Aviation Week & Space Technology

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April 16, 1962

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McDonnell Gemini Mockup

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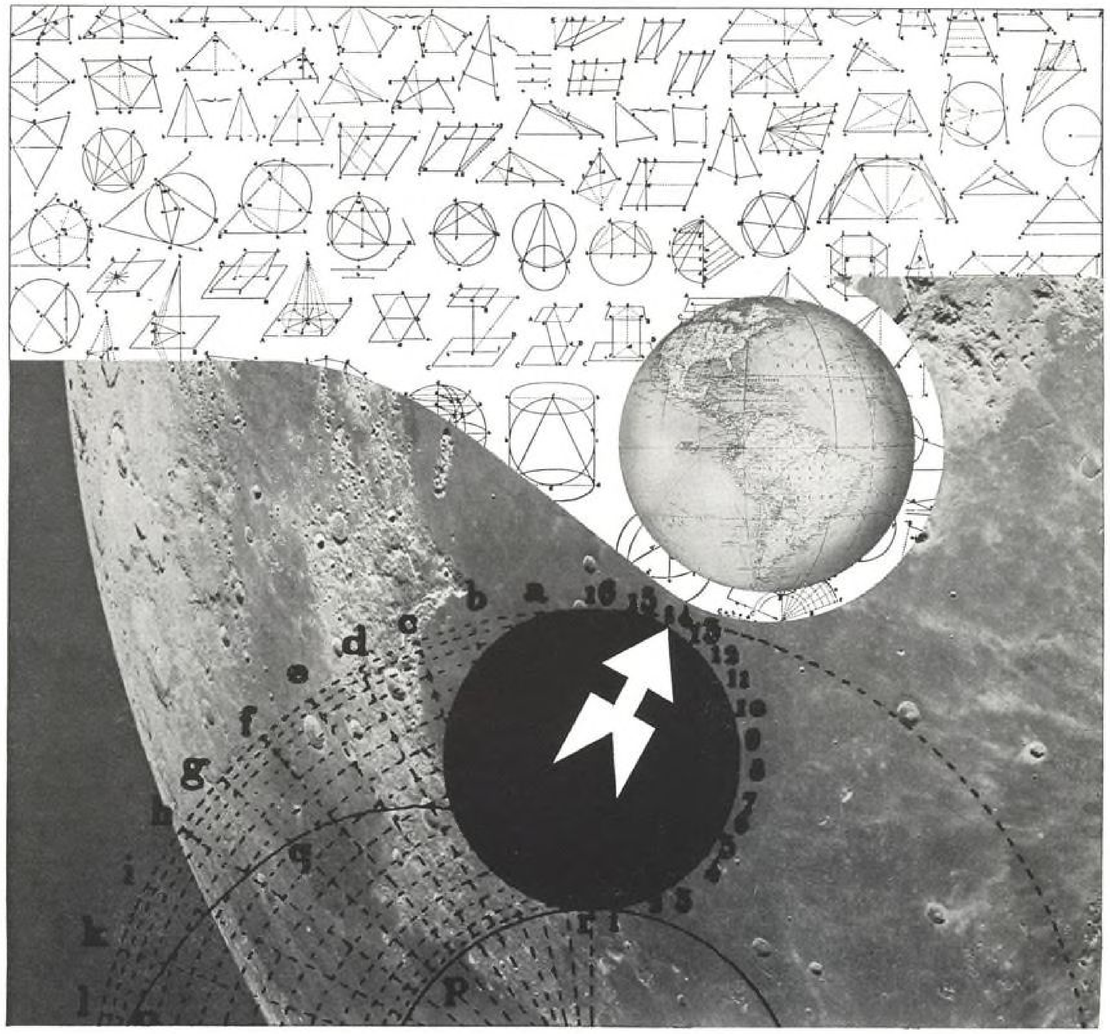


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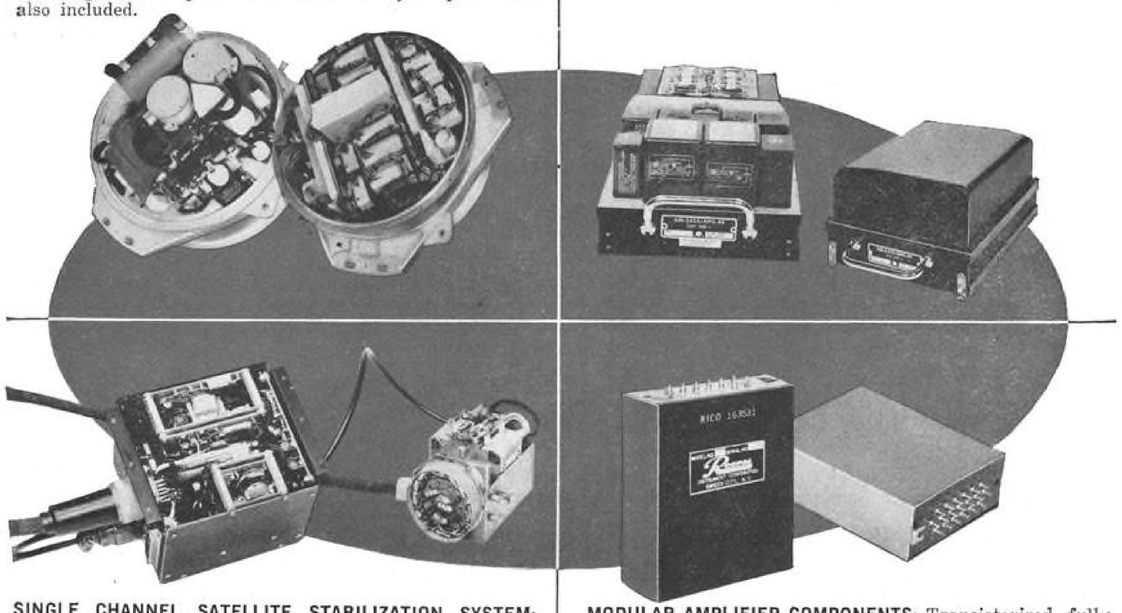
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AEROSPACE CALENDAR

Apr. 24-26—Polytechnic Institute of Brooklyn's Symposium on the Mathematical Theory of Automata, United Engineering Center, New York, N. Y.
Apr. 25-29—Western Space Age Industries and Engineering Exposition, Cow Palace, San Francisco, Calif.
Apr. 26-27—Quarterly Regional Meeting, Assn. of Local Transport Airlines, Hilton Inn, Atlanta, Ga.
Apr. 29-May 8—Hanover Air Show, Hanover, Germany.
Apr. 30-May 1—Annual Meeting, National Aeronautical Services Assn., Shoreham Hotel, Washington, D. C.
Apr. 30-May 2—Meeting on Manned Space Flight, Institute of the Aerospace Sciences, Hotel Chase, St. Louis, Mo.
Apr. 30-May 3—Design Engineering Show & Conference, McCormick Place, Chicago.
May 1-3—Spring Joint Computer Conference, Fairmont Hotel, San Francisco.
May 1-3—Biologistics for Space Systems Symposium, Biltmore Hotel, Dayton, Ohio. Sponsor: Aerospace Medical Research Laboratories, Aeronautical Systems Division, AFSC, Wright-Patterson AFB.
May 2-3—Sixth Navy Science Symposium, U. S. Naval Radiological Defense Laboratory, San Francisco, Calif. Sponsor: Office of Naval Research.
May 2-4—18th Annual National Forum, American Helicopter Society, Sheraton Park Hotel, Washington, D. C.
May 2-11—International Space Research and

(Continued on page 7)

AVIATION WEEK and Space Technology

April 16, 1962

Vol. 76, No. 16

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AEROSPACE CALENDAR

(Continued from page 5)

Technology Exhibition, London, England. Sponsor: British Interplanetary Society.

May 3-4—First International Congress on Human Factors in Electronics, IRE, Lafayette Hotel, Long Beach, Calif.

May 7-9—Materials & Processing for Space Environments Symposium, Society of Aerospace Material and Process Engineers, Hotel Statler, St. Louis, Mo.

May 7-11—Annual Conference, Society of Photographic Scientists and Engineers, Somerset Hotel, Boston, Mass. Co-sponsor: AF Cambridge Research Laboratories.

May 7-11—1962 Tool Exposition & Engineering Conference, Public Auditorium, Cleveland, Ohio.

May 8—Management Conference on Marketing in the Defense Industries, Boston College, Chestnut Hill, Mass. Sponsors: American Marketing Assn.; Bureau of Business Research, Boston College.

May 8-10—12th Annual Electronics Components Conference, Marriott Twin Bridges Motor Hotel, Washington, D. C.

May 8-10—Second National Conference on Peaceful Uses of Space, Seattle, Wash. Sponsor: National Aeronautics and Space Administration.

May 11-12—Western Regional Convention, Air Traffic Control Assn., Senator Hotel, Sacramento, Calif. Fly-In: Mather AFB.

May 14-16—National Aerospace Electronics Conference, Institute of Radio Engineers, Biltmore Hotel, Dayton, Ohio.

May 14-16—Joint Technical Society-Department of Defense Symposium on Thermionic Power Conversion, Antlers Hotel, Colorado Springs, Colo.

May 14-17—21st Annual National Conference, Society of Aeronautical Weight Engineers, Benjamin Franklin Hotel, Seattle.

May 16-18—Spring Meeting, Society for Experimental Stress Analysis, Sheraton-Dallas Hotel, Dallas, Tex.

May 17-18—Spring Meeting, Jet Testing Assn., Allison Division, General Motors Corp., Indianapolis, Ind.

May 20-24—Annual Conference, American Assn. of Airport Executives, Ambassador Hotel, Los Angeles, Calif.

May 20-26—Annual Meeting, Aviation/Space Writers Assn., Mark Hopkins Hotel, San Francisco, Calif.

May 21-22—Annual Meeting and Aviation Fire Safety Seminar, National Fire Protection Assn., Sheraton Hotel, Philadelphia, Pa.

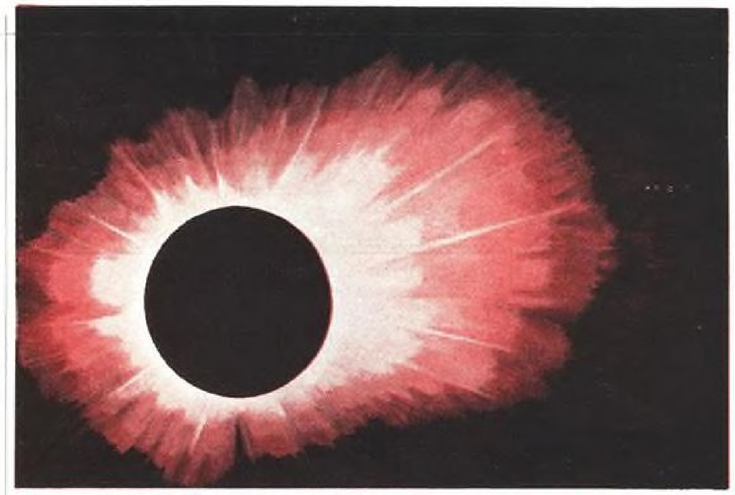
May 21-25—Second Annual Air Transportation Conference, New York University, Washington Square Center, New York, N.Y. Co-sponsor: International Transport Institute.

May 21-25—Eighth Aerospace Instrumentation Symposium and National Telemetering Conference, Sheraton Park Hotel, Washington, D.C.

May 22-24—Conference on Self-Organizing Systems, Museum of Science and Industry, Chicago, Ill. Sponsors: Office of Naval Research; Armour Research Foundation.

May 22-24—National Microwave Theory & Techniques Symposium, Institute of Radio Engineers, Boulder, Colo.

(Continued on page 9)



SOLAR ENERGY WHERE THERE IS NO SUN?

Man is accustomed to the age-old concept of night and day. Long hours of sunshine, equally long hours of darkness. Not so, during Earth Orbit, in the unexplored regions of outer space, when life-giving rays of the Sun are eclipsed for a brief period every hour. Though momentary, these periods of darkness threaten the feasibility of Solar Powered space vehicles. This is but one of the many challenges confronting Ken Nichols and his associates at Sundstrand Aviation-Denver. Ken is Project Manager, guiding the development of a 15 KW (electrical) Solar Dynamic Space Power System under Air Force Contract. ■ Briefly, the system is comprised of a huge mirror which reflects solar energy into a boiler. Here, under intense heat, liquid metal is vaporized, thus powering an axial flow turbine which drives a generator floating on liquid metal bearings. Sundstrand had to devise a method for continuing the generation of power, when solar energy was blotted out by the Earth's shadow. In some Earth Orbits, night would last only a short period of time. Even so, energy must be stored during this brief period in order to sustain electrical power aboard the vehicle. Ken and his fellow workers believe they've solved the problem. They are testing a system which utilizes the phenomenon of the latent heat of fusion. Salts of some metals, when changing from liquid to solid state, release large amounts of thermal energy. This heat provides for continued accessory **power where there is no sun.** The Solar Mechanical Engine is but one of four important Space Power Systems for which Sundstrand has been given the responsibility of development. ■ Each day, engineers at Sundstrand are confronted by such vexing problems as the containment of highly corrosive liquid metals, finding adequate methods for operating in Zero G environment, and liquid metal journal bearing performance. ■ Still, never let it be said that Sundstrand employees live with their heads in the clouds. They appreciate the permanent, ideal working conditions . . . Colorado's exceptional recreational opportunities . . . the friendly, congenial Mile-high surroundings. And most of all, they are enthusiastic about the myriad challenges that confront them daily. Each has the satisfaction of knowing that he is taking an active part in the conquest of space. ■ If YOU are a qualified space age engineer or technician and would like to meet the challenges of tomorrow, act today! Apply in person or send a resume of qualifications to:

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AEROSPACE CALENDAR

(Continued from page 7)

May 24-26—Seventh Region Conference on Space Communications, Institute of Radio Engineers, Seattle, Wash.

May 30-June 2—14th Annual Wright Memorial Glider Meet. For information: Soaring Society of Dayton, Inc., Far Hills Branch, P. O. Box 581, Dayton 19, Ohio.

June 6-7—Symposium on Standards for Filament-Wound Reinforced Plastics, Naval Ordnance Laboratory, Silver Spring, Md.

June 6-8—Eighth Annual Radar Symposium (classified secret), Institute of Science and Technology's Radar Laboratory, University of Michigan, Ann Arbor.

June 8-9—13th National Maintenance and Operations Meeting, Reading Aviation Service, Inc., Reading, Pa.

June 13-15—Annual Meeting, Heat Transfer and Fluid Mechanics Institute, University of Washington, Seattle, Wash.

June 18-Aug. 10—Advanced Subject Matter Institute on Nuclear Rocket Propulsion, University of Florida, Gainesville, Fla. Sponsor: National Science Foundation.

June 19-21—39th Meeting, Aviation Distributors and Manufacturers Assn., Ambassador Hotel, Los Angeles.

June 19-22—Summer Meeting, Institute of the Aerospace Sciences, Ambassador Hotel, Los Angeles, Calif.

June 20-22—Annual Convention, Airline Ground Transportation Assn., Barclay Hotel, New York, N. Y.

June 25-27—Sixth National Convention on Military Electronics, Institute of Radio Engineers, Shoreham Hotel, Washington.

June 25-30—Symposium on Electromagnetic Theory & Antennas, Copenhagen, Denmark. Sponsors: Technical University of Denmark; International Scientific Radio Union.

June 26-28—Aviation Conference, American Society of Mechanical Engineers, University of Maryland, College Park, Md.

June 27-28—Ninth Annual Symposium on Computers and Data Processing by the University of Denver's Denver Research Institute, Elkhorn Lodge, Estes Park.

June 27-29—Joint Automatic Control Conference, Institute of Radio Engineers, New York University, New York, N. Y.

July 17-19—Lunar Missions Meeting, American Rocket Society, Pick Carter and Statler Hilton Hotels, Cleveland, Ohio.

Aug. 10-11—Future of Manned Vehicles in Air and Space, Institute of the Aerospace Sciences, Olympic Hotel, Seattle, Wash.

Aug. 21-24—Western Electronics Show and Conference, Institute of Radio Engineers, Los Angeles, Calif.

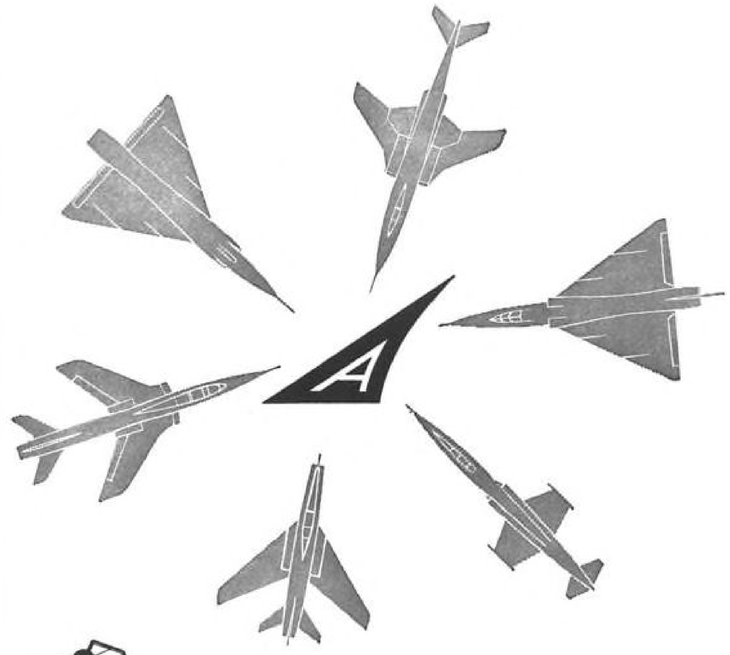
Aug. 21-Sept. 17—14th Session, International Civil Aviation Organization Assembly, Rome, Italy.

Aug. 27-Sept. 1—Third International Congress, International Council of the Aeronautical Sciences, New Congress Hall, Stockholm, Sweden.

Sept. 3-9—1962 Flying Display and Exhibition, Society of British Aircraft Constructors, Farnborough, England.

Sept. 10-14—Annual General Meeting, International Air Transport Assn., Dublin, Ireland.

Sept. 18-23—16th National Convention & Aerospace Panorama, Air Force Assn., Las Vegas, Nev.





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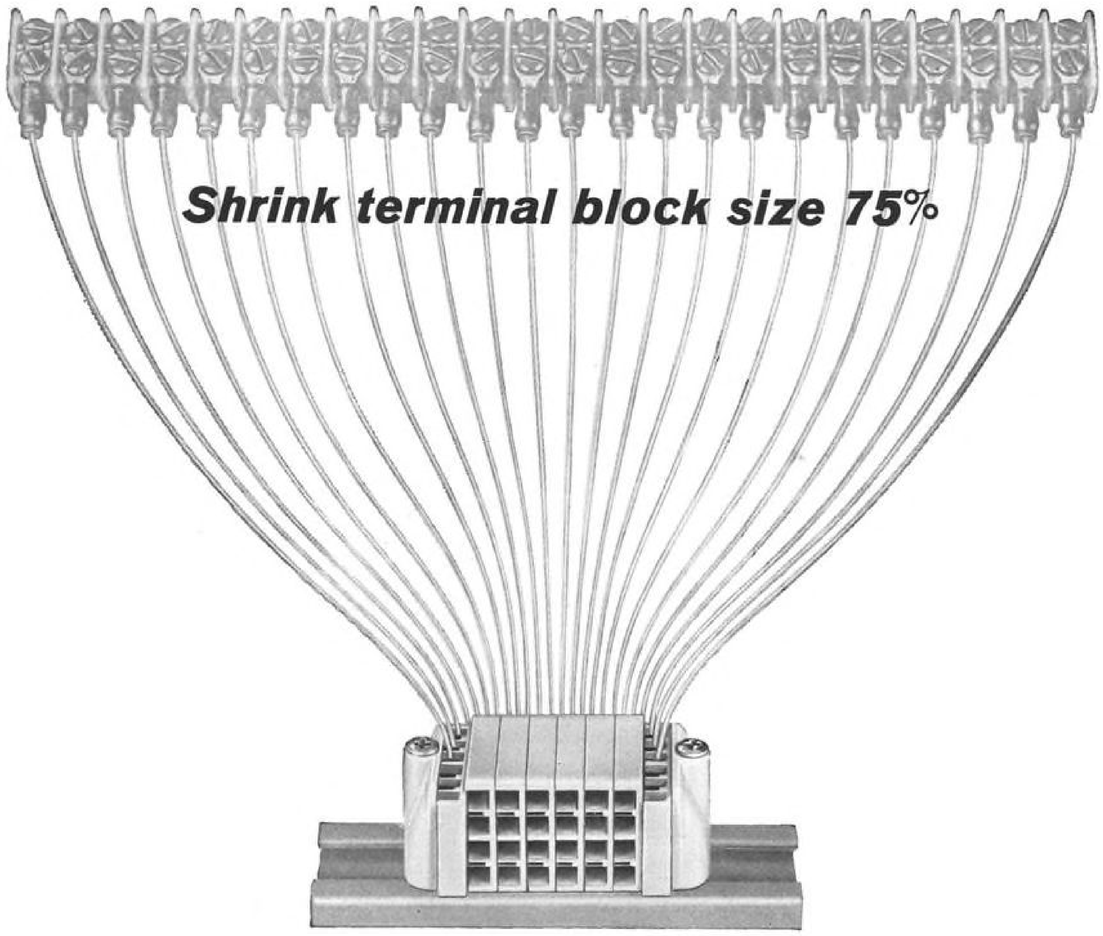
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Very truly yours,
A. C. Ford
Superintendent of Engineering

ACF:jk

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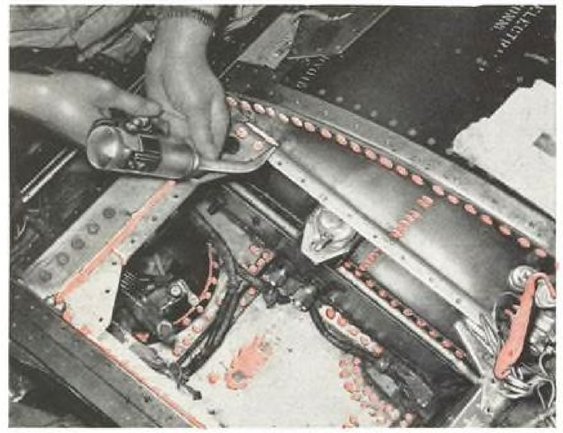
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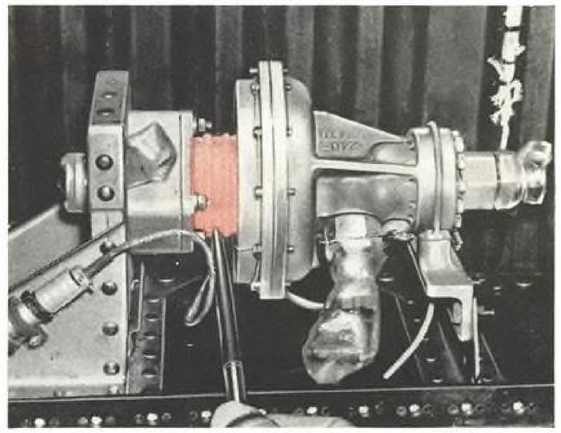
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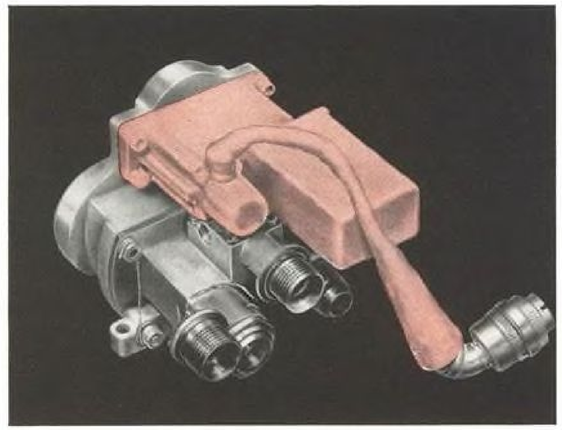
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RTV adhesive seals heating blanket for helium pressure regulator. RTV rubber forms tenacious bonds to most materials provided surfaces are properly primed. It is easily removed from unprimed surfaces. It can be applied by dipping, pouring, spraying or buttering—cures in place at room temperature to form a tough, flexible seal. Cure times can be varied from minutes to hours depending on catalyst used and heat, if applied.



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Viscosity, Poises	120	300	450	550	8,000	10,000	12,000
Color	White	Pink	White	Red	White	Red	Red
Consistency	Easily Pourable	Pourable			Spreadable Thixotropic Paste		Stiff Paste
Temperature Resistance	FROM −90°F TO +600°F FOR EXTENDED PERIODS TO 9,000°F FOR LIMITED TIME AS THERMAL INSULATION						
Specific Gravity	1.18	1.35	1.37	1.47	1.33	1.47	1.47
Radiation Resistance	10^7 ergs/gram						
Tensile Strength, psi	350	450	550	650	500	750	750
Shrinkage, %	0.4	0.2	0.2	0.2	0.3	0.3	0.2
Durometer, Shore A	45	50	55	60	50	65	60
Volume Resistivity, ohm-cm	6×10^{13}	5×10^{15}	1×10^{15}	2×10^{14}	1×10^{15}	1×10^{14}	2×10^{14}
Solids Content, %	100	100	100	100	100	100	100
Elongation, %	180	140	120	110	220	110	190

A wide range of RTV compounds meet a variety of application requirements. Low viscosity RTV-11 (or transparent LTV-602) is used for potting electronic assemblies and coil impregnation. RTV-77, 88 and 90 are mainly used for high-temperature sealing and for thermal insulating and ablative applications. Intermediate viscosities meet other insulating and sealing requirements, are also used as flexible mold materials.

GENERAL ELECTRIC



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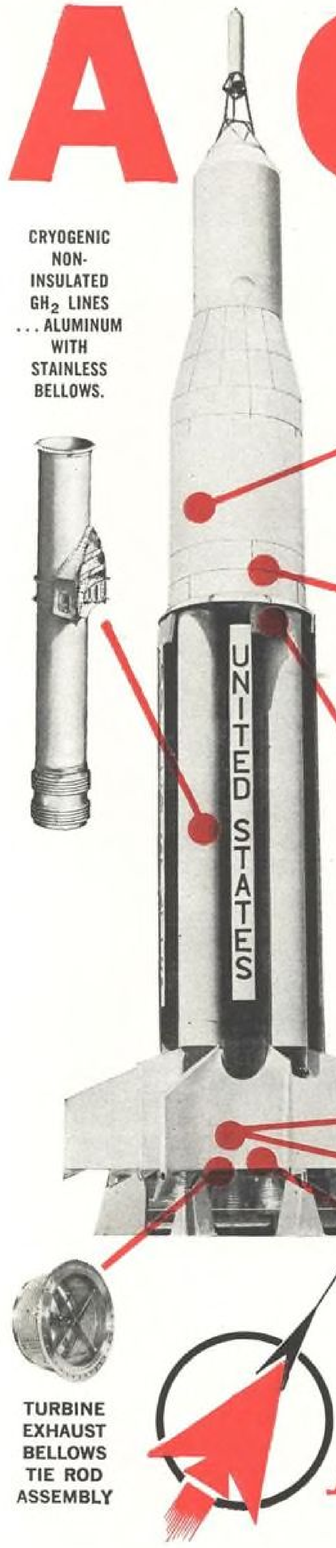
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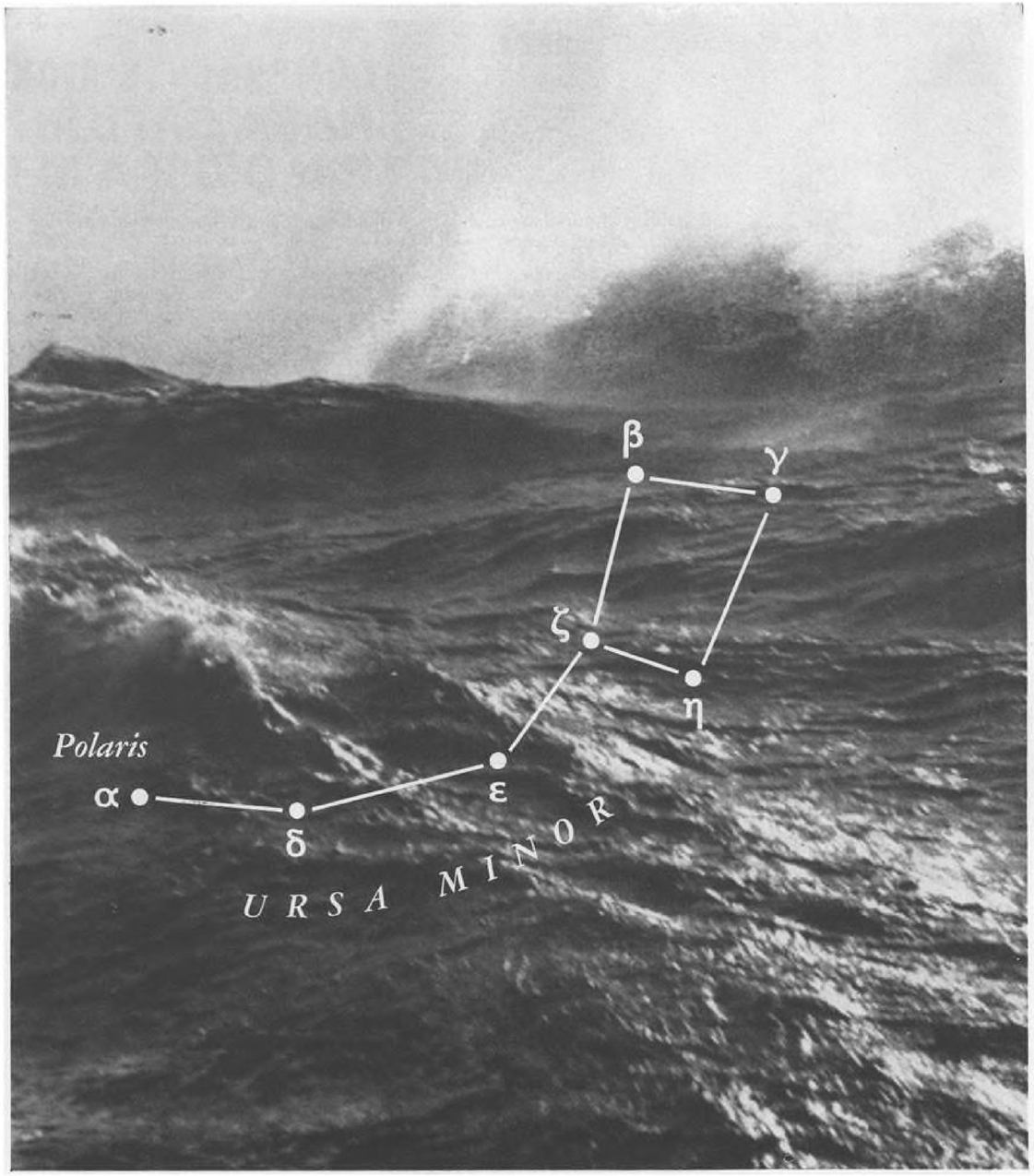
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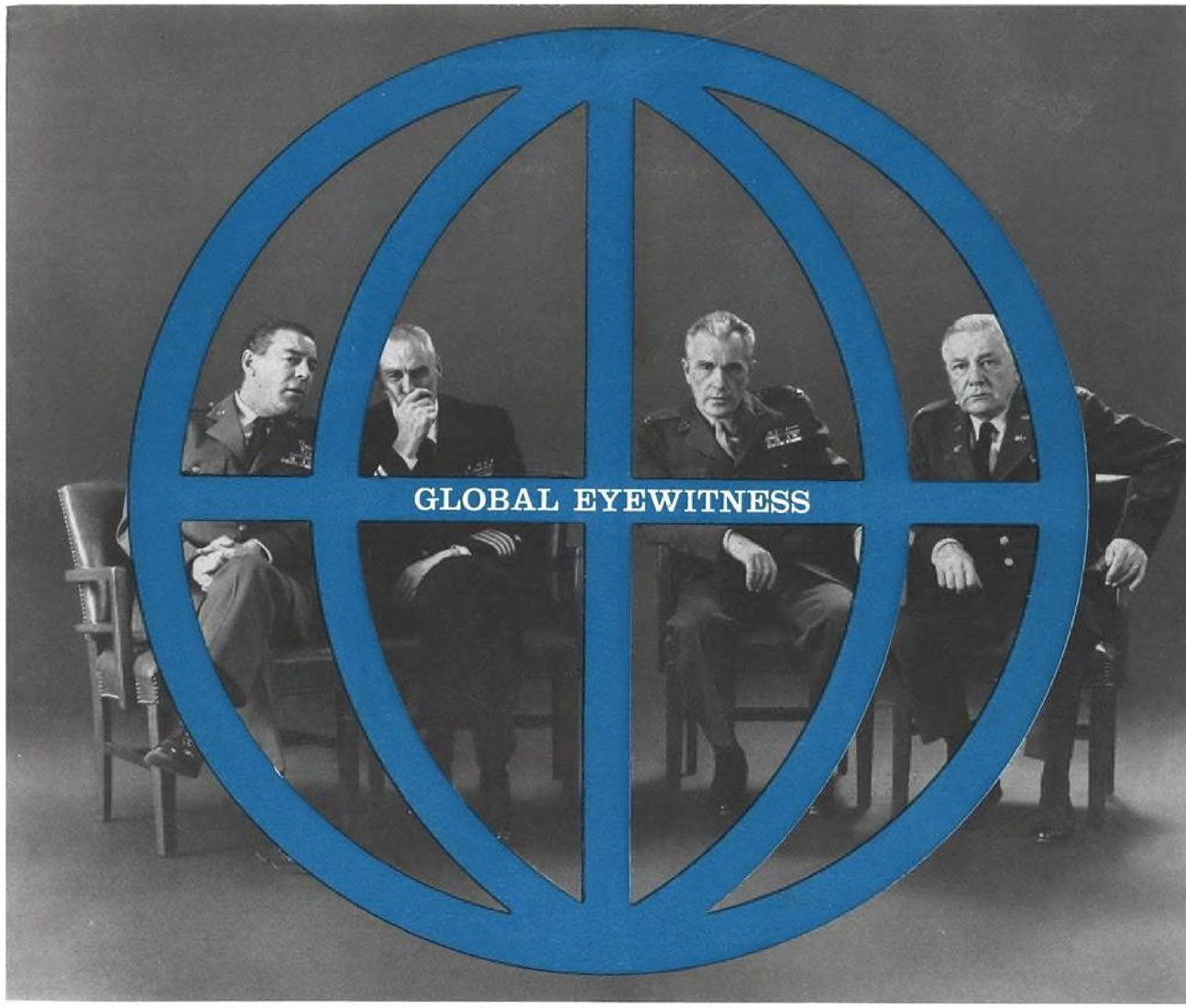


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To get the precise position fix they need for missile launching after spending weeks or months under water, Polaris submarines will rely on two Northrop-developed celestial navigation devices, the Type 11 Periscope and the Radiometric Sextant.

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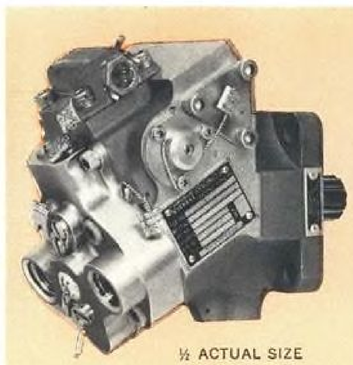
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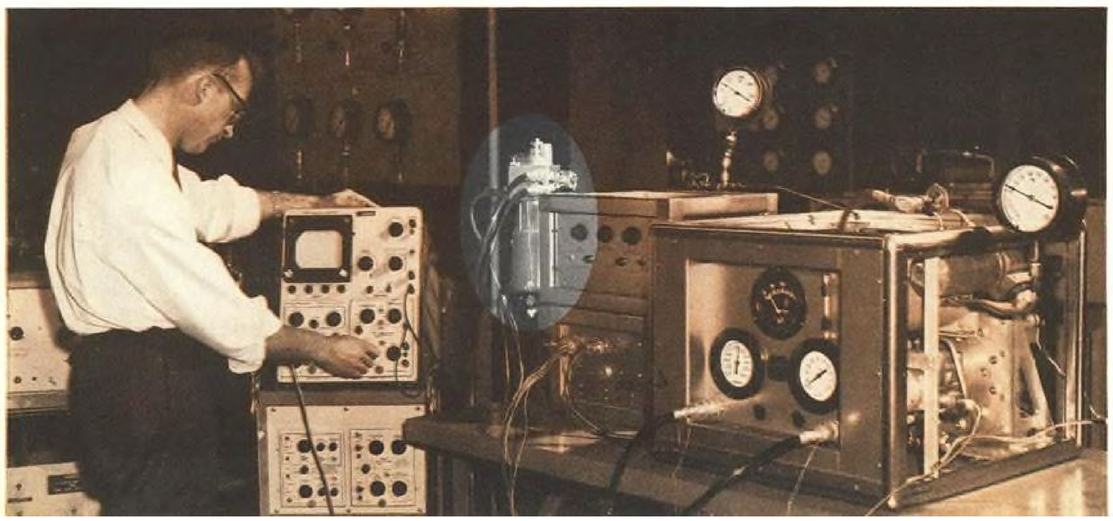
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1206



April 16, 1962

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► Appropriations group closer to McNamara position; $42 million for acceleration of Dyna-Soar is urged.

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COVER: General arrangement of the two-man Gemini spacecraft is shown in this McDonnell Aircraft Corp. mockup which illustrates considerable reliance on technology developed by McDonnell in design of the Project Mercury capsule (AW Apr. 9, p. 32). To be launched by a Martin Titan 2, Gemini will be flown to develop rendezvous techniques and to provide experience in weightless flight in earth-orbital missions of two weeks or more. Pilots will be equipped with ejection seats for escape during a launch abort, and a Rogallo-type wing will be phased into advanced Gemini vehicles for landing control.

PICTURE CREDITS

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EDITORIAL

Noise Versus Safety

After several years of shadow boxing with the airport noise problem and hoping it would eventually evaporate into kerosene-scented air, it looks as though the air transport industry may have to face squarely all of the basic issues raised by the increasing decibel levels of its jet-powered fleet. The airport noise issue is certainly one of the most complex legal and technical problems now facing the airline industry. This complexity is well detailed by one of AVIATION WEEK & SPACE TECHNOLOGY's pilot-editors, David Hoffman, in a series of two articles beginning on page 36 of this issue.

There are several aspects of the airport noise problem that bear close scrutiny. Most important is the harassing tactics of some airport authorities that have already forced airline pilots to dip below minimum safety operational requirements and if allowed to continue unchecked will certainly lead to tragedy. London airport and Idlewild appear to be the worst offenders in this regard. Since both of them handle jet transports heavily loaded with passengers and fuel for the long transatlantic hauls, any activity that reduces the margin of safe performance of the jet transports either by regulation or bureaucratic harassment is despicable.

Jealousy in England

At London airport particularly there is an unmistakable trace of the competitive jealousy that followed the introduction of the Boeing 707 transport into airline service. The British penny press campaign against the Boeing 707 was extremely vituperative and found tacit support, if not original inspiration, from British officialdom still smarting from unsatisfactory explanations of how their own transport planning missed the commercial mark by such a wide margin.

At Idlewild, the politically sensitive New York Port Authority simply handled the noise problem with the high-handed autocracy that characterizes all of its operations. Whatever the motives, it is now apparent that airline pilots are being pressured into operating heavily loaded passenger transports with procedures that fall far below the best safety margins these aircraft are capable of providing. Naturally, there are signs of airline pilots' revolt against this erosion of basic safety standards in the name of anti-noise procedures. We think John Carroll, veteran Trans World Airlines pilot and vice president of the Air Lines Pilots Assn., will find support from the traveling public as well as his fellow pilots for his sentiments that "We will not move farther in a less safe direction while studying whether to retreat. We will not turn nearer the ground, steepen our banks, climb at dizzier angles or throw away thrust—for there are safer ways to reduce noise."

