICOM - for which ITTFL is designing the store and forward portion of a comprehensive world-wide digital communication system for the U.S. Army Signal Corps

OTHERS — include complete development of the ground equipment for the Courier communication satellite, participation as a ground terminal for the NASA Relay satellite program

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□ Tropo Scatter Communications - design and development engineers skilled in radio or wire line communication equipment for voice and data transmission equipment. Design experience in microwave antennas, transmission lines, filters, IF amplifiers, multipliers, parametric amplifiers and varactors. Versed in telephone transmission standards and tropospheric scatter propagation

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SPAN OF THE NEW ORLIK VT-16 sailplane is 52.5 ft.; length is 24.7 ft., height 5.2 ft., wing area of the sailplane is 138 sq. ft.

Czechs Curtail Lightplane Development

By Edith Walford

Brno, Czechoslovakia-Czech aircraft industry is sharply curtailing its planned development of a new series of light-

Aviation program cutback follows recent government policy limiting future production throughout the country generally to a much smaller range of goods than that anticipated in the past.

Skilled labor remains scarce in Czechoslovakia, and the tendency to spread available resources too thinly has recently increased considerably, causing a number of key industries to fall short of predetermined annual target figures. Consequently, the government now is taking steps to reorganize output and ensure that preference is given to the manufacture of commodities which do not impose a continuing drain on the country's limited foreign currency and, so far as aircraft are concerned, have an export sales potential.

Officials of Omnipol Foreign Trade Corp., Czech government agency in charge of export sales of light aircraft and aircraft accessories, outlined to AVIATION WEEK the general plans concerning the aircraft industry's immediate future within this new program during the Fourth International Brno Trade Fair here.

Only two new aircraft are currently being developed-a replacement for the high-wing, four-seat L-60 Brigadyr utility lightplane and a successor to the L-40 Meta-Sokol sport and touring aircraft, both of which were missing among this year's exhibits at Brno as they have been since 1960.

Production of both the twin-engine, four-seat Aero 145 and the L-60 Brigadyr aircraft was discontinued in the fall of 1960, and the Czechs also plan to discontinue production of the L-40 Meta-Sokol series, probably between the end of this year and the beginning of 1963, according to an Omnipol spokesman.

Unlike the multi-purpose Brigadyr, the new utility model is being designed for agricultural use only and if, as is hoped, the first prototype is completed on schedule, it will be introduced at the Fifth International Brno Trade Fair next September.

Aircraft either in the development or production stage that will be dropped under the new program include the following:

 Small turbine-powered, two-seat helicopter designated the Z-35 for domestic use and export.

 HC-103 six-seat version in the Czech HC helicopter series built by the Moravan Aircraft Works, Ostrokovice. Development of the piston-engine V/STOL tilt-wing light aircraft on which design work was begun about one year ago (AW Sept. 18, 1961, p. 23), is

however, continuing. It is scheduled to make its first flight next year, according to an Omnipol spokesman (AW Oct 1,

Four-to-five seat L-200D Morava, latest improved version in the Morava series, was featured prominently in the outdoor aircraft section at Brno this year, but an all-wood, single-seat, standard class sailplane, the Orlik VT-16, built by the Orlican Works, Chocen, was the only really new exhibit in the

Other aircraft shown included the now-familiar Z-326 Trener Master; the HC-102 Heli-Baby, predecessor of the HC-103 helicopter; the all-metal L-13 Blanik sailplane, in addition to the Orlik sailplane, and the L-200D Morava

The two-seat multi-purpose HC-102



ORLIK VT-16 all-wood single-seat sailplane designed for standard class service training was the only new entry shown in the aircraft section at Czechoslovakia's recent Fourth International Brno Trade Fair. Orlik is seen on left of picture behind L-13 all-metal Blanik sailplane. On the right is an HC-102 Heli-Baby helicopter behind a Z-326 Trener Master, latest version in the Czech Trener Master acrobatic lightplane series.



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helicopter is now being used in Czechoslovakia as a civil and military trainer and courier aircraft, and last year the Czech national carrier, CSA Czechoslovak Airlines, added several of this type to its fleet. Originally, a first production series of 200 was planned. However, only between 60 to 80 were built, according to Omnipol Sales Manager Ing. Skocdopole, before production was discontinued last fall pending any additional orders that would warrant quantity production (AW Oct. 16, 1961, p. 83).

In addition to a more sophisticated interior finish than that incorporated in previous models, the L-200D Morava shown at Brno this year included two

major modifications:

 Three-blade constant-speed V-506 propellers fitted with deicing equipment made by the Avia Works of Prague to replace the two-blade variable-speed V-410 type propellers on the earlier Morava series.