Few aeronautical engineers would argue with Carroll's thesis that there are safer ways to reduce ground level noise than by executing more violent low level maneuvers at reduced power with a cabin load of lives at stake. Here neither the manufacturing nor the airline industry has taken a uniformly sound approach to a technical rather than operational solution of the noise problem. One of the biggest alleviating factors in reducing airport vicinity noise is the turbofan engine. It provides twin solutions for the noise problem in more power, permitting steeper climb-out angles with no reduction in safety standards, and also in a less noisy efflux. Yet only one domestic carrier—American Airlines—has completely converted its jet fleet to turbofan power. There are other aerodynamic devices that can contribute to higher aircraft performance, adding safety while reducing the airport vicinity decibel level. But the airline industry has shown no burning interest in this equipment.

The airline case against restrictive noise procedures would rest on a far firmer and publicly acceptable foundation if the airlines had first done everything technically possible to quiet their jets. It is true that many of these technical solutions are expensive, although the turbofan engine in the long run can offer an operational economy that will more than offset its initial expense. But how costly to the airlines now are the anti-noise procedures in schedule restrictions, payload limitations and increased hazard? And how costly will they become in the future if these airport authority-imposed procedures can be definitely established as the primary or even contributory cause of fatal accidents?

FAA Shuns Responsibility

The Federal Aviation Agency has played a rather ambiguous role of late in skirting the basic noise issues, relying on glib repartee and twisted legalisms to provide an appearance of strong safety concern while actually permitting the airport authorities to push their regulations beyond the real limits of safe operating procedure.

The air transport industry and the federal regulatory bodies responsible for air safety have been trying to sweep the noise dirt under the rug, but we predict this procedure will prove to be ineffective and expensive as the noise problem expands with neglect and aroused public ire impinges on airline apathy.

There is still time for some aggressive and technically enlightened leadership in the airline industry and the FAA to make a meaningful attempt to achieve the maximum technical solution to the noise problem and then move in a solid phalanx on the airport bureaucrats who are content to scuttle air transport safety to save their own calloused hides.

—Robert Hotz

TOUCHDOWN ON THE FIRST PASS

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Gerald E. Donovan, formerly Douglas Aircraft Co.'s vice president-finance, a director of Crescent Engineering & Research Co., El Monte, Calif.

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Poul Beck-Nielsen, executive vice president-Denmark region, Scandinavian Airlines System (SAS), succeeding **V. J. Rasmussen**, resigning.

Alfred A. Goldberg, vice president-sales, Power Designs, Inc., Westbury, N.Y.

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Gene Hopkins, executive vice president-aerospace controls group, Dorsett Electronics, Inc., Norman, Okla.

Fred Snell, vice president-operations, Okanagan Helicopters, Ltd., Vancouver.

William C. Chambliss, a director and director of planning, California Computer Products, Inc., Downey, Calif.

Arthur H. Kuljian, president, the Kuljian Corp., Philadelphia, Pa., succeeding **Harry A. Kuljian** who continues as board chairman and chief executive officer.

John W. Winter, vice president-engineering, Aviation Instrument Manufacturing Corp., Houston, Tex.

Edwin R. Gamson, vice president, Ampex Corp., Redwood City, Calif. Mr. Gamson is general manager of the company's Computer Products Co.

Melvin B. Kline, vice president-research and development, American Avionics, Inc., Los Angeles, Calif.

Allan C. Johnson, assistant to the board chairman, Aerojet-General Corp., Azusa.

Honors and Elections

Otto E. Kirchner, Sr., aeronautical scientist and engineer, has received the 1962 Laura Taber Barbour Air Safety Award for "many years of dedicated effort to improve aircraft safety . . ." At present, Mr. Kirchner is airline safety adviser to the Preliminary Design Section of The Boeing Co.'s Transport Division.

(*Continued on page 129*)

INDUSTRY OBSERVER

► **Ninety-day study of Apollo lunar-rendezvous technique (AW Apr. 9, p. 29), being conducted by Ling-Temco-Vought for NASA, is scheduled to be completed by the first week in June. Among other subjects, study will include investigation of a one-man lunar "bug" to shuttle Apollo astronauts from lunar orbit to the moon and back.**

► Air Force nuclear-detection system (Nudets) being developed by General Electric Defense Systems Dept. will use optical, seismic and electro-magnetic sensors to define time, place, height and size of nuclear bursts. Nudets units will cost about $110,000 each, will be located in huts within 100 mi. of target areas. Huts will have about 80 sq. ft. of floor area each, and will be built to take pressures up to 30 psi.

► **Laser weapon effects will be investigated in a research program by Raytheon's Surface Radar and Navigation Equipment Division under an Army contract expected to be awarded soon. Raytheon hopes to develop theory to predict effects of high-intensity radiation at optical wavelengths, and to confirm that theory with tests. Army also will soon award contract to Avco's Research and Advanced Development Division for research on the terminal effects of intense electromagnetic radiation.**

► Air Force Ballistic Systems Division may initiate industry study of means to provide its mobile medium-range ballistic missile (MMRBM) with some protection against enemy attack. One idea being considered is to build a number of conveniently sited "hardened" locations, such as re-inforced, arched road drains, in which the MMRBM squadrons could take cover.

► **Rocketdyne has about 15 1.5-million lb. thrust F-1 engines in various stages of production and test. Five F-1s will power Saturn C-5 boosters and eight will power Nova first stages.**

► Eight Lacrosse battalions have been deployed by Army, four in overseas locations, completing its production contract with Martin Co.'s Orlando division. First battalion of the point-target attack missile, complete down through field manuals, was airlifted from Orlando in one Lockheed C-130 and two Douglas C-124 aircraft.

► **Some characteristics of nuclear explosions in the ocean will be simulated in a new high-gravity centrifuge to be built by Hayes Corp., Birmingham, Ala., for Naval Ordnance Laboratory. Centrifuge will produce up to 300g in a water tank. Explosive charges as small as one-fifth gram will be detonated and monitored photographically. Data will be analyzed to study formation of water columns, diffusion of nuclear debris and other phenomena. Operations are scheduled to start in early August.**

► Italian Antilope turboprop-powered business and sport aircraft prototype, designed and partially manufactured by Procaer in Milan, will undergo final assembly in France at SIPA factory in Paris (AW Mar. 5, p. 63). Procaer retains all rights outside France in the license agreement granted to SIPA. Single Turbomeca Astazou powerplant delivering 600 hp. will give the plane a cruise speed of 286 mph. at 75% power. Antilope weighs 3,196 lb., carries four people a maximum range of 994 mi.

► **Altitude-chamber tests of the air pumping system for Northrop's laminar flow control test aircraft are about to begin at the Phoenix, Ariz., plant of Garrett Corp.'s AiResearch division. Chamber tests will simulate altitudes of 45,000 ft., and compressor inlet temperatures ranging from −20F to 200F.**

► Site survey team was on Kyushu Island in Japan last week looking at potential sites for a new NASA Far East Data Acquisition Station to be used in combination with the Rosman, N. C., station for geophysical and astronomical satellites. The team earlier looked at sites in the Philippines.

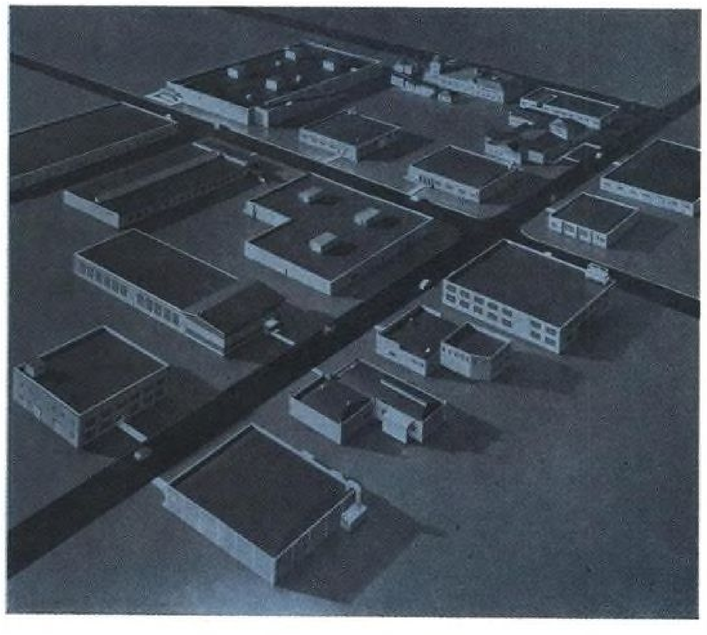
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Shown below is a composite view of Librascope's facilities where a variety of computer systems are currently in different stages of design and production. Some are strategically involved with national defense...others deal with business and industrial process control. Each is uniquely designed to answer a particular need. The success of these systems illustrates the value of Librascope's engineering philosophy: A decentralized organization of specialized project teams responsible for assignments from concept to delivery...and backed up by excellent research, service, and production facilities. For your computer requirements, call on the company whose breadth of diversification in computer technology is unsurpassed. ■ Librascope Division, General Precision, Inc., 808 Western Avenue, Glendale, Calif.





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GENERAL PRECISION

Washington Roundup

Space Funds

Climate in Congress now looks so favorable for space spending that the House Science and Astronautics Committee is expected to go easy this week in its final cutting of the National Aeronautics and Space Administration's Fiscal 1963 budget authorization bill. Much of the earlier concern generated among committee members by the apparent lack of enthusiasm for the space program both in their districts and among financial conservatives in Congress was overcome by the orbital flight of Astronaut John Glenn, according to Chairman George Miller. Rep. Edgar Chenoweth, a veteran Republican member of the committee, goes so far as to say: "We would have been in real trouble if it had not been for the Glenn flight."

The House committee wants to report the authorization bill before the Easter recess late this week. Cuts probably will total about $100 million, or less than 3% of the $3.8 billion total. They are likely to include about $80 million from manned space flight facilities and the Nova program, and $10.4 million from the Prospector lunar vehicle.

Another favorable sign came last week in the Senate when the appropriations committee restored the $5 million cut earlier by the House from the $85 million requested by NASA in supplemental Fiscal 1962 funds for such key programs as the advanced Saturn and Centaur. The House Appropriations Committee, which gets the NASA budget bill next, will provide the next major test of congressional sentiment on space spending.

NASA Housing Worry

Aerospace companies are responding very unenthusiastically to letters soliciting them for contributions toward the $275,000 price of a NASA exhibit stall at the Seattle world's fair. The letters, sent out in the name of the fair, make reference to a $25,000 contribution from Dan Kimball, president of Aerojet-General Corp. Kimball is heading an informal committee that is trying to help raise the funds. This is being done with the approval of NASA Administrator James E. Webb and Sen. Warren Magnuson of Washington. NASA has an exhibit to install in the space, but no funds for construction of an exhibit area. Kimball is chairman of the board of governors of Aerospace Industries Assn., which has recently taken a stand de-emphasizing company exhibits.

Contractors testifying on profits before the Senate Permanent Investigating Subcommittee (see p. 33) are finding it hard to change the subcommittee's mind on any of the facts and figures. The subcommittee has been preparing for the hearings since last May and the staff's figures and calculations have been reviewed by the General Accounting Office for accuracy.

Advent Under Review

Advent military communications satellite project is undergoing a detailed review by the office of Director of Defense Research and Engineering Harold Brown at the request of the Secretary of Defense. A report is due in the secretary's hands by the end of April. The Army-managed program has exceeded original budget estimates, forcing Defense to tighten the financial reins on major Advent subcontractors. Slow progress and reduced payload ability of the Atlas-Centaur launch vehicle (see p. 35) also are problems. Army is considering reducing the satellite's weight by wider use of miniaturized components.

First class of Cuban jet pilots, five of them veterans of previous Cuban air battles and most of them under 25 years of age, has been graduated. Cuba's announcement did not say how many there were or where they were trained, but some Cubans went to Czechoslovakia last year for training as pilots and mechanics, and Russia has supplied Cuba with MiG-17 and MiG-19 jet fighters.

Soviet decision to halt production on its four-jet Bison bomber has resulted in the transfer of a large number of engineers in Andrei Tupolev's design group from the Bison program to Tupolev's supersonic transport project.

Military Space Security

Among the inconsistencies involved in current Pentagon security practices regarding military satellites (see p. 35) is the fact that Satellite Situation Reports, compiled periodically by the civilian space agency with the help of North American Air Defense Command and issued publicly, do not carry code names for Discoverer, Midas and Samos satellites but do list launching dates, inclination of orbits, apogees and perigees for each one.

Sidelight on security: Defense Secretary Robert McNamara told the House Defense Appropriations Subcommittee that the number of U. S. bombers on 15-min. ground alert is classified, "but that is derivable and can be guessed at within reasonable limits by a knowledgeable person. . . . That is definitely classified. But even here, to be quite realistic we must assume that a knowledgeable Soviet air attache located in Washington can derive this relatively simply." **—Washington Staff**

House Faces Another Decision on B-70

Appropriations group closer to McNamara position; $42 million for acceleration of Dyna-Soar is urged.

By George C. Wilson

Washington—House this week will help determine the magnitude of the B-70 program by voting for either the moderate experimental development advocated by Defense Secretary Robert S. McNamara or the original Air Force recommendation to build three additional aircraft equipped for reconnaissance strike missions.

The question also pits the House Appropriations Committee, which last week recommended adding only $52.9 million to the B-70 program, against the House Armed Services Committee, which has recommended adding $320 million. President Kennedy requested $171 million for Fiscal 1963 to continue the development of three B-70's.

The House Appropriations Committee also recommended adding $42 million to the $115 million President Kennedy requested for Fiscal 1963 for the Dyna-Soar program. This $157 million total compares with the Air Force's original Fiscal 1963 request of $191 million for Dyna-Soar.

The additional $52.9 million recommended by the appropriations committee for the B-70 program would be spent for development of high resolution radar for the aircraft. Whether an effective radar can be developed for an aircraft like the B-70 flying at Mach 3 is one of the major questions being debated.

McNamara's basic position has been that accelerated spending is not justified until such technological problems as high resolution radar for the B-70 are solved. But such high ranking officials as Air Force Secretary Eugene M. Zuckert and Air Force Chief of Staff Curtis E. LeMay have argued that the final decision about B-70 production should not be made without first developing reconnaissance-strike aircraft.

Chairman Carl Vinson (D.-Ga.) of the House Armed Services Committee backed this Air Force stand as did the House itself in voting for his committee's authorization bill allocating $491 million for the B-70 and RS-70 program (AW Mar. 26, p. 17).

The House Appropriations Defense Subcommittee in its report said it long had supported the B-70 program and still does. It said the Defense Department could use the $300 million it has in emergency and transfer funds to accelerate the B-70's development if that appeared desirable at a later date. The subcommittee said it favored an "orderly" development of the B-70.

The $52.9 million will help finance the parallel radar development efforts ordered by McNamara after Chairman Vinson attacked the size of the Defense Department's B-70 program. Dr. Brockway McMillan, assistant secretary of the Air Force for research and development, told the House Appropriations Defense Subcommittee he was surprised when McNamara ordered dual radar development programs. "Certainly," McMillan said, "at no time in its recent preparation of programs relating to the B-70 or the RS-70 concept has the Air Force felt that the Department of Defense would be sympathetic to a program involving elements of duplication like that."

Dr. Harold Brown, director of defense research and engineering, has raised the possibility of applying any radar advances in the B-70 program to the Boeing B-52, thus giving the B-52 a reconnaissance-strike capability. Brown told the House Appropriations Defense Subcommittee during its recent hearings that the B-52's ability to fly low toward a target and thus escape radar detection gives the aircraft an advantage over the faster but higher flying B-70 in reconnaissance missions.

In this day of the anti-aircraft missile, the ability to fly high and fast is not adequate defense, he said, and Russia "can be expected to have" a missile capable of knocking down an aircraft like the B-70. "We have one right now," Brown said. "The Nike-Hercules probably could knock down the B-70."

He is not advocating an RS-52 program, he said, but feels it is "very desirable" to look at the sensors developed for the B-70 and determine if they could be applied to the B-52. "My personal opinion," Brown said, "is that it will turn out that to the degree this problem [of perfecting adequate sensing devices] can be solved and the capability obtained, most of that capability could probably be attained with subsonic aircraft." He said the B-52's longer range makes that aircraft preferable to the General Dynamics B-58 for the type of reconnaissance strike missions envisoned for the B-70.

The major technological problem facing development of the RS-70, Brown said, is perfecting radar which could locate mobile targets on-the-ground from an airplane flying at Mach 3 at 70,000 feet in time for the airplane to react. "I think it is almost everybody's judgment that the RS-70 will not be able to do that—partly because of the resolution required in the radar, partly because of the processing and display and partly because of the inability of the human to make the judgment and to act fast enough."

When asked if the B-52 will mark the zenith of bomber development unless the Air Force goes ahead with the B-70, Brown said another area worthy of exploration is an aircraft "designed specifically to fly low and as fast as it can comfortably fly low."

Currently the entire B-70 program is under review (AW Mar. 26, p. 17, Apr. 2, p. 15). The study ordered by Defense Secretary McNamara is slated to be completed by Apr. 23. President Kennedy requested $171 million for Fiscal 1963 for the B-70, but the House went along with the Air Force and voted $491 million to start the development of three additional B-70's equipped for reconnaissance-strike missions. Under the Kennedy Administration's $1.3-billion program, only three B-70's would be built and none of them would be equipped extensively. The first B-70, slated to fly this December, is designed merely to prove the airworthiness of the aircraft. The second, to fly in 1963, will test its aerodynamics by maneuvering at full speed, while the third B-70, to fly in 1964, will have a bomb navigation system, including a side-looking radar.

Brown said alternatives to the Air Force proposal include building a fourth B-70 and equipping it for reconnaissance-strike missions or delaying development of the third B-70 long enough to make it an RS-70.

Brown's idea of using the B-52 for reconnaissance-strike missions ran into opposition during the House Appropriations Committee hearings as Air Force spokesmen defended the RS-70.

USAF Maj. Gen. David A. Burchinal, deputy chief of staff for plans and programs, said that from an operational point of view it does not seem efficient to incorporate radar developed for the B-70 in the B-52 and try to make it perform reconnaissance-strike missions.

USAF Col. David C. Jones, deputy chief of staff for operations, said in defense of the B-70 that its lift-to-drag ratio has been verified and that the General Electric YJ93 engine has undergone performance tests at Mach 3 conditions and bettered thrust specifications by 3% and fuel consumption by 3.5%. He said the Air Force sought $675.8 million in Fiscal 1963 for the RS-70.

Col. Jones said a company has offered to provide an air-to-ground missile for the RS-70 under a fixed-price type contract. He said the missile would be ready before the sixth aircraft recommended by USAF was ready to fly.

Other information about Defense programs developed during closed hearings of the House Appropriations Defense Subcommittee and was recently released in unclassified form:

• **TFX, VAX aircraft.** Brown said the decision has not been made to proceed either with the development of the TFX, the Air Force-Navy tactical fighter now designated the F-111A, or the Army-Navy-Air Force close-support aircraft (VAX).

Plans call for the Air Force, which is managing the program, to spend $115.6 million in Fiscal 1963 on the F-111A for what USAF Lt. Gen. James Ferguson, deputy chief of staff for research and technology, has described as "an orderly development program." Vice Adm. W. T. Raborn, deputy chief of naval operations for development, said F-111A will be armed with an advanced, long-range guided missile and carry Sparrow 3 missile as secondary armament.

The VAX is more in the idea stage than the F-111A. It may have STOL or VTOL capability, according to Defense officials. Brown said for VAX's full-scale development to be justified, "it would have to complement the TFX by being optimized for the close air support role, be half as costly and replace, along with the TFX, many different models of aircraft in the current inventory."

Raborn described the VAX's essential characteristics as "survivability, simplicity and ease of maintenance." He said the VAX would have an all-weather navigation system and be able to deliver nuclear weapons.

• **Nike Zeus.** Brown said successful tests of this anti-missile missile means that "we are finding out the information we want to find out. That does not say whether the information is favorable or unfavorable. We are really in that stage now." He said the tests will continue with an installation at Kwajalein Island firing Zeuses against targets fired from Vandenberg AFB.

"I believe we are in the anti-ballistic missile business for good whether we like it or not," Brown said. "This is too important a problem to stop working on just because it seems very hard or because we have not gotten any satisfactory solution. Even if we think it will never be satisfactory, we should continue." He said Defense was conducting "a whole group" of fundamental experiments with anti-missile weapons such as lasers (AW Mar. 20, p. 41).

Army spokesmen expressed confidence that the Nike Zeus technological problems, such as separating decoy missiles from the actual ones, would be solved. The Defense budget calls for $267.5 million for Nike Zeus in Fiscal 1963 compared with $274.745 million requested in Fiscal 1962. Army asked Defense for $285.4 million for Fiscal 1963.

DOD Makes Cuts in Air Force Budget

Defense Department reduced Air Force money requests for major research programs in Fiscal 1963 by $904 million.

	(in millions) Air Force Request	Defense Approval	Reduction
XB-70	573.8	171.0	402.8
Dyna-Soar	171.0	115.0	56.0
Mobile Minuteman	160.0	0	100.0
Large solid booster	120.0	40.0	80.0
Penetration aids	232.1	182.1	50.0
496L Spadats	51.5	21.0	30.5
Space plane components	40.0	19.0	21.0
Pluto	41.0	24.0	17.0
Applied research	275.0	255.0	20.0
Stellar inertial guidance	25.0	15.0	10.0
Bioastronautics orbital space program	14.0	0	14.0
Other unspecified	—	—	42.7
Total	—	—	904.0

Titan 3 Bidders' Meeting

Washington—Bidders' conference on a high-energy third stage for the Titan 3 launch vehicle will be held this week at USAF Space Systems Division Headquarters in Los Angeles, with the principal liquid rocket engine companies invited to attend.

Major contenders for the stage are engines fueled with hydrogen and oxygen, although both USAF and industry have been actively investigating fluorine-hydrogen propellants.

Soviets Orbit Cosmos 2 Satellite

Washington—Second Soviet satellite to go undetected by U.S. tracking stations for its first two orbits was launched Apr. 6 and named Cosmos 2. Russia again revealed no weight for the spacecraft and gave few details on its mission.

In the first report on the observations made by Cosmos 1, which was launched last Mar. 16 (AW Mar. 26, p. 24), Soviet Prof. Y. L. Alpert said study of the ionosphere and space by observation of coherent radio waves transmitted from the satellite has fully justified itself.

Cosmos 2, like Cosmos 1, has an orbit inclined at 49 deg. to the equator. The new satellite had an initial apogee of 961.06 mi. and perigee of 131.49 mi., according to the Soviet news agency Tass. Period was 102.25 min. Cosmos 2 carries a Mayak 2 (Beacon 2) transmitter working on coherent frequencies of 20.005 and 90.0225 mc.

Tass said these are the same frequencies used by Cosmos 1. The first Russian announcement of Cosmos 1, however, gave the frequencies as 20.003 and 90.018 mc. Nature of the signals transmitted from Cosmos 2 differs from Cosmos 1, Tass said. The period of sending is about four seconds and the interval is 0.5 sec. On Cosmos 1, the signal was two seconds and the interval was 0.5 sec.

When Cosmos 1 was launched, Russia said its flight would be tracked and telemetry received "by ground tracking-command stations in the territory of the Soviet Union." After Cosmos 2 was launched, Tass said signals were being received successfully by a network of special stations in the Soviet Union and in other areas. The reference to other areas was not explained, but Russia has been attempting to create tracking stations outside its geographical limits (AW Mar. 5, p. 17).

Cosmos 1, which was the first in a new series that Russia said will conduct an extensive survey of space conditions near the earth this year, carries a special multiwave radio transmitter, according to Prof. Alpert. The transmissions on two waves are coherent, or rigidly linked by frequency and phase, he said.

By measuring phase difference and variation in time at ground stations, it is possible to establish with great accuracy both the electron concentration of the ionosphere and the full electron concentration all along the route of propagation of the waves, Prof. Alpert said. Special ground receiving stations were developed for this purpose, he said.

Dispute Delays 120-in. Solid Selection

Dispute between the Director of Defense Research and Engineering and the Air Force Systems Command over which shall manage development of the 120-in. dia. solid propellant rocket motor delayed selection of a contractor or contractors for the project last week.

There also was a probability late in the week that the effort might be reduced to two three-month, $1-million study contracts, even though the 120-in. has already been studied extensively. Aerojet, Lockheed, Thiokol and United Technology bid for the project, valued at about $100 million over three years. Fiscal 1963 request is for about $40 million.

Requests for proposals for work on a 156-in. dia. motor were to be sent to the same four companies today.

The competitive effort has been as sharp as any in the aerospace industry—it is the first of the large solid rockets to get the development tag for a specific vehicle, the Titan 3 combination space-payload and weapon-system booster. Industry observers see the 120-in. program as the keystone of successive building blocks leading to huge solid rockets, both segmented and monolithic. Another incentive in the competition is the program's aerospace ground equipment, for which the solid rocket motor contractor also will have responsibility.

Looming sharply in the development background are requirements for two other immediate possibilities in the larger solid-propellant rockets—the 156- and 240-in.-dia. units. Amassing know-how as the development contractor in the 120-in. solid rocket program could mean getting an effective foot in the door for any follow-on development for larger solids.

There's little doubt that the program for the 156- and 240-in. rocket motor programs will be pushed. The only big question is whether they will be advanced as applied research programs under the 6593rd Test Group (Development) at Edwards AFB or as development hardware for specific boost vehicle tasks under SSD. Indications now are that programs for these motors will be kicked off as research efforts under Edwards AFB's cognizance.

Competitor Scoring

Early this month, Col. Langdon F. Ayres, chairman of the proposal evaluation board in the 120-in.-motor program, brought the board's scoring of competitors—in areas of management, PERT, facilities, thrust vector control, chemical formulation and ignition,—to AFSC headquarters, presented its recommendation to Gen. Bernard A. Schriever, AFSC commander and answered questions on scoring by the command headquarters' staff officers. Gen. Schriever's recommendation in the competition was presented to Gen. Curtis E. LeMay, Air Force chief of staff, from whom it was routed successively to Air Force Secretary Eugene Zuckert and the Office of the Secretary of Defense, for a chain-of-authority, concerted decision for the contract award.

Selection of the contractor could not have been an easy choice. In addition to the critical requirements of judging in categories of capability, there are considerations of existing workloads and broadening the base of solid propellant contractors—a point the National Aeronautics and Space Administration views as important. NASA recently has evidenced a vital interest in the development of large solids for its space jobs.

Aerojet has extensive solid propellant experience and has a relatively heavy workload including the Navy's Polaris and the Air Force Minuteman second stage. Thiokol, also experienced in solid propellants, has developed the Minuteman first stage and Nike Zeus stages. Lockheed Propulsion Co. (formerly Grand Central Rocket Co.) has solid propellant experience plus the backing of Lockheed Aircraft Corp. United Technology, relatively new in the field, has management talent and facilities available and the backing of United Aircraft Corp. Both UTC and Aerojet have successfully fired 100-in.-dia., solid propellant segmented motors in feasibility programs for Edwards AFB. Lockheed Propulsion will fire a 120-in.-dia. motor next month under this same program. Previous largest solid fired was a 36-in.-dia. unit.

Large Proposals

Proposals submitted in the competition by the four companies were limited to 300 pages, plus supporting data (a catch-all category allowing, in effect, unlimited data submission), plus motor drawings and program evaluation review technique (PERT) charts. Lockheed Propulsion submitted the most voluminous proposal, closely followed in size by Aerojet. Thiokol volume was third while United Technology's was smallest.

Cost estimates submitted for the program generally ran between $85 to $90 million through preliminary flight rating test (no production) for three of the contractors, while Aerojet's bid may have been about 15% lower, but this could have been the result of its specific approach in the PERT time/cost analysis requirement.

Proposal evaluation board comprised of eleven members heard each of the four competitors on Mar. 12 at SSD make an oral presentation for 1½ hr. on its program approach and competency which was followed by a 15-min. question period.

Board members included, from SSD, Col. Ayres, Col. J. P. Gibbons, Col. P. L. Fishburen, Lt. Col. D. B. Harris, Maj. R. P. Bright; A. W. Griffith and T. R. Schaus, Ballistic Systems Division's Maj. I. K. Holdener, Edwards AFB's Col. H. W. Robbins and Capt. J. F. Douglas and NASA's R. A. Wasel. Sitting with the board, but not as members, were Lt. Gen. H. M. Estes, Jr., AFSC's deputy commander for aerospace systems, Maj. Gen. O. J. Ritland, SSD commander, SSD's Col. L. W. Burt, Maj. G. P. Nelson, Capt. A. Gironda, Jr. and J. R. Ralston, and Aerospace Corp.'s Dr. C. J. Wang, C. Hartsell, M. Goldman, and G. A. Sears.

Test Firings

Development of the 120-in motor will be carried out in three phases—a preliminary flight rating test (PFRT) series involving seven four-segment motors, a design verification series involving three five-segment motors, and a qualification test series involving nine four-segment firings.

The PFRT series will involve demonstration of thrust vector control, temperature cycling and firing at high, low, and medium temperatures, thrust termination under conditions simulating a pad abort, test firing of segments which have been transported and destruct action.

The three five-segment-motor design verification firings will come at the end of the PFRT series, will involve only demonstration of thrust vector control, firings over a range of temperatures, and tests to simulate firing under conditions of restraint.

Qualification test firing will be similar to the PFRT series but will involve a firmed development design and larger test samples.

While the tests involve both four- and five-segment configurations, intention is for the 120-in. motor to be a four-segment unit with growth potential to a five-segment unit. The two configurations would have interchangeable center and end-cap components, and a five-segment motor would be available by simply adding an additional center segment.

Highlights of the motor design will involve these technical details:

- **Specific impulse** of propellant will be pegged at approximately 260, but margin of tolerance could decrease this figure substantially, or increase this value, which is not considered likely.
- **Burning time** for the four- and five-segment configurations would be between 100-110 sec. Burning capability would be required up to about 35-mi. altitude.
- **Length of the five-segment motor** will be approximately 75 ft., including a nozzle approximately 10 ft. long. Nozzle will be a fixed type, canted about six degrees from the motor centerline.
- **Weight of the five-segment** configuration will be approximately 450,000 lb., with a mass fraction of about 0.89. Four-segment configuration would weigh about 375,000 lb., with mass fraction of approximately 0.88.
- **Thrust vector control** will be by fluid injection through ports in the four quarters of the nozzle perimeter. Aim will be to use an inert fluid (freon) or a reactive fluid (nitrogen tetroxide) in the same basic thrust vector control design, and all motors used in the flight test program will incorporate thrust vector control systems. Duplicate systems may be installed to improve reliability.
- **Modes for transporting** motors by truck, boat, railway car and aircraft will be analyzed by contractor.
- **After storage for one year** under conditions of about 50% humidity and temperatures ranging from 60F to 90F, propellant will have to meet all operational requirements.
- **Ignition system** probably would use a duplicate installation to ensure reliability.

The contractor will have complete responsibility for designing, developing or procuring through subcontract all aerospace ground equipment which will be required throughout the test and development program. This responsibility covers equipment sufficient to support application of the 120-in. rocket motor in a weapon or space booster system and includes all items for checkout, launch, command and control, as well as all associated functions, including application in support facilities for assembly and test.

Lethal Laser Weapons Efforts Expand

Fourteen avionics companies will deliver the results of parallel 45-day feasibility studies of optical maser (laser) radiation weapons to the Office of Naval Research in Washington early next month to conclude the first phase of a $2.5-million Advanced Research Projects Agency effort, funded through Project Defender, the over-all program of ballistic missile defense.

Both written and oral presentations are to be made to ONR detailing the results of the approximately $20,000 studies awarded to the 14 companies last month (AW Mar. 26, p. 41).

The 14 are American Optical Co., Autonetics Division of North American Aviation, Inc., Electro-Optical Systems, Inc., General Electric, Syracuse, Hughes Aircraft Malibu Research Laboratories, Radiation, Inc., Melbourne, Fla., and its subsidiary Radiation at Stanford, Radio Corp. of America, Camden, N. J., the Technical Research Group, Texas Instruments, Trion Instruments, Inc., Watkins-Johnson and Westinghouse, Baltimore.

Meanwhile, other indications of blossoming tri-service interest in possibilities of using the high energy beams of optical masers for weapons include:

- USAF's Rome Air Development Center is asking for qualified sources in apparent preparation for a competition for a high-intensity radiation device research and development program.
- Army's Aberdeen Proving Ground is negotiating a laser weapons effects program with Raytheon Co. The company is to derive and test a theory of the interaction of optical electromagnetic radiation with matter. This contract may be a part of a larger multi-company Army Ordnance Missile Command program.
- Army Ordnance Missile Command has completed terms of contracts for weapons programs with American Optical Co. and Quantatron, Inc. American Optical will receive $76,000 for research on a fiber optics high-intensity laser device and Quantatron will receive $50,000 for R&D on an ultraviolet optical maser.
- USAF's Aeronautical Systems Division will soon pick industry contractors for at least five separate laser weapon or weapon oriented programs, including a phased optical maser array, two pump sources developments, and a materials program.

P&W Wins Snap 50

Washington—Pratt & Whitney Aircraft Division of United Aircraft Corp. has been awarded a contract to develop a prototype Snap 50 lithium-cooled reactor to be used as a power source for electric propulsion space engines and advanced satellites with high power requirements.

Fiscal 1963 portion of the contract is valued at $3.5 million, and continues an Atomic Energy Commission-P&W research program on lithium cooling under way since 1959. The company work is being done at the Connecticut Advanced Nuclear Engine Laboratory, which, until the nuclear aircraft development was canceled, had been called the Connecticut Aircraft Nuclear Engine Laboratory.

Objective of the program is to develop by the late 1960's a compact, lithium-cooled reactor which will operate over long periods at high temperatures. It also will have a power output greater than any Snap unit under development. Highest power level now being developed is 60 kw., and Snap 50 will be in the megawatt-class.

The prototype unit will be housed in the National Reactor Testing Station, Idaho Falls, Idaho. Burns and Roe has been named by AEC as architect-engineer for the new facility.

Steel Price Increase

Washington—President Kennedy, in assailing the decision by major steel companies to boost prices about $6 a ton, said the increase would boost defense costs $1 billion "at a time when every dollar is needed for national security and other purposes."

House Unit Approves Missile Base Funds

Washington—House Armed Services Committee last week approved a $1.2 billion authorization for Fiscal 1963 military construction, earmarking $549 million for facilities for strategic retaliatory forces.

It includes $225 million to complete the base program for Atlas and Titan and $262 million for bases for additional Minuteman squadrons.

The measure also provides $41 million for facilities for integration, testing, and launching of the Titan 3 booster system, with $11 million of this designated to support the Dyna Soar space glider vehicle. An additional $1 million is for direct support facilities for the glider.

Arpat Intercept

Intercept rocket consisting of Thiokol's solid-propellant XM-33 Castor first stage, TX-261 Pedro second stage, and special 29-in.-dia. spherical-motor third stage will be used in upcoming Arpat (ARPA terminal) re-entry tests over Pacific Missile Range (AW Apr. 9, p. 37). Aerolab Development Co. will assemble first two stages and Hughes Aircraft will add the third stage plus payload.

In the tests, the target could be balloon-launched or ground-launched missiles with infrared augmentor heads to simulate re-entry vehicles. A number of the hypervelocity interceptor rockets could be launched against a single or multiplicity of targets, with interceptor payloads fitted with sensors and proximity fuzing to explode the payload into chunks to provide a shrapnel effect to destroy the target.

Rolls-Royce to Lay Off 3,000 Workers

London—Rolls-Royce last week said it will lay off 3,000 workers from the Aero Engine Division because of the company's present estimate of future business. The division now employs 39,500 persons.

At the same time, Whitworth Gloster laid off 26 members of its design staff and said layoffs face another 200 of the 600 persons involved in that aspect of its business. The 26 initially involved are working on the Argosy 650 series.

Rolls last week was talking with union officials to reduce hardship to a minimum. It is Rolls' second major layoff; last November the roster was cut by 1,000.

Company officials said that since January, 1960, division strength had been increased by 6,000 persons and the peak level of business was achieved in 1961. Current estimates, they pointed out, show a good continuing business with output at the average level of 1958-1960. In a statement, they added:

"Government requirements, as at present known, show a declining trend but the growth of the company's commercial aero engine business is well known and in 1961 it accounted for the greater part of Aero Engine Division sales. It is inevitable that the volume of commercial business will fluctuate with airline re-equipment programs."

The layoff decision probably will spark another round of attack in Parliament on the government's policies affecting the British aircraft industry (AW Apr. 9, p. 119). Shop stewards at Rolls' Glasgow factory have already approached the Scottish parliamentary delegation.

Need for Human Crew Stressed In Formal Report on Glenn Flight

Washington—Vital need for a human crew to observe and take corrective action in space flight was emphasized by Marine Lt. Col. John H. Glenn, Jr., and other Project Mercury officials during the formal report of Col. Glenn's orbital flight in the Friendship 7 capsule.

This major conclusion came Apr. 6 as detailed results of the flight were given here before representatives of industry and governments, including two Soviet embassy officials.

Vice President Johnson, chairman of the Space Council, keynoted the day-long presentation by underscoring that the significance of the Glenn flight—conducted in the full public gaze—actually "transcends details" of the reports. He said this openness "is the only acceptable policy. We have the strength to demonstrate our successes as well as our failures, and the courage to accept the risks."

He said Col. Glenn's flight has raised U.S. prestige to a high point because it was successful, and it was open.

In the field of space science, Dr. John A. O'Keefe, assistant chief of the theoretical division of National Aeronautics and Space Administration's Goddard Space Flight Center, made these major conclusions about Glenn's observations:

• **Glenn Effect,** the luminous particles the astronaut saw at sunrise on all three orbits, probably came from paint flaking from the outside of the capsule. Another possibility is water from the cooling system.

• **Luminous band** around the horizon was probably due to reflections of the horizon between the layers of the capsule window. Col. Glenn disagrees with this theory, and said he feels there is some type of solid band around the horizon. Dr. O'Keefe said "the balance of probability is that the luminous band was due to reflection in the spacecraft window. The outstanding reason for connecting the two is that the inclined windows should have given a ghost image."

Col. Glenn said he feels it important for ground operations to keep the pilot fully informed in the event of a suspected malfunction, rather than waiting until a decision is made, as was done when it was feared the heat shield was loose in the Mercury Atlas-6 flight (AW Mar. 5, p. 18).

Weight Loss

Major physiological changes recorded in pre-flight and post-flight observations of Col. Glenn were weight, which went from 171 lb. 7 oz., to 166 lb. 2 oz., and in the fact that he bruised his hand after landing.

Other observations were:

• **Respiration,** 14 breaths per min. before and after flight, and a range of 8-19 during the flight.

• **Pulse,** 68 beats per min. before flight, a range of 76-134 during flight, and 72 in the postflight examination at Grand Turk. The 134 maximum reading occurred just prior to drogue parachute deployment when capsule oscillations were great. The average inflight pulse reading was 86, which was raised to 125 after exercising with bungee cords over Zanzibar in his first orbit.

• **Blood pressure,** 118/80 mm. Hg sitting before flight, and 128/78 sitting at 9:30 p.m., about five hours after landing. Col. Glenn took his own blood pressure 10 times during the flight with a mean reading of 129/70.

The pilot voided 800 cc. of urine shortly before re-entry, although he ingested the equivalent of only 94 cc. of water in pureed applesauce during the flight. Specific gravity of the recovered urine was 1.016, compared with 1.019 at 3:30 a.m. on flight day, and 1.018 51 hr. after landing.

Tumbling Sensation

Col. Glenn reported a forward tumbling sensation just after sustainer engine cutoff, a sensation which had been reported by Capt. Virgil I. Grissom in the Mercury Redstone-4 flight (AW Jan. 29, p. 28).

The Friendship 7 capsule was at the Atlantic Missile Range 166 days. During which 255 design changes were accomplished. Among the major changes from earlier flight capsules were:

• **Reaction control system:** Plastic flare seals were replaced by soft aluminum washers in the automatic thrust chamber solenoid valves. Beryllium heat sinks were added to both manual and automatic roll thruster assemblies.

• **Electrical system:** Fuses were removed from the manual standby inverter, and fuse holders were re-inforced. Inverter indicator lights were added, and an auxiliary battery was installed for the maximum altitude sensor wiring. The abort sensor signal was interlocked with the capsule separation signal to prevent the escape tower from jettisoning prematurely; a camera programmer was installed, and thruster solenoid wiring was brought through a single connector so that the solenoids could be disabled for long periods during test.