 Czech-built RKL 301 radio compass first introduced at Brno last year, now has been installed to provide the aircraft with an all-weather capability. Export price of the L-200D model, including full instrumentation, is \$46,-

250.

The Orlik VT-16 sailplane, with a low cantilever wing and Plexiglass covered cockpit, has been designed for standard class service flying. Total of 150 have been built thus far and delivered to Czech aero clubs. Although the VT-16 is intended initially for internal use only, an Omnipol spokesman says, it may be made available for export later, once home market requirements are fulfilled.

With an empty weight of 484 lb., its maximum flight weight is 704 lb. Span is 52.5 ft., length 24.7 ft., height 5.2 ft. and wing area 138 sq. ft.

Performance details include a maximum glide rate of 1:32-1 at 46 mph., minimum sink rate of 1.84 fps. at 39 mph., and a minimum speed of 38.5 mph.

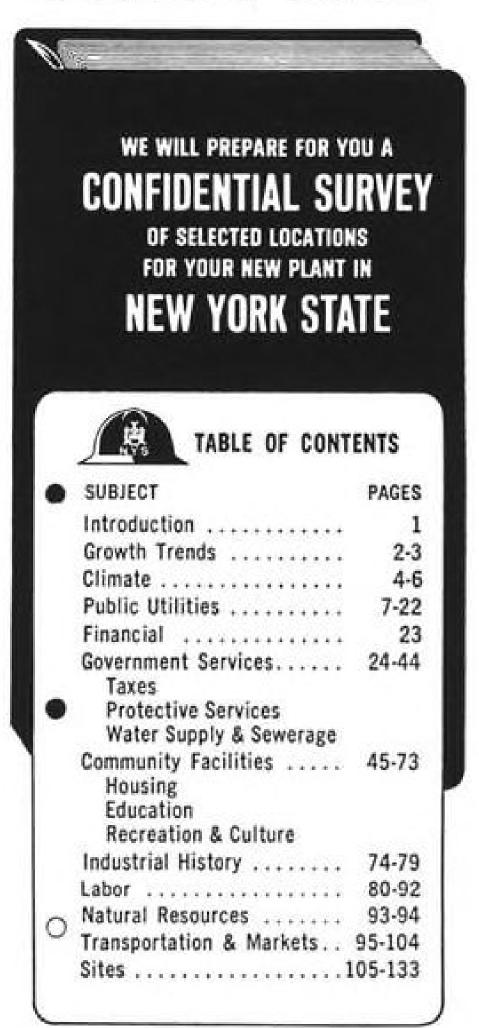
Maximum speed when towed by an aircraft is 87 mph., by tow-winch 68 mph. Maximum speed permitted in vertical flight is 124 mph.



S-58 Used for Demolition

Sikorsky S-58 helicopter was used recently to knock down a 204-ft.-high building on the New Jersey shore of the Hudson River. S-58 carried a 1,000-lb, steel ball suspended from a 100-ft, cable. Helicopter was used to evaluate practicality of using such aircraft for demolition projects by Kaiser-Nelson Steel and Salvage Corp. of Cleveland, Ohio.

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- Dynamist, Trajectory Analysis
- · Missile Structures Analyst
- Rocket Propulsion Analyst

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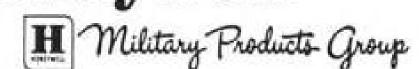
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Publications Received

Government Contracts Handbook—Gilbert A. Cuneo—Machinery & Allied Products Institute, 1200 18th St., N. W., Wash. 6, D. C. Member Companies—\$15.00 per copy, nonmember companies—\$25.00. 375 pp. Inclusive coverage of the many phases of government contracting supplemented by bibliographies and reference tables.

Planning & Design of Airports—Robert Horonjeff—McGraw-Hill Book Co., Inc., 330 W. 42 St., N. Y. 36, N. Y. \$14.50; 464 pp. Available methods for structural design of pavements and drainage. Relates aircraft performance and characteristics to geometric design of runways, taxiways and aprons; operation of ATC and relation to airport capacity.

Systems Philosophy—David O. Ellis, Fred J. Ludwig—Prentice-Hall, Inc., Englewood, N. J. \$13.00; 387 pp. View of concepts involved in the engineering and management of man-made systems and man/machine systems.

Electromechanical Components for Servomechanisms—Sidney A. Davis, Byron K. Ledgerwood—McGraw-Hill Book Co., Inc., 330 W. 42 St., N. Y. 36, N. Y. 511.50; 338 pp. Explains potentiometers, synchros, induction potentiometers and resolvers, tachometers, and a.c. and d.c. servomotors, with design features of various components.

Pulsating Combustion—collected works of F. H. Reynst—Pergamon Press, Inc., 122 E. 55 St., N. Y. 22, N. Y. \$15.00; 310 pp. Papers presented in chronological order with Reynst's contributions to combustion science enumerated and reference to papers describing ideas given by Professor M. W. Thring.

The Determination of Orbits—A. D. Dubyago—The Macmillan Co., 60 Fifth Ave., N. Y. 11, N. Y. \$12.50; 431 pp. Translated from the Russian by R. D. Burke, G. Gordon, L. N. Rowell, and F. T. Smith, all of the Rand Corp. Primarily deals with computation of the heliocentric orbits of asteroids, comets, and meteors.

Electronic Equipment Design and Construction—Geoffrey W. A. Dummer, Cledo Brunetti; Low K. Lee—McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. 36, N. Y. \$8.50; 241 pp. Techniques and basic working data necessary for constructing electronic equipment are recommended.

Flight Test Instrumentation—edited by M. A. Perry—Pergamon Press, Inc., 122 E. 55 St., N. Y. 22, N. Y. \$8.50; 153 pp. Papers of the First International Flight Test Instrumentation Symposium, sponsored by the Dept of Flight, College of Aeronautics, Cranfield, England.

Structural Design of Missiles and Space-craft—Lewis H. Abraham—McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. 36, N. Y. \$12.50; 335 pp. Covers advances in field of thermal stress, thermodynamics, manufacturing technology, and structure analysis methods.

Nonlinear & Parametric Phenomena in Radio Engineering—A. A. Kharkevich—John F. Rider Publisher, Inc., 116 W. 14th St., N. Y. 11, N. Y. \$6.50; 208 pp. Translated from Russian. Discusses theory of operation of oscillation in oscillators, development of limit cycles, parametric action and related subjects.



Boom Dusting Demonstrated by Hughes 269A

Hughes 269A helicopter is fitted with Agricultural Aviation Eng. Co. span flow boom duster in a recent demonstration. New concept uses air pressure injection system causing chemicals to act as liquid to permit pumping through separate tubes to orifices on booms.

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SOLID STATE PHYSICIST OR CHEMIST — PhD plus at least 5 years experience to direct basic materials research section working in superconducting alloys, magnetoacoustics, ultrahigh pressure, physics of failure in metals and non-metals.

BIOPHYSICIST — PhD to conduct basic research in Bionics.

ENGINEERING METALLURGIST - B.S. or M.S. in Metallurgical Engineering plus 2 years experience in industrial physical materials laboratory work to perform laboratory tests involving physical, fatigue testing and metallography.

SENIOR ENGINEERING METAL-LURGIST - M.S. or PhD in Metallurgy or Metallurgical Engineering plus 2 years experience in industrial or academic physical metallurgical laboratories to perform advanced physical metallurgical testing and research.

CERAMIC ENGINEER - B.S. or M.S. in Ceramic Engineering plus 3 years experience in aerospace industry or related fields to perform work in refractory materials research and development which includes ceramic materials, protective coatings, and electromagnetic materials.

SCIENCE INFORMATION SPE-CIALIST—Advanced degree in Library Science with an undergraduate degree in Engineering or a Physical Science to perform work exclusively directed to the support of research programs, through literature searches, etc. Experience is essential.

SPACE SYSTEMS ANALYSIS -PhD's in engineering, physics or mathematics are needed for work on advanced scientific and military space projects. These assignments will involve conceptual design studies which will include feasibility studies, evaluation of system requirements, and evaluation of various approaches. The individual will not only be responsible for performing such work himself, but will also be expected to coordinate studies by groups of technical specialists. In addition, he will make customer contacts and maintain customer liaison.

OPERATIONS RESEARCH ANA-LYSTS — Operations Research and Systems Analysis (For Space Systems) - Individuals with desire to do broad conceptual analysis in the need for, requirements for, and the determination of capabilities of proposed systems to meet future space needs. Advanced degrees and experience in systems thinking desirable.

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to perform research and development on contracts involving air and space vehicles, ground installations involving radar cross section techniques, and reconnaissance data processing.

AERODYNAMICS ENGINEERS -B.S., M.S. or PhD to conduct theoretical and applied studies in the area of supersonic and hypersonic compressible, viscous, real gas flows. This work is directed toward the complete appraisal of the aerodynamics of re-entry of orbital and space vehicles.

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WHO'S WHERE

(Continued from page 23)

Changes

Bernard Strassburg, head of the newly established Office of Satellite Communications, Common Carrier Bureau, Federal Communications Commission, Washington, D. C.