• **Environmental control system:** Cold plate water-type heat exchangers were installed to cool main inverters; cooling fan duct inlet screens were changed to 0.06 in. dia. from 0.25 in. dia. when it was found that small bits of material jammed the larger screen on earlier flights; stainless steel valves replaced aluminum check valves in the freon-water inverter cooling system to eliminate effects of corrosion, and a heat exchanger exhaust temperature indicator was installed for the suit cooling flow circuit.

• **Automatic stabilization** and control system: New autopilot with logic circuitry was installed; fuses were added to rate gyro power leads and heat blankets to maintain a constant 75F temperature were placed on the scanners.

Nova Study Winners Must Share Costs

By Edward H. Kolcum

Washington—Primary emphasis will be placed on willingness to share costs, experience and management histories in selecting two or three companies to develop a detailed systems definition and preliminary design of the Nova launch vehicle to be used for single launch of the manned lunar landing vehicle if this method is chosen for the Apollo mission.

Direct ascent using Nova is regarded as the principal competitor to the rendezvous method for manned lunar landing (see box p. 32). If rendezvous wins the Apollo role, the Nova vehicle is regarded as necessary for interplanetary exploration. The Nova vehicle under consideration can boost 150,000 lb. into an escape trajectory, or 400,000 lb. into an earth orbit.

National Aeronautics and Space Administration invited 15 companies to bid for the study (AW Apr. 2, p. 20), and a bidders' conference was held Apr. 10 at Huntsville, Ala. (see box below). Bidders are being asked to provide a detailed management plan in program evaluation review technique (PERT) form, and to describe their technical approach and distribution of effort, estimate complexity of each task and detail the percentage of over-all effort on each particular problem.

The PERT plan must show each critical event, the time between events and also the scheduling of decision events.

Costs to Be Shared

Contractors must clearly specify in their bids how much they are willing to spend of their own funds in a cost-sharing plan with NASA. The agency will sign the contracts for $700,000 each, but says the depth of study and design detail desired is beyond available government funds.

Estimates are that successful bidders will have to at least match NASA's funding with their own money in order to conduct a thorough study. Re-imbursement by NASA will be on a fractional basis, so that in effect, the contractors will be spending their own money under close supervision by the government.

It is almost certain that one of the study contractors will get a part of the hardware contract, but NASA says a separate competition will be held for the hardware phase, which should be started before the end of this year.

Two-Part Proposals

Proposals are due Apr. 26 and are to be submitted in two parts:

• **Study program,** limited to 75 pages and to detail the bidders' capability to complete the study and its report in six months; type and number of people available and estimated time they will participate in the study; names, backgrounds and specialty areas of key personnel; previous experience in work of a similar nature; analog and digital computing equipment available, and other technical facilities which would be used in the study.

• **Hardware phase,** limited to 40 pages, showing capabilities to conduct Nova hardware development. It would detail management caliber and communication lines; availability and competence of engineering, scientific and other technical personnel; availability and source of research, test and production facilities; prior experience in developing similar or related items, financial status and other qualifications in hardware production.

The study will emphasize a two-stage Nova configuration, but the companies conducting the program will be allowed considerable latitude in defining the best vehicles for orbit using a two-stage chemical vehicle, and the best vehicle for escape trajectories using three chemical stages and another using two chemical stages and one nuclear stage.

As part of their proposals, companies should specify subcontractors, the work they will do and cost. Marshall Space Flight Center already has studies out for F-1 engine support, M-1 engine support, launch operations and facilities and stage and vehicle system test facilities.

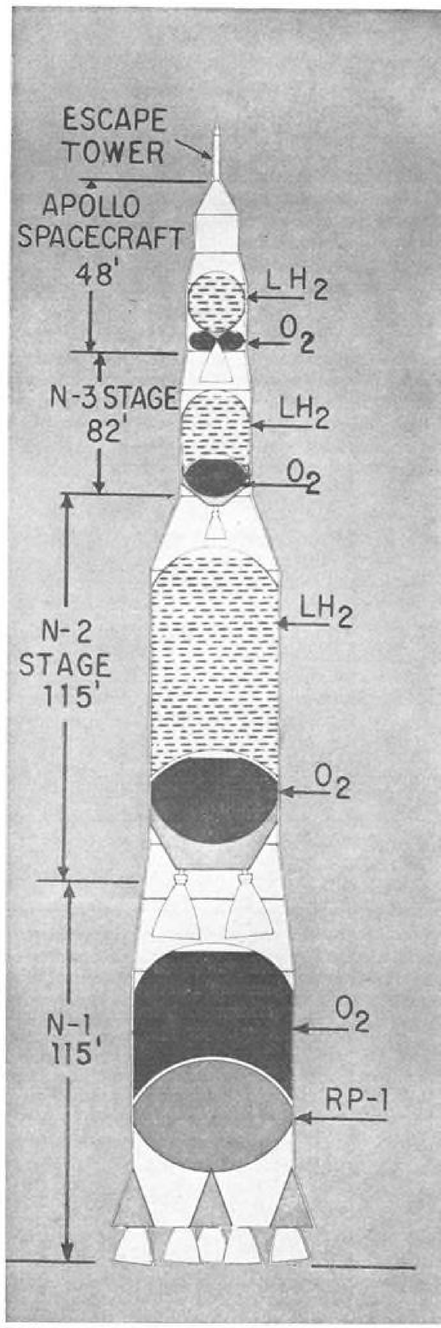
Winners will coordinate with NASA and with firms conducting these studies throughout the project.

The two-stage vehicle in the basic configuration consists of a booster cluster of eight Rocketdyne F-1 engines, and a second stage powered by two Aerojet M-1 engines. Contracts have not been let for either stage. De-

Nova Bidders Briefed

Washington—Thirteen of the 15 companies invited to compete for the contract to study the Nova launch vehicle attended a bidders' briefing Apr. 10 at Huntsville, Ala. Proposals will be due at Marshall Space Flight Center Apr. 26.

Companies represented at the briefing were Aerojet-General, Bell, Boeing, Douglas, Ford, General Dynamics/Astronautics, Grumman, Ling-Temco-Vought, Lockheed, Martin, McDonnell, North American and Republic. Chrysler and Northrop, invited to compete, did not attend the session.



CONFIGURATION of 360-ft. three-stage Nova-Apollo vehicle to be studied in detail by two or more contractors following a competition which will end Apr. 26. Upper stages and lunar landing engines are fueled by hydrogen and oxygen. Booster stage is kerosene and oxygen fueled. Fins may be added to provide stability during boost.



Sikorsky S-64 Flying Crane Rolled Out

Sikorsky S-64, scheduled for its first flight in May, was rolled out of the Sikorsky factory at Stratford, Conn. last week. Flying crane helicopter, powered by two Pratt & Whitney JFTD-12 turbine engines, is designed to carry a nine-ton payload. Gross weight is 38,000 lb. and useful load is expected to be 20,760 lb. Helicopter is designed for cruise speed of 110 mph.

sign studies will establish compatibility and payload performance for the following combinations:

- **Apollo earth-orbital** payload consisting of crewmen and cargo.
- **Earth-orbital** payload consisting of a Douglas S-4B escape stage, which is powered by a single Rocketdyne J-2 engine.
- **Specification of the best** third stage for escape to place the lunar landing vehicle into a lunar transfer trajectory.
- **Nuclear escape stage** plus payload of cargo and passengers. This stage will be the second generation nuclear rocket.

In all configurations, the final report will specify cargo densities, location of passenger compartments and abort system characteristics. Payload limits in size, weight and mass distribution also should be defined.

Among design choices left open to the contractors are propellant loading for individual stages, which depends on the flight method selected; second stage propulsion; fluid dynamics and control, and tank construction.

Although the basic vehicle has a second stage (N-2) consisting of two M-1 engines, the contractors are asked to study and recommend changes in engine number, thrust level and mixture ratio.

Work statement calls for a detailed analysis on control system dynamics, basic vehicle structural dynamics and liquid propellant sloshing. Problem of tank construction centers around whether tanks should be built as single or multicell units; separate tanks versus a common bulkhead; propellant feed systems and insulations.

NASA feels that clear answers to these design choices require supporting hardware developments, particularly in these areas:

Welding techniques for thick materials; tank fabrication, both single tank and multicell; bulkhead fabrication and joint configuration; design and test of large valves and lines; inspection methods and equipment, and development and test of insulation techniques.

Operational Studies

The work statement also calls for operational studies of the Nova vehicle, including test and reliability, manufacturing, transportation and launching, and development and funding schedules.

Ground test and reliability program becomes highly important for the Nova because the unit cost of each vehicle prohibits extensive flight tests.

Major test facilities for Nova will be located at the Mississippi Test Area, but test equipment design will depend heavily on results of the Nova vehicle study. Contractors will be asked to define facilities necessary to support vehicle development, time phasing, capabilities and justification.

Detailed manufacturing plan, including determination of major tooling, jigs, fixtures, manpower and floor space requirements also will be specified in the study. Major transportation emphasis will be on barges or ships, with limited study called for in short-distance transportation.

A considerable amount of study already has been given to Nova construction and transportation (AW Mar. 26, p. 54), and all data from the previous work will be made available to the study contractor.

PERT method is specifically required for detail schedules of the Nova program. Assumptions made to define program schedules and funding must be shown so adjustments can be made as the program develops.

Rendezvous Still First

Washington—Earth-orbital rendezvous remains the primary method for the U. S. manned lunar landing flight profile, but National Aeronautics and Space Administration will continue to study direct ascent and lunar-orbital rendezvous several more months before making a final decision on which route to take.

Contractor studies over the past year (AW Mar. 19, p. 78) have been intensified recently either to re-certify earth rendezvous or to pick another approach which would allow an earlier manned lunar landing. These studies have been described by NASA as providing "nothing detrimental to earth rendezvous as our primary mode."

Gaining top place in earth rendezvous is the tanker method, in which an empty propulsion stage will be orbited with a manned spacecraft, to rendezvous with a fueled S-4B stage. Second method under consideration is the connecting approach, in which a fueled S-4B stage and a manned spacecraft join in rendezvous.

ARS/IAS Merger

Phoenix, Ariz.—List of agreed principles of consolidation was near completion at the end of a two-day joint steering committee meeting of the Institute of the Aerospace Sciences and the American Rocket Society.

The list is to be completed informally by the presidents of the two societies for submission to the members at or before the next joint meeting on Apr. 29 in St. Louis. IAS President Eugene Root and ARS President Dr. William Pickering can meet conveniently to resolve remaining problems because both are located in California.

If members respond favorably to the list of principles, the consolidation proposals will be submitted to a legal vote of the members of the two societies. The joint steering committee then will set a date for the beginning of operation as a consolidated society.

Two unresolved questions are how to create a sound financial basis for the consolidated society and how many technical publications to produce. One proposal is to have a publication for each technical field. Cost considerations will be the deciding factor. In the present two societies, cost of publishing technical information is estimated at $65 per year per member.

Profit Hearings May Bring 'Fee' System

By Katherine Johnsen

Washington—Senate Permanent Investigating Subcommittee's hearings on defense profits last week pointed toward legislation that would limit a weapon systems contractor's profit for supervising subcontracts to a "management fee."

The widespread practice now is to pay the contractor a profit based on the costs and profits of the subcontractor, as well as a profit on his own costs.

This solution to the subcommittee's objective—the elimination of what it calls "pyramiding of profits" or "profits on profits"—was suggested by Sen. John McClellan (D.-Ark.), subcommittee chairman, and Jerome Adlerman, counsel, at the conclusion of four days of testimony by Donald Douglas, Jr., president of Douglas Aircraft Co., and three other Douglas officials: Robert L. Johnson, vice president, Missiles and Space Systems Division; Edward Curtis, director of contracts; and R. L. Keane, assistant comptroller.

Douglas declined comment on the McClellan proposal except to emphasize that it had many ramifications and that his company would submit a studied opinion as soon as possible.

The substantial effect on the aerospace industry's earning position that a switch to a "management fee" for supervising subcontract work could have was indicated by the subcommittee's analysis of Douglas' subcontract program under 17 Nike production contracts over the past 10 years.

The cost to Douglas totaled $599 million. This included the subcontractors' bills to Douglas for cost and profit plus Douglas' own direct and general and administrative costs for overseeing the subcontract work. Douglas' profit on the total $599 million effort was $45.5 million, or an average of 7.6%. The range on the 17 contracts was from 5.8% to 9.9%.

Measured against Douglas' own costs, the $45.5-million profit amounted to an average 44.3% ranging from 18.3% to 200% on individual contracts.

Subcontractor bills to Douglas—on which Douglas received a profit—totaled $496 million. Douglas' own costs for its own work and for supervising the subcontracts amounted to $103 million.

Had Douglas been paid a "management fee" of 7.6% for its own effort only, its profits would have totaled $7.8 million instead of the $45.5 million paid on the total $599 million subcontract program. Adlerman, in his proposal, had suggested a much higher "management fee"—about 15%.

The subcommittee focused on one case in detail in order to support its allegations of excessive profits to contractors on the work of subcontractors.

This showed that on an order for launcher loaders, on which Douglas performed $3,316 worth of supervision, it received a $1.2 million profit. Douglas was paid only $332, or 10%, for its own supervisory effort. The remainder of the Douglas profit was based on the $13.5-million bill from its subcontractor, Consolidated Western Steel Division of U. S. Steel Corp. The launcher loaders were shipped directly from Consolidated's plant to the Army.

After an initial clash on the first day of Douglas' testimony, in which he denounced the subcommittee's calculations as "gross distortions of the traditions and practices of all business" and "arithmetical manipulations," the sessions with Douglas officials ended on an amicable note.

At the final session, Douglas said that subcommittee figures and calculations were completely accurate. He said there was room for improvement in weapon systems procurement procedures, and volunteered to cooperate to try to achieve this.

McClellan emphasized that the subcommittee's aim is to be constructive, not destructive. Sen. Edmund Muskie (D.-Me.) observed that the staff's investigation showed that on the Nike program, "the quality of performance of Douglas was outstanding."

The two major points Douglas stressed were:

- **Aerospace weapon system** contractors cannot survive on their profits from in-house research and development and subcontractor supervisory work, but require either substantial returns from production or a much higher rate of return on research and development. "You cannot support the defense industry on the profits now paid in research and development without giving them profits on production," Douglas told the subcommittee.
- **Out of the so-called** "profits" that aerospace manufacturers receive, they must meet many legitimate expenses. He suggested that the subcommittee should re-designate its investigation as an investigation of the "pyramiding of fees" rather than the "pyramiding of profits."

Douglas argued that the $63.8 million in "profits" his company billed to Western Electric Co., the prime contractor, over the 17-year Nike program should be considered as "fees." He said Douglas' real profit was only $29.8 million. He listed these costs, totaling $34 million and not allowable against government contracts, which the company had to meet out of its $63.8 million:

- **Interest,** $3.6 million.
- **Specific development** projects, $24.9 million. Douglas observed that the national defense benefits considerably from technical work financed by the company. Sen. McClellan suggested that this work was in connection with Douglas' commercial business, and said: "I thought Douglas had separate research contracts for work related to defense." The subcommittee requested a breakdown of the $24.9 million.
- **Advertising,** $2.14 million. Douglas commented that the company "must sell itself to the public" so that it can compete on the financial market for stockholders and with banks and invest-

Western Electric Defends Nike Work

New York—Western Electric Co. did "a good job" as systems manager of the Nike program and its profits were "reasonable." President H. I. Romnes, assured the annual stockholders meeting last week.

Allegations by the Senate Permanent Investigating Subcommittee that Western Electric made excessive profits on the work performed by subcontractors were based on "statistical manipulations," Romnes said.

As systems manager, with complete responsibility for over-all system planning and performance for the detailed specifications and design of all elements of the system and for management of the entire operation, the company earned all of its profits, he said. Over the 17-year life of the Nike program, these amounted to only 3.5 cents per dollar of sales, he said.

Romnes said it is "absolutely without meaning" to consider Western Electric's specific profits on specific subcontracts. "The profit we earned on the Nike contracts we earned for our over-all responsibility and no part of it is specifically allocable to the bits and pieces of the entire program. Only a persistent refusal to see this simple point keeps the charges of 'profit pyramiding' from collapsing altogether."

All profit figures emanating from the subcommittee are more than twice the actual profits earned, since they fail to reflect federal taxes, he said. Romnes reported that reductions in cost introduced by Western Electric totaled more than $350 million, "a figure many times our total profit for our work on Nike."

Atlas F Explodes

Washington—Atlas F development missile blew up just after liftoff at the Atlantic Missile Range Apr. 9 in what was apparently a malfunction in the propulsion system. Pad 11 was extensively damaged and will require six to eight weeks to repair, which will cost an estimated $250,000.

ment houses. He noted that only very limited types of advertising are allowable as government contract costs.

• **Amortization** of emergency facilities, $1.3 million. Douglas said this represents the excess over the normal depreciation that is allowed in contract negotiations.

• **Miscellaneous,** $2 million. This included charitable contributions, scholarships to children of employes, grants to universities and research foundations, and legal costs. Sen. McClellan observed that contributions to charities and schools, although they are legitimate deductions for tax purposes, certainly do not represent costs the company had to meet to perform its defense work.

Douglas concurred with Sen. McClellan's observation that the entire $63.8 million represented funds "the company could do with what it pleased—even invest it and make another $2 or $3 million profit."

Douglas said he considered that the $29.8 million end profit that can be reported to stockholders did have a public interest and should be noted at the hearings.

The total contractor cost to the government of the Nike Ajax and Nike Hercules program, launched in 1945, was $2.5 billion—$956 million for research and development and more than $1.5 billion for production.

The subcommittee reported these figures on Western Electric's mark-ups on Douglas subcontract work:

• **Of the $1.5 billion** in 17 production contracts, a total $644 million was farmed out to Douglas. To Douglas' $644-million bill, including $45.5 million profit, Western Electric added more than $21 million in costs and more than $35 million in profits, and billed the Army for $701 million.

• **Of the $956 million** in six research and development contracts, $308 million was subcontracted to Douglas. To Douglas' $308 million bill, including $18.2 million in profits, Western Electric added $6.5 million in costs and $17.9 million in profits, and billed the Army for $332 million.

• **Grand totals were:** to Douglas billings of $952 million, including $63.8 million profit, Western added $28 million in costs and $53 million in profits, and billed the Army more than $1.03 billion.

Justice, FCC Propose Changes In Compromise Comsat Legislation

Washington—Justice Department and Federal Communications Commission last week suggested two changes in widely-supported compromise legislation to establish a communications satellite corporation (AW Apr. 2, p. 20).

Justice, which favors ownership of ground stations by the satellite corporation to minimize the possibilities of domination of the system by American Telephone & Telegraph Co., proposed the elimination of language supporting this view if eliminating it would be in the "public interest."

The FCC proposed that there be three government observers on the corporation's board of directors. The compromise measure, jointly sponsored in the Senate by Sen. Robert Kerr (D.-Okla.), chairman of the space committee and Sen. Warren Magnuson (D.-Wash.), chairman of the commerce committee, provides for 15 directors—three appointed by the President and confirmed by the Senate. This would complicate the job of regulation of the corporation, FCC said, because it might place FCC in the position of opposing policies already approved by the presidential appointees.

In opposing favored treatment for common communications carriers in the ownership of ground stations, Nicholas Katzenbach, assistant attorney general, told the commerce committee: "We recognize that the carriers, having consistently opposed public participation in the ownership of the system, may feel that even with public investment they can still control the system if only they can control the ground stations."

FCC also asked that the ownership of the ground stations be left completely open—but for a different reason than Justice. "Public interest" is too vague a standard, FCC said, and "may tend to create confusion and controversy." FCC has favored ownership of the complete satellite system, including ground stations, by the common carriers.

FCC and Justice both endorsed the compromise measure even though, as Sen. Kerr commented, "no one is completely satisfied with it." The emphasis of all government witnesses has been on speed in establishing the corporation so the U. S. can retain its leadership in developing a world-wide system.

Penetration Aids

Bidders' briefing on a low observability re-entry vehicles program will be held Apr. 19 by the Penetration Branch, Re-entry Vehicles Directorate of USAF's Ballistic Systems Division.

USAF is seeking new concepts in re-entry vehicles which have almost no radar cross section, apparently in connection with developing and testing ballistic missile penetration aids during the two-year Nike Zeus/Atlas tests.

Present plans call for tests involving about 35 rockets and missiles to test concepts generated by the program. Seven of these will use the Atlas F. The remainder will be small rockets.

Siegler May Acquire Trion Instruments

Los Angeles—Siegler Corp., Los Angeles, is expected to acquire Trion Instruments, Inc., Ann Arbor, Mich., a manufacturer of optical masers, after the anticipated stockholder approval of its recent acquisition of Lear, Inc. (AW Feb. 19, p. 34).

Siegler recently extended to Trion a loan which can be converted into equity in the company, although not a controlling interest. With it, however, Siegler acquired an option to pick up control of the Ann Arbor company through additional financing. Siegler's present intentions are to exercise this option provided it acquires 100% of the optical maser firm.

Once acquired, Trion would work jointly with Lear's Grand Rapids Division, with which it already has a close working relationship.

United Aircraft Widens Financial Staff's Scope

Financial management's increasing importance in the aerospace business is recognized in six appointments made last week in the United Aircraft Corp. staff, all in the financial area.

William R. Robbins, vice president and controller, will become vice president-finance, and Harvey H. Corydon, assistant controller, will become controller. Corydon will be succeeded as assistant controller by Charles B. Preston, general accountant, and two new assistant controller posts will be created. C. Ronald Millikin, assistant Pratt & Whitney controller, will become assistant controller-systems and data processing, and Edward C. Grimshaw, former manager of the Norden Data Systems Dept., will be assistant controller and property manager.

Robert A. Aspinwall, now general manager of the Norden Division, will become assistant treasurer.

Cosmonaut Training Program Changed

Moscow—Training program for Russian cosmonauts has been changed in an attempt to increase stability of sensing devices in the inner ear and avoid the motion sickness experienced by Maj. Gherman Titov in his 25½-hr. orbital flight last August.

Meanwhile, Soviet scientists continue to deny foreign press reports that either Titov or Yuri Gagarin are suffering mental or physical space after-effects.

Vasili Parin, a leading space physiologist, said the flights did not affect either cosmonaut mentally or physically, and said the health of both is "enviable." There have been reports that Parin, in a paper that was not released publicly, described Titov as having serious after-effects of his flight.

Active training of cosmonauts has been accelerated "according to a special scheme (looping-revolving swings, batounde or circus spring board, rhoenrad) and so has passive training on stands," the Soviet publication Trud said. "Besides, flights in planes continue, including those . . . for creating conditions of brief weightlessness."

Defense Orders News Blackout On Military Vehicle Launchings

Washington—Defense Department has clamped a blackout on information relating to military space vehicle programs in the belief that too much information affecting national security is being released which is valuable to Soviet Russia.

A secret directive dated Mar. 23 and signed by Deputy Defense Secretary Roswell Gilpatric specifically prohibits prior announcement of impending launches, and ordered names such as Discoverer, Midas, Samos, Saint, Anna and Vela Hotel deleted from military programs. The House Government Information Subcommittee said it will look into the directive and reasons for its classification.

A Defense Department spokesman said each launch will be followed by a brief announcement of the launch with no details, and after an analysis of scientific data, a second announcement might be made. The directive does not affect missile test launches.

The spokesman said the directive is a continuation of a program begun several months ago by Arthur Sylvester, deputy defense secretary for public affairs, designed to reduce the volume of information "which may be valuable to the USSR in their efforts in the field."

Provisions of the directive have been carried out since January, although it was issued in March. Information plan for the Nike Zeus program is generally along the lines of the new directive (AW Feb. 5, p. 32).

Further indication that the directive was imminent has come in the Satellite Situation Report, a summary of the orbital characteristics of space vehicles issued bi-weekly by the National Aeronautics and Space Administration. With the exception of Discoverer 38 launched Feb. 27, code names for military satellites launched since January have been listed as "none" in the NASA report.

The directive was brought to light last week after the successful launch of an undesignated satellite from Point Arguello, Calif., by an Atlas-Agena vehicle. There was some belief that this was the first Saint development payload, designed to rendezvous with a Blue Scout-launched payload. The Blue Scout was launched from the Atlantic Missile Range late last week, but the second stage failed to ignite.

The directive apparently originated within the Defense Department, since the National Aeronautics and Space Council did not consider it formally or informally. The earlier directive issued last July by Sylvester specifically covers photography, and the new directive extends to information.

A NASA spokesman said there is no plan to curtail that agency's information policy, which Vice President Johnson has repeatedly said is completely open to public scrutiny. The Defense directive already has had a side effect on NASA launches, however. On Apr. 10, 55 representatives of the United Nations Committee on the Peaceful Uses of Outer Space (see p. 87), including delegates from six Communist countries, toured Cape Canaveral in connection with the first international satellite—S-51—which carries British instruments in a U. S. structure and is to be launched by a U. S. Delta vehicle.

During the visit, all military test missiles were shrouded with weather curtains, a move requested by the State Department. The S-51 launch was delayed at least two weeks because of a component malfunction in the second stage of the Delta vehicle.

The UN delegation, with 24 nations represented, was the first international group permitted to tour the Atlantic Missile Range launch facility. Soviet delegates at first accepted an invitation to attend, and later declined.

News Digest

Thiokol Chemical Corp.'s Elkton, Md., Division will build the solid propellant tower jettison motor for the Apollo manned spacecraft under a contract expected to exceed $1 million from North American Aviation's Space and Information Systems Division, Apollo principal contractor.

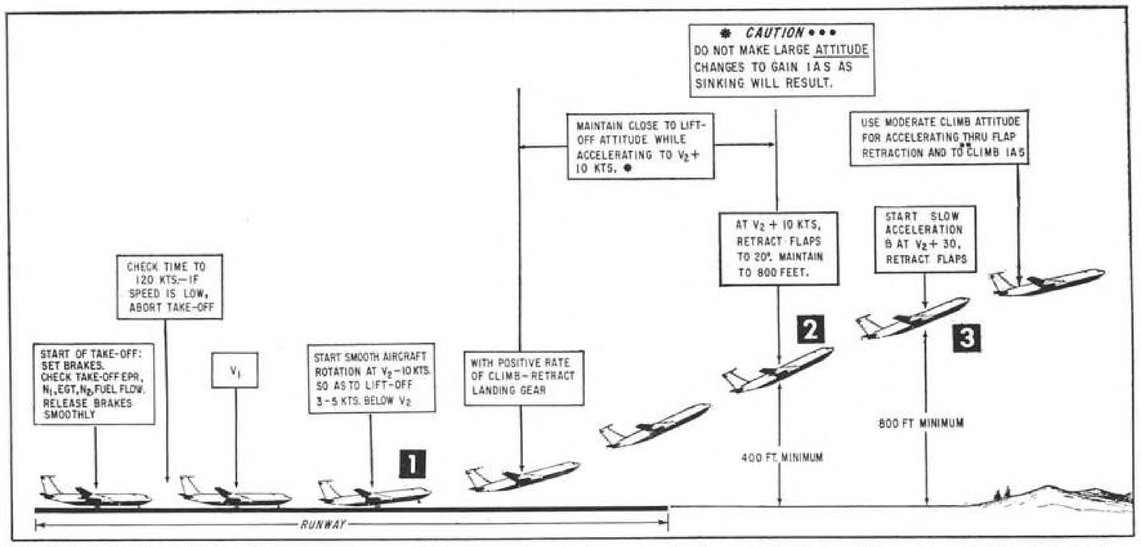
Allison Division of General Motors Corp. has made the first shipment of YT63-A-5 turboshaft engines (AW Dec. 25, p. 46) to the three airframe manufacturers in the Army light observation helicopter competition. They are: Bell Helicopter Co., Hiller Aircraft Corp. and Hughes Tool Co.'s Aircraft Division.

United Technology Corp. has received a $2,141,542 Air Force research contract to design and demonstrate nozzles to withstand extended firing durations, hypergolic ignition for solids, and advanced thrust vector control systems. All these efforts will be tested in subscale firings before final designs of the components are demonstrated with two full-scale UTC P-1 rocket motors developing about 250,000 lb. thrust, and a P-1-2 motor producing almost 500,000 lb. thrust.

Melvin N. Gough, director of Civil Aeronautics Board's bureau of safety, plans to resign May 1 apparently because of conflicts between himself and administrative personnel brought in to evaluate the bureau's efficiency. Gough, an aeronautical engineer and 15,000 hr. pilot with 36 years government service, formerly was director of NASA's Atlantic Missile Range office and chief of the NACA flight research division at Langley AFB, Va. He became a pilot in 1929, three years after graduating from Johns Hopkins University.

Faulty regulator caused pressurization loss in the Atlas liquid oxygen tank on Apr. 11, delaying first launch of the Atlas-Centaur from the Atlantic Missile Range until Apr. 19.

Civil Aeronautics Board agreed last week that Air Line Pilots Assn. complaints have enough merit to docket an enforcement action against Southern Airways, for allegedly allowing its non-union pilots to exceed monthly flight time limitations. Meanwhile, ALPA has begun a refresher ground school course for the Southern pilots, all of whom struck 22 months ago. The course is being taught by pilots employed by Eastern Air Lines.



TYPICAL 707-320 TAKEOFF PROFILE is from an FAA-approved operating manual of a major U. S. trunkline. From 1 (lift-off) to 2 (first flap retraction) normal and noise abatement takeoff procedures are identical. But at 3, the point at which a pilot normally would retract all flap and begin to gain airspeed, anti-noise procedure calls for a power reduction of about 33% effective engine pressure ratio. Thrust reduction is permissible above 600 ft. and results in a rate of climb between 400 and 700 fpm. Takeoff power is reapplied when 707 either clears residential congestion or reaches 2,000 ft.

Report on Trunklines' Noise Dilemma: Part 1

Noise Returns as Major Airline Problem

Abatement costly and is cited as perilous by pilots; congressional action, court ruling stir issue.

By David H. Hoffman

Washington—Jet noise threatens to return this year as a major operational problem that could hamper the domestic trunkline industry in its vital struggle to keep costs in hand.

The running argument of many airline pilots—that anti-noise procedures compromise the safe operation of a jet transport—won congressional recognition when Sen. A. S. Mike Monroney (D.-Okla.), chairman of the Senate aviation subcommittee, announced he would hold hearings to resolve the issue (AW Apr. 9, p. 43). Openly skeptical of certain anti-noise flight profiles for the past year, Sen. Monroney said that anything that tends to narrow the margin of safety available to a pilot cannot be tolerated.

The sensitivity of legislators to the fact that jet noise bothers their constituents was reflected last week in a bill introduced by Sen. Kenneth B. Keating (R.-N. Y.). If enacted, this law would order the Federal Aviation Agency administrator to cooperate with public and private agencies on noise abatement problems under an amendment to the Federal Aviation Act of 1958. The bill would "direct the administrator to move forward with vigor and imagination" and put "the full weight of congressional support" behind anti-noise efforts, Sen. Keating said.

But it would not empower FAA to tell the airlines, "Only X-amount of noise can be made within X-distance of an airport."

With jet costs holding at high levels, net 1961 losses in excess of $34 million and an oversupply of seats per available passengers, the trunks feel the $36 million bill they claim to pay each year for noise abatement is all they can afford. But the volume of noise around the nation's larger terminals is being turned up as carriers expand their jet fleets. And the U. S. Supreme Court reaffirmed last month that the loud, unwanted sound of an aircraft can "take" another's property as surely as a thief.

Higher airport charges, night operating restrictions, mandatory purchase and installation of high lift devices, prolonged litigation or perhaps other cost items that would slow the industry's return to financial health could follow these two developments.

As the open-window summer season approaches, the complex questions at issue involve who will bear the burden of lowering jet noise to a level most courts will tolerate? Or, if noise cannot be suppressed the required amount, who will compensate those injured by it? Can the industry avoid paying such compensation by tightening the anti-noise approach and departure procedures pilots now fly?

Airport operators, especially those in charge of the big hub terminals, have begun mapping a bold legislative program apparently designed to shield themselves from future damage suits. If even the substance of their recommendations passes Congress, federal liability for jet noise will be firmly established, and either the Federal Aviation Agency or Congress—not the courts—will prescribe acceptable noise levels for the airlines.

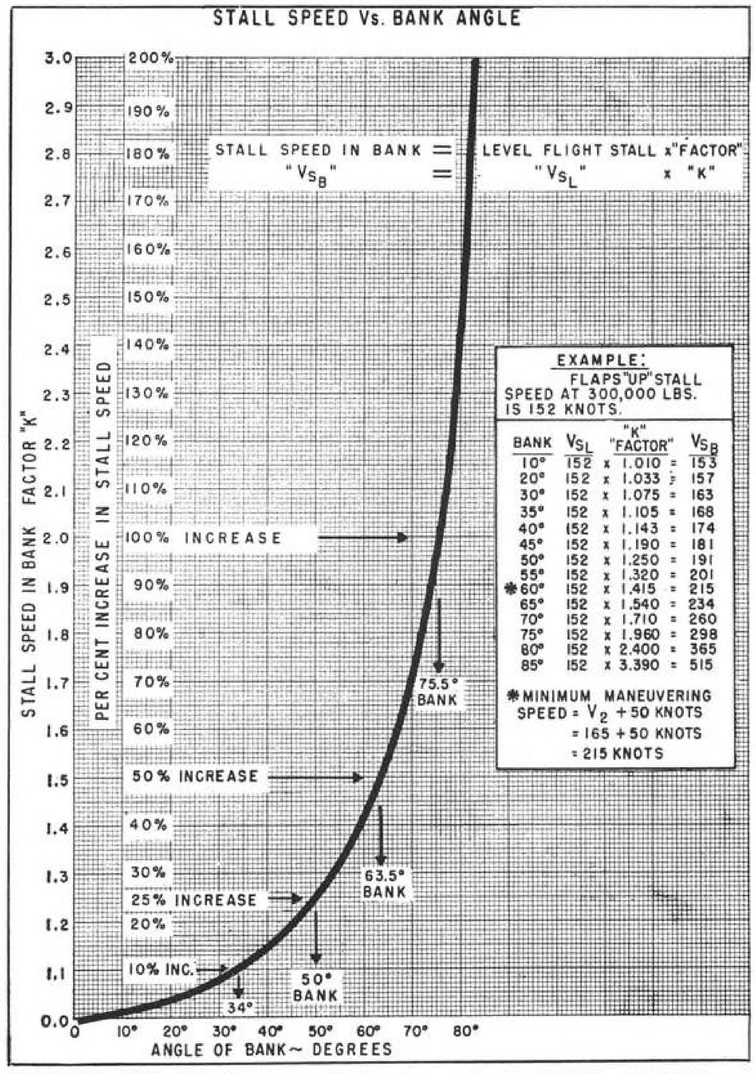
Concurrently, within Air Line Pilots Assn., new leadership is challenging the wisdom of procedures published in November, 1960, to define the maximum maneuvers an aircraft can perform to reduce noise. Speaking for those who feel such procedures represent a less safe way of operating essentially unforgiving aircraft, Capt. John C. Carroll, ALPA's first vice president, told AVIATION WEEK:

"A young pilot in flying school would be washed out promptly for copying the techniques we are asked to use to hold down 707 and DC-8 noise. Management, the FAA and the airport operators constantly urge us to swoop unnoticed out of the sky, discharge our passengers quietly and, by using climb and power reduction techniques that under any other circumstances would endanger our licenses, zoom silently back into the clouds."

During most of 1960 and 1961, FAA and organized aviation groups insisted that noise was a "problem second only to safety," but with no sense of urgency. Industry's anti-noise efforts proceeded at a slow, steady pace. American Airlines retrofitted all of its 707-120s with turbofan powerplants, but no other U. S. carrier followed suit. A new FAA rule laid down guidelines for local noise abatement takeoff and landing procedures. Some carriers sought to reduce turbojet compressor whine by installing so-called hush kits. Delta Air Lines bowed to the Port of New York Authority and agreed to abide by, rather than test in court, the Port's elaborate anti-noise rules. FAA sent Federal Housing Administration criteria to use in granting mortgages on dwellings near airports.

Behind the resurgence of noise as a national issue are these forces:

- **Trend of recent federal and state** court actions, especially the controversial U. S. Supreme Court ruling last month in Griggs vs. County of Allegheny (AW Mar. 12, p. 319).
- **Residential encroachment** on airports that lack protective buffers of pre-zoned land, as well as airport encroachment on old residences through expansion projects.
- **Steady phase-in** of more than 325 turbojets by U. S. airlines since October, 1958. Of these, less than half now have, or are programed to get, turbofan powerplants.
- **Relative stand-still** in the state-of-the-art of sound suppressor development coupled with a shortage of financially meaningful airline interest in high-lift devices.
- **Crash of an American Airlines** 707-123B at New York International Airport Mar. 1, shortly after the turbofan-powered jet completed a transition from noise abatement to standard instrument departure procedure.



SHALLOW BANK ANGLES of up to 20 deg. increase Boeing 707-120 and 707-320 stall speeds by up to 5 kt. Note that stall speed climbs sharply when bank is steepened beyond the 20 deg. point. Stall speed (V_{sb}) of a Boeing 707-320 in a 45 deg. bank with gear and flaps retracted and a gross weight of 300,000 lb. is about 181 kt. IAS, or 29 kt. higher than the transport's level flight stall speed (V_{s1}). Pilots' argument that low-level turns at reduced airspeeds compromise safety is based partially on this bank-stall relationship.

- **Jet exhaust noise**—not compressor whine—originates in the shear between the hot gases expelled by a turbine and the surrounding air. The strength of this sound increases rapidly as jet exhaust velocity is increased. In the turbofan engine, power is absorbed from hot gas exiting the turbine and used to turn a fan. Jet velocity on the Pratt & Whitney JT3D turbofan, for example, is lowered from 2,130 fps. to 1,510 fps. as one result of this absorption process. The higher thrust-to-weight ratio afforded by the turbofan also makes possible steeper angles of climb after takeoff. Thus the turbofan helps abate noise in at least two ways.

In the Griggs case, the original plaintiff brought suit in 1953 against Allegheny County, the operator of the Greater Pittsburgh Airport, to recoup damages he said were caused by the noise of arriving and departing airline transports.

The Mar. 5 decision of the Supreme Court acknowledged that the pertinent facts of the case had been stated accurately by a lower court, which found that "regular and almost continuous daily flights . . . have been made . . . directly over and very, very close to plaintiff's residence." During these flights, the plaintiff's household was unable to sleep "even with ear plugs and sleeping pills," the decision said. The

windows of the home would "frequently rattle and at times plaster fell down from the walls and ceilings." As a result, the health of the plaintiff and his family was "impaired," and all were "compelled to sleep elsewhere" at times.

About 3,250 ft. separates Griggs' former home from the beginning of Pittsburgh's northeast runway. A standard, FAA-approved 40-to-1 slope gradient marked the runway's approach path. If presented as a plane, this gradient extended from the runway's threshold through a point 11.36 ft. above the Griggs chimney.

The legal question at issue when the case reached the Supreme Court was whether Griggs was entitled to compensation because someone had taken an air easement over his property. While answering in the affirmative, the court laid down what a number of informed lawyers interpret as a narrow but very important rule of law. They consider this to be its meaning:

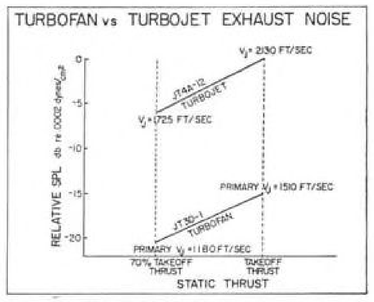
When the tempo of aircraft activity near an airport renders property unfit for a natural use to which it has been put, and this fact is proved, there has been a taking of an air easement over that property by the airport's operator and the owner of the property is entitled to compensation.

In the 1945 case of United States vs. Causby, the Supreme Court held that frequent low-level flights of the U.S. Army Air Corps over Causby's chicken farm amounted to such a "taking." But in the Causby case the Army Air Corps was a user of the airspace, rather than the operator of a nearby airport. The Air Corps, in the Causby litigation, was a tenant of the Greensboro-High Point (N.C.) Municipal Airport Authority.

Congress probably was responsible for basic distinction between the Griggs and Causby cases. When the Causby case reached Supreme Court, only "airspace above the minimum safe altitudes of flight" prescribed by the old Civil Aeronautics Administration was placed in the public domain by federal statute. Responding to the Causby decision, Congress later amended the law to read that airspace in the public domain was also to include "airspace needed to insure safety in takeoff and landing of aircraft."