Howard W. Kreiner, director, Operations Evaluation Division of the Operations Evaluation Group, Center for Naval Analyses, Arlington, Va.

Richard J. Wood, assistant weapon system manager, Beech Aircraft Corp.'s Aerospace Division, Wiehita, Kan.

Carl H. Amme, Jr., senior operations analyst, Defense Analysis Center, Stanford Research Institute, Menlo Park, Calif.

Col. Robert W. Van Wert, director, Directorate of Supply and Maintenance, Army Missile Command, Redstone Arsenal,

Winfield G. Wagener, manager, Technical Services, International Operations Section of Varian Associates, Palo Alto, Calif.

Charles O. Miller, special assistant to the Director of the Flight Safety Foundation, New York, N. Y.

Dr. Kenneth G. Halvorsen, technical director, Beckman Instruments, Inc., Fullerton, Calif.

Andrew Williams, cost reduction manager-Apollo, Lockheed Propulsion Co., Redlands, Calif.

Richard W. Lindgren, executive assist-

ant, Hughes Aircraft Co.'s International Group, Culver City, Calif.

Paul M. Hachigian, director of engineering, International Electric Corp., Paramus, N. J., a subsidiary of International Telephone and Telegraph Corp., and George S. Mauksch, director, Development Division of International Electric Corp.

James L. Clark, manager of AN-MPQ-32 weapons-locating radar program, Eastern operation of Sylvania Electronic Systems, Waltham, Mass., a division of Sylvania Electric Products, Inc. Other Eastern operation appointments: Richard R. Fidler, assistant director of engineering; Daniel J. Crowley, marketing manager.

Robert L. Kirby, associate department head, The Mitre Corp.'s Systems Integration Office, Bedford, Mass., and Dr. David F. Votaw, Jr., associate head of the Economic Factors Department.

Jack Shaver, manager of International Programs, Douglas Missile & Space Systems Division, Santa Monica, Calif.

Thomas H. Pretorius, central regional sales manager, Northrop Space Laboratories, Dayton, Ohio.

Capt. J. H. Terry (USN, ret.), quality control manager, Granger Associates, Palo Alto, Calif.

Harry W. Scudlo, manager of manufacturing, Standard Products, Inc., Wichita, Kan., a subsidiary of Electronic Communications, Inc.

chief engineer for space technology-Apollo engineering, North American Aviation's Space and Information Systems Division, Downey, Calif.

Daniel R. Fisher, assistant manager, Surface Armament Division, Sperry Gyroscope Co., Great Neck, N. Y., and Donald E. Lange, director of marketing, Sperry's Air Armament Division.

Henry H. Hovland, district manager, The Marquardt Corp.'s Washington, D. C., office, succeeding E. G. Riley, resigned. Also: Marquardt has established a corporate field office at Houston, Tex., and appointed James E. McHenry, field office manager, and Paul J. Papanek, corporate sales manager.

Harry L. Thurman, deputy director of special products, Systems Management Department, Westinghouse Defense Center,

Dr. George H. Lee, chief of ground warfare technology, Minneapolis-Honeywell's Research and Development Planning and Management Activity, Military Products Group, Washington, D. C., and Murray Greyson, staff scientist.

Joseph L. Borden, director of engineering, Vernistat Division, Perkin-Elmer Corp., Norwalk, Conn.

Robert J. Baumann, manager, Spinco Division of Beckman Instruments, Inc., Palo Alto, Calif., and Louis B. Horwitz, manager, Systems Division, Fullerton,

Kenneth E. Cochran, assistant manager for operations, Department of Engineering Physics, Battelle Memorial Institute, Columbus, Ohio.

George P. Bates, Jr., deputy director of Dr. John F. McCarthy, Jr., assistant the Federal Aviation Agency's Aircraft Development Service.

Ernest Stern, manager, Sensor Department, Spacecraft Organization, Lockheed California Co., Burbank, Calif.