Under this definition, airlines gained solid legal authority to operate at glide slope and climbout altitudes, while liability for the noise they generated was shifted to the airport operator.

The court's majority flatly rejected Allegheny County's claim that the federal government was guilty of expropriating property and should reimburse Griggs. The Federal Airport Act, the court said, allows the FAA administrator to approve 50 to 75% of the "costs of acquiring land or interest



SCALE AT LEFT reflects the relative sound pressure levels (SPL) of exhaust noise generated by two Pratt & Whitney engines. Noise reduction is achieved by lowering the speed (V_1) at which exhaust gas exits the fan engine. Jet takeoff noise, as opposed to the compressor whine associated with lower power approaches, has an intensity that varies directly with the seventh power of V_1. Takeoff thrust of the JT4A-12 and JT3D-1 is almost equal.

therein or easements through or other interests in airspace." Allegheny County, in designing the Greater Pittsburgh Airport, "had to acquire some property. Our conclusion is that by Constitutional standards it did not acquire enough." An airport without adequate "approach areas is not operable," the court concluded.

Reaction to the case ranged from the Air Transport Assn.'s stand, which scorned its significance, to that of FAA Administrator N. E. Halaby, who recently hinted that federal aid to airports may have to be stepped up to protect communities from lawsuits arising out of the Griggs rule.

ATA's analysis of the decision stated that "from any viewpoint, there is nothing in the Griggs case which is new, startling or unexpected." On three separate occasions, however, the ATA interpretation warned that "public overstatement of the significance of the case" could open the floodgates of litigation. ATA's memorandum, dated Mar. 9, reappeared verbatim the same day, as a news story, in the National Aircraft Noise Abatement Council's news letter. NANAC is composed of ATA, ALPA and Aerospace Industries Assn.

Reaction to the ruling that probably represents a consensus is that the true significance of the case will not be known until subsequent litigation can define circumstances within which airport neighbors can sue and expect to collect for noise damage. While this framework is being developed, airlines undoubtedly will strenuously oppose any attempt by airport operators to impose limitations that might lessen noise but handicap the efficiency of their aircraft.

Concurrently, airline pilots are making it clear that they will not tolerate more demanding noise abatement procedures and may well seek to repeal some of those now in effect. On this subject, Capt. Carroll, the only announced candidate for ALPA's presidency, said this:

"We will not move farther in a less safe direction while studying whether to retreat. We will not turn nearer the ground, steepen our banks, climb at dizzier angles or throw away thrust—for there are safer ways to reduce noise."

"The aviation industry," Carroll said, "will find ALPA a willing partner in any effort to perfect high-lift devices, sound suppressors or quieter, more powerful turbines." But, he added, airline interest in improvements such as boundary layer control and slotted wings and flaps seems to have evaporated and only one carrier has converted its jet fleet to turbofan power.

"Airlines have ordered jets with specific ranges, specific interiors, specific costs and specific seating capacities, but never, to my knowledge, has an airline linked a purchase to the presence of a quiet engine," Carroll said.

In all, there are 57 air carrier airports with FAA-approved anti-noise procedures. Of these, six involve a system of preferential runways and nothing more; 30 entail special procedures of an air traffic control nature; and 21 use a combination preferential runway and ATC system to abate noise.

FAA Red Book

Each calls for maneuvers based on standards set forth in FAA's "Red Book" on noise—a pamphlet that emerged from an Apr. 20, 1960, meeting attended by airline, pilot and manufacturer representatives. Sections of this pamphlet applicable to the 707, DC-8 and 880 authorize the following procedures:

- **Shallow turns** of 5 to 10 deg. bank at altitudes less than 500 ft. to adjust heading to "avoid obstructions or congested areas."
- **Bank angles** of up to 20 deg. above an absolute altitude of 500 ft. on takeoff. At 2,000 ft., noise levels are presumed acceptable.
- **Climbout at V_2** plus 10 kt. to 1,000 ft. where, if necessary, power can be reduced to 2.1 EPR (engine pressure ratio) on JT3-equipped aircraft or to 1.9 EPR on aircraft powered by JT4s.
- **Minimum descent** angle of 2.5 deg. on visual final approach to be initiated, if practicable, when aircraft is not less than 2,000 ft. above terrain.
- **Takeoff on preferential** runway if crosswind is not more than 15 kt. at an angle of 15 deg. or if downwind component is not more than 5 kt.

Technically, V_2 is that speed which gives the best angle, not the best rate,



Cunard Eagle to Begin 707 Service May 5

First of two Rolls-Royce Conway-powered Boeing 707 jet transports purchased by Cunard Eagle Airways is shown in the airline's markings. Aircraft will be used on routes from London to Bermuda, Nassau, Miami and Jamaica, with first scheduled flight set for Miami on May 5. There will be three services weekly in each direction. Cunard Eagle, first British independent airline to put jets in service, will work with the parent corporation, Cunard Steamship Ltd., to promote a "one-way sea, one-way air" transatlantic tour package.

of climb in takeoff configuration; it must be at least 10% greater than the minimum control speed.

The Red Book containing these procedures is careful to point out that judgment should be kept in the cockpit, and that the pilot always should follow the safest course of action he has available. It is also true that most of these anti-noise procedures lack the force of formal civil air regulations, and that line captains representing ALPA took part in the technical discussions that led to their formulation.

Dissident Faction

However, those pilots who favor a total re-evaluation of the Red Book maintain that ALPA never endorsed the precise procedures it contains, that these were unveiled as accomplished facts after a few group discussions. According to this ALPA faction, the disputed noise procedures are identical to those proposed by Pan American World Airways in October, 1958, when it sought permission from the Port of New York Authority to operate 707s through Idlewild Airport. Because of a four-month ALPA boycott, all of the experience on which the Pan American proposals was based had been accumulated by supervisory or "management" pilots and hence did not reflect the line captain's viewpoint.

ALPA critics of the current anti-noise procedures also contend they were drafted during a period when the union was battling former FAA Administrator E. R. Quesada's proposal for mandatory pilot retirement at age 60. Not only did the pilots lack a broad base of turbojet operating experience in 1958, 1959 and 1960, they also were reluctant to admit that anything in the cockpit was difficult to perform until the retirement issue had been decided.

What probably arouses the most anger within ALPA is its own charge that the original anti-noise procedures became less optional, more demanding and less safe as they found their way into the trunklines' FAA-approved operating manuals. Here is one example cited by the pilots:

FAA's Red Book says takeoff procedures "do not preclude" 5 to 10 deg. banks at less than 500 ft. to avoid congested areas, as well as power reductions at 1,000 ft. to reduce noise. But manuals issued pilots employed by a carrier operating JT3-powered 707-120s and JT4-powered 707-320s say that bank angle while flying at V_2 plus 10 kt. should not exceed 15 deg. and that thrust reduction should not be completed below 600 ft.

Pilots describe the difference between the original FAA standard and the company standard as "typical erosion," and note that neither places an upper limit on the amount of turn that can be required at very low altitudes.

The same carrier's manual shows that normal and standard noise abatement takeoff techniques are identical for both 707 types until 800 ft. is reached. Rotation is begun 10 kt. before V_2 on signal from copilot. Flaps are retracted from 30 to 20 deg. at 400 ft. V_2 plus 10 kt. is maintained to 800 ft. At this point, the pilot normally would trade climb for airspeed, accelerate to V_2 plus 30 kt., retract all flap and, when desired climb speed was attained, continue his climbout.

Reaching 800 ft. in a noise abatement climb, however, a 707-320 pilot on this airline would reduce power from about 2.5 EPR to about 1.9, thus losing about 33% of his effective thrust. Rate-of-climb at this EPR should be 400 to 700 fpm., according to the company, which cautions pilots: "It is very important to carefully maintain the airspeed at V_2 plus 10," for "acceleration at this point will destroy the positive rate-of-climb."

"After clearing the critical area or reaching 2,000 ft.," this company advises, "acceleration to climb speed is sometimes a problem, particularly on the 120." As a result, the company authorizes a return to dry rated power, which can be used no more than 5 min. per takeoff. Three minutes of this should remain for acceleration beyond V_2 plus 10 kt. at the 2,000 ft. level, the company said.

Testifying before Civil Aeronautics Board on what could have led to the crash of a 707-123B at Idlewild Airport Mar. 1, veteran American Airlines Capt. Hamilton Smith said that the terminal's anti-noise procedure was essentially safe. But, Smith added, the word "safety" applies to a broad band of operating procedures. Within this band, anti-noise procedures are very close to the boundary between the safe and the unsafe, according to Smith.

Such rules, he said, allow no cushion of time to recognize, analyze and decide what action must be taken to cope with a cockpit crisis. A pilot needs airspeed to handle emergencies involving a sudden loss of power, and he cannot get it by following anti-noise procedures, Smith told CAB.

Example Cited

To illustrate what Smith meant, V_2 plus 10 kt. for a fully loaded 707-320 departing a sea level runway on a relatively hot day is about 175 kt. IAS. Assuming that one engine was lost very early in such a takeoff, a pilot could not cope with a subsequent loss of rudder boost power, for his aircraft would be below minimum control speed. His alternatives would be limited to reducing thrust on the opposite side of the aircraft. Another probable response would be to push forward on the control yoke to avert a stall. But in a swept-wing jet transport, any large change in attitude to gain airspeed leads to sinking, as does substantial loss of power.

The lighter the aircraft, the lower the figure for V_2 plus 10 kt. On short stage lengths it can be as low as 150 kt. for the 707-320. Yet recommended two or three-engine climb speed for the transport is 257 kt. at maximum continuous thrust.

When reminded that no noise abatement procedure can legally supersede their own judgment in the cockpit, the pilots answer that pressure to obey such rules is being generated constantly by

the airlines, some airport operators and FAA. At Idlewild, for example, anti-noise takeoff procedure from Runway 31L calls for a 20 deg. left turn to a 290 deg. heading.

Instructions for executing this procedure are included in the pilots' operating manuals. A sign at the takeoff end of the runway repeats what should be done. The controller who clears the flight for takeoff tells the pilot, "In the interest of noise abatement, do not delay your turn to 290," or, according to some pilots, "begin your turn immediately" or tighten it. Then, if the takeoff still produces what the Port of New York Authority considers an excess number of "perceived noise decibels [PNDB]" the captain is likely to receive a letter from his airline asking for an explanation.

A similar situation prevails in London (AW Mar. 19, p. 42), where TWA and Pan American are competitive and where the government allows even less noise than the Port Authority. To remind its pilots not to make loud takeoffs, TWA sends them letters that read:

"Your Flight 307/29 December, 1961, recorded a noise reading of 106 DBS on Runway 10L, with a reported wind of 110/16 knots, temperature 53.05F, and a takeoff gross weight of 258,081 pounds.

"The noise level recorded for this flight is considerably in excess of the maximum allowable by the Air Ministry [110 PNDB daytime, and 103 PNDB at night].

"Your report, outlining the circumstances which contributed to this unusually high noise level, is requested at your earliest opportunity."

Under CAR 60.18, which took effect on Sept. 22, a pilot who elects not to follow an FAA-approved preferential runway system also may be ordered to furnish wihin 48 hr. a full description of his reasons to local FAA authorities.

When the CAB hearings adjourned last month, Capt. E. J. Bechtold, safety chairman of ALPA's Eastern Region, called for a "complete review and re-evaluation" of Idlewild noise procedures. In a letter to Wayne Hendershot, a deputy assistant FAA administrator in New York, Bechtold asked that the radio transmission, "In the interest of noise abatement, do not delay turn to 290 deg.," be discarded at Idlewild.

Hendershot replied that New York anti-noise and ATC separation procedures were being reviewed. FAA, he said, would call a meeting this month to report on the controversial phraseology and discuss whether it should be retained, deleted or modified.

Although seemingly unimportant, Idlewild's Runway 31L, where the anti-noise turn to 290 deg. is required, is 14,600 ft. long and last year accounted for 66,639 departures or 49.2% of the airport's total. The Port Authority, in addition, does not permit jet takeoffs between 10 p.m. and 7 a.m. unless they can be made from a runway that aims the aircraft over water.

Unless a turn to 290 deg. is begun about two-thirds of the way down 31L on takeoff, jets fly directly over the densely populated village of Howard Beach, Long Island. And a spokesman for the Port Authority told AVIATION WEEK that if the turning procedure was scrapped, jet use of the airport's longest runway would be banned at night.

(This is the first of two articles on airport noise problems. The second will appear in a subsequent issue of AVIATION WEEK.)

Douglas 2086 Fate Hinges on 125 Orders

Long Beach, Calif.—Douglas Aircraft Co. formally unveiled a full-scale mockup of the Model 2086 short-haul, twin-jet transport designed to operate economically on route segments of 250-300 mi. (AW Jan. 22, p. 48).

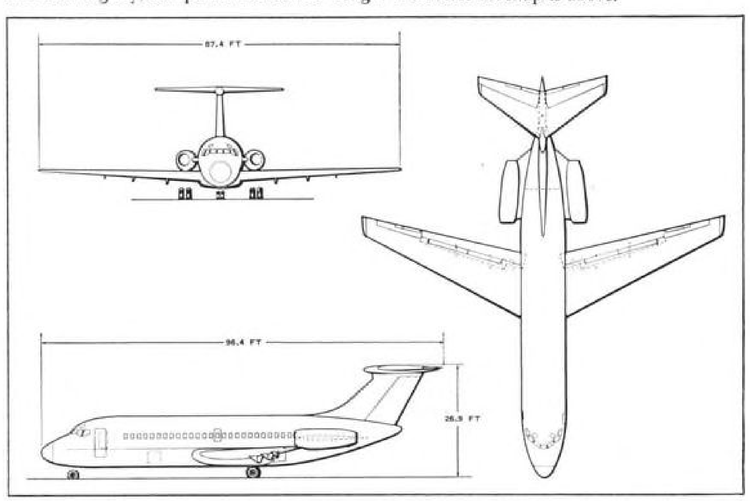
Outlining a tight time table which calls for the first aircraft to be delivered to a customer in late 1964, a Douglas official said that the company would not proceed beyond the present preliminary design stage until firm orders for 125 Model 2086s were on hand. Mid-summer is the latest date for go-ahead to meet the 1964 delivery. A tight engineering, production and flight testing schedule will be necessary in order to bring the 2086 to customer airlines in the same time interval as the competing British Aircraft Corp. BAC 111.

Proposed powerplants are two 10,500 lb.-thrust Pratt & Whitney JTF10 A-6 turbofans. Development cycle of these engines, Douglas said, is parallel to the development schedule of the airframe. An alternate engine could be the Rolls-Royce Spey RB163-2 which is in the same thrust category.

Maximum takeoff weight of the Model 2086 is 69,500 lb. and this and all other specifications are very close to those reported earlier. Average cruising speed on a typical flight stage at 25,000 ft. is 530 mph. or Mach .76. The design philosophy is to keep the maximum speed at a reasonable figure and concentrate on low speed handling.



MODEL 2086 engines have been positioned lower and brought forward, and dimensions increased slightly, compared with earlier design. Full-scale mockup is above.



National Stock Option for Maytag Reported

Washington—Option to purchase the National Airlines stock of Board Chairman George T. Baker at above-the-market prices reportedly has been acquired by Louis B. Maytag, Jr., former president and majority stockholder of Frontier Airlines.

Though Baker's holdings do not represent a controlling interest, such a sale would insure Baker's cooperation for Maytag to gain a voice in management of the airline.

Baker told Aviation Week that he would neither "deny nor confirm" persistent reports that he has been negotiating the sale of his 10% interest in National Airlines to Maytag. Baker added that he would be willing to "sell anything for the right price."

Maytag, who recently sold his 67% interest in Frontier to the Goldfield Mining Corp. for a reported $3 million, was unavailable for comment and his close associates denied any knowledge of the transactions with National.

Unless announced publicly by either Baker or Maytag, details of the alleged transaction could remain undisclosed until the middle of May. There is no record of a large stock sale by Baker, or the acquisition of any holding in National by any party in the Securities & Exchange Commission files. SEC spokesmen point out, however, that if the sale has been made the commission's regulations would not require a filing before May 10.

Civil Aeronautics Board reports show that Baker owns 165,932 shares of National's authorized 1,851,823 outstanding shares, plus $450,000 of the company's issue of $10.2 million in 6% subordinated convertible debentures.

In addition, Baker's wife, Irma W. Baker, holds 61,683 shares of stock and $256,700 in debentures, according to the airline's 1961 proxy statement.

Baker resigned as president of National last November, but remained as chairman of the board, and selected his nephew, Robert E. Wieland, as president.

In another development last week, a former National vice president, Lewis W. Dymond, was elected president and director of Frontier Airlines at a stockholders meeting in Denver. Richard C. Pistell, chairman of the board of Pistell & Co., which has controlling interests in Goldfield Mining, and Willis A. Swan, president and chairman of Goldfield and Getchell, a subsidiary of the mining corporation, were named co-chairmen of the Frontier board of directors.

Douglas has designed the aircraft to existing state of the art primarily to gain high reliability.

The wing is designed for a maximum Mach divergence drag number of .84 so that stability augmentors and complicated flight control mechanisms will not be needed. Aileron and elevator controls will be direct mechanical, no-boost system using aerodynamic tabs. The rudder will have dual, tandem hydraulic actuators with a mechanical backup. Engine driven pumps with a.c. electric pumps for backup will supply hydraulic power. Electrical system will be a.c. using engine driven alternators. Flaps, spoilers, landing gear and nose wheel steering will be hydraulically powered.

Approach speed will be 133 mph., 1 mph. faster than the DC-7. FAA landing distance at a maximum permissible landing weight of 65,800 lb. at sea level is 5,300 ft.

Model 2086 is designed to carry 74 coach class passengers, three fewer than planned earlier, or 56 first class. Combinations of mixed coach and first class also are possible.

Douglas computes the market potential for the aircraft at 400 units in replacement of Electra, Viscount and piston-powered equipment. Quoted cost of the aircraft is approximately $3 million per aircraft including normal customer options.

Specifications include:

- **Maximum ramp weight, 69,500 lb.;** maximum takeoff weight, 69,000 lb.; maximum landing weight, 65,800 lb.; operating weight, empty, 42,185 lb. and zero fuel weight, 60,000 lb.
- **Fuel capacity, 2,620 gal.**
- **Payload (weight limited),** 17,950 lb.
- **Rate of climb, 2,900 fpm.**
- **FAA takeoff field length** at maximum gross, sea level, 5,020 ft. FAA landing field length at maximum landing weight, sea level, 5,300 ft.
- **Landing speed** (maximum landing weight at 1.25 stall speed), 129 mph.

Early Action Doubted On President's Plan

Washington—Airlines have adopted a "wait and see" attitude on President John F. Kennedy's transportation message (AW Apr. 9, p. 42) on the assumption that little, if any, action can be expected on the proposals this year.

Only the President's formation of a special merger guidance committee under the Department of Commerce was regarded as a new development by the carriers. The balance of the recommendations, they point out, are already in the form of bills now awaiting action in Congress. Most observers doubt that there is sufficient time for congressional action on the measures and predict that they may be held over until next year, or even shelved indefinitely like many other transportation recommendations.

While the industry generally approved the President's emphasis on less government regulation, a majority of carriers expressed confusion over the appointment of the merger committee. Rather than reducing government regulations, they contend, the addition of this committee would seem to "add another layer of bureaucracy" over the present authority of the CAB.

In addition, other spokesmen contend, the committee's appointment could amount to nothing more than an "after-the-fact" move since the CAB's current consideration of a proposed American-Eastern Air Lines consolidation can be expected to establish acceptable criteria for all future merger proposals within the airline industry.

Kennedy's insistence on lower air fares to increase traffic volume also appears to clash with other segments of the message recommending heavy fuel taxes to recapture some of the cost of operating the federal airways system and a 5% tax on all airline tickets, many operators feel.

On the one hand, the financially troubled industry faces the prospect of significantly higher operational costs through the fuel tax proposals, the airlines point out.

Repeal of the 10% transportation tax, also suggested by Kennedy, is partially offset by imposition of the tax on tickets.

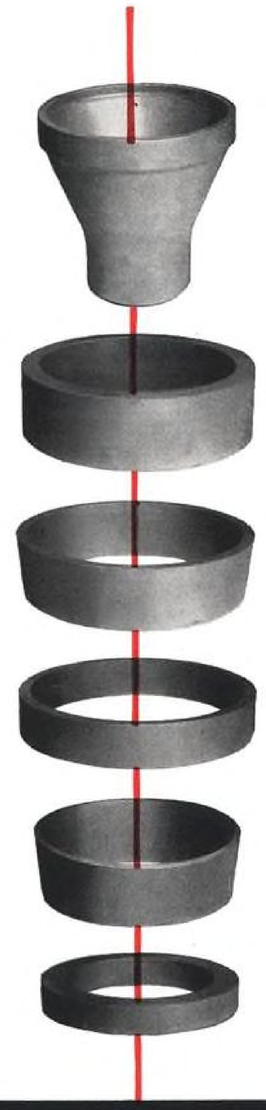
On the other hand, they claim, the industry is asked to meet these rising costs by charging lower fares, despite their unprofitable experience with low cost coach services.

While the President's plea for a sharp reduction in the industry's total subsidy bill brought no unified objection from the airlines, they expressed concern that any acceleration of the present pace of subsidy reduction might injure the future of many airlines.

The President endorsed CAB legislation which would make domestic trunk carriers ineligible for subsidy in the future, and called for a sharp reduction and eventual termination of subsidy for the local service airlines and helicopter operators.

Several airline spokesmen conceded that the elimination of subsidy for trunk airlines has long been expected and that it was anticipated the President might recommend a termination of subsidy for the three present helicopter carriers because of their high subsidy bills and lack of profit potential in the foreseeable future.

However, they questioned Kennedy's directive to the CAB to develop, by June 30, 1963, a detailed program of subsidy reduction, "with annual targets."



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Big 1962 Atlantic Traffic Gain Doubted

By Glenn Garrison

New York—Despite some predictions of greatly increased traffic on the North Atlantic this coming summer season, the airlines' chances of recovering from a disastrous 1961 peak period were clouded with uncertainty last week:

• **Group fare decision** by the Civil Aeronautics Board was expected momentarily. But while some carriers believed the fares, if approved, would provide a strong stimulus this season, others felt the impact of the new plan for this summer at least might have been lost by the delays in selling it.

• **Advance bookings** in general show no significant increases over last year at this time, although there are exceptions. However, airlines say that the trend to later and later bookings is increasing and advance bookings are a poor indication of prospects for the season. Furthermore, the bookings picture this year has been complicated by the uncertainty over whether group fares would be available during the summer for those who wished to take advantage of them.

• **Traffic for the first quarter of 1962** was up 16% over the same quarter of 1961, but load factor was off 3%. In the 1962 quarter (with March estimated), the scheduled airlines carried 341,941 passengers and offered 726,981 seats in both directions, a capacity increase of 23% over the same period of last year. In first quarter of 1961, traffic had increased 29% and capacity was up 47% over the first quarter of 1960. Load factor for the 1961 quarter was 50%, for the 1962 quarter load factor was 47%.

The soaring increase in seat capacity last summer—37% for the June through September peak period—is unlikely to be repeated this year, since the jet fleets made their full impact in 1961. Given any significant increase in traffic, therefore, load factors should not suffer as they did last year.

Capacity Increase

Over-all capacity increase this summer over last, an AVIATION WEEK survey indicates, should range between 15% and 20%.

Some airlines report strong response to the group fare plan. Pan Am, for example, by early last month had had about 20,000 inquiries and made 10,000 reservations. But most of the reservations are conditional on CAB approval. The Board approved the plan only through May 31, held hearings earlier this month and was expected to issue a decision on extending the fares by late last week.

Pan Am's first group, 32 members of a Denver club booked through a travel agent, was scheduled to leave yesterday for London, where members would disperse. British Overseas Airways Corp. has already flown a group. Trans World earlier this month had booked—conditionally—272 groups totaling 9,106 seats.

In its presentation to the Board, Pan Am estimated the group plan would provide a 10% transatlantic traffic increase annually for that airline, some 40,360 passengers. TWA estimated it would carry 25,000 passengers this year under the plan, of whom 10,000 would not make the trip if the plan were not available.

But some airline officials feel that the timing of the plan—even assuming CAB approves it for the summer—has ruined chances for it to make a big success this season. International Air Transport Assn., after being stalled for some time on reaching any low-fare agreement for this year, finally approved the plan for groups of 25 or more only in early February. It was in that month that the first promotional efforts were made, and then came CAB's cut-off date of May 31 until the hearing was held and a decision rendered. According to one view, IATA is at fault because a decision should have been made early enough to allow plenty of time for CAB to study the plan.

Adverse Effect

One official suggested that the delay and uncertainty involved in the group plan might even adversely affect the season as a whole, because potential customers, not being sure whether they could book under the plan, might become discouraged with the idea of a transatlantic trip and decide not to go at all.

There continues to be some criticism of the plan as a discriminatory fare with confusing rules. IATA, subsequent to its approval of the fare, issued a memo spelling out more precisely how a spontaneous group should be defined:

". . . a group formed when all the persons of which it is composed are assembled for purposes excluding that of the formation of a travel group. Its formation must not have been referred to previously in writing of any kind, including personal notes or letters. It must not have resulted in whole or part from solicitation by telephone, from oral solicitation other than that directed simultaneously to the persons assembled for purposes excluding that of the formation of a travel group, or from use of any other media of public communications including public address systems, radio, telegraph, or television . . ."

In the view of some officials, the travel agent is put in a position where he must break the rule—if he understands it in the first place—to stay in business.

By and large, however, most officials believe the group fares should have at least some beneficial effects on traffic this year.

Airline estimates of the season's probable traffic vary considerably, but most foresee an improvement over last year. Among the factors cited, in addition to the group fares if approved, are an upturn in the U. S. and European economies, less publicity concerning the U. S. balance of trade which may have caused fewer Americans to travel to Europe last year, lessened political tensions, and an accumulated desire to travel.

Airline Prospects

Here are some individual prospects for the season:

• **Pan American's capacity** will rise about 16% this summer at the peak, with 184 weekly flights in both directions compared with 158 flights last year. The airline is estimating a 20-25% increase in its summer traffic. Pan Am expects to have received two or three of its 707-321B turbofan Boeings by the peak and will use them in nonstop service to Rome. Reflecting the trend to increased service at gateways other than New York, the airline this summer will operate increased frequencies from Baltimore to Paris via Philadelphia, and add transatlantic schedules from Detroit and Chicago.

• **Trans World Airlines** will increase capacity by about 15%, with 92 weekly flights in both directions during the season's peak period. Traffic forecast is for a 30% increase. Among TWA's reasons for optimism are an increased jet fleet for domestic and international operations; the domestic jets provide better feeder services for the transatlantic routes. TWA also believes its new, spectacularly-designed terminal building at Idlewild, scheduled to open next month, will arouse interest and stimulate customers for TWA. The airline's 1961 international passenger total represented a decline from the previous year, so a big percentage increase would not mean as much in absolute terms as would such an increase from some other carriers. TWA, which had nine 707-331 jets on the Atlantic route last year, this summer will schedule 12. Interest in group fares caused large reductions in TWA's charter requests, which suits TWA, because it had no more piston equipment available for Atlantic charters. TWA's traffic has shown an in-



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crease for each of the past six months over the same months of the previous year, with an international passenger-mile increase of 28% for the period. The March, 1962, increase over the previous March for the North Atlantic was 48.3% in revenue passenger-miles to a total of 74,442,000.

• **Air France is predicting** a traffic increase for the season of 53%, with a capacity rise of about 12% to 5,382 seats each way during a peak period week. Early bookings for June, July and August are up 10-13%. Air France is scheduling a new Chicago-Paris nonstop service and a new Houston-New York-Paris service.

• **BOAC will schedule** 146 flights in each direction during a peak week, up about 6%. A 10% or more increase in traffic is forecast. BOAC's capacity was up about 23% last year, so an improvement in load factor is anticipated this summer. Bookings are slightly ahead of last year's. The airline said, if CAB approves the group fares, a considerable increase in business would result.

• **KLM Royal Dutch Airlines** anticipates an increase of 20% in transatlantic revenues for the season. Bookings are slightly ahead of last year's, and a number of people interested in group fares may be waiting. KLM's frequency will total 28 each way in a peak week, of which one daily flight will be an all-economy DC-7C. Last summer the schedules were the same except for one less jet flight weekly.

• **Lufthansa's capacity** will be up by 5-9%, depending on how traffic develops. This should range from 7,064 to 7,350 seats in both directions during a week at the season's height.

• **Scandinavian Airlines System** will hold to 21 weekly round trips at New York, increase its Los Angeles flights by one to a total of seven. Bookings for June and July are lagging while the group fare question is decided. SAS had about 2,000 group fare seats booked when the cut-off point came.

• **Alitalia is predicting** a 40% increase in traffic, with a 33% rise in capacity to 24 flights each way in a peak week. Bookings through July are up 18%. Alitalia believes its position in the Atlantic competition is especially favorable this year, with six weekly nonstops to Rome and daily service to London. It also is serving the Chicago gateway this year.

• **Trans-Canada Air Lines is increasing** its all-DC-8 services from 21 flights to 24 in each direction. TCA reports an unexpectedly heavy demand for travel under the group fare plan, which the Canadian Air Transport Board did not set a cutoff date for as did CAB. TCA said it had some extra DC-8 time available this year for charter, and several charters were canceled in favor of group fare bookings.

Electra Crash Award

Houston, Tex.—Attorneys for Lockheed Aircraft Corp. and Allison Division of General Motors last week indicated that they would appeal a verdict by a Houston district state court jury that the two companies were negligent in the crash of a Braniff Airways Lockheed Electra at Buffalo, Tex., in 1959. The jury absolved Braniff from liability in the accident and recommended an award of $250,000 to the plaintiff in the suit, Mrs. Suzanne Quick, whose husband was killed in the crash. Mrs. Quick had asked for $500,000 in her suit against Braniff.

The airline had filed cross-suits against Lockheed and Allison.

The decision may set a precedent for some $55 million in other lawsuits now pending in courts as a result of the Buffalo, Tex. crash and a crash of a Northwest Airlines Electra at Tell City, Ind. in 1960 and for possible follow-on claims filed by operators of the Electra who suffered financial losses as a result of performance restrictions placed on the airplane by Federal Aviation Agency pending modification of the Electra's wing.

Eastern Files Revised Excursion Fare Plan

New York—Eastern Air Lines has filed a schedule of summer excursion fares in the northeast-Florida market which replaces the broad package proposal it had made to Civil Aeronautics Board in February (AW Mar. 5, p. 30).

The broader package, the Board had informally indicated to Eastern was unacceptable because of competitive objections.

National and Northeast have filed somewhat similar tariffs. Under the new schedule, round-trip day or night jet coach New York-Miami fare will be $99 during the spring and fall periods and $113 during the summer peak between June 15 and Sept. 3. This distinction between the "off" and "peak" non-winter periods was a feature of Eastern's original proposals to the Board.

Present comparable day coach fare is $146.10. New fares apply Monday through Thursday.

National also has filed for a propeller aircraft excursion fare with a New York-Miami round trip for $89. The excursions involve a minimum and maximum number of days for the trip.

Also a feature of the plans is a half-fare rate for children, between the ages 2 to 17, accompanied by an adult. This also was a feature of Eastern's package proposal.



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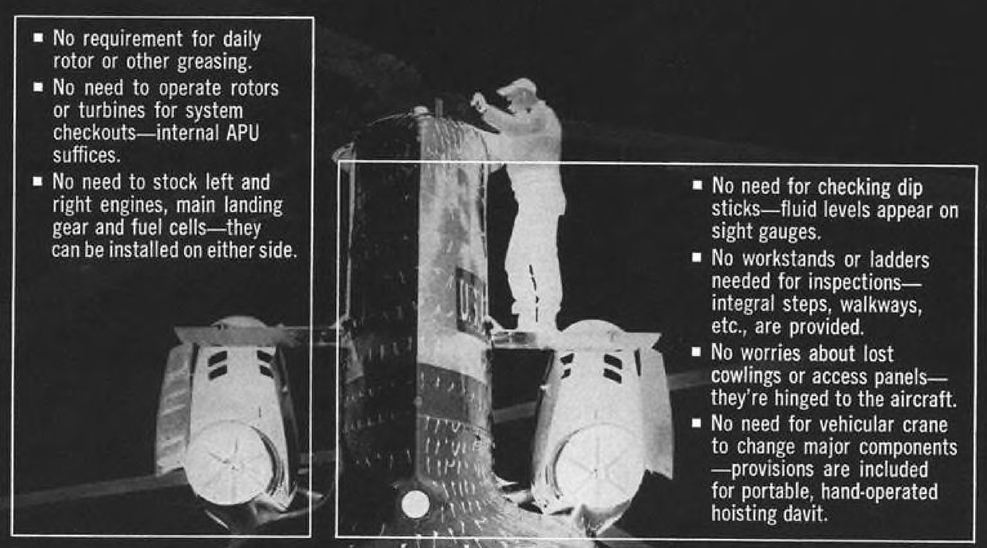
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- No need for checking dip sticks—fluid levels appear on sight gauges.
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All in all, the HC-1B is just about the most self-sufficient helicopter conceivable . . . as well as possessing outstanding payload and performance capabilities.

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Hughes' Past Management Barred As Northeast Control Case Issue

Washington—Hughes Tool Co.'s management of Trans World Airlines before losing control to a three-man voting trust will not be reviewed in the Hughes Tool-Northeast Airlines Control Case (AW Apr. 9, p. 43), Civil Aeronautics Board Examiner Merritt Ruhlen ordered last week.

In his ruling, Ruhlen said the present issue is whether it is better for an inefficient operator to control Northeast or for the airline to go bankrupt. Barring approval of Hughes Tool control, Ruhlen said that subsidy is the only thing that could save the airline. So far, both Northeast and Hughes Tool witnesses at the hearing have denied any intention of seeking subsidy.

The ruling could strengthen considerably the position of Hughes Tool in its bid to gain control of Northeast. However, CAB Bureau Counsel Paul Y. Seligson told the examiner the ruling made it impossible for the Board to make an "intelligent" decision on the basis of record.

Seligson told the examiner that the question was whether the public interest in keeping Northeast alive outweighed interest in maintaining honest, economic and efficient management for the air transport system.

Seligson has consistently held that the only way to determine how Hughes Tool would manage Northeast, should CAB allow it to take control, is by examining Hughes Tool and Howard Hughes' management of their other aeronautical interests, notably TWA.

At present, TWA and Hughes Tool are locked in a $366-million anti-trust suit in a New York district court over alleged attempts to force TWA to buy Hughes Tool equipment and countercharges that lending institutions conspired to gain control of the airline (AW Feb. 19, p. 47).

In a letter to the examiner last Monday, Seligson said he wanted to cross-examine certain key witnesses from TWA, Atlas Corp. and Hughes Tool to determine whether Hughes or Hughes Tool had run TWA in an efficient and economic manner.

He said he believed the evidence would show that Hughes had retained personal control of equipment manufacture, design, acquisition, and disposal. In addition, Seligson said, he believed the evidence would show that Hughes had interjected himself into the day-to-day operation of the airline, its advertising and its financing to the over-all detriment of TWA's good management.

As a result of the ruling, Seligson told the examiner that he will probably not ask for witnesses to be called. Seligson's letter to the examiner had listed two past presidents of TWA, Floyd B. Odlum, past executive director of Atlas Corp., which now controls Northeast, and several other key TWA and Hughes Tool officials as possible witnesses.

Raymond Holliday, executive vice president, corporate secretary and a director of Hughes Tool, testified that in May, 1960, TWA began planning a Northeast merger. The merger plan passed through several studies and management changes, culminating in a Hughes Tool offer last May to ease any money troubles a Northeast merger would cause TWA.

Holliday said the merger plan was shelved after last Aug. 15, when TWA, losing money and involved in anti-trust action with Hughes Tool, decided the merger would bring more problems than it would solve at the time.

Holliday said that during the present TWA-Hughes Tool litigation it is unlikely that Hughes Tool would try to negotiate a Northeast merger with TWA.

Holliday reiterated Hughes Tool's earlier contention that if control is approved the company will provide or obtain "financial assistance consistent with sound business practices."

Seligson told the examiner that if Hughes Tool were to present a firm financial plan that would ensure managerial independence for Northeast and if it were accompanied by voting trust or some arrangement to guarantee the airline's independence, his department would seriously reconsider its position.

Morse Urges Probe; Backs Supplementals

Washington — Congressional anti-trust subcommittees were asked to conduct a full-scale probe of monopoly in the airline industry last week by Sen. Wayne L. Morse (D.-Ore.), who charged that pending legislation on supplemental airlines is part of a "blueprint" designed to eliminate competition and provide a monopoly over domestic air routes among "four supercarriers."

In a Senate speech, Morse urged that Congress delay action on the supplementals pending the completion of an investigation of the entire airline industry, including the role of regulatory and military procurement agencies involved.

House and Senate conferees last week were still unable to agree on a compromise bill which would give the supplemental carriers permanent operating authority. The main points of contention are the liberal ticketing powers and permanent operating authority provided by the Senate, as opposed to more restrictive and temporary authorities in the House bill.

Morse said the airline industry is arriving at a "state of total monopoly," and emphasized that while he did not support any individual carrier, he was concerned over the possibility of elimination of competition and a resulting concentration of power in the airline industry.

"It is this which most gravely concerns me," he said, "that we may be witnessing the last act in the closing of the sky to free enterprise, and the unconditional surrender of the airways to certain gigantic corporate combinations, who exert their economic power through the magnitude of loans to the airlines and through interlocking directorates between the lenders and the operating companies."

Tracing the 15-year history of the supplemental airline industry, Morse credited these carriers with being the first to introduce low fare transportation and other innovations without the necessity of subsidy. He said their existence had been made difficult by the "constant campaign on the part of major airlines to strangle them," and while they have been promised status by both Congress and the Civil Aeronautics Board, none has received a common carriage certificate on any domestic route.

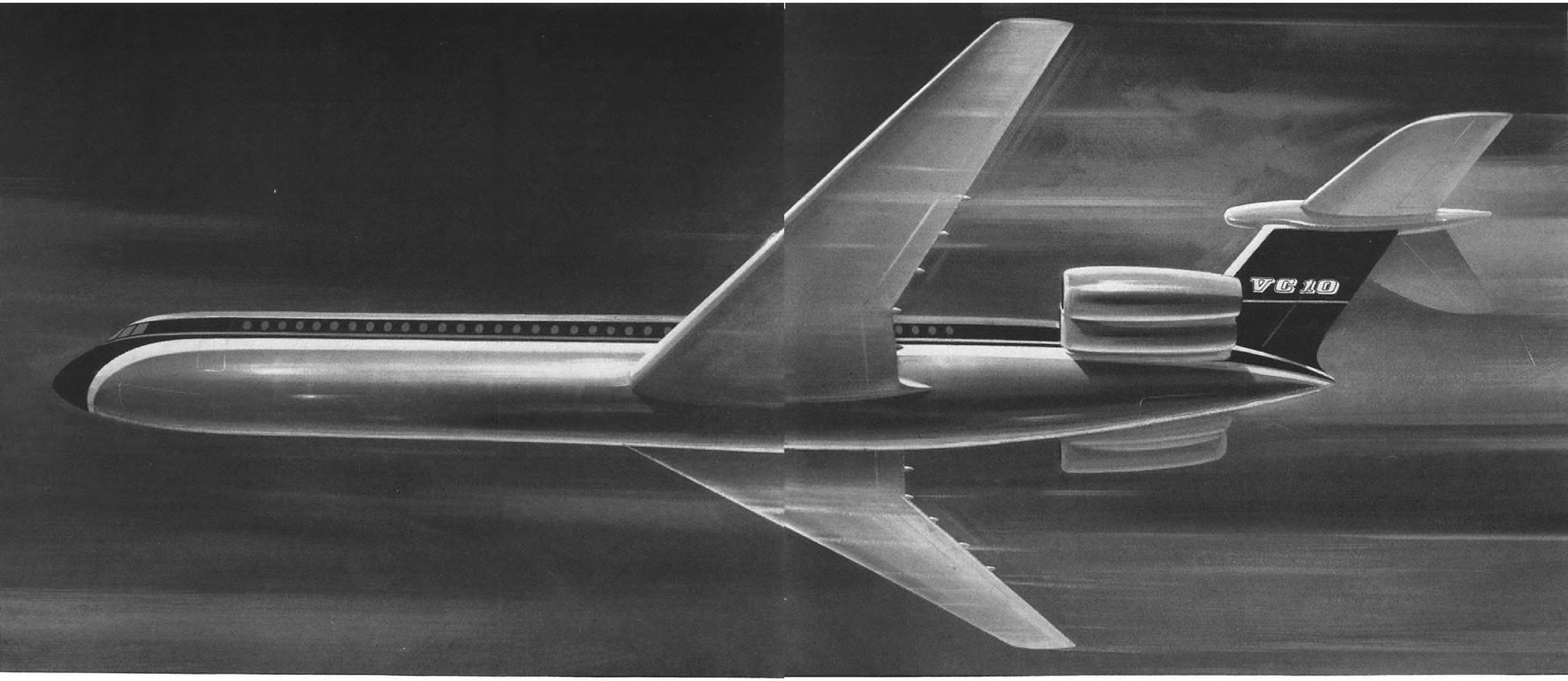
BEA Opposes Awards

London—Licensing independent airlines to directly compete with the state-owned British European Airways would force BEA into the red, Anthony H. Milward, chief executive said here last week.

Testifying before Sir Arthur Hutchinson, commissioner appointed to hear BEA's appeal against award of domestic and continental routes to the independents (AW Jan. 29, p. 45), Milward said implementation of the licenses would cause a 7% drop in BEA's load factor.

The airline's secretary, Henry Marking, also pointed out that BEA is contractually committed to nearly $100 million for new aircraft, mostly the de Havilland Trident, of which BEA has ordered 24. He contended the Air Transport Licensing Board has disregarded this capital expenditure.

In counter testimony, Gerald Gardiner, counsel for British United Airways, the largest British independent, contended that granting all the routes—14 to Europe, 3 to Dublin, and 8 domestic—would amount to only 4.4% of BEA's total international traffic.



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AIRLINE OBSERVER

► Merged seniority list compiled by a board of arbitrators for United and Capital airlines' pilots does not include United flight engineers, over whom the board said it had no jurisdiction. Until June 1, 1966, bids to fly turbine equipment will be allocated on a percentage basis. After that date, only seniority will govern which pilots fly the lucrative jet trips, the arbitration ruling said.

► **British Aircraft Corp. is planning a longer-range BAC 111 of the 80,000-lb. class to meet the varying needs of North American operators, which the manufacturer estimates represent a market potential for 250-300 of the aircraft. The larger version of the triple-jet aircraft has already been offered to Australian operators.**

► Ethiopian Airlines is nearing completion of a $12 million loan agreement with the Export-Import Bank to finance two Boeing 720B turbojets. First of the aircraft will be delivered in November, to replace the carrier's present DC-6s in service to Europe. A credit of $3.1 million from the U.S. Agency for International Development, to cover the cost of jet overhaul and support equipment, depends on formal signing of the loan agreement. AID also is providing $20.2 million for additional aviation facilities within the country and improvement of existing facilities.

► **Riddle Airlines now reports that Whitworth Gloster has put "its full support" behind the seven AW 650 Argosy freighters purchased by the carrier in an effort to "overcome service troubles, increase component lives and provide adequate spares and technical assistance." Earlier, Riddle claimed these problems were responsible for its inability to achieve a high Argosy utilization rate on Logair routes operated by Military Air Transport Service (AW Mar. 12, p. 319).**

► Tension over Berlin air corridor incidents has caused the British government to tighten regulations for air traffic entering the Communist-dominated territory. Beginning May 1, all British airlines must present to the Ministry of Civil Aviation advance data on proposed corridor flights. Meanwhile, East Germany contends that such traffic is illegal on grounds that agreements for air travel into Berlin were not made by the governments concerned, but by their airlines.

► **Russia hopes to gain a dominant position in international aviation by 1980 with a heavy concentration of service to most of the capitals and larger cities of the world. Aeroflot predicts it will be flying "80 to 90 times" as many international flights by then, as compared with an expansion of "18 to 20 times" its present domestic service.**

► Teamsters' bid to take over representation of 2,200 International Assn. of Machinists members at Northwest Airlines brought about a new contract agreement last week after the intervention of IAM's airline division head, Frank Heisler. Terms of the contract, which do not include flight engineers, are subject to ratification by the members. Contract details were not announced.

► **British Minister of Aviation Peter Thorneycroft apparently is winning an argument over night jet flights from London-Heathrow Airport (AW Feb. 5, p. 45). By limiting jet movements between 11 p.m. and 7 a.m. to only 1,500 during the period between Apr. 1 and Oct. 31 and ruling that the estimated balance of 500 must depart from London-Gatwick, his edict has forced British European Airways and other operators to cancel or reschedule a high percentage of their Heathrow operations.**

► Allegheny Airlines' interest in a Convair 440-540 replacement is centering on the Douglas Model 2086 and British Aircraft Corp. 111 twin-jet, short-range transports. Allegheny will re-equip with Convair 440s while it returns five 540s to D. Napier & Son (AW Mar. 12, p. 321). BAC 111 or 2086 would be acquired about 1964-65 if possible, according to current plans.

SHORTLINES

► **Allegheny Airlines** has begun a no-reservations commuter service between Washington-Philadelphia and Philadelphia-Hartford at fare reductions of 13 and 26% respectively. Washington-Philadelphia fare is $10 and Philadelphia-Hartford fare is $11.82, both plus tax. The airline operates 15 flights daily among the three cities.

► **Delta Air Lines** will begin through plane service four times weekly between Los Angeles and San Juan, P. R. via New Orleans on May 2. During the same week Delta will also begin through plane service twice weekly between Los Angeles and Caracas via New Orleans and Montego Bay, Jamaica. Convair 880s will be used on the new flights.

► **Central Airlines** reported 22,239 passenger boardings in February—a 93.6% increase over the same month last year.

► **Flying Tiger Line** reported a net loss of $328,496 for the last six months of 1961. The airline attributes the loss to the high cost of placing its 10 Canadair CL-44 airfreighters into service. The airline expects to raise its annual revenues from $28 million in 1961 to $45 million this year.

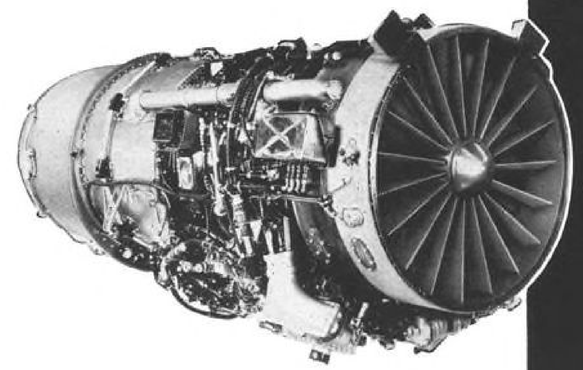
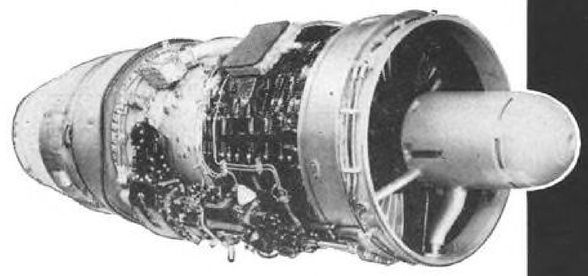
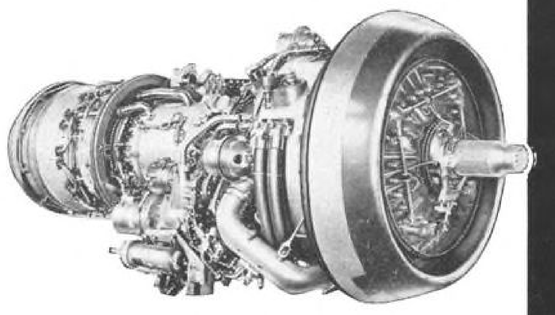
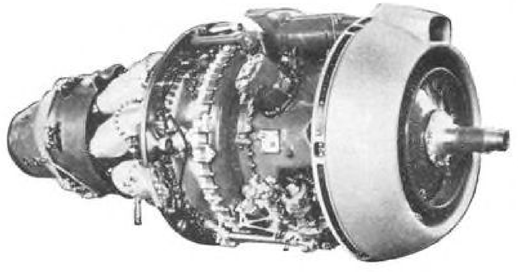
► **Japan Air Lines** has begun service between Tokyo and Europe with its recently delivered series 50 DC-8 jet transport. The series 50 aircraft will replace an earlier DC-8 which will be used on Japan Air Lines' transpacific flights. The airline is scheduled to add two weekly flights on its Los Angeles-Honolulu-Tokyo route and a new weekly Honolulu-Tokyo flight.

► **Northwest Airlines** reported a net loss of $517,156 during February. Operating revenues for February were $9.3 million and expenses were $10 million.

► **Piedmont Airlines** carried 48,390 passengers during March—a 21% increase over the same month last year.

► **REA Express and Pan American** will begin a low-cost joint air-surface freight service between the 48 mainland states and Hawaii on Apr. 30. Shipments will move via REA surface carriers to Los Angeles, Portland, San Francisco, and Seattle and be flown to Honolulu by Pan American. Rates will be competitive with motor carrier-steamship rates.

► **Trans-Texas Airways** reported it carried 30,122 passengers during March, 13.3% increase over the same month last year.

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Rolls-Royce turbine engines fly more than 15,000 hours every day in airline service; their operating experience now totals more than twenty million engine hours. These engines have been chosen by more than 100 airlines and over 100 other civil operators. They power over half of the turbine airliners in service or on order in the western world and hold world record times between overhauls (overhaul lives) for all three types of turbine engine—prop-jets, turbo-jets and by-pass jets.

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Supersonic Transport Simulator Tested

By William S. Reed

Moffet Field, Calif.—Aerodynamic stability and control characteristics inherent in most supersonic transport designs under consideration are of such poor quality that effective, highly reliable stability augmentation systems probably will be needed throughout all flight regimes.

Preliminary results of piloted simulator studies here at the National Aeronautics and Space Administration's Ames Research Center reveal that the supersonic transport probably will be marginally controllable by the pilot without artificial stability at subsonic speeds in good weather. Such conditions would not be acceptable for safety reasons, however, and either design compromises must be made to provide satisfactory handling qualities or operation with one or more axes of stability augmentation working at all times must be accepted.

If the latter course is chosen, it would avoid economic penalties in performance stemming from design compromises, but vast improvement must be forthcoming in the reliability of stability augmentation systems (SAS). Reliability of the one axis SAS—yaw dampers—in today's jet transports falls far below that required for a full-time, no-go system. These conclusions were gathered by this AVIATION WEEK pilot during extensive "flying" in the supersonic transport simulators at Ames and from thorough discussion of the simulator program with research scientists M. D. White, M. Sadoff and R. S. Bray and with engineering test pilot G. E. Cooper, Chief of Operations at NASA-Ames.

To date, only a handful of pilots have had the opportunity to fly the supersonic transport simulators at Ames mainly because the simulators have not yet been brought to the prescribed state of development. Within a short time, Ames' researchers will seek to have as many pilots as possible spend some time in the simulators in order for their opinions to be integrated into handling-quality requirements. Specifically sought will be pilots with extensive experience in supersonic aircraft and large multi-jet aircraft, including airline captains, military pilots and experimental test pilots.



CLOSED CIRCUIT TELEVISION PICTURE of a model moving runway is projected onto a screen from the projector mounted on roof of a stationary cockpit salvaged from a C-134. Considerable realism is obtained by this method of simulating instrument approaches with 200 ft. and ½ mi. visibility.

Simulator Program

Under consideration in the simulator program is a typical supersonic transport design consisting of a low aspect ratio delta wing carrying four pod-mounted engines. A canard control surface is used for longitudinal control. Variable geometry wing planforms also are considered. Static and dynamic stability derivatives for this configuration were obtained in wind tunnel tests of typical delta-canard models.

Two simulators are in use at Ames for supersonic transport handling qualities investigation:

- **Cruising flight stability** and control qualities are simulated dynamically in a machine having four degrees of motion; roll, yaw, pitch and lateral acceleration. A cockpit is mounted on a centrifuge arm, 30 ft. in length. Three angular degrees of freedom are provided —roll, pitch and yaw—by gimbal-mounting the enclosed cockpit. Linear acceleration is provided by moving the simulator around the track. Installed, but not working, is a second degree of linear motion in the vertical achieved by moving the cockpit vertically.
- **Approach and landing simulator** consisting of a stationary cockpit with flight simulated by servo-driven instruments and a closed-circuit television display projected onto a screen mounted ahead of the cockpit.

Care must be exercised in operating the cruise simulator. Simulation of abrupt power loss on an outboard engine produces lateral accelerations of up to ½g and can generate nausea, especially after a meal.

The cockpit in the cruise simulator contains more or less standard instrumentation with the inclusion of a Δ Mach meter and sideslip meter. Two throttles are used which control the outboard engines, which are the most critical. For convenience, a control stick is installed rather than a wheel. Stick buttons are used to stop the simulator if the need arises.

The problem is started with the machine in a trimmed condition for flight at 70,000 ft., Mach 3 and indicated speed of 417 kt. Stability of the simulated aircraft can be varied by the adjustment of potentiometers at the analog computer with zero pot settings corresponding to "damper off" operation.

Prior to closing the hood on the simulator cockpit, lap and shoulder harnesses are snugly fastened, a restraining strap is buckled around the chest and a crash helmet is donned. This apparent overcautious procedure later was justified when simulated engine failure produced the aforementioned ½g side accelerations. The machine is capable of maximum angular velocity of 2.5 rad./sec., maximum angular acceleration of 2.5 rad./sec/sec. and maximum radial acceleration of 6g.

Engine cuts at cruise speed seem to be one of the more critical emergencies which concern aerodynamicists about the supersonic transport. Not only will the loss of an engine produce a yawing moment due to loss of thrust but expulsion of the shock wave within the engine inlet adds a further moment which about doubles the initial yawing moment. Simulaton of the yaw ing moment by lateral accelerations realistically reproduces the effect felt in the cabin of a large supersonic transport wherein the pilot may be located 80 ft. ahead of the center of gravity.

For the purpose of the problem, 5 deg. of yaw at cruising speed was considered to be the structural limit. With SAS on, it was not difficult to keep yaw within limits but regaining a zero yaw rate after engine cut without the benefit of the SAS was very difficult. Yaw limits which would have meant structural failure were exceeded nearly every time.

It was during these yawing maneuvers that the advisability of flying the simulator before a meal became apparent. After the initial lateral acceleration, a constant velocity must be maintained by the simulator carriage in order that the pilot does not experience an opposite acceleration as he would if the carriage stopped. This results in whirling around the track at a moderate rate with attendant radial acceleration, which physically is discomforting. Then too, once the yaw rate is zeroed out, the simulator is moving with constant velocity and while the instruments indicate to the pilot that he is under steady-state flight conditions, the movement of the carriage wheels over the tracks can be felt causing one sense to belie the other.

Normal maneuvers with all engines running were easily performed with the SAS operating. The high indicated airspeed resulted in very slow turning rates even at moderate bank angles. Also, slight changes in longitudinal trim resulted in large changes in altitude making it difficult to hold altitude. Effect of induced drag resulted in noticeable changes in airspeed as the aircraft banked and slight incremental g forces were imposed.

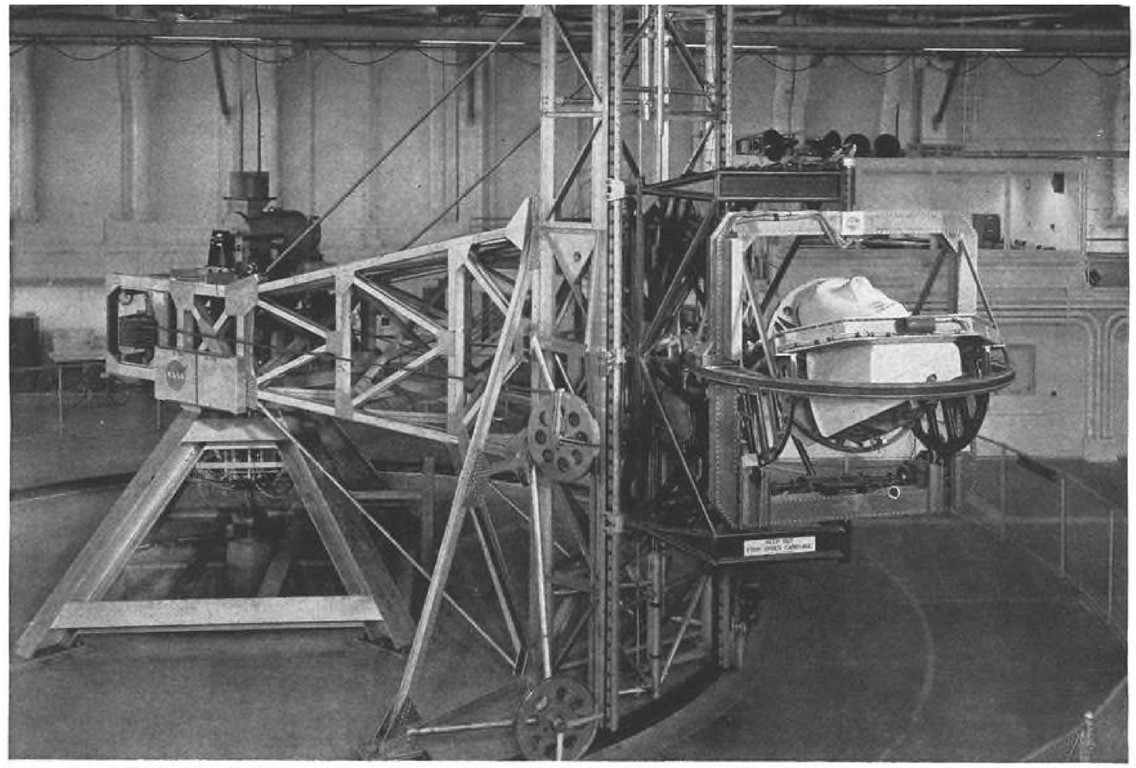
With the SAS turned off, handling qualities became much worse especially in the directional axis. Failure of one axis only was the usual case presented since it was assumed unlikely that all three axes of the SAS would fail simultaneously.

In general, the opinion prevails among pilots who have tried the simulator that it would be inadvisable to continue the flight if one or more axes of the SAS failed. Level of damping in the yaw, roll and pitch axes would have to be augmented to a much higher value than that possessed by the aircraft inherently. Consideration could be given to accepting some performance degradation to achieve better aerodynamic damping if a high level of increase was not desired, but to make the aircraft fly satisfactorily, NASA scientists conclude that the basic damping derivatives would have to be augmented by 15 times in yaw, 6 times in roll and 5 times in pitch.

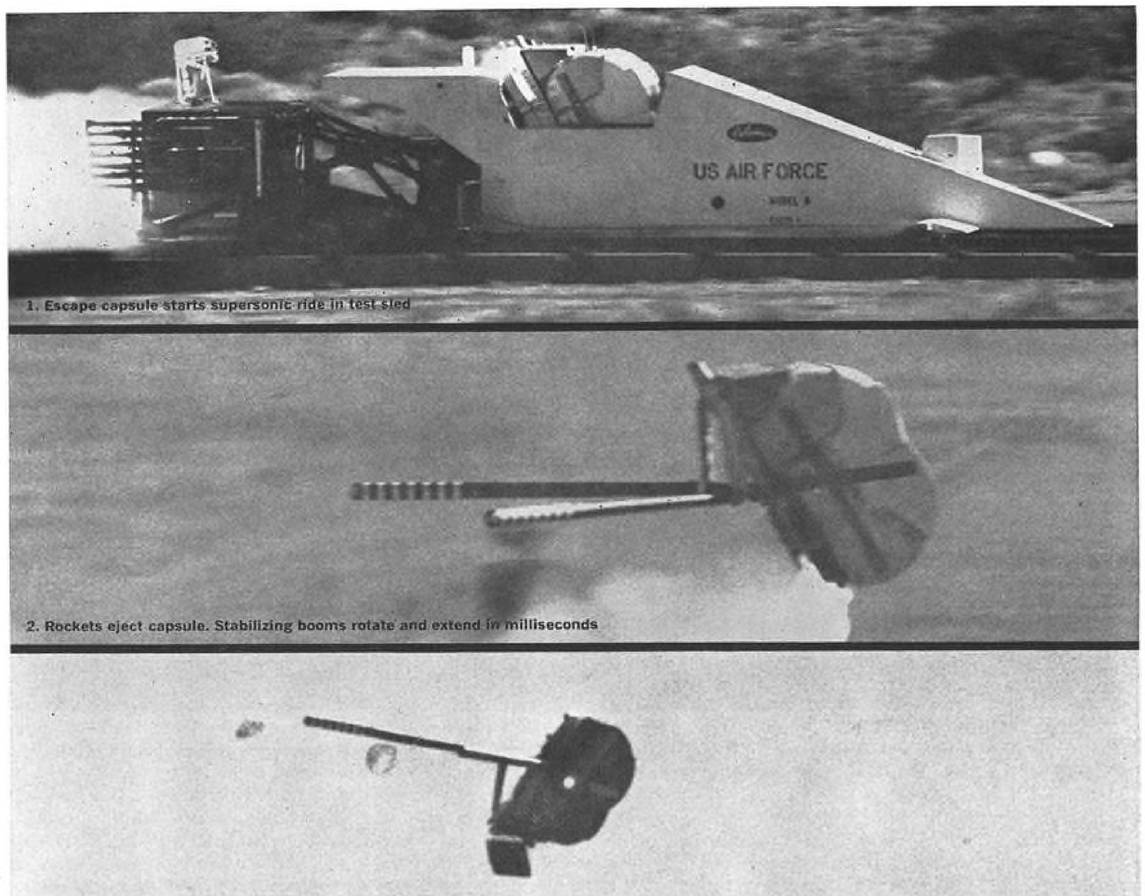
Even to reduce controllability to the bare minimum level, the derivatives would still require augmentation to four, three and two times the natural level in yaw, roll and pitch respectively. Configurations necessary even to achieve the minimum levels would result in greatly increased lift/drag ratios result ing in unacceptable performance degradation. Stability augmentation systems therefore appear to be a necessary evil for the supersonic transport and the problem will be to increase reliability which experience has shown to be poor.

Some stability augmentation also seems unavoidable for the low end of the supersonic transport speed regime. During AVIATION WEEK's stay at Ames, approximately 50 simulated instrument approaches and touchdowns were flown in the landing simulator. One third of these were with the computer set to reproduce handling characteristics of a contemporary four-engine, subsonic jet transport and the remainder with the computer making the simulator behave like a supersonic transport in the delta-canard configuration.

Cockpit section of the landing simulator is a salvaged nose section of a C-134, an experimental version of the



CRUISING FLIGHT SIMULATOR provides three angular degrees of freedom—roll, pitch and yaw—and two degrees of linear freedom by moving the cab around the track for lateral acceleration and vertically for pitching accelerations. Arm on the centrifuge is 30 ft. long and lateral accelerations of up to ½g are provided to simulate sudden failure of an outboard engine.



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3. Drogue chutes open

4. Main chute opens. Booms prevent capsizing when landing on land or water; permit safe exit

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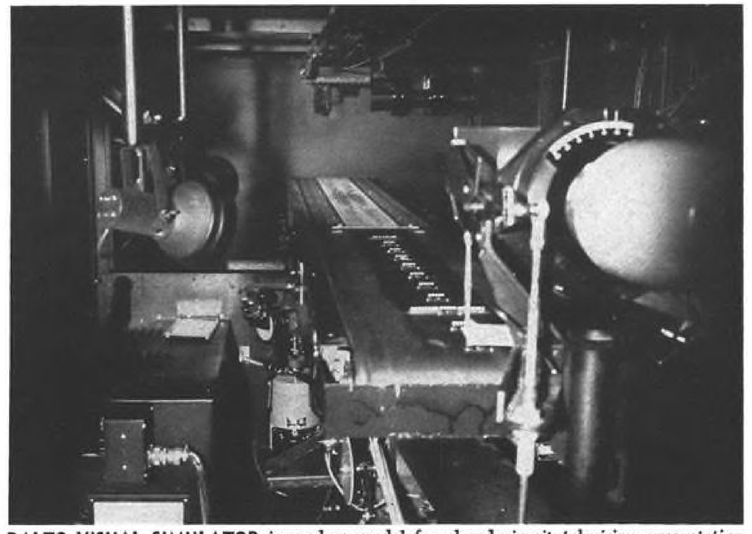
HOUSTON FEARLESS CORPORATION

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C-123 with boundary layer control. Ahead of the stationary cockpit is a screen onto which a closed circuit television picture is projected. A Dalto visual simulator which uses a model runway and a servo-driven camera provides the image for projection of a runway as it would appear when emerging from a 200 ft. ceiling with one-half mile visibility. The simulator can be flown down to touchdown which is depicted by a rapid fall-through of the nose. It can even be guided along the runway with the rudder down to minimum rudder-effectiveness speed.

Conventional cockpit instrumentation is provided with a three-axis gyro horizon integrated with course director needles. A small index to the left of the gyro can act as a slow-fast indicator which is helpful when trying to maintain a precise airspeed.

Experience first was gained in the simulator by flying the typical subsonic jet transport. A Phugoid oscillation, also typical of the simulated transport, was evidenced by a long-term longitudinal oscillation. Some lateral/directional instability, Dutch roll, was evident and while the handling qualities of the simulated aircraft left much to be desired, it was typical of the actual flying hardware. No yaw damper efffect was simulated as this is turned off prior to landing.



DALTO VISUAL SIMULATOR is used as model for closed circuit television presentation. Runway model has threshold lights, boundary lights and strobe-type approach lights on a moving belt. Camera in foreground is servoed to aircraft control system to reproduce roll, yaw and pitch changes. Skid marks are reproduced on the runway adding to realism.

Landing Attempt

The problem is started 7 mi. from touchdown at an altitude of 1,500 ft. on the centerline of the localizer. Normal ILS procedure is used with the ILS information either presented on a separate ID 249 instrument or on the Flight Director superimposed on the gyro horizon. The latter presentation was preferred especially when the Flight Director needles were servoed to act as a "Zero Reader."

At the interception of the glide slope, power was reduced and an airspeed of 140 kt. was held with a descent rate of 750 fpm. Strobe lights on the approach began to emerge when the aircraft reached about 250 ft. and the runway threshold appeared on the screen at 200 ft. and ½ mi.

Some practice was required to make satisfactory touchdowns because of a lack of presentation for peripheral vision. Thought has been given to extending the display so that it covers about 60% of the pilot's forward vision rather than the present 30%. It appears that peripheral vision is very important to judging height above the runway. Moderate turbulence and crosswinds can be simulated.

After sufficient practice with a known configuration, a prepunched tape is fed into the computer which changes flight characteristics to resemble those of the typical supersonic transport. Two airspeeds are chosen to investigate operation on or near the "back side" of the power curve.

At 160 kt., the power required to maintain level flight or a constant rate of descent varies little with small changes in airspeed. At 145 kt., considerable power must be added to maintain constant altitude rate. If airspeed is reduced to 140 kt., power must be added to counteract the sink rate.

Most commercial aircraft do not operate on the back side of the power curve although this has been done successfully by the military. Care must be taken in landing in this condition, however, or the sudden onset of high sink rates can be caused with slight reductions in airspeed on final approach.

Lateral/directional derivatives were not varied in the landing simulator during flights but at some future date will be evaluated as part of the simulator program. Derivatives used were based on a model which provided sensitivity on control in the roll axis and somewhat sluggish reaction in the longitudinal mode. The simulated aircraft weighed 390,000 lb. at takeoff and landing weight was 210,000 lb. It was again a delta wing with a small canard control surface.

Lift/drag characteristics of the aircraft were altered to produce variations in thrust with velocity for operation on the front, bottom and back sides of the power curve. Static margins were altered for the three cases above to provide values of 8%, 4% and zero.

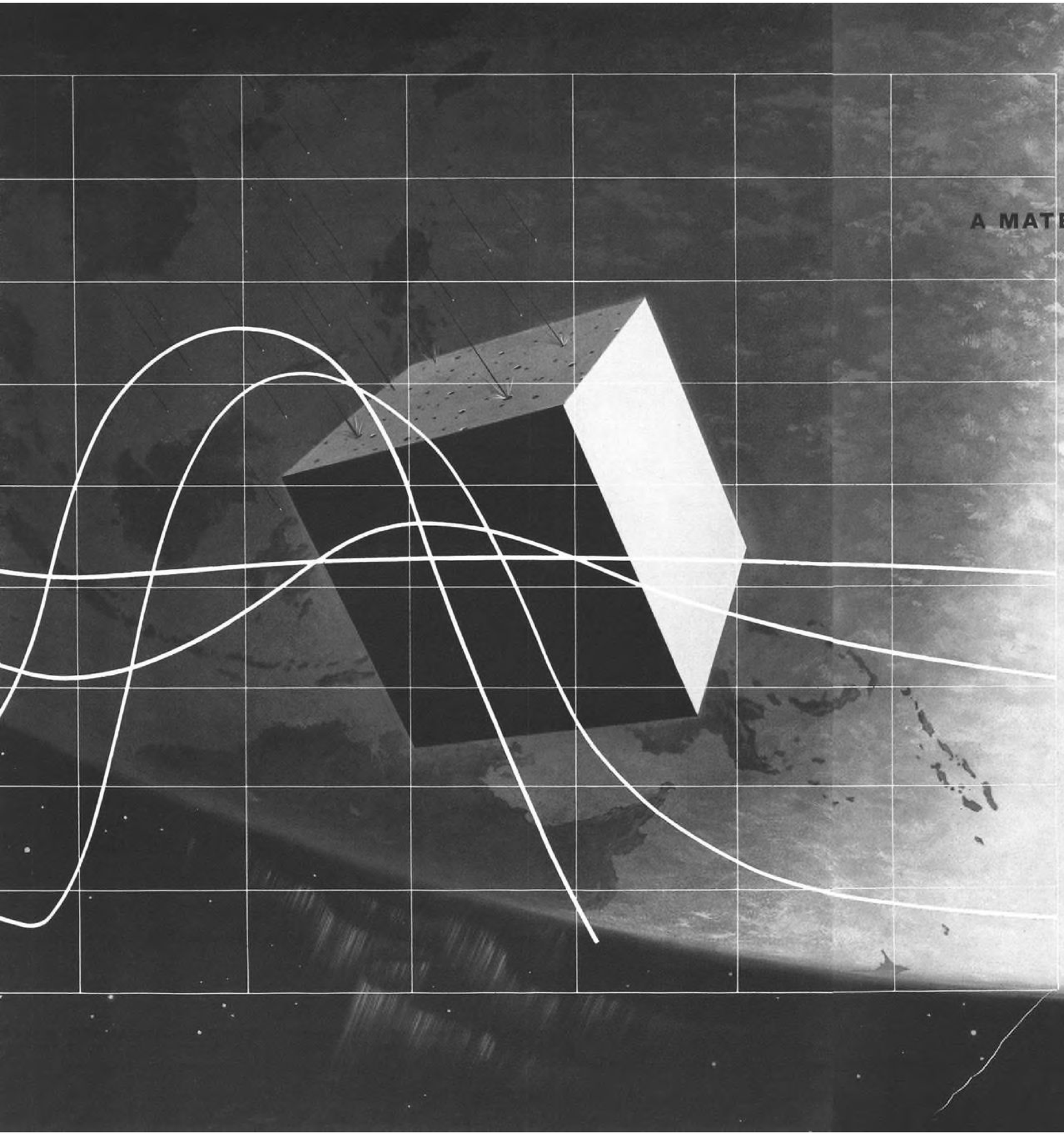
In general, as the speed stability moved toward the negative, i.e., lower airspeed required more power, and the static margin decreased, the aircraft exhibited poorer handling qualities. Operating on the front side of the power curve with a static margin of 8% made the simulator respond like a subsonic jet transport but this resulted from low speed design features which would have seriously compromised high-speed performance. More likely, the supersonic transport without SAS will handle more like the simulator did with a low static margin on the back side of the power curve.

Pilot Work

It was of interest to note that if the course director needles on the three-axis gyro were switched so as to act as a zero reader, static stability criteria became less important to the pilot. Reason seemed to be that less time was needed before detecting an off course and cranking in the proper amount of correction was automatically done by centering the needles. A great many more corrections were required to keep the needles centered and pilot effort was much more intense but the results were better.

Most of the ILS approaches and landings performed by AVIATION WEEK in the simulator would have been disasters if attempted in real aircraft under similar conditions of weather and handling qualities. Most generally, alignment with the runway was poor and tight turns would have been required to line up at the last moment. Flashing strobe lights on the runway approach helped in determining alignment but at approach speeds of 160 kt., too little time was left after visual contact was established.

Despite what appeared to be good roll rates and ample static stability in the longitudinal mode, landing from 200 ft. ceilings with ½ mi. visibility became a delicate matter.



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A comprehensive understanding of the reaction of materials to outer space is an important key to this country's space program. In their study of materials, scientists at Lockheed Missiles & Space Company found the problem could be most graphically depicted by showing the various environmental factors impinging on a simple cube-shaped vehicle. A cube, placed in a noon polar circular orbit, would allow unusual isolation of the effects of space on materials; make their measurement simpler and more accurate; and offer a built-in control of the results. For example: The horizontal surface facing away from the earth would receive only direct solar insolation, while that facing the earth would get mostly earth shine and earth-reflected solar radiation. This hypothetical model lucidly illustrates the effects of such phenomena as: Solar irradiation, sputtering, micro-meteoritic erosion, solar corpuscular radiation, auroral radiation and the like.

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T-38s Cut Pilot Combat Readiness Time

By Erwin J. Bulban

Randolph AFB, Tex.—Combat readiness time of USAF Air Training Command's first class of undergraduates to complete basic training in the supersonic Northrop T-38 Talon here should be markedly less than any previous class, ATC Commander Lt. Gen. James E. Briggs said here during graduation exercise for Class 62-FZ.

High-performance characteristic of the T-38, which embodies many of the handling characteristics of modern tactical aircraft, including high sink rate, high climb rates, high altitude-true airspeed navigation and supersonic formation flight will permit these students to rapidly assimilate the individual characteristics of the aircraft in the tactical units they will join. About half the class will go into F-100s and half into F-102s and therefore will be able to start earlier to learn weapon system delivery techniques and tactical operations.

Students began formal supersonic work within five hours after the start of training in the Talon.

Time lag that has been present in familiarizing students with actual tactical aircraft and their weapon systems following assignment to units was pointed up by several officers here, including Col. Charles E. Yeager, Deputy Director of Flight Test at Edwards AFB, who indicated that more time and money could be saved with use of an armed T-38 or an aircraft that could perform weapon systems training on the undergraduate level.

The T-38 would lend itself to such a program since Northrop already has developed a single-seat N-156F version of the airplane having tactical weapons delivery capability.

As a further indication of USAF interest in the Talon in providing low-cost supersonic training, two General Dynamics B-58A Hustler bomber pilots will fly the Talon for 10 hr. and evaluate its usefulness in the supersonic bomber training program.

T-33 Phasing Out

Class 62-FZ provided several important inputs to USAF training and test programs in the course of becoming the first class to fly at supersonic speeds before its members received their wings here last month.

New Air Training Command undergraduate program, utilizing the T-37A twin-jet for primary and the Northrop T-38 for basic, marks the beginning of phase-out of the Lockheed T-33A for the basic training mission.

For this first class, carrying the Z for "test" designation, Air Training Command culled 26 students from 62-F classes from several schools, seeking an average group to get a fair judgment of the student-T-38 capabilities, since the airplane concurrently was finishing its Category 3 test program which evaluates the airplane on a user basis. Class graduation also marked end of the Category 3 trials, although some product improvement and other tests will be made.

Under consideration is a proposal for windshield and intake duct anti-icing; tests will be made on the airplane against the new MA-1 pop-up cable runway barrier system.

Aircraft has been checked out against the standard web-type runway barrier. Some minor engineering is also being done to prevent in-flight canopy losses, including simplification of the canopy thrust arm.

Class 62-FZ, along with other members of 62-F, also pointed up some notable efficiencies from the Air Force standpoint in its work as a result of the new Air Force Undergraduate Pilot Training Program under which civilian contract schools were phased out of the primary training cycle last year.

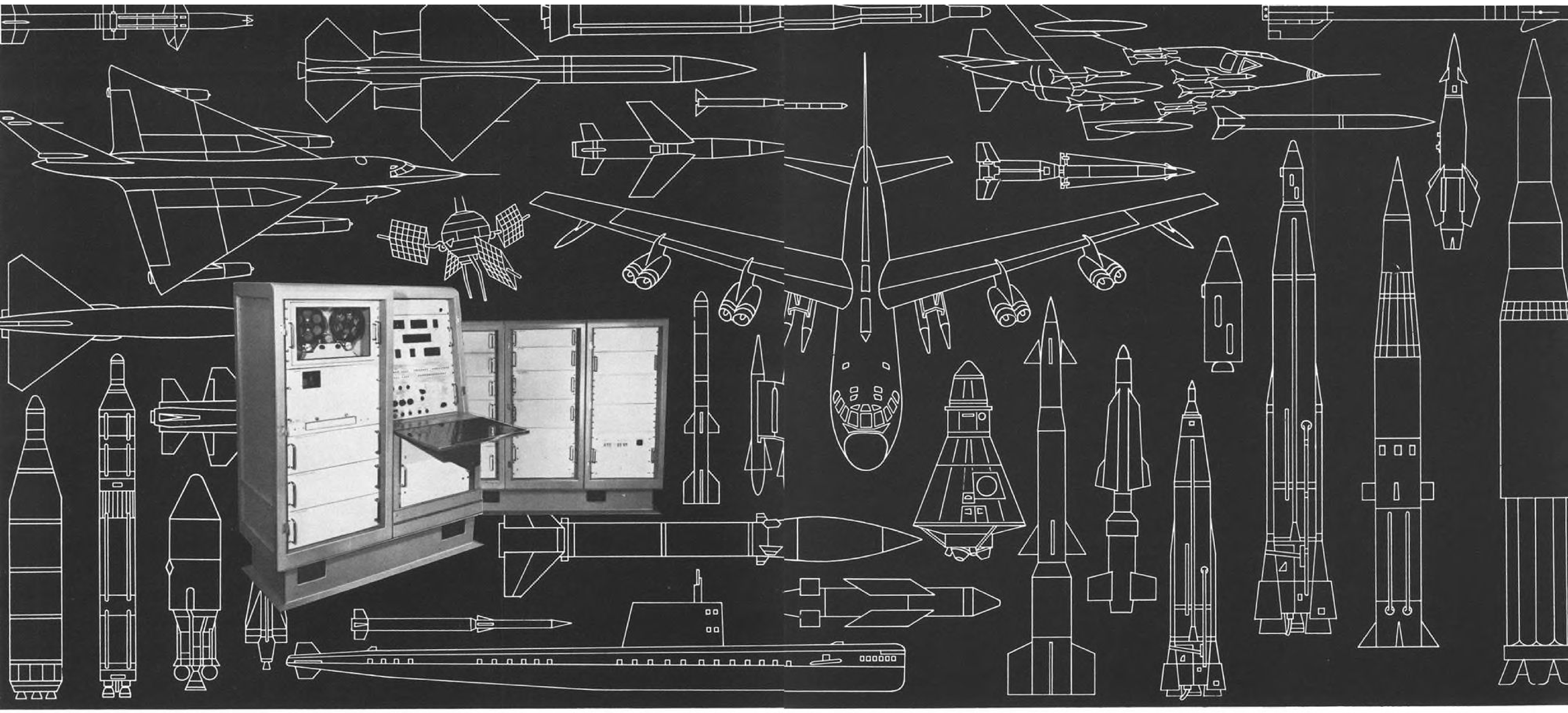
Air Training Command states that the new system, under which undergraduates take all their training at one base under a completely military environment has paid off in better training since the service maintains better control of the students and claims an improved student-instructor relationship. Formation flying and low-level navigation are now introduced in the primary training phase, providing much easier transition for the student, according to ATC personnel here.