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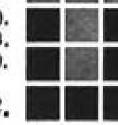


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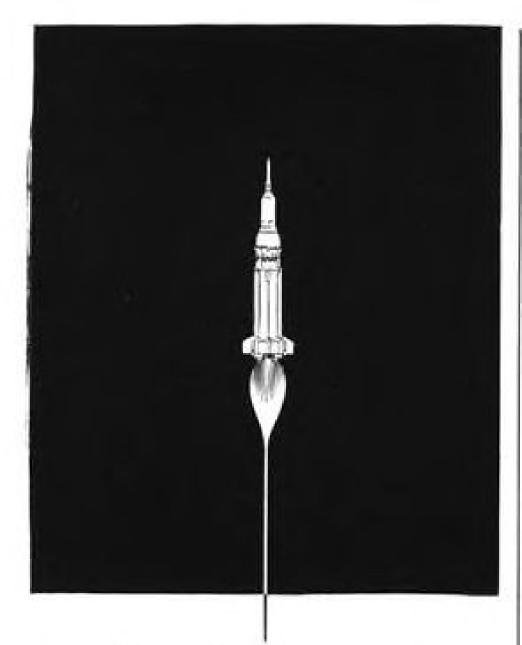
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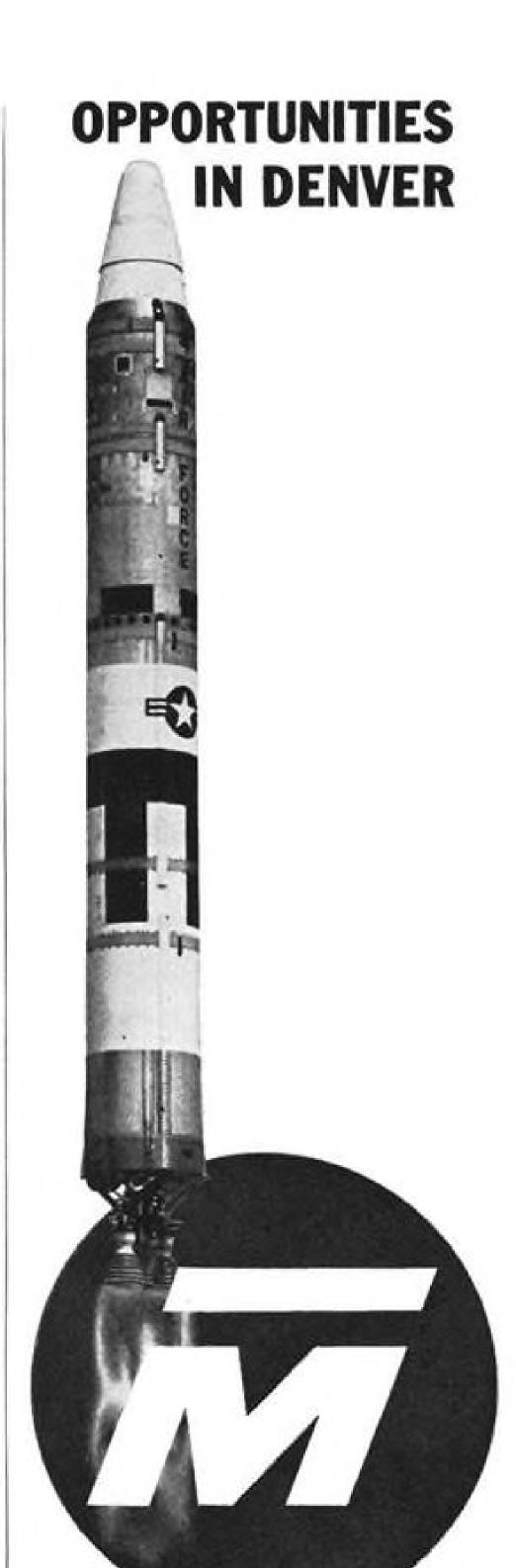
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Of complete rocket motors, including pressure vessels, nozzles, all accessories. Experience in fluid flow, stress analysis, heat transfer, and mechanics desirable.

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Theoretical and applied studies of combustion process in rocket chamber under
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GAS DYNAMICS (MS, PhD). Analytical and experimental studies of particle flow, nozzle efficiency, altitude performance parameters, thrust magnitude and vector control.

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STRESS ANALYSIS (BS, MS, PhD). Analysis of filament-wound pressure vessels and rocket motor components.



Write in confidence to: Mr. W. D. Linkenhoker, Dept. 2K-3

ENGINEERING SPECIALISTS (BS, MS, PhD). 8-10 years experience; analysis, heat transfer, systems analysis, missile ballistics, internal rocket ballistics, insulation, fluid dynamics.

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TEST ENGINEERING (BS, MS). Build and analyze static firing test stands and associated hardware. Recommend range handling and operating equipment including environmental test.

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DATA REDUCTION (BS, MS). Prepare calculation systems for programming complex data into IBM 7074 computer.