There is also much time saved since all the training is done on one field. Under the contract system the students went to an Air Force base to complete training. Students now are kept in the same squadron throughout the undergraduate course. Not only are time savings due to elimination of "pipeline" traveling important, but the fact that the student stays at the same field makes it easier when he goes to higher performance aircraft because he already is familiar with topographical landmarks. Exposure to the basic trainer airplanes while he is undergoing primary training is also credited with providing a more efficient environment.

Class 62-FZ went through 108 days



SUPERSONIC T-38s at Randolph AFB, Tex., underwent Category 3 testing concurrently with training of first USAF class in the new aircraft.



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For information on how E-P can best assist your operations in every area—whether undersea or on it, airborne, or in space—we invite you to write, call or visit us in Teterboro, N. J.

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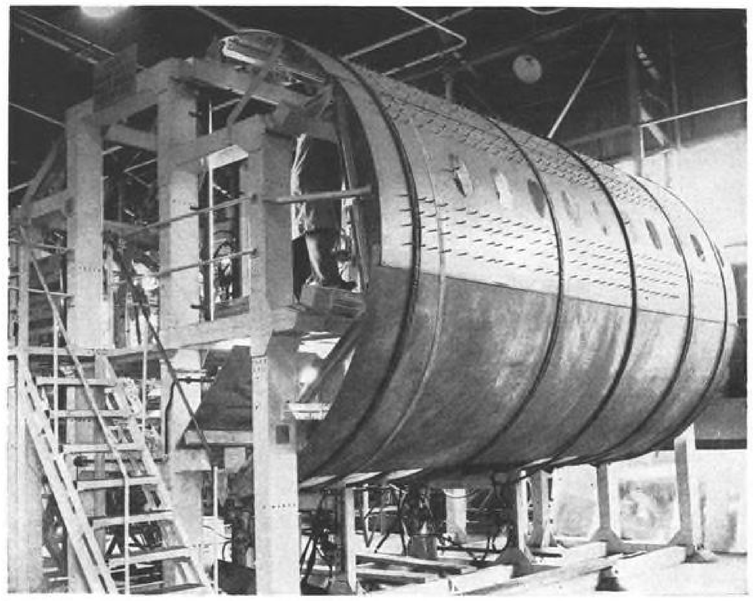
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First BAC 111 Fuselage Jig Built

First British Aircraft Corp. BAC 111 forward fuselage side panel jig has been built at Vickers-Armstrongs' plant at Hurn. Upper panel incorporates VC.10 type elliptical passenger windows, measuring 14 in. x 9 in., between each of the fuselage frames. Channel section frames at 20 in. pitch support Z-section stringers to which skin is flush-riveted with 70 deg. cut counter-sunk rivets. Frame and stringers are continuous and cleated to the skin, a construction form used on the Vickers Viscount, Vanguard and VC.10. Windows have Reduxed stiffening panels surrounding the aperture.

of training at Randolph, divided into three categories—flight training and academic taking 140 hr. each. Officer training subjects totaled 159 hr.

Formation flying, a total of 38.5 hr., involved the largest portion of the flight training curricula. Instrument flying totaled 33.5 hr., navigation 27.25 hr. and T-38 ground instrument trainer 27 hr. Flight indoctrination totaled 23 hr. The course included 30 hr. solo in the T-38, with the average student time to solo being 14.5 hr. Minimum time for a Class 62-FZ student to solo was 12:30 hr.

The course was 10 hr. longer than used for the T-33A, but this was planned on the conservative side and to provide additional formation and instrument training.

"Wash-out" rate of students was low —62-FZ graduated 25 out of the 26 students who started on the T-38 and the class completed the course without a single accident. Student wash-out rate has gone down markedly from approximately a year ago, ATC officers noted—from approximately 38-40% to about 25% on the average. This decline is also noted as a benefit of revising the training system to an all-Air Force operation at one base.

The T-38 has a more efficient instrument and control presentation than exists on the T-33A—which was adapted for training in contrast to the T-38 which was specifically designed for the job from the start. T-38s high rate of climb—over 30,000 fpm.—is a distinct training aid in attaining "working" altitude and providing more training time than slower climbing airplanes.

Although a more complex airplane than the T-33A, the T-38 has posed no major problems on the line and its man-hours of maintenance per flight hour are being programed at approximately 14 as against 10 for the Lockheed, which has been in service for approximately a decade. "Pull-out," "plug-in" component replacement concepts are widely used in the new airplane to reduce down-time. Other features are single-point high-pressure refueling and a liquid oxygen system requiring only one filling daily, which reduces turn-around times.

With the graduation of Class 62-FZ, the undergraduate program utilizing the T-37A/T-38 is building up at ATC's seven training bases which are getting Talons to replace their T-33As, starting with Webb AFB, Big Springs, Tex. The approximately 40 airplanes used by the first class will remain at Randolph AFB for use in instructor training programs. Webb AFB is scheduled to have its T-38 complement in June. Production rate on the T-38 now is approximately 12 aircraft monthly.



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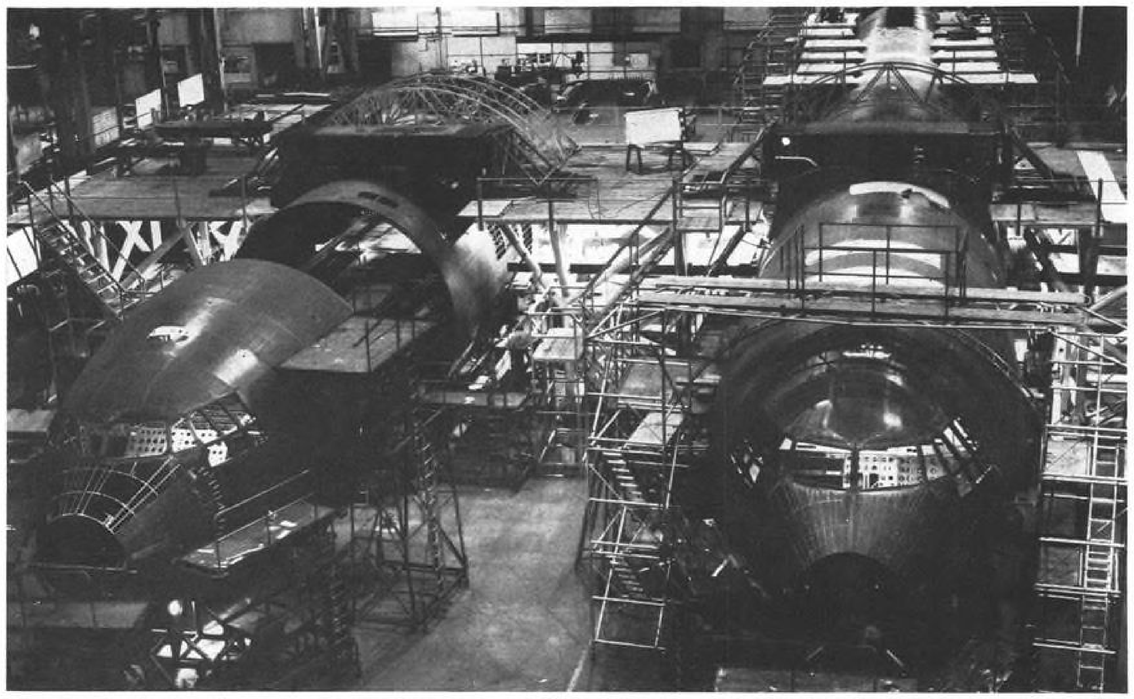
Lisle Chip Detectors are also widely used in jet and reciprocating engines, accessory drives, etc.

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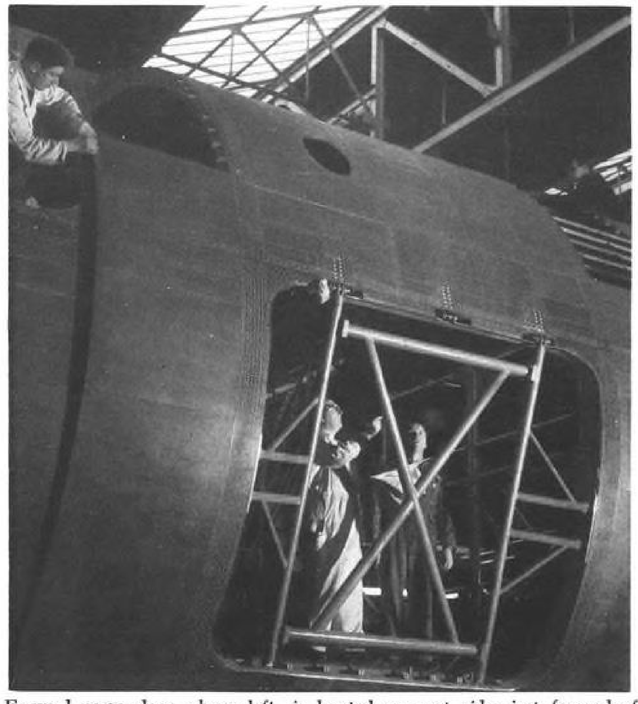
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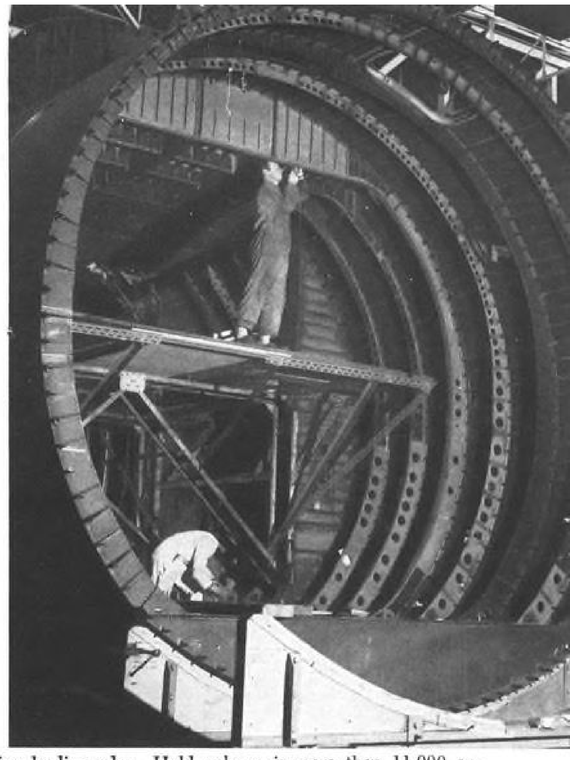
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First two aircraft are under construction at Short Brothers & Harland, Ltd., plant in Belfast, Ireland. All fuselage sections have been mated on the first airplane, above right. Aircraft is 159 ft. long, powered by four Rolls-Royce Tyne R. Ty. 12 turboprops.



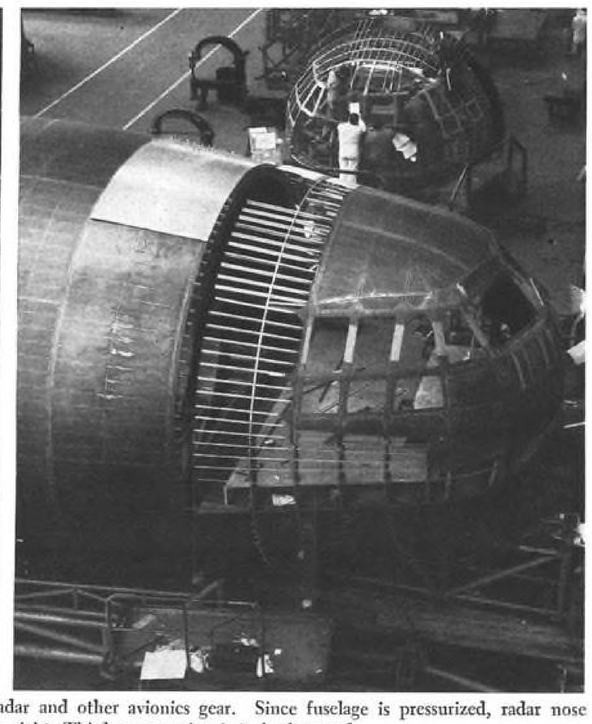


Forward cargo door, above left, is located on port side, just forward of wing leading edge. Hold volume is more than 11,000 cu. ft. Cargo hold, above right, can carry up to 100,000 lb. of freight or 60,000 lb. and 141 passengers.

First RAF Short Belfast Turboprop Freighters Reach Advanced Construction Stage in Ireland

Belfast fuselage sections are built in barrel assembly jigs, below. RAF has ordered 10 planes, with first flight set for early 1963.





Above left, workmen install nose housing on first aircraft for radar and other avionics gear. Since fuselage is pressurized, radar nose section is installed after entire nose is mated to fuselage, above right. Third nose section is in background.



PRODUCTION BRIEFING

Chance Vought Astronautics Division will provide blockhouse and ground-support equipment for a new Scout research rocket launch facility at Pacific Missile Range, Pt. Arguello, Calif., under a $1.6-million NASA contract.

Babcock Electronics Corp.'s BAP-5 all solid-state autopilot for target drone aircraft has completed three months of testing at the U. S. Navy's Missile Test Range, Pt. Mugu, Calif.

Northrop Corp.'s Ventura, Calif., division will produce KD2R-5 radio-controlled aerial target drones for the Navy under a $2.5-million contract.

Greenhut Construction Co., Inc., Pensacola, Fla., will build a research and development facility for the Army Ordnance Missile Command at Redstone Arsenal, Ala., under a $4-million contract. The new building, first step in provision of added in-house capability of eight R&D laboratories, will house three new labs and part of a fourth. Completion is scheduled for September, 1963.

United Aircraft Corp.'s Hamilton Standard Division has completed a successful 30-day continuous test of a system for removing waste gas in human breath from a manned space vehicle. The system traps carbon dioxide in adsorbent zeolite pellets and expels the waste CO_2.

Atlantic Research Corp. has been awarded a $500,000 contract from Jet Propulsion Laboratory to develop a 17-in. solid propellant spherical motor and to study a 36-in. motor. Contract is under JPL's advanced development program, with no application announced.

United Control Corp., Redmond, Wash., will supply temperature monitoring and control units for Minuteman ICBM guidance and control sections under a $500,000 Boeing Co. contract. The units will be used during missile storage in underground launch silos.

Steward-Davis, Inc., Gardena, Calif., will provide jet power augmentation units and spare parts for India's U. S.-built Fairchild C-119 Flying Boxcars under a $1.25-million contract from the Indian government.

Douglas Aircraft Co. has formed Vortec Products Co. to develop, manufacture and market products employing fluid dynamic principles and has acquired rights to more than a dozen such products from Hydro-Mill Co., Santa Monica, Calif. New facilities for Vortec, adjoining Douglas' plant in Long Beach, Calif., will be completed in May.

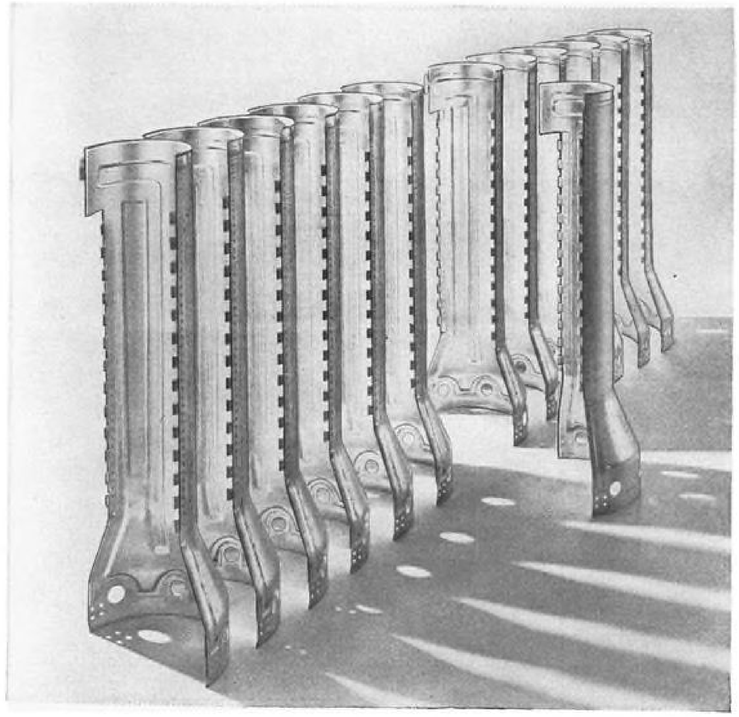
Ryan Aeronautical Co., San Diego, Calif., has received follow-on orders totaling $4.75 million for augmentation and ground support equipment and spares for Navy Q-2C Firebee jet target missiles.

Aero-Space Division of Walter Kidde & Co., Inc., will provide monopropellant peroxide reaction control systems for the Project Syncom communications satellite under contract to Hughes Aircraft Co. The systems, which will be operational for the life of the satellite, employ nitrogen gas to pressurize liquid hydrogen which in turn is catalytically decomposed and expanded through a nozzle to produce required thrust.

Amcel Propulsion, Inc., has been established as a fifth operating domestic division of Celanese Corp. of America and has been renamed Amcel Propulsion Co. Amcel, formerly a wholly-owned Celanese subsidiary, develops and manufactures explosive devices, propellants and propulsion systems.

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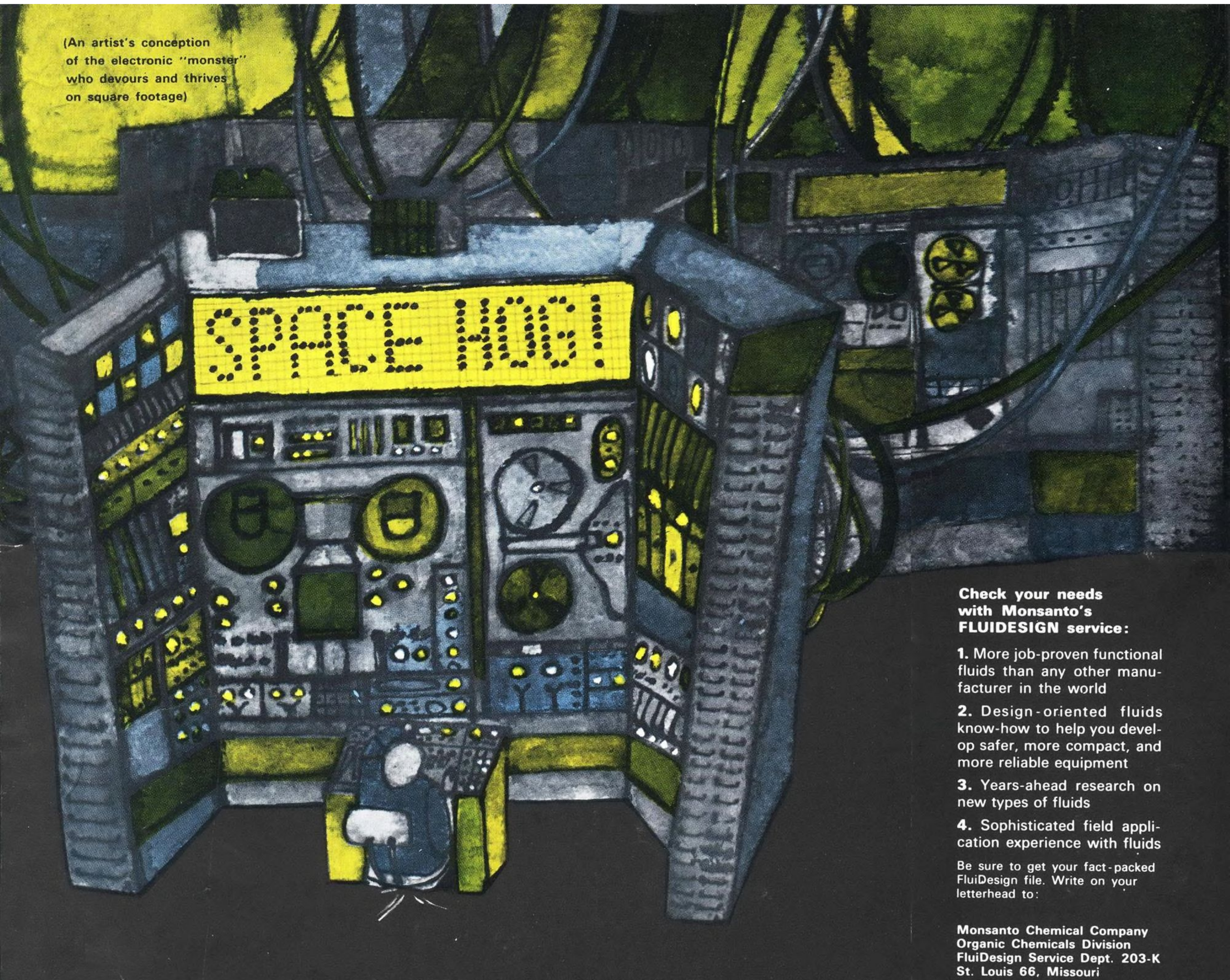
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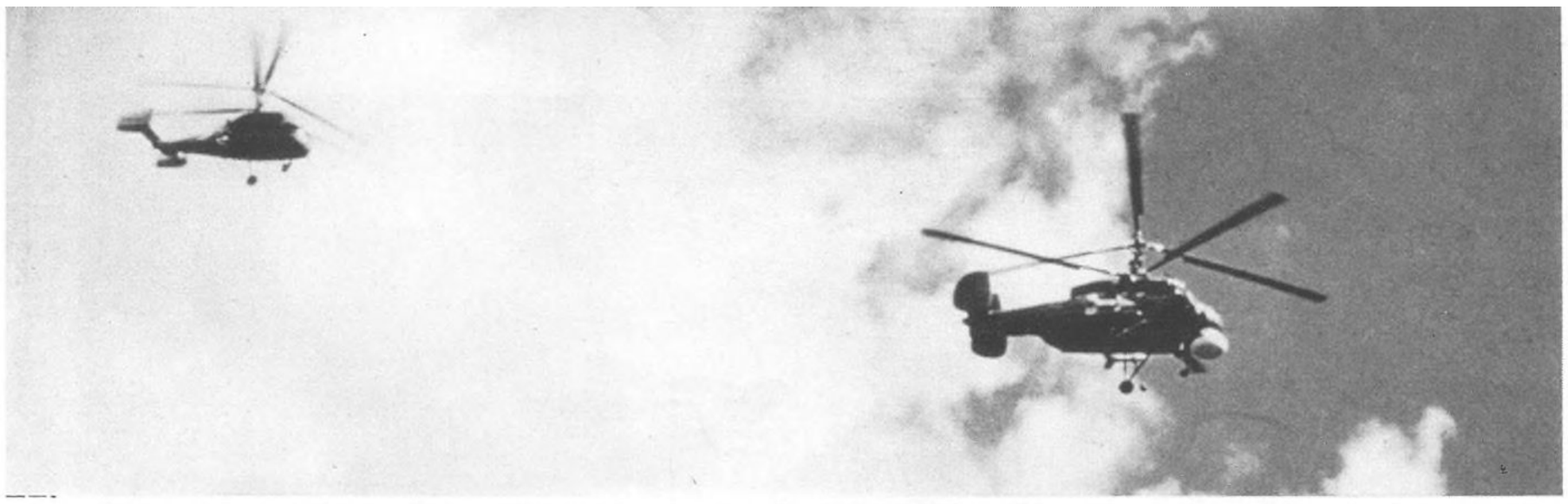
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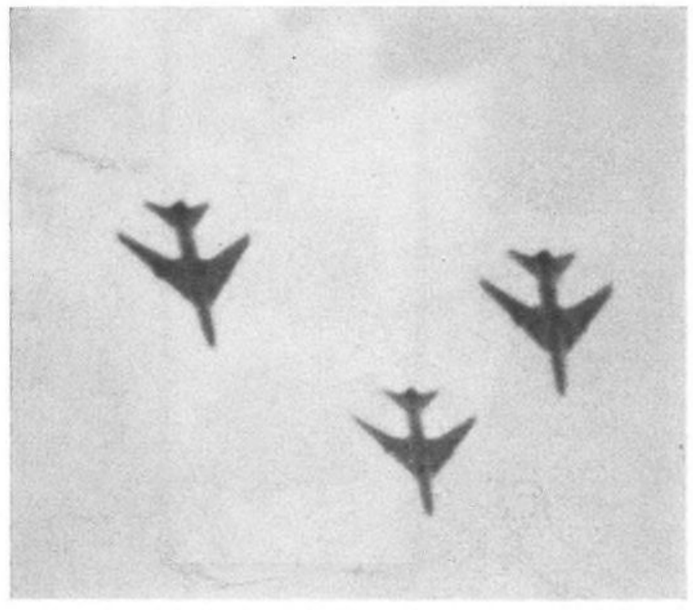
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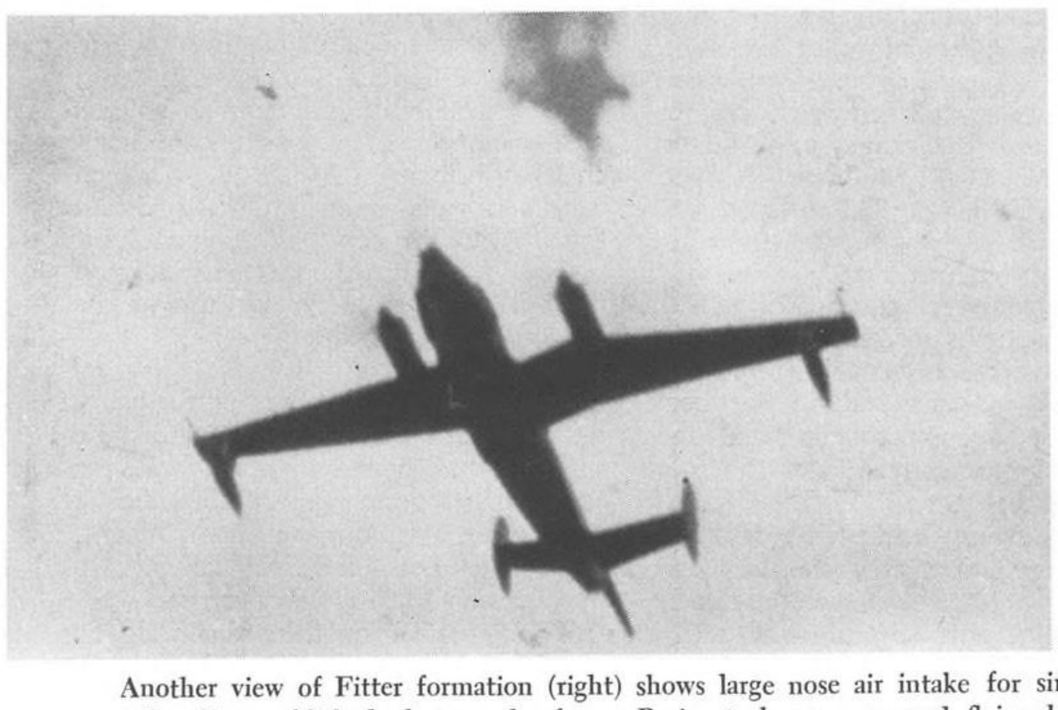
Two coaxial rotor helicopter designs of Nicolai Kamov are the Hog (left), and Harp (right). Harp is designed for anti-submarine warfare with large white radome housing search radar in chin installation. Movable turret with two 37 mm. cannons is mounted above the radar. Pair of air-to-surface missiles are mounted on each landing gear strut. Harp is larger than the earlier-designed Hog which was built primarily for crop dusting and civil transport.

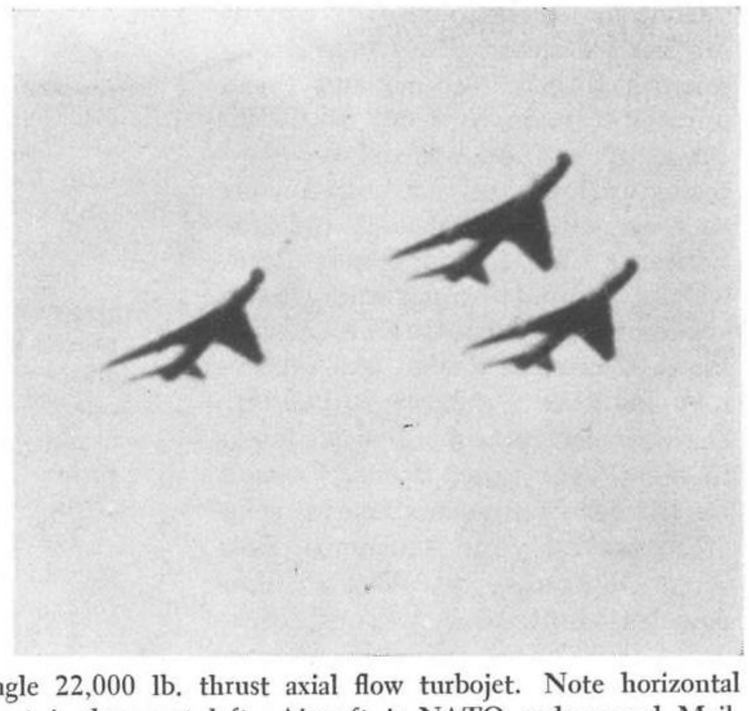
New Soviet Aircraft, Helicopter Details Revealed





New gas turbine-powered version of the basic Mi-4 helicopter design has NATO code-name Hip (left). Fuselage is larger than Mi-4 and provides capacity for 24 passengers. Also note additional fuel tanks added in lower fuselage bulges. Arrowhead wing planform of the Pavel Sukhoi Fitter design (right) is revealed in these photos taken from underneath formation of these 1,200-mph. fighters. Wing plan is basic delta with tips extended, a design Soviets favor for combining efficient subsonic cruise with top supersonic performance.

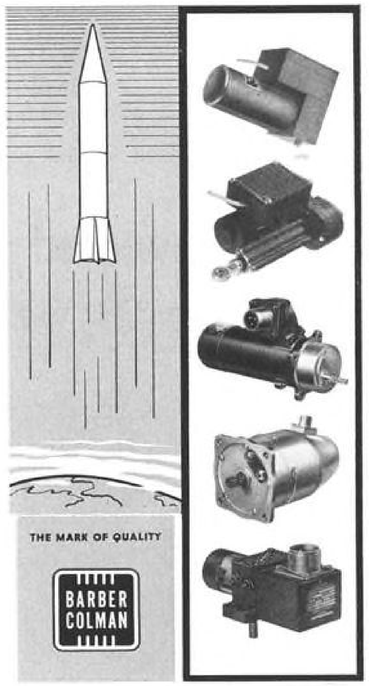




Another view of Fitter formation (right) shows large nose air intake for single 22,000 lb. thrust axial flow turbojet. Note horizontal tails. First published photograph of new Beriev turboprop-powered flying boat is shown at left. Aircraft is NATO code-named Mail. Gull wing with high aspect ratio is typical of earlier Beriev designs. Two turboprop powerplants are estimated to produce 5,600 eshp. each. Note wingtip floats, nose-mounted radar and magnetic detection gear protruding in tail stinger.

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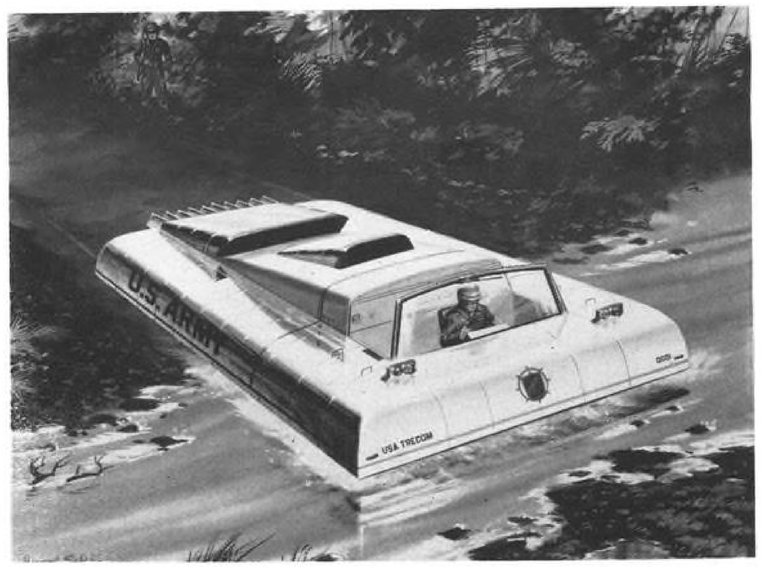
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MARTIN EJECTIJET ground effect machine, shown as artist's concept, would travel forward at approximately 20 mph. while about a foot off the ground. Air cushion is recirculated.

Martin Ejectijet Recirculates Air Cushion to Ease Engine Load

Orlando, Fla.—Martin Ejectijet, a ground-effect machine using recirculation of the air cushion, is nearing rollout and shakedown flights at Martin Marietta Corp.'s Aerospace Division here.

The man-carrying testbed grew out of a feasibility contract funded by U.S. Army's Transportation Research Command (TRECOM) starting in January, 1961, and carrying a delivery date for hardware of Apr. 18.

Basic idea behind the Ejectijet principle is the recirculation of air under the vehicle. This is in contrast to other GEM designs which generate a cushion of air beneath the vehicle and allow it to flow outward and away from the base. This requires that the full amount of air necessary to form the cushion be continually generated at all times by the powerplants. In the Martin GEM, most of the air is recirculated and only about 5% leaks away continually. Thus, once the initial air cushion has been established, the powerplants need only furnish approximately 5% of the total air flow as makeup air.

The design uses the periphery of the rectangular vehicle as a shroud to direct and contain the recirculated air. In cross-section, this shroud shows as a truncated ellipse. Air enters the shroud through an ejector nozzle at the inboard lower portion, moves up and outward through the shroud, and receives turning forces as it passes along. It leaves the outer rim of the ejector shroud with downward and inward components of velocity so that its natural tendency is to flow from the outside of the vehicle toward the center.

The ejector nozzle action creates a low-pressure area upstream of the ejection point, which traps the moving air and entrains it to go through the cycle again. No side curtains are used to contain the flow, and there is no cross curtain.

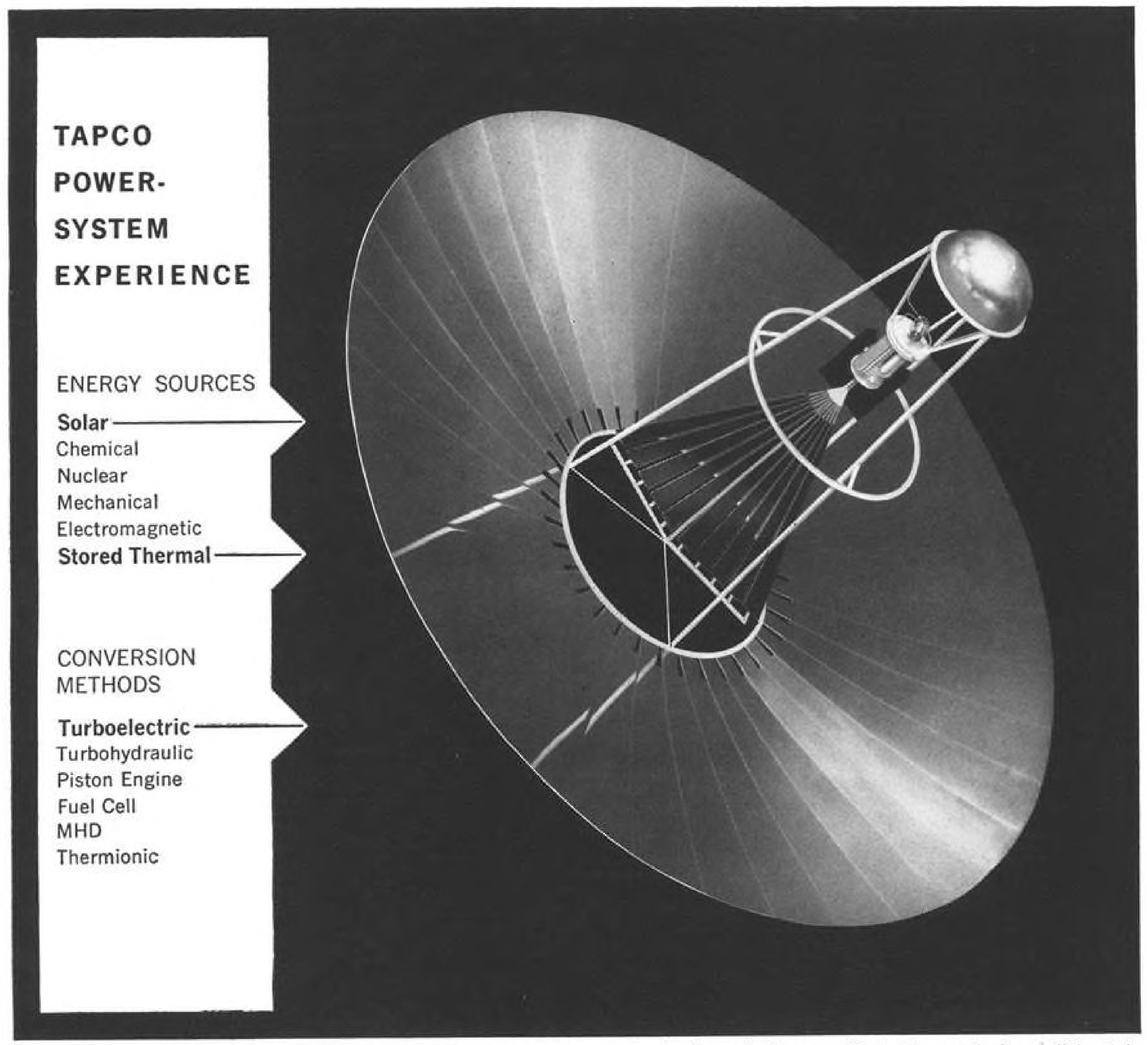
Martin engineers believe the Ejectijet will show much higher over-all efficiencies—perhaps as high as 65%—and that both stability and control will be greatly improved because of the recirculation principle. Model tests, which were performed under the first phase of the TRECOM contract, showed great promise for the principle; the validation of those tests is one major aim of the full-scale vehicle work.

The man-carrying Ejectijet will be used to establish basic performance data for the type, and to evaluate static stability and control efficiency. As a test bed, its performance is limited; it will hover at about one foot height, Martin predicts, and will be able to make about 20 mph. over terrain.

The vehicle is on the order of 12 ft. wide and 20 ft. long. The planform is rectangular. Powerplants are an unspecified number of AiResearch gas turbines, furnished by the Army to Martin for the testbed.

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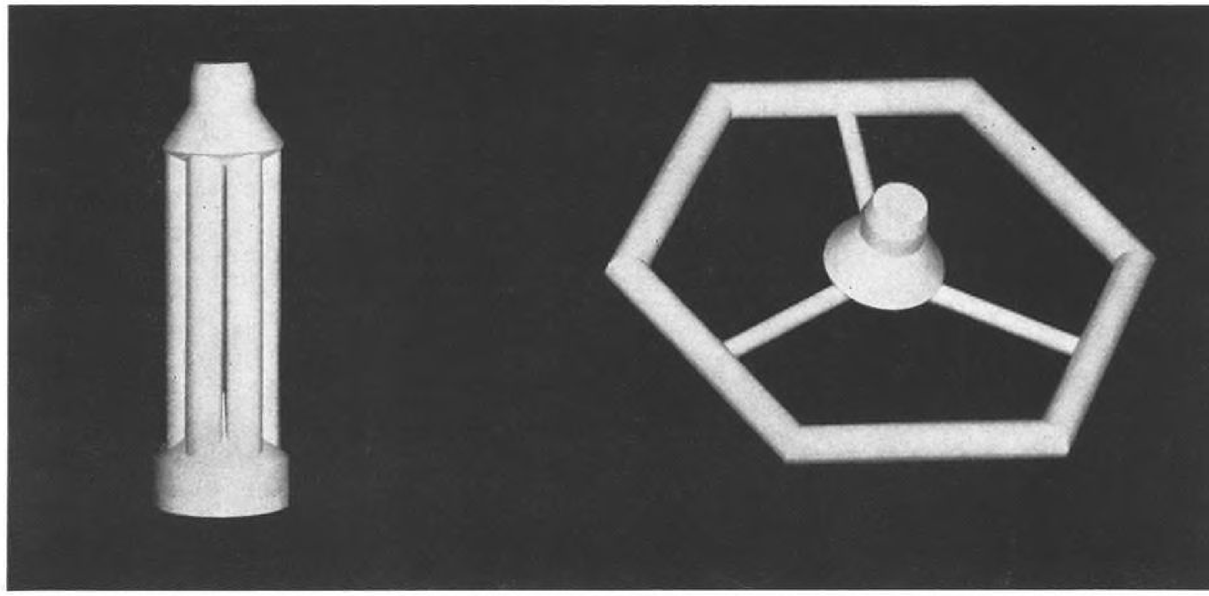
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MODELS of 21-man space station, or space laboratory, being designed for National Aeronautics and Space Administration by North American's Space & Information Systems Division, are shown in launch configuration (left) and in fully erected, hexagonal wheel shape (right). NASA may attempt to put station in 300-mi. earth orbit in 1966. Astronauts will be able to transfer from Apollo spacecraft into the station through locks in the command capsule, shown at hub of wheel. Hub will have nine Apollo docking ports.