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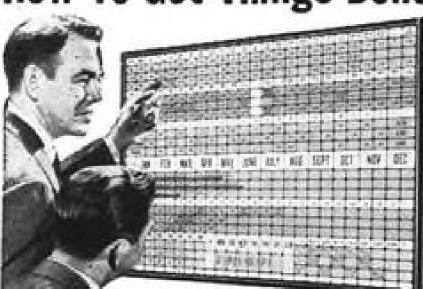
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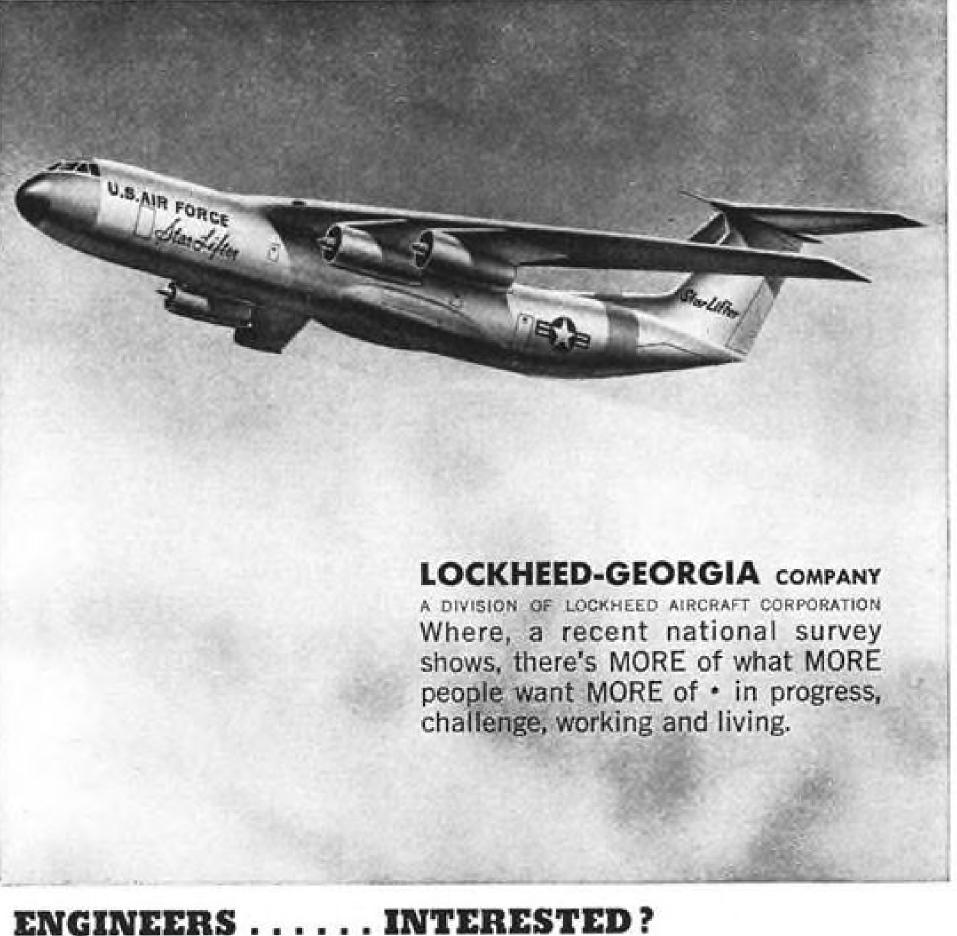
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LETTERS

Machine Gun Search

I am requesting your assistance in helping the Air Force Museum locate the following World War 1 machine guns essential to the successful completion of the museum's World War 1 exhibit area:

• Machine Gun, World War 1, German Parabellum, 7.92 mm., aircraft type.

• Machine Gun, World War 1, French Hotchkiss better known as the Benet-Mercie-used during the early part of the

• Machine Gun, World War 1, U. S., Lewis Model 1918-aircraft type-used as rear gun on DH-4s.

• Machine Gun, World War 1, U. S., Marlin Models 1917 or 1918. Used as forward synchronized firing gun.

The Air Force Museum is not permitted to purchase historical items and must depend solely on loans or donations. Individuals or organizations are requested to contact the Director, Air Force Museum, Wright-Patterson Air Force Base, Ohio, for details concerning loan agreements or taxdeductible donations.

> WILLIAM J. RATSCH, JR. Chief, Information Office Air Force Museum Wright-Patterson AFB, Ohio

Digital Input

Your issue of Sept. 24 (p. 126) lists an answer to the problematical recreations No. 136, of Litton Industries advertising of the issue of Sept. 17, as 998,001 equals (998 plus 001)2.

It might interest you to know that another six digit number exists with the same property, namely, 494,209 equals (494 plus 209)2.

S. M. Hamzeh Dynamics Engineer Bell Helicopter Co. Fort Worth, Tex.

'Duplex' Misnomer

Your article, "Exploratory FAA Tests Completed on U.K. Automatic Landing System," (AW Aug. 20, p. 98) comments that a duplex system is being designed by Elliott Bros. for the VC.10.

This is misleading as the word "duplex" in this context normally refers to systems which disengage completely following a failure in either channel. In fact the VC.10 system has a failure survival capability equivalent to that of the triplex installation proposed for the Short Belfast transport. The Elliott system achieves this with two separate autopilots, each having a complete parallel comparison monitor.

The system is referred to as "monitored duplicate" and it deteriorates to the equivalent of "duplex" only after the first critical

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R. W. Howard, Manager Transport Aircraft Controls Division Elliott Brothers (London) Ltd. Borehamwood, England

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.

Redesignation

On p. 66 of Aviation Week and Space TECHNOLOGY, issue of Sept. 17, you show an airplane designated as a Douglas B-26.

World War 2 pilots were taught that Martin Aircraft Co. made the B-26, otherwise known as the Marauder. (This is not it in your picture.)

Is the airplane you show a modified version of the old A-20 Havoc?

> RICHARD BRUNELL Air Preheater Corp. Wellsville, N. Y.

(USAF changed designation in 1948 when it eliminated the A for attack category and changed the Douglas A-26 light bomber to B-26. At that time only one Martin B-26 remained in the USAF inventory.—Ed.)

Number of Successes

We of the Field Projects Branch of NASA's Goddard Space Flight Center, who are responsible for launch operations of the Delta Program at AMR, appreciate your kind words in the Tiros 6 story (AW Sept. 24, p. 441). However, in the interest of accuracy, I must point out that this was the eleventh consecutive Delta success, not the tenth. The Telstar launch on July 10 was the tenth.

Your photo story on the Echo type balloon (p. 80) was also of interest to us. The same NASA/Douglas team at AMR is responsible for the launches of these "Big Shot" vehicles.

JOHN J. NEILON Associate Chief Field Projects Branch Goddard Space Flight Center Greenbelt, Md.

Missing by Miles

I read with interest your article that was in the Aug. 13 issue titled "Boeing Faces Unique Fabrication Challenge in Developing NASA's Saturn S-1C Booster" (p. 52). This was a good writeup. I would like to call your attention to one error noted on p. 59. There are not six miles of welding on the S-1C vehicle. There are close to 0.5 mi, or 32,000 to 33,000 in, of weld. I felt sure you might want to include this correction.

WILLIAM A. WILSON Chief, Methods Research and Development Branch, NASA Huntsville, Ala.

(The correct 33,000 in. of weld figure was given in the paragraph above the error. The translation into miles should have read 0.5 mi.-Ed.)

12-Point Star

The inside story on the Nationalist Chinese U-2 flights over the Chinese mainland, (AW Sept. 17, p. 29), was off the track when it came to the Chinese Republic's insignia. It is not a 24-point white star in a blue field encircled by a white band as stated-but a 12-point star in a blue field encircling a white circle outlined by a blue

The device was originally designed by Dr. Sun Yat-Sen in 1906 during an assembly of the Revolutionary League in Tokyo prior to the Chinese revolution. Although the Chinese Republic was established in 1911, Dr. Sun's design, originally incorporated in a national flag, wasn't adopted until Oct. 8, 1928, after Chiang Kai-Shek had succeeded in establishing his Central Government at Nanking.

Various versions of the insignia had appeared on Kuomintang aircraft prior to official adoption, but following this date the insignia was formalized with minor change taking place until the present time. The 12-points stand for the twelve two hour periods in the traditional Chinese day, and symbolize progress.

The blue stands for "rights," the white for "livelihood." The same device is carried in a blue field in the flag of the Chinese

Nationalist aircraft also carry twelve alternate white and blue horizontal stripes on the rudder.

Although the insignia is "new" for the 20th Century, the symbolism of twelve progressive segments in a 24 hr. day is ancient, and still a part of Chinese tradition on the

> RICHARD M. BUESCHEL Mt. Prospect, Ill.

Credit Expansion

Your Industry Observer column for Aug. 27 (p. 23) gives credit for the development of the 20-mm, cannon Mark II to Hughes Tool Co. It is felt that this statement should be amplified to place credit where

Mr. Frank Marquardt, who is with the Bureau of Naval Weapons, conceived the original design of the Mark II and this cannon for several years was known by Naval personnel as the "Marquardt Gun." A number of prototypes were designed and they were fabricated by the Aviation Ordnance Group of the now closed Naval Gun

The first guns were test fired at the Naval Proving Ground, Dahlgren, Va., in the early 1950s in order to prove the feasibility of the

I am sure the personnel involved will greatly appreciate this correction, even though the groups have been disbanded and scattered.