1966 Orbit Planned for 21-Man Station

Los Angeles—National Aeronautics and Space Administration's 21-man self-erecting space station may be placed in a 300-mi. earth orbit as early as 1966, it was reported here recently at a local meeting of the Institute of Radio Engineers.

North American Aviation's Space and Information Systems Division has been studying the hexagonal-shaped station (AW Mar. 19, p. 27) for the past four months under a contract (probably a cost-sharing one) from NASA, according to Len M. Tinnan, principal scientist with the company's Military Space Systems Group. A booster, probably a Saturn C-1 or a Titan 3, is already assigned to orbit a manned space station stemming from the design being worked out by North American. The station will be designed to operate in space for a period of one to two years.

As it is now envisioned, the station will consist of six cylindrical modules, each about 75 ft. long and 10 ft. in diameter, which will erect on command in space into a six-sided wheel.

A manned command capsule, located at the hub of the wheel, will be connected via three five-foot-diameter, two-section telescopic spokes to the midpoints of alternate rim modules. Once the station erects in space, the crew can pass from the command capsule through the spokes and into the rim modules.

The station will provide about 2,000 to 3,000 cu. ft. or space for each crew man, slightly more volume than is available in the average U.S. home for each member of a typical family. Crew will stand in the rim modules with their heads pointed toward the hub which faces the sun.

In the launch mode, the six rim modules are bundled together, with their long axes parallel, and the bundle placed atop a booster. Alternate tops and bottoms of the modules are hinged to one another. A restraining mechanism is released in space permitting the rim modules to simultaneously spring into a hexagonal wheel-shape much like a household folding bridge table which has spring-actuated legs.

In this mode and until erection, the command capsule is situated atop the bundle, with the wheel's telescopic spokes pointed downward into the rim module bundle. The diameter of the rim module bundle will not exceed the booster diameter.

The present space station design, which North American refers to as its base point configuration, is an outgrowth of several tries to combine the best features of two space station approaches—inflatable structures and structures composed of rigid mechanical sections. Initially, the company considered an inflatable structure, the skin of which would be as thin as that of a beach ball. This inflatable structure can be conveniently put into a pre-launch package but would require that sophisticated equipment be installed after erection in space. In addition, an inflatable structure would be subject to damage or puncture by meteoroids.

While the rigid section approach may overcome these shortcomings of an inflatable structure, it imposes a greater burden on devising a suitable launch package.

One design leading up to the base point configuration consisted of six rigid rim cans interconnected by inflatable sections and connected from the hub to the rim by inflatable spokes attached to alternate can joints. This design in over-all characteristics is similar to the base point configuration. Its 150 ft. dia. wheel would rotate about the hub in space at 2 to 3 rpm. and experiences one-third of one gravity force at the rim. An actual working model of the inflatable/rigid design was built by North American.

Solar cell arrays will supply electrical power. Three large solar panels will be attached to the outside surface of each module and coplanar with the wheel's plane of rotation.

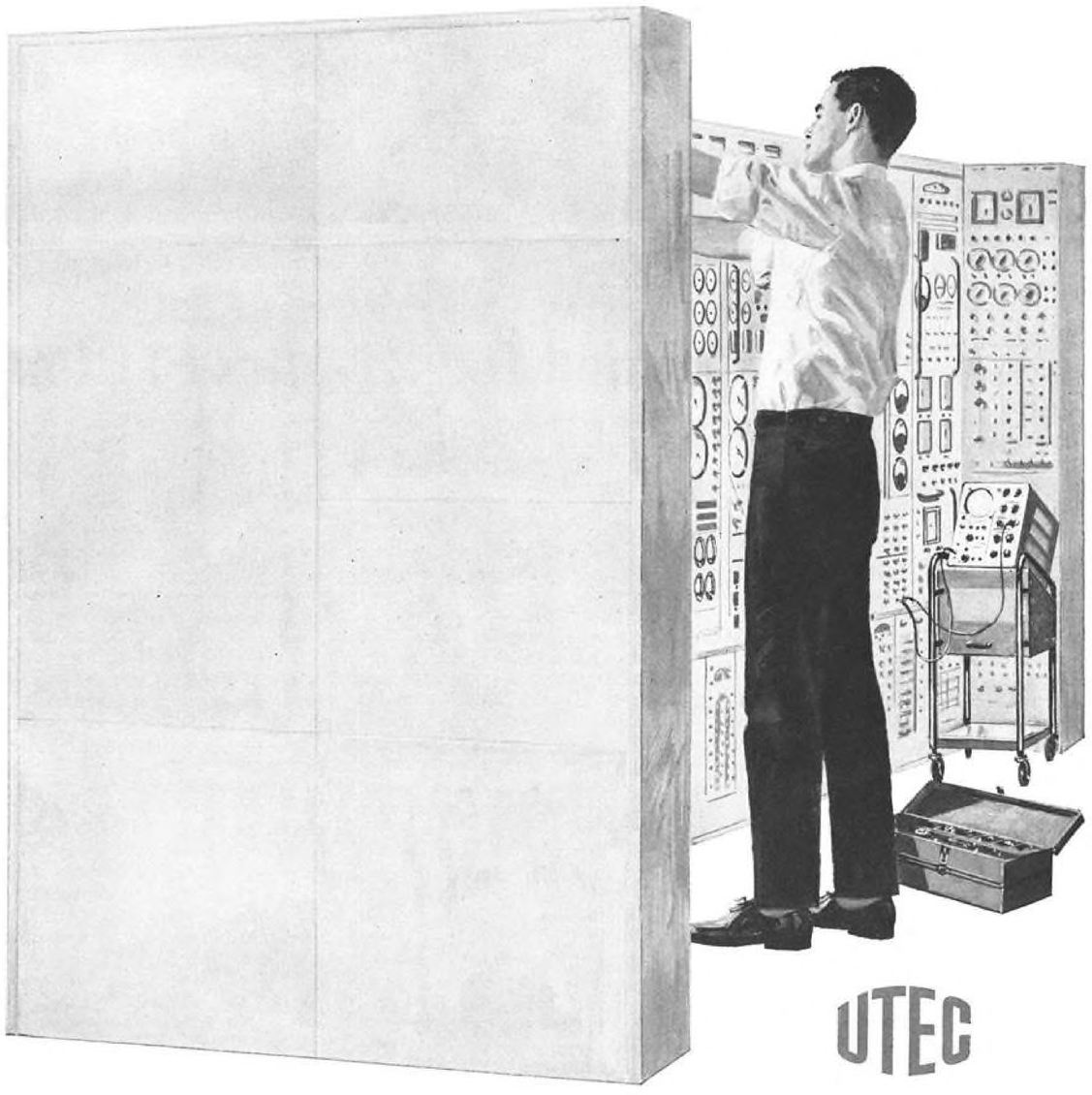
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Cooling, Power System Proposed for Apollo

Denver, Colo.—Integrated capsule cooling system and accessory power unit operating at a maximum temperature of 120F is being proposed as a backup development for two separate systems aboard the Apollo spacecraft. System has been demonstrated by Sundstrand Corp.'s Aviation Division.

The system is named Cryhocycle and Sundstrand officials believe it also has a good chance of being selected for Dyna-Soar 2, operational version of the space glider. Cryhocycle uses hydrogen stored as an 80% frozen slush to reduce its volume below that of liquid hydrogen. The hydrogen is passed through heat exchangers to absorb the heat generated by the spacecraft system and the metabolic heat of its crew.

Heat from these sources evaporates and pressurizes the hydrogen and the cold gas is used to drive a turbine or reciprocating motor which in turn drives an alternator to provide electrical power. Apollo proposal is to use a reciprocating motor.

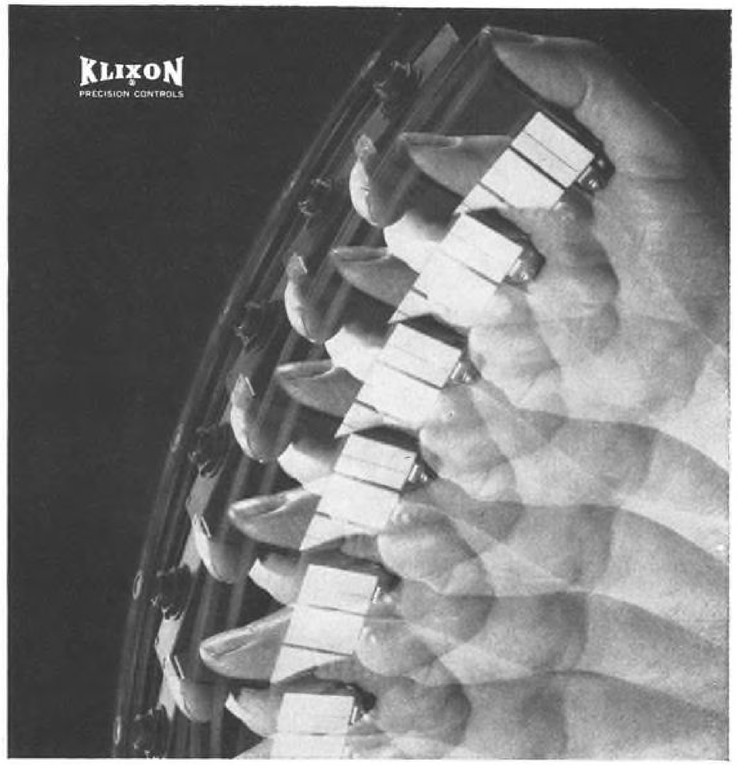
Sundstrand officials claim the Cryhocycle would be especially useful on the lunar surface where daytime surface temperatures as high as 250F may reduce the efficiency of the selected Apollo thermal control system which has outside radiators to dump heat into space.

Apollo accessory power units and thermal environment systems are both to be located in the service module. Sundstrand is asking that the Apollo service module be designed to leave room for the Cryhocycle unit which is somewhat larger than the equipment it would replace. If the backup proposal is to be accepted, NASA must act by June 1.

Venus Atmosphere

Moscow—New 157.6-in. solar telescope at the Crimean Astrophysical Observatory, by means of a special spectrograph, has discovered molecular oxygen in the upper layers of the atmosphere of Venus, according to the Soviet news agency Tass. The recent report stemmed from observations made a year ago when Venus was nearest the earth.

U.S. observers feel the report is valid because of the advanced observation instrumentation used in Crimea. The Soviet conclusion was made on the basis of a slight absorption of solar light, indicative of oxygen. Major element in the atmosphere of Venus has long been known to be carbon dioxide, and there is an indication, Tass said, that nitrogen also is present.



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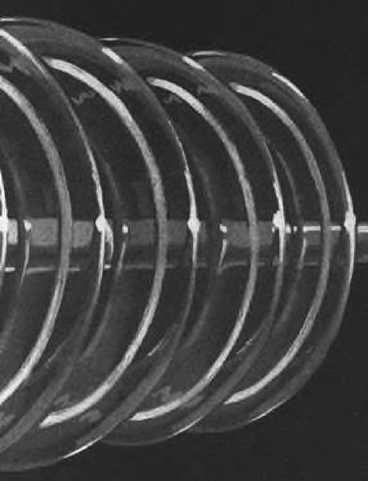
For complete performance and test data on the new KLIXON 7276 3-phase circuit breaker, write for Bulletin CIRB-27.

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Insulation resistance	100 megohms, minimum
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Overload calibration	At 200% 2-20 sec.
Trip-free calibration	Same limits
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Mechanical cycling	1000 cycles
Overload cycling	100 cycles at 200% rating
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Space Committeemen Face New Problems

By George C. Wilson

Washington—Rep. Olin E. Teague (D.-Tex.) dug through a mountain of mail on his desk and threw down an editorial which he said exemplified the political price of chairing one of the four new House science and astronautics subcommittees.

The editorial suggested in the strongest terms that the people in his district particularly and the nation generally would be far better off if "Tiger" Teague spent more time on problems here on earth than on those in space.

Yet, as chairman of the Manned Space Flight Subcommittee, he must go to the House floor in a few days and help persuade his colleagues to let the National Aeronautics and Space Administration spend some $3.8 billion in the coming fiscal year on everything from Florida swampland to Venus-bound rocket vehicles.

How well he and other congressional leaders meet the political challenges to the NASA budget will have a lot to do with how much the U.S. spends on space. Realizing this, Space Committee Chairman George P. Miller (D.-Calif.), who succeeded the late Rep. Overton Brooks (D.-La.), this year, revamped the House space committee by breaking it into specialized units and encouraging their members to do everything possible to educate themselves. Some glaring deficiencies in Congress' ability to pass on multi-billion-dollar space questions showed up in the process.

Cram Course

"I had no background for this job," said Rep. Teague. "I studied animal husbandry. And nobody else on the committee is a scientist, either. I just had to work overtime reading all kinds of stuff and got help wherever I could—NASA, the Air Force, industry—everyplace I thought I could learn something."

He also took his subcommittee to places like Cape Canaveral to get further background, through briefings and on-the-spot inspections. For example, the subcommittee held closed hearings at Cape Canaveral in an attempt to learn what was behind the Air Force-NASA dispute on the Atlantic Missile Range (AW Apr. 9, p. 33).

The other three subcommittees worked much the same way on the NASA Fiscal 1963 budget. All told, there have been two full committee hearings and more than 40 subcommittee hearings since the House space committee began consideration of the NASA budget Feb. 21. Approximately 125 witnesses appeared and more than 2,000 transcript pages of testimony were recorded. The printed hearings will be studied far beyond the confines of Congress since they represent the most detailed explanation to date of the national space effort President Kennedy ordered May 25, 1961.

Despite all these hearings and homework, most House space committee members feel queasy about recommending the appropriation of so much money to NASA. Their uneasiness stems primarily from the strange element in which they have been suddenly immersed. They have found during the space hearings that conventional methods of obtaining a clear picture by a probing examination of witnesses seldom works while questioning an official steeped in the technicalities of propulsion, space vehicles or tracking systems. The problem is compounded by the cold war urgency enveloping NASA requests for money. Despite this urgency and their lack of technical knowledge, House space leaders are refusing to give NASA a blank check.

Prospector Dropped

"I'm all in favor of accelerating the space program as fast as it is logically possible to do," said Chairman Joseph E. Karth (D.-Minn.) of the Space Sciences Subcommittee, "but I don't want to remain so ignorant about the program that I overlook those critical areas where investigation should be made." This attitude, he said, led the subcommittee to recommend that the $10.4 million requested for Fiscal 1963 for the unmanned Prospector roving lunar vehicle be struck from the NASA budget. Rep. Karth said by the time Prospector is ready to fly—NASA estimates a launch in 1965—the U.S. will be close to putting a man on the moon. Also, he said, by that time the more advanced Surveyor unmanned lunar craft will have gathered the same type of information. Surveyor is slated to make a soft lunar landing in 1963.

This selective cutting—a technique being followed by most of the subcommittees—is in sharp contrast to the actions of the full House Science and Astronautics Committee, which usually met as a whole last year. At that time the committee under Rep. Brooks tried to give the program what he called "a sense of urgency" by authorizing more money than NASA requested.

This year's turnabout from expanding to cutting the NASA budget marks the start of the new treatment space budgets will receive from Congress from now on, barring a national emergency. No longer will NASA's budget run through Congress relatively unscathed. But, in the opinion of three of the four subcommittee chairmen, this new treatment cannot be fully implemented until Chairman Miller agrees to hire additional staff grounded in science and engineering. Right now the eight-man space staff consists of four lawyers, two former journalists, a communications specialist and an Army civil engineer colonel. Of the eight, only Col. Earl G. Peacock of the Corps of Engineers has had extensive training and experience in space engineering and science. He is on loan to the committee.

Subcommittee Chairman Teague, Karth and Victor L. Anfuso (D.-N. Y.) contend overseeing space spending is different than watching the military budget because the space program came full bloom before Congress practically overnight; there was not the same backlog of knowledge to draw upon which the House and Senate armed services committees enjoy as a result of long exposure to the subject. This difference, the chairmen argue, makes them especially dependent on their staffs. Only Chairman Ken Hechler (D.-W. Va.) of the Application and Tracking and Data Acquisition Subcommittee is unconvinced that more staff is needed by the House space committee. High ranking Republican members of the committee agree with the majority view.

Rep. James G. Fulton (R.-Pa.), sec-

Committee Members

House Science and Astronautics Committee subcommittees, with the chairmen listed first:

- Manned Space Flight. Democrats: Reps. Olin E. Teague (Tex.), Emilio Q. Daddario (Conn.), Thomas G. Morris (N. M.), William F. Ryan (N. Y.); Republicans: Rep. James G. Fulton (Pa.), R. Walter Riehlman (N. Y.), Richard L. Roudebush (Ind.).
- Advanced Research and Technology. Democrats: Rep. Victor L. Anfuso (N. Y.), Walter H. Moeller (Ohio), David S. King (Utah), James C. Corman (Calif.); Republicans: Rep. J. Edgar Chenoweth (Colo.), Charles A. Mosher (Ohio), Alphonzo Bell (Calif.).
- Space Sciences. Democrats: Rep. Joseph E. Karth (Minn.), Bob Casey (Tex.), William J. Randall (Mo.), Thomas N. Downing (Va.); Republicans: Rep. K. William Van Pelt (Wis.), Perkins Bass (N. H.).
- Applications and Tracking and Data Acquisition. Democrats: Rep. Ken. Hechler (W. Va.), J. Edward Roush (Ind.), John W. Davis (Ga.), Joe D. Waggonner (La.); Republicans: Reps. Jessica McC. Weis (N. Y.), Thomas M. Pelly (Wash).



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ond ranking Republican, said five persons with scientific backgrounds should be added to the staff. "We have to have people who understand these subjects and who go and see the facilities, who know Canaveral, who know Houston. Then they can keep us current."

Similarly, Rep. R. Walter Riehlman (R.-N. Y.) said "our committee has been lacking in a staff that is qualified to follow thoroughly these programs and be of assistance to members in evaluating them." He stressed that he had no criticism of the present staff—it just needs scientific help.

The staff question pits the three subcommittee chairmen against Chairman Miller, who feels the additions should be management personnel with scientific experience rather than professional scientists and engineers "who know all about psi. And such details." He said his committee is so short of office space that he does not plan to add more than three persons to the committee staff this year.

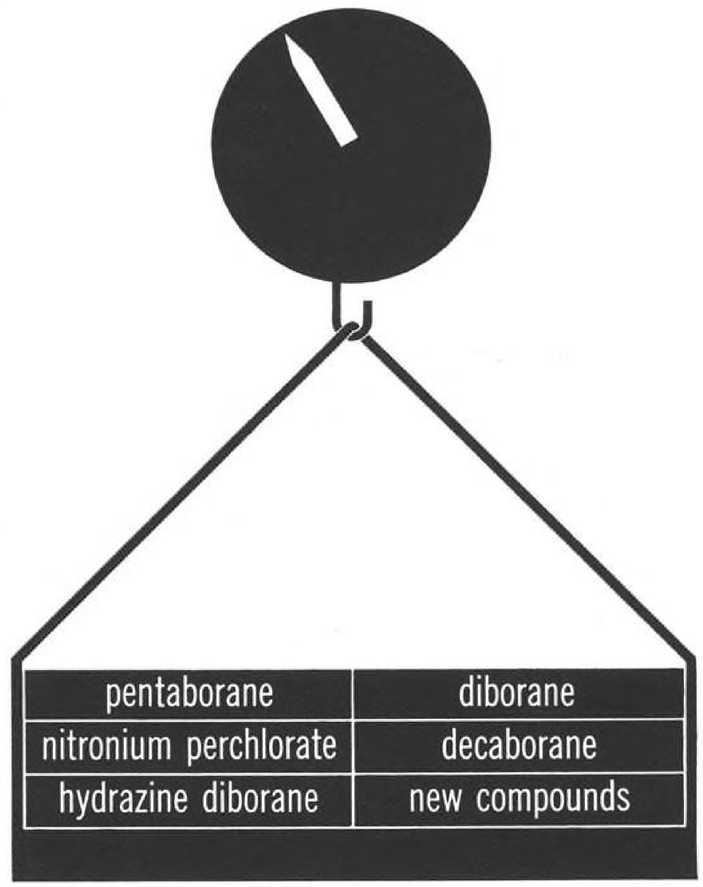
This difference between the subcommittee chairmen and Rep. Miller on staffing certainly is not major enough to wreck committee harmony. But it does symbolize two basically different approaches to congressional review of the U.S. space program. The Miller approach—the more generalized one—is the technique employed by the House Armed Services Committee where Rep. Miller served for many years. The other approach—more specialized—represents the way newer members of Congress hope to satisfy their consciences and constituents that the space billions are not squandered. Significantly, the age difference between Rep. Miller, 71, and the second ranking Democrat on the committee, Rep. Teague, 52, is 19 years.

Miller's Plans

For the immediate future, Chairman Miller intends to take his committee on extensive field trips to scientific installations and then focus national interest on such unheralded institutions as the National Bureau of Standards.

Rep. Miller also emphasizes the "science" part of the House Science and Astronautics Committee name, declaring this gives the committee a mandate to look into such down-to-earth scientific developments as monorail transportation and air cushion vehicles.

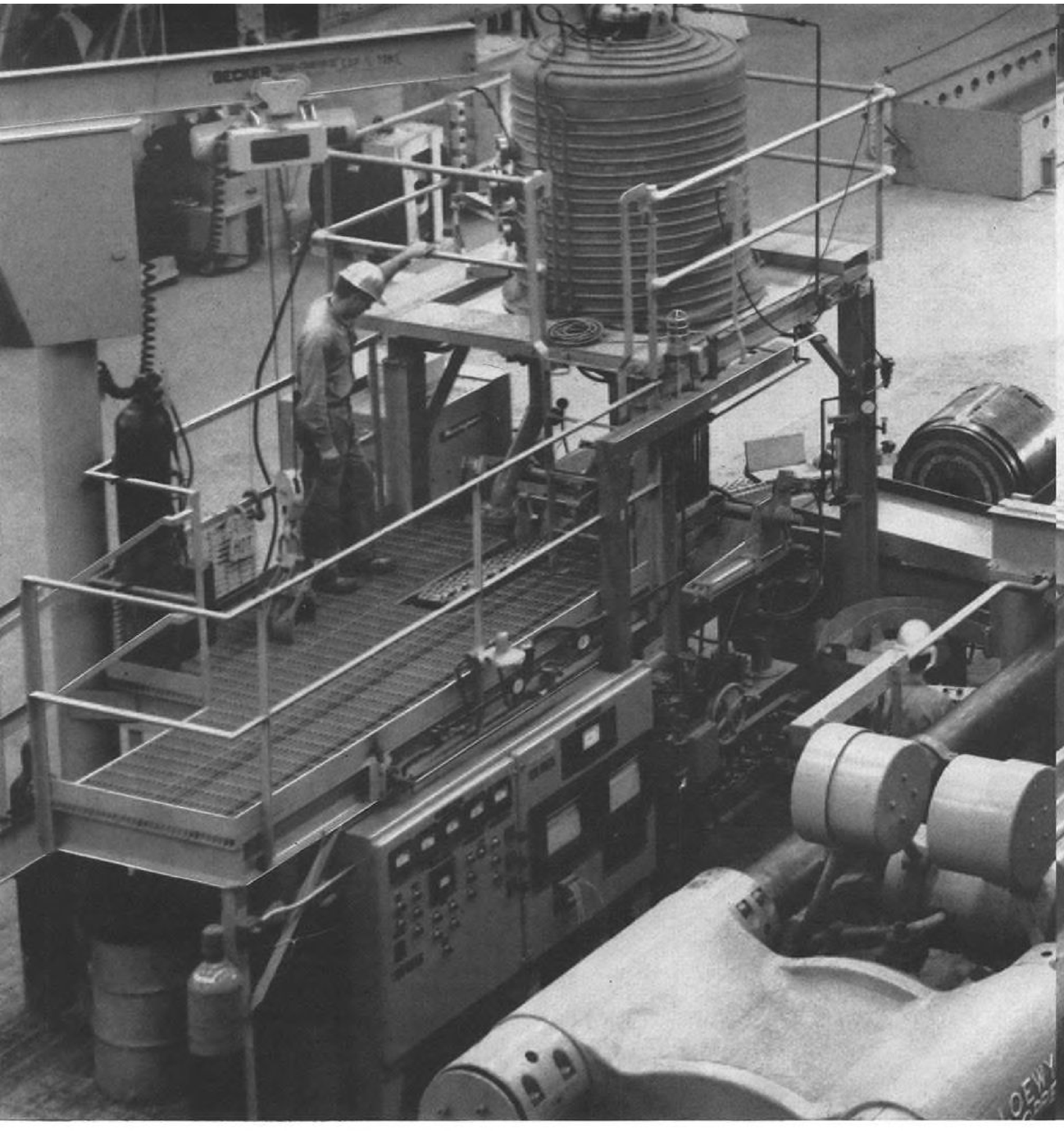
But what seems certain to become the most consuming interest of the House space committee is the national space program—if for no other reason than its very bigness makes overseeing it a full-time job. And the unprecedented breadth of interest the committee showed in the program this year in reviewing the NASA budget indicates the House, not the Senate, will become the most influential forum for the U.S. space program in the years ahead.

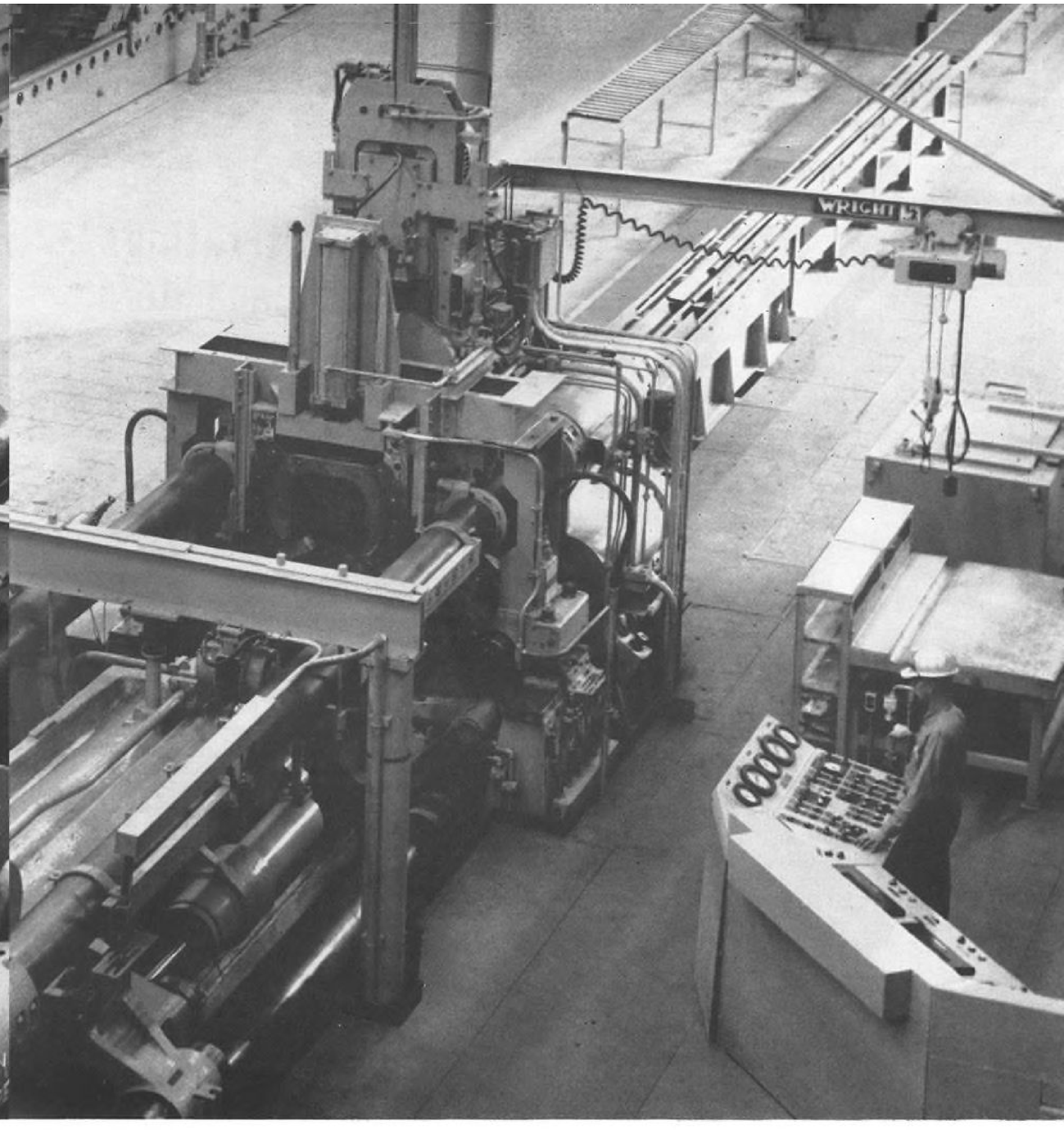


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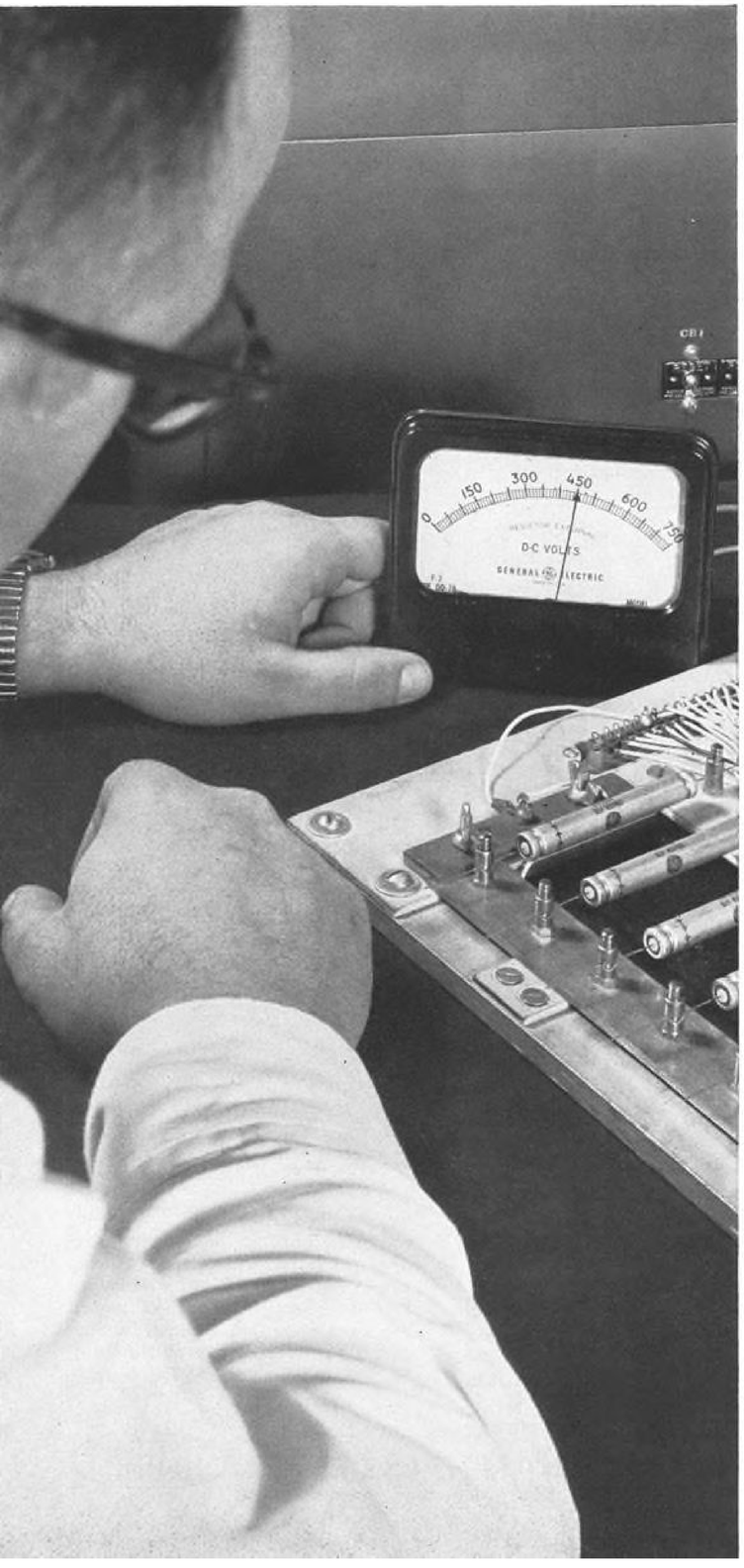
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Data on G-E high-voltage foil capacitors, including the new 375- and 450-volt units, is found in Bulletin GET-2977. Ask your G-E Sales Engineer for a copy today. Or, write to Section 430-10, General Electric Co., Schenectady, N. Y.

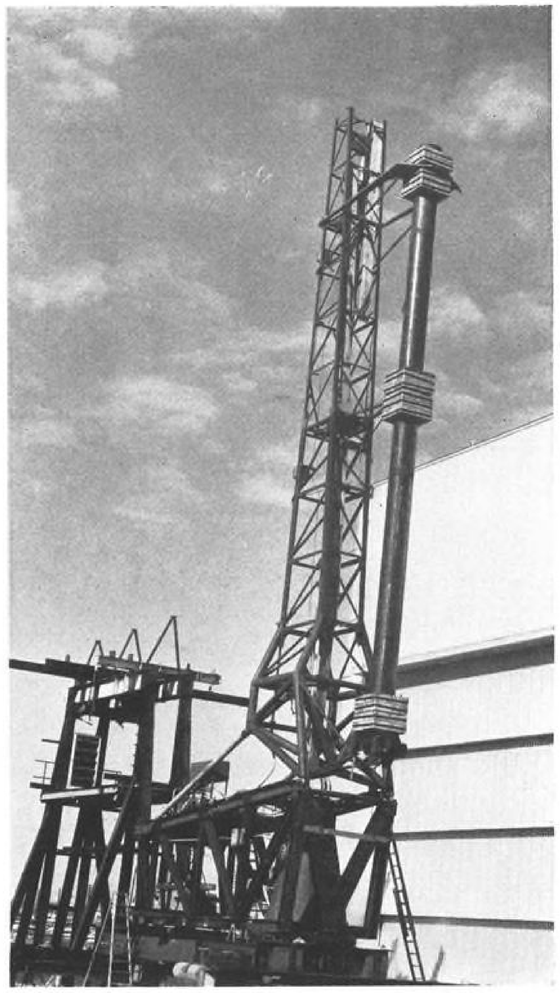
Capacitor Department, Irmo, South Carolina

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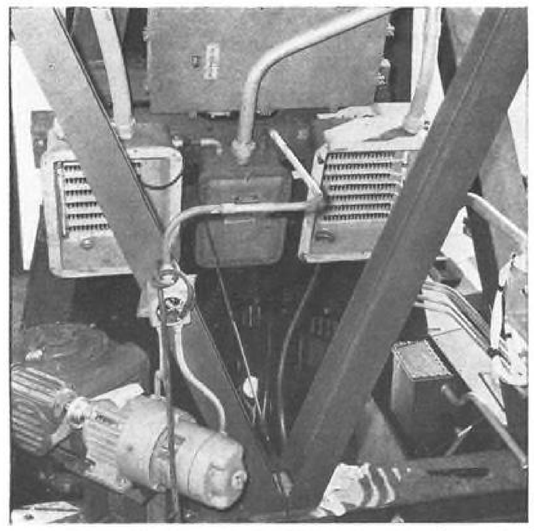


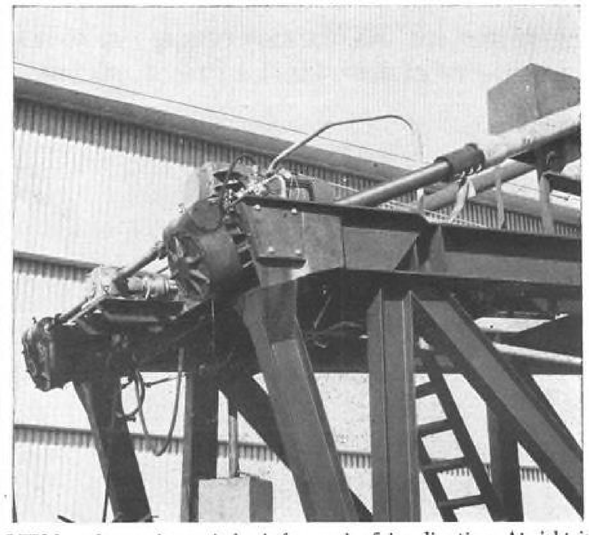
Water-filled dummy test load is shown supported by upper launch structure in the horizontal position. Screwjacks extending from rear portion of base to rear legs of upper launch structure can elevate rocket to precise firing position in less than 10 min.



New Scout Launcher Cuts Preparation Time in Half

New launcher for Ling-Temco-Vought Scout research rockets, expected to cut prelaunch preparation time in half, has been delivered to National Aeronautics and Space Administration and is now being installed at Navy's Pt. Arguello, Calif., Pacific Missile Range. New Scout launcher will be used by both NASA and USAF. Personnel from Air Force are now undergoing Scout operations training at Vought's Dallas plant and at NASA's Wallops Island, Va. facility. Designed by Chance Vought Astronautics Division under a contract for approximately $500,000, the new equipment features an 85-ft. derrick-like launcher that can lift a fully assembled 72-ft. Scout from the horizontal to any desired position. Other key components of the system include a 70-ft. assembly and transporter vehicle and a 120-ft.-long rail-mounted assembly and servicing shelter. Launcher consists of a swiveling base and the launcher structure is hinged to the base. Launcher, with rocket installed, is capable of swiveling 140 deg. by means of a 1-hp. motor.





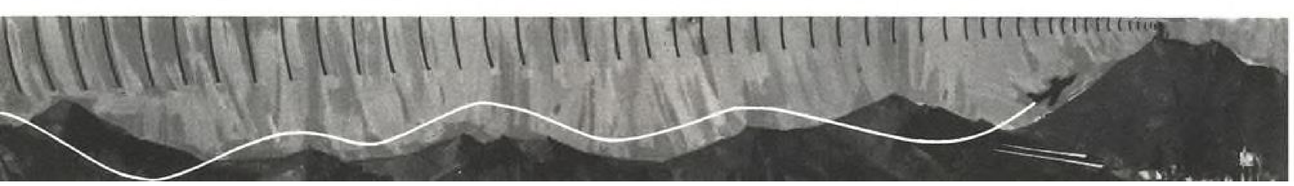
Closeup shows 1-hp. motor (lower left), and gearing for rotating LTV launcher on its vertical axis for precise firing direction. At right is 20-hp. motor, gearing and screwjacks used to elevate or lower upper structure of Scout rocket launcher.



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U.S., USSR to Continue Space Discussions

By George Alexander

United Nations, N. Y.—United States scientists are cautiously—but optimistically—preparing to meet again soon with their Soviet counterparts for a second round of discussions on the possibility of joint U.S.-USSR space exploration.

American scientists, led by National Aeronautics and Space Administration Deputy Administrator Dr. Hugh L. Dryden, will gather with Soviet representatives, led by Prof. Anatoli A. Blagonravov of the Soviet Academy of Sciences, either in Washington, D. C., later this month or in Geneva, Switzerland, next month. The meetings will be coincidental with either the Committee on Space Research (COSPAR) session in Washington Apr. 30 through May 10 or the first convening of the subcommittees of the United Nations Committee on the Peaceful Uses of Outer Space in Geneva May 28.