Hughes Tool Co. should be commended for an excellent job of production engineering with the present Mark II cannon, as a result.

> . F. Plexico Huntsville, Ala.

AVIATION WEEK and SPACE TECHNOLOGY, October 15, 1962



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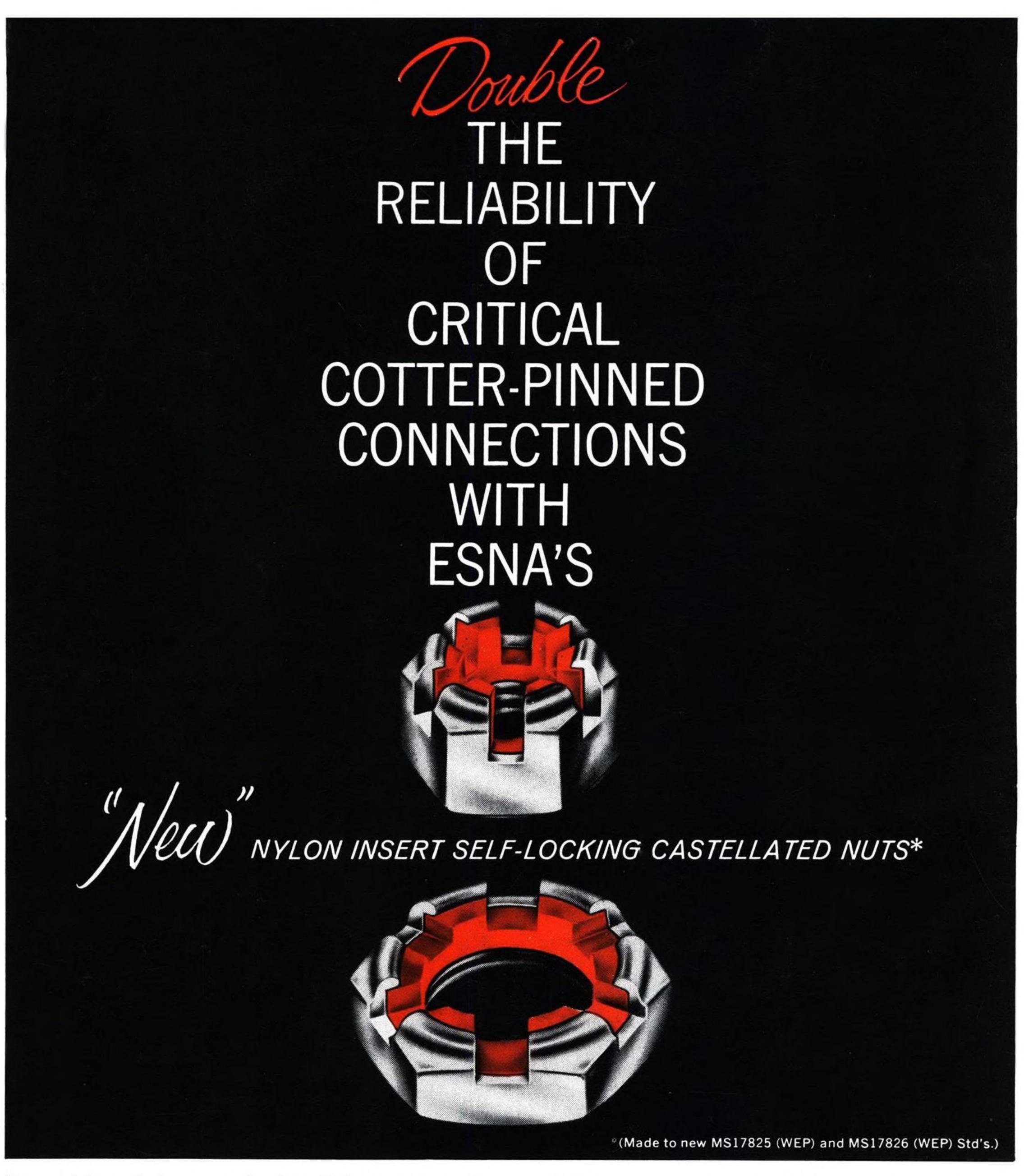
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safe" extra was revealed by laboratory tests to destruction: even when threads were deliberately stripped upon installation, the new ESNA parts consistently withstood vibration loosening for extended periods of time.

For a set of standard drawings with complete dimensional and performance details of the new ESNA castellated nuts, or samples: write to: Dept. S76-1025.



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