First two meetings between U.S.-USSR scientists and diplomats were held recently in New York after President John F. Kennedy and Premier Nikita Khrushchev had exchanged letters calling for mutual cooperation in space activities (AW Mar. 26, p. 23).

One U.S. source said that the Soviets in the first round "were soft-pedaling their usual cold-war line." He also indicated that the talks between U.S. and Soviet scientists, led respectively by Dr. Dryden and Prof. Blagonravov, had been more fruitful than those carried on between the two nations' deputy permanent representatives to the UN—Francis T. P. Plimpton of the U.S. and Platon D. Morozov of the USSR.

Of the five areas in space research proposed by Kennedy and the six by Khrushchev where a joint cooperative attempt could be made by both nations, it appears that U.S. and USSR representatives are considering a modest start with two non-controversial programs—meteorological and communications satellites. Successful cooperation in programs such as these could lead in several years to the establishment of tracking stations by each nation within the other's boundaries or permission to land returning spacecraft of one nation on the other's territory, should the need to do so arise.

Key Instrument

Key instrument through which the U.S. and USSR have been attempting to reach an understanding in the exploration of space has been the United Nations Committee on the Peaceful Uses of Outer Space.

Created in late 1959 by the UN General Assembly, the committee had been all but given up for dead as the U.S. and USSR fought for nearly two years over the procedural rules to be followed in the committee's operation. The Soviets insisted that proposed committee actions be adopted by unanimity of the committee's 24-nation members; the U.S. contended that this attitude was tantamount to veto power. The U.S. pressed for rule by the majority, but the Soviets rejected this approach as an attempt by the U.S. and its allies to dominate the committee and impose the objectives of the Western-bloc on the USSR and its satellite nations.

The committee, now increased to 28 members with the addition of Chad, Morocco, Mongolia and Sierra Leone, counts 12 nations generally regarded as pro-West, 8 as pro-East and 8 as neutral.

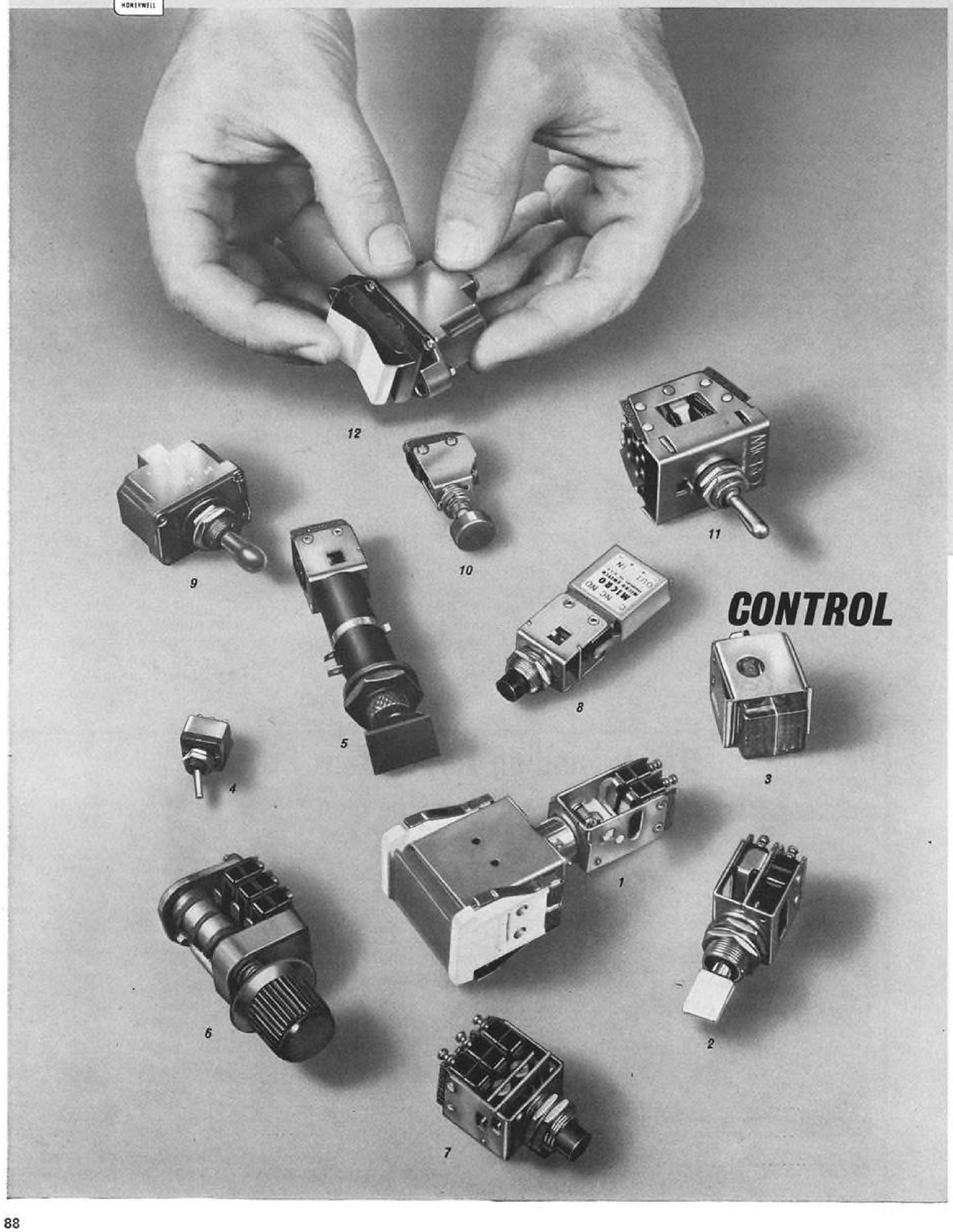
The committee met briefly for the first time last November and adjourned after electing Dr. Franz Matsch, Austria, as chairman, Prof. Mihail Haseganu, Romania, as vice-chairman and Geraldo deCarvalho Silos, Brazil, as recording secretary. Upon receipt of the committee's report on this simple meeting, the General Assembly passed a resolution which extended the mandate of the Committee on the Peaceful Uses of Outer Space, commended basic principles for space exploration (AW Dec. 18, p. 32), called for a central UN registry of all objects launched into space and requested the cooperation of the World Meteorological Organization (WMO) and the International Telecommunications Union (ITU). It also directed the committee to meet again no later than Mar. 31, 1962.

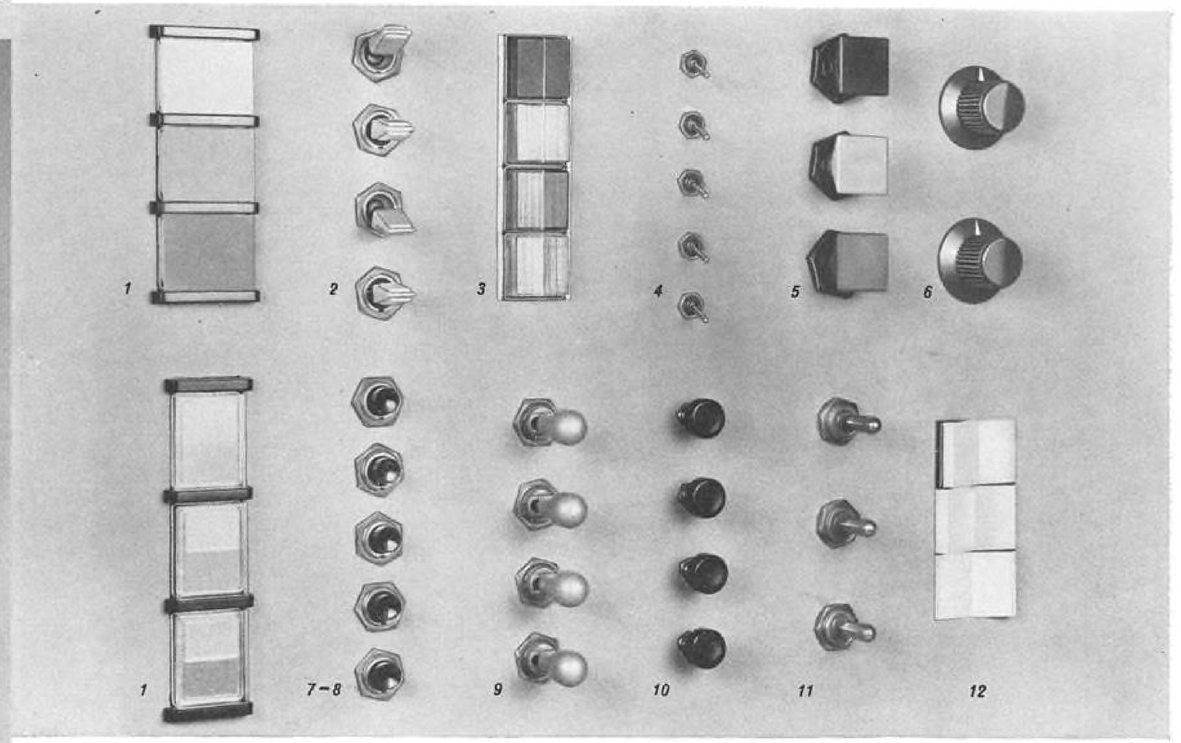
U.S. and USSR continued discussions on committee procedures and finally compromised on consensus as the method of operation. Dr. Matsch announced this agreement on Mar. 19 as the committee re-convened for its first

NASA Funding for Centaur Program

This chart shows the money the National Aeronautics and Space Administration has allocated for its Centaur program in Fiscal 1961 and Fiscal 1962, and its requests for Fiscal 1963.

	Fiscal 1961	Fiscal 1962	Fiscal 1963
Vehicle Development			
Second stage design engineering	$9,108,000	$14,642,000	$7,600,000
First-stage procurement	4,500,000	3,950,000	7,400,000
Second-stage fabrication	14,874,000	16,331,000	13,860,000
Ground testing	8,891,000	11,308,000	7,400,000
Launch support	.....	5,669,000	10,700,000
Total	$37,373,000	$51,900,000	$46,960,000
Engine Development			
Design, engineering	$5,662,000	$4,035,000	$2,940,000
Fabrication	7,946,000	8,401,000	6,000,000
Ground testing	10,352,000	7,500,000	2,200,000
Total	$23,960,000	$19,936,000	$11,140,000
System Support			
NASA	$2,180,000	$600,000	$1,388,000
Air Force	.....	1,250,000	900,000
Marshall Space Flight Center	$1,160,000	654,000	2,276,000
Propellants	.....	500,000	4,000,000
Total	$3,340,000	$3,004,000	$8,564,000
	$64,673,000	$74,840,000	$66,664,000





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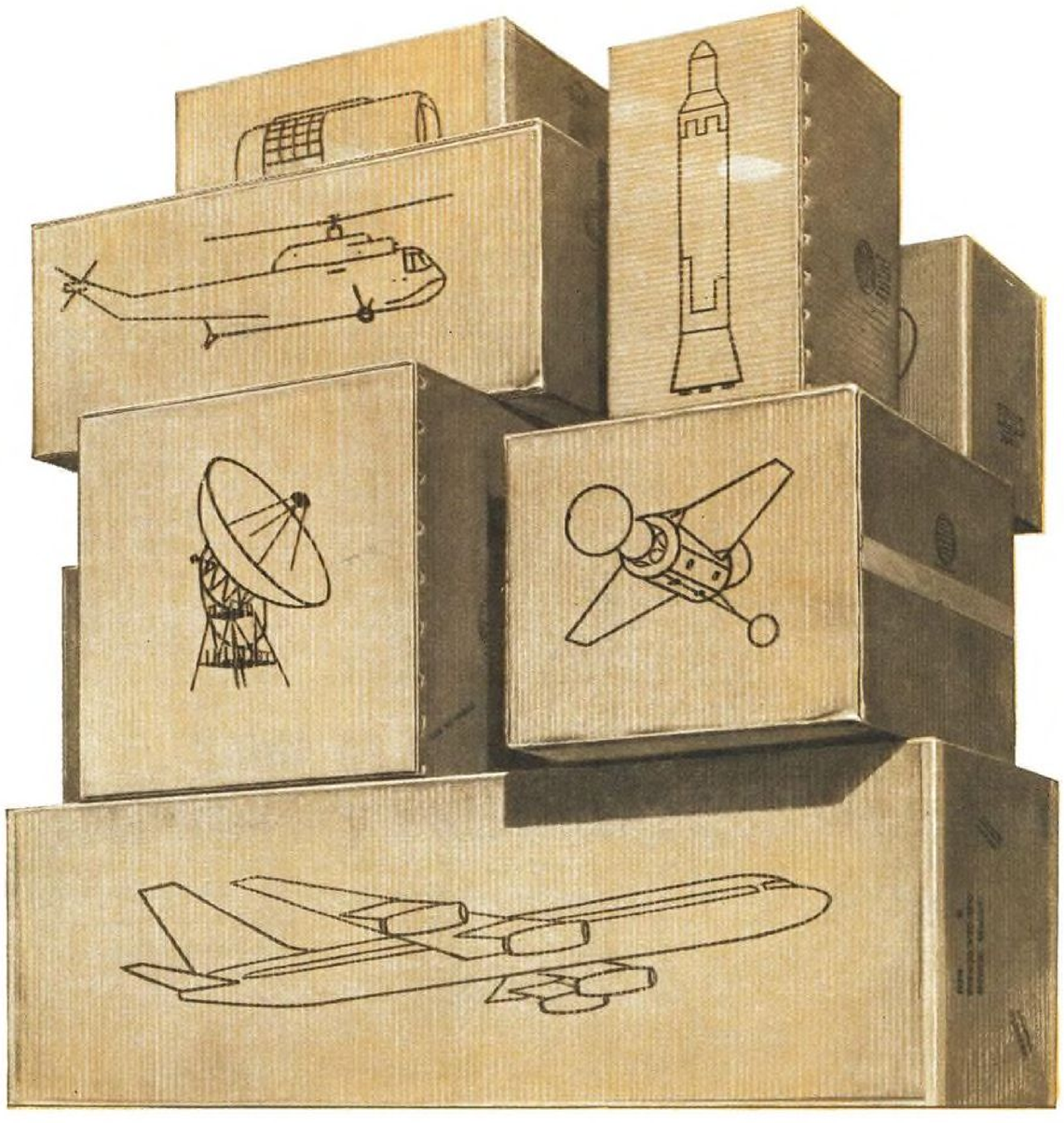
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practical working session, saying: "I should like to place on record that through informal consultations it has been agreed among the members of the committee that it will be the aim of all members of the committee and its subcommittees to conduct the committee's work in such a way that the committee will be able to reach agreement in its work without need for voting."

In effect, the agreement means that the Soviets will honor the prevailing attitude of committee members as determined by private conferences and, in turn, the U.S. will not push for public showdowns.

Having found an area of agreement, the committee then invited the WMO, ITU, the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Committee on Space Research of the International Council of Scientific Unions to participate in the committee's work.

Subcommittees Formed

The committee then turned its attention at the end of its 10-day session to organization and created two subcommittees of the whole—the first Scientific and Technical and the second Legal. Both subcommittees were urged to meet at the same time during May and at the same place—Geneva—to permit exchange of viewpoints. The subcommittees were allowed to work out their own agendas when they meet, although both the U.S. and USSR offered suggestions.

The committee agreed to meet again at the United Nations either in August or September this year to consider the reports of the subcommittees and to receive the reports requested of the WMO and ITU by the previously mentioned General Assembly resolution.

The WMO specifically was asked by the UN to make a study of:

- **State of the art advances** required in meteorology to provide greater knowledge of the basic factors affecting climate and the possibility of weather modification on a large scale.
- **Development** of existent weather forecasting capabilities and the rendering of assistance to UN member states—through regional meteorological centers—to make more effective use of forecast data.

The International Telecommunications Union was asked to outline those aspects of space communications that would require international cooperation and to consider what UN member states would have to do in the development of their domestic communications facilities, so as to make effective use of communications satellites.

Most UN observers viewed the committee's 10-day working session as constructive and a hopeful start toward genuine international cooperation in space. The U.S., which has long contended that the Soviets do not divulge enough data on their space flights, found itself in the embarrassing position of providing less data to the UN's space registry than the USSR. The U.S. took a literal interpretation of the registry's requirements and submitted data only on those satellites and space vehicles still in orbit. As a consequence, data on the flight of Lt. Col. John H. Glenn was not offered to the world organization. Soviets, who have never overlooked an opportunity of mentioning Sputnik 1 or Gagarin's and Titov's flight —or all three in their speeches before the UN, submitted data on everything they have flown to date, regardless of the fact that many of the satellites have long since fallen from orbit (see p. 97).



Second Advent Antenna Erected

Nine-ton parabolic reflector antenna dish which will track Advent communications satellite is installed at Camp Roberts, Calif. A similar dish has been erected at Ft. Dix, N.J. Sylvania erected the antenna, designed to track Advent on its 22,300-mi.-altitude orbit.

Gemini Recovery Tests

North American Aviation's Space and Information Systems Division will test paraglider recovery system on a model of NASA's Gemini capsule, for which it is programed.

Backup unit for this recovery system is an 84-ft.-dia. Mercury capsule-type parachute system being developed by Northrop's Ventura Division for McDonnell Aircraft Corp. A special ejection seat for off-the-pad abort of the Gemini spacecraft is being designed by McDonnell, but will be developed and qualified by a seat manufacturer.

Gemini's seat will be similar to the Dyna-Soar seat to be built by Weber Aircraft Corp. for Boeing. Gemini seat will embody some modifications and will flip back to allow astronaut to go into a semi-supine position to spread the gravity force load.

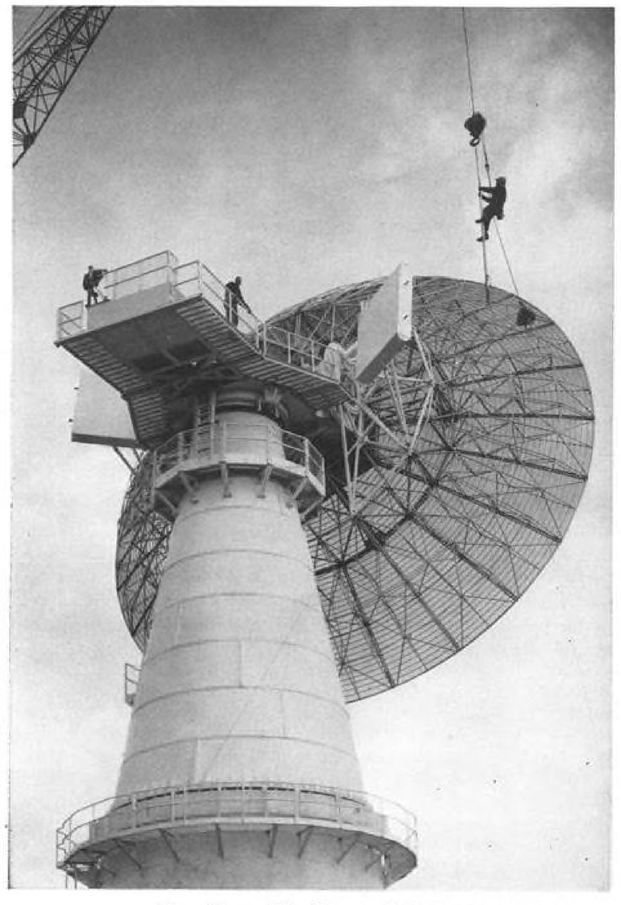
Half-scale testing of the Gemini seat is scheduled to begin in May at Edwards AFB to be followed in June with full-scale testing at El Centro, Calif.

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Newer, more powerful radar systems with brighter, clearer image display for better viewing are Raytheon developments which make radar more useful and practical for industry and defense. Accurate and economical large scale radar systems for weather predictions, space projects, air traffic control, and military requirements have been made possible through these advanced techniques. At Raytheon, research is constantly exploring new technologies for new applications. Radar technology is one of Raytheon's many electronic skills. Through simultaneous application of these skills in military and commercial areas, Raytheon is providing new and more useful products to serve you in industry, science, and defense. Raytheon Company, Lexington, Massachusetts

RAYTHEON



Tracking Missiles and Satellites with High Power Radar that enables scientists to study the performance of space vehicles re-entering the earth's atmosphere will be possible with a new five million-watt transmitter now under development by Raytheon for the National Aeronautics and Space Administration. Broad experience in the development of highly sophisticated radar systems has made it possible to design this exceptionally long range, reliable radar transmitter.



Long Distance Weather Observations for greater forecasting accuracy are accomplished with Raytheon "Storm Finder" radar systems now operated by the U.S. Weather Bureau. The Storm Finder's 250-mile range and variable sensitivity permits meteorologists to penetrate the eye of a hurricane, locate rain, snow and clouds, or predict within minutes the arrival of a storm front at a given location.





Fire-Control Radars for Navy's Tartar Missile on the first of new guided missile destroyers, the Charles F. Adams, DDG-2, were developed and produced by Raytheon for the Navy's Bureau of Weapons. The radars, which help guide the Tartar missile despite enemy evasive tactics or jamming devices, can be used as part of the ship's overall fire-control system to direct the vessel's conventional guns.

Coast-to-Coast Control of fast, high-flying jet traffic is now possible with Raytheon "Flight Tracker" radar systems ordered by the Federal Aviation Agency for 51 locations as part of a nationwide radar network. Using greatly increased power and a "bright display" radar picture viewing screen, this system gives air traffic controllers a continuous flight path and history of all air traffic. The equipment tells where the planes are headed, where they came from and how fast they're moving.

Can RAYTHEON Electronics help you?

RENDEZVOUS ROUTE OR COLLISION COURSE?

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. ■ 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's seed-bed of advanced ideas in the technology of navigational equipment and radar beacons. ■ Every product we make started with a question. We solicit yours. Write 1400 North Goodman St., Rochester 1, New York.



GENERAL DYNAMICS | ELECTRONICS – ROCHESTER

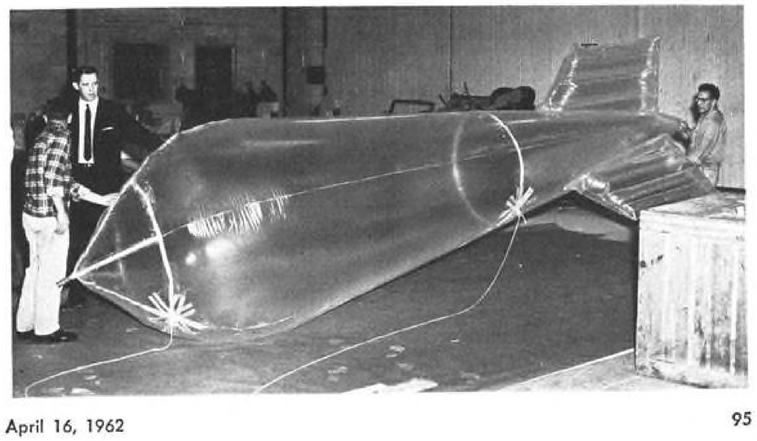


Echo 2 Camera Capsule Recovery Technique Devised



Recovery technique developed by All American Engineering Co. will be used to retrieve a 16-mm. camera capsule to photograph ejection and inflation of a 135-ft. dia. Echo 2 in a ballistic test scheduled from the Atlantic Missile Range shortly. Grumman SA-16 of the Air Rescue Service 48th Squadron will drop two frogmen after the capsule has been ejected (AW Jan. 8, p. 28), who will attach a 240-ft. length of nylon line to the capsule. A polyethylene balloon, helium-filled, will be attached to the end of the line and ascend. Trailing a snare, the SA-16 will snatch the line and draw the capsule into the aircraft. Major components of the All American system are the air droppable recovery station, which houses the polyethylene balloon, line and helium bottles (right). Fully-inflated balloon (bottom, right) is inspected at the All American plant in Georgetown, Del.



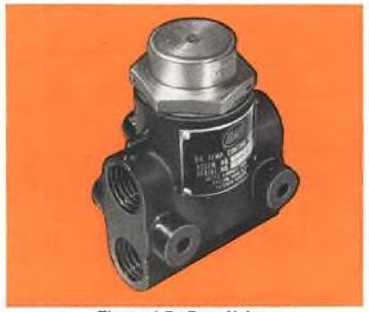




Water Alcohol Check Valve



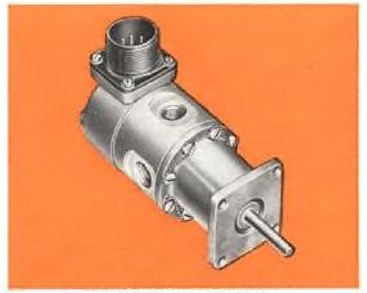
Oil Dilution Solenoid



Thermal By-Pass Valve



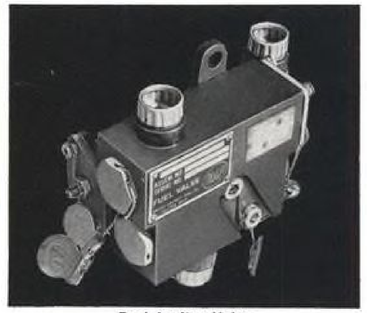
Diverter Segregator Valve



Direct Acting Solenoid



Brazed Fuel By-Pass Valve



Fuel Igniter Valve



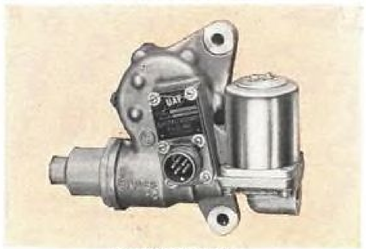
Aerofuse



Thermostatic Air Bleed Valve



Pressure Regulator



Hot Streak Igniter



Fuel Throttling Valve

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Soviets Reveal Data on USSR Space Vehicles

Soviet Union filed the following log of USSR earth satellites and other space vehicles with the United Nations Committee on Peaceful Uses of Outer Space. The log contains some corrected data, relatively minor, on perigee, apogee and vehicle inclination, the Soviets said in a letter submitted to the United Nations with the data. Perigee and apogee figures, given by the Soviets in kilometers, are followed by figures in parentheses which represent conversions to statute miles. Sputnik 1, launched in October, 1957, was the first successful launch of an artificial satellite from the earth. Purpose of Lunik 1, launched by the Soviets in January, 1959, was to achieve escape velocity and explore interplanetary space. In April, 1961, Vostok 1 carried Yuri Gagarin into space and marked the first time a man had successfully been orbited outside the earth's atmosphere.

Vostok 2, which was launched in August, 1961, and manned by Gherman Titov, investigated the effects on the human organism of prolonged flight in orbit, re-entry into the earth's atmosphere, and tested man's ability to function during prolonged periods of weightlessness.

Consecutive No.	Name	Purpose	Date	Main characteristics of orbit according to corrected data		
				Perigee (Km.) Apogee (Km.) (statute miles)		Inclination (deg.)
1	First satellite (Sputnik 1)	Launching of first ever artificial satellite of the earth; physical study of the atmosphere	4 Oct. 1957	227 (141.0578)	947 (588.4658)	65.1
2	Second satellite (Sputnik 2)	Study of the physical processes and conditions of life in outer space	3 Nov. 1957	225 (139.8150)	1671 (1038.3594)	65.3
3	Third satellite (Sputnik 3)	Research in the upper atmosphere and in outer space	15 May 1958	226 (140.4364)	1881 (1168.8534)	65.2
4	First space rocket (Lunik 1)	Attainment of escape velocity and exploration of interplanetary space	2 Jan. 1959	.....	.....	.....
5	Second space rocket (Lunik 2)	Impacting on the moon; delivery of a pennant to the surface of the moon, and research during flight to the moon	12 Sept. 1959	.....	.....	.....
6	Third space rocket (Lunik 3)	Placing an automatic interplanetary station in orbit around the moon; photographing the surface on the far side of the moon; exploring outer space	4 Oct. 1959	..... (24,840)	..... (292,000)	.....
7	First space ship (Sputnik 4)	Development and checking of the main systems of the space ship satellite, which ensure its safe flight and control in flight return to earth and conditions needed for a man in flight	15 May 1960	312 (193.8768)	369 (229.2966)	65
8	Second space ship (Sputnik 5)	Development of systems ensuring man's life functions and safety in flight and his return to earth	19 Aug. 1960	306 (190.1484)	339 (210.6546)	64.95
9	Third space ship (Sputnik 6)	Medical and biological research under space flight conditions	1 Dec. 1960	187.3 (116.38822)	265 (64.6710)	65
10	Heavy satellite (Sputnik 7)	Development of heavier spacecraft	4 Feb. 1961	223.5 (138.8829)	327.6 (203.57064)	64.95
11	Space rocket towards Venus (Sputnik 8)	Checking of methods of setting space objects on an interplanetary course. Checking of extra-long-range communications with and control of a space station; more accurate calculation of the dimensions of the solar system; a number of physical investigations in space	12 Feb. 1961	.....	.....	.....
12	Fourth space ship (Sputnik 9)	Development of the design of the space ship satellite and of the systems on board, which ensure necessary conditions for man's flight	9 Mar. 1961	183.5 (114.02690)	248.8 (154.60432)	64.93
13	Fifth space ship (Sputnik 10)	Development of the design of the space ship satellite and of the systems on board, designed to ensure man's life functions during flight in outer space and return to earth	25 Mar. 1961	178.1 (110.67134)	247 (153.4858)	64.9
14	Space ship satellite "Vostok" ("The East")	Placing in orbit around the earth of the first ever space ship satellite with a man on board	12 Apr. 1961	181 (112.4734)	327 (203.1978)	64.95
15	Space ship satellite "Vostok-2" ("The East-2")	Investigation of the effects on the human organism of a prolonged flight in orbit and subsequent return to the surface of the earth; investigation of man's ability to work during a prolonged period of weightlessness	6 Aug. 1961	178 (110.6092)	257 (159.6998)	64.93
16	Satellite	Investigation of the upper atmosphere and outer space; development of elements in the design of spacecraft	16 Mar. 1962	217 (134.8438)	980 (608.9720)	49

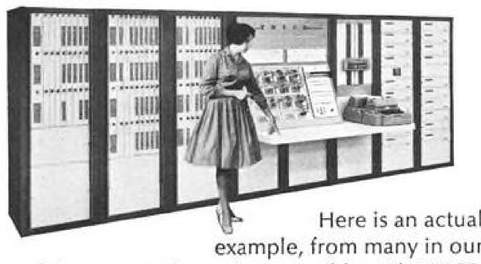
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Here is an actual example, from many in our files, of the spectacular savings possible with TRICE. A certain transformation problem required two months of programming for solution by a large scale computer; the same problem was programmed and solved on TRICE in just three days. That problem, like many others, cannot be solved satisfactorily on obsolete analog computers. Space age technologies demand accuracy and repeatability beyond analog capability plus the computing sophistication offered by TRICE.

TRICE is simple to use. One customer's engineering staff learned to program TRICE in only one morning—from a sales brochure. Such a sales brochure would probably be of interest to you. Why don't you write for your copy?

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SIMULATOR SCREEN is positioned directly in front of the copilot's seat. Infrared photo cell (1) follows red lamp on headphone earpiece (2), moving the screen to compensate for vertical head motions by the pilot.

Cockpit Fog Simulator Facilitates FAA's Study of Runway Lighting

Atlantic City, N. J.—Fog simulator mounted in the cockpit of a Douglas C-54 testbed aircraft will be used here to assist Federal Aviation Agency's Aviation Research Development Service (ARDS) in evaluating lighting systems for runway approach and touchdown zones.

The simulator, which employs a moving strip of coated Mylar film to create a steadily-changing fog picture in the pilot's normal visual field, was developed by Link Division of General Precision, Inc., Binghamton, N. Y. It is the outgrowth of a feasibility study conducted by Link and Franklin Institute of Philadelphia under an FAA contract.

ARDS is scheduled to begin a new series of evaluation flights here this month to check out lighting systems at FAA's National Aviation Facilities Experimental Center (NAFEC). Test personnel are seeking to determine which lighting materials, intensities and configurations are most helpful in minimum visibility landings.

Ultimate goal of the program is establishment of a standard U. S. runway lighting system which later might be submitted for consideration as an international standard.

Smoke Tests

In previous tests, ARDS attempted to use natural fog or to simulate its effect by placing smoke generators alongside the test runway. Fog and smoke, however, create different light diffusion effects. Also, there was no method available for consistently duplicating fog patterns, so test data was of relatively little value.

"The fog simulator should give us the ability to conduct controllable experiments under actual VFR conditions," says Lt. Col. Richard S. Griffith, USAF, chief of the airports section in the ARDS experimentation division. "We'll have to test all lighting systems under the same conditions before we can honestly decide which is best," he said.

The simulator is designed to provide this uniformity. Three film rolls, each conforming to a different visibility

FEATURE FOR FEATURE

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The 1¾" diameter on-off hot air valve shown serves a vital function in a system for engine bleed air anti-icing. Flange configuration can be made to your specification. Whatever your application, Vāp-Air has complete facilities for design, development, engineering, manufacturing and environmental testing of entire systems and a complete line of sensors, electronic controls, precise voltage regulators and electric power controllers. Vāp-Air has off-the-shelf electro-pneumatic and electro-mechanical valves, advanced hot-air inline valves, pressure regulators and heat exchanging equipment.

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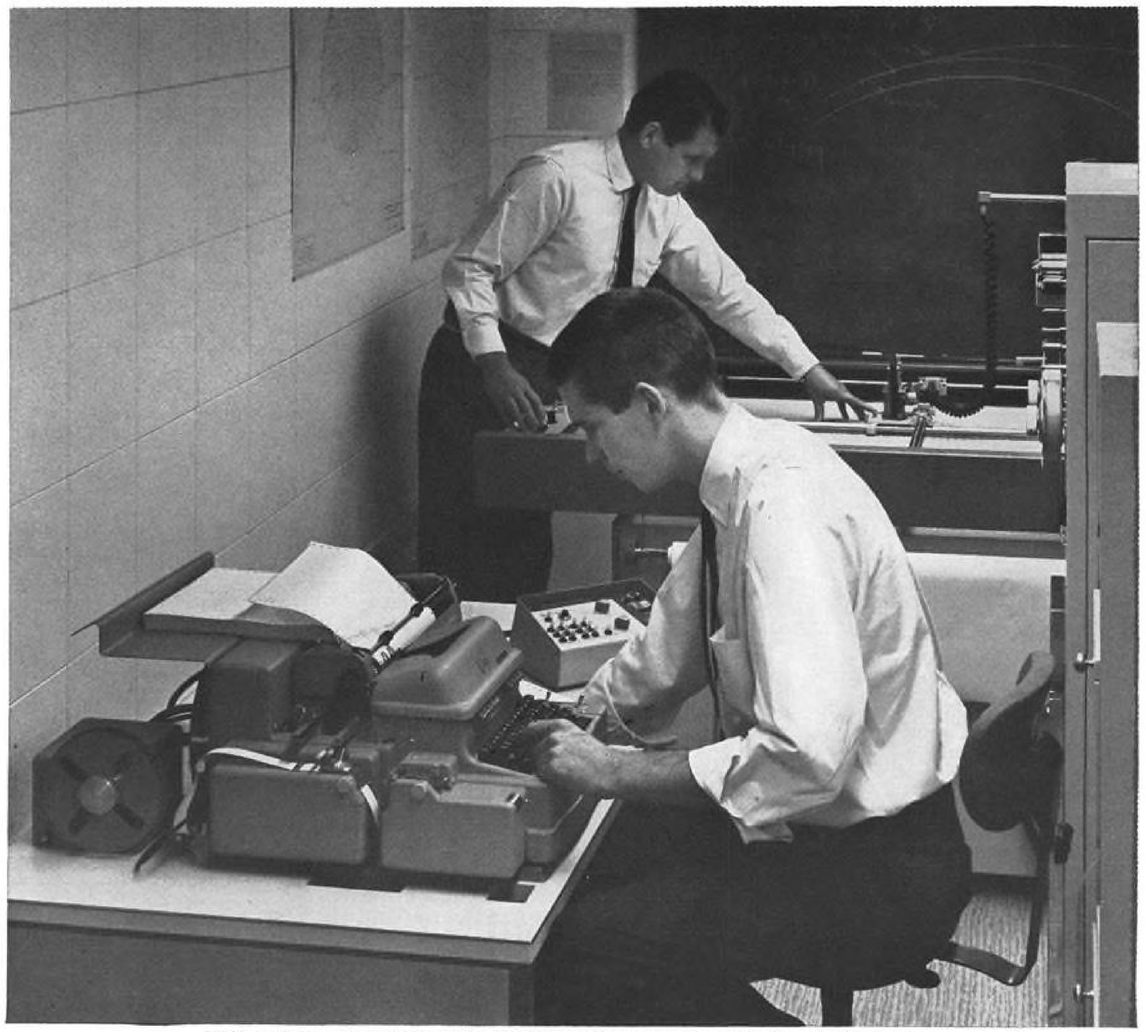
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We don't know of any compact computer that has a larger word length than Recomp. 40 binary digits per word. Keep that in mind for problems such as matrix conversion.

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range, have been developed to date:

- **High IFR**—2,000 to 3,000 ft. maximum visibility.
- **Medium IFR**—1,000 to 1,500 ft. maximum visibility.
- **Low IFR**—400 to 600 ft. maximum visibility.

The 8 in. wide clear film was sprayed with a non-pigmented lacquer which lends an effect precisely the same as natural fog. Spraying was accomplished with a gun automatically controlled by a computer. Spray rate was programed to coat the film with densities that vary as widely as a ratio of 1:60. Each roll contains 210 in. of film treated to simulate a typical fog pattern—lighter at the bottom of the film, denser at the top.

Film density also varies with altitude, so that higher altitude produces a proportionally darker film. Film rolls can be changed in a few minutes.

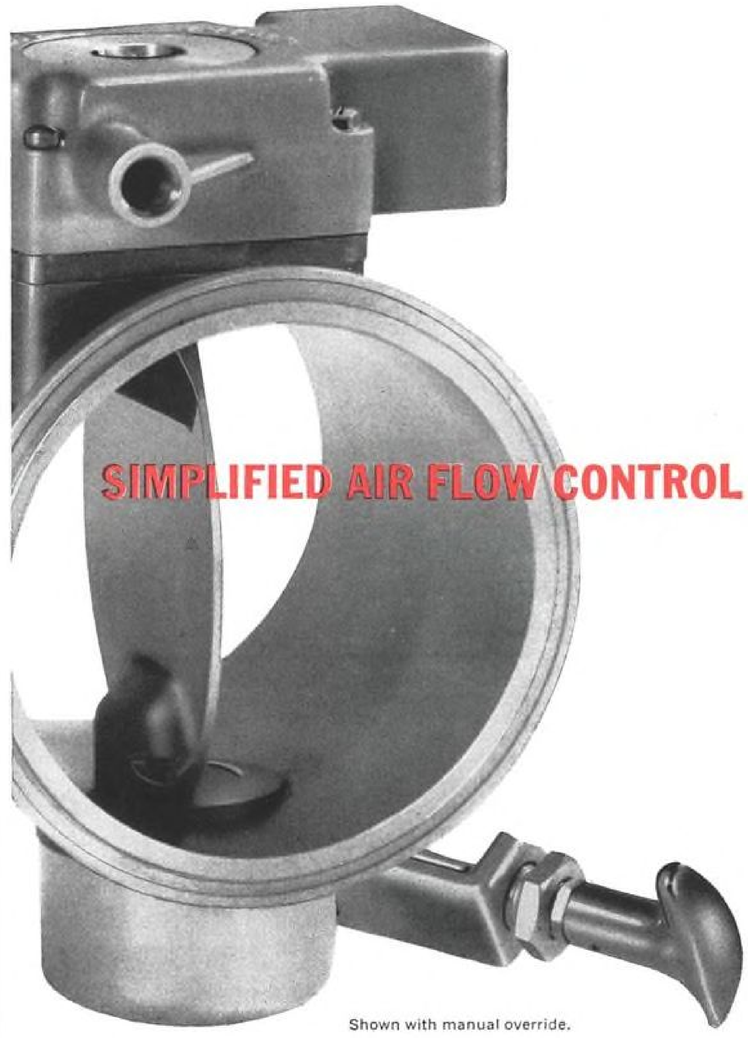
Simulator Components

The Link simulator, which has a 40-amp. power requirement, consists of three basic sections:

- **Three analog computers,** carried on cargo pallets in the C-54's midsection. These are linked individually with the aircraft's altimeter, horizontal gyro and vertical gyro. Altitude changes sensed from the altimeter trigger signals from the computer to the servo system which drives the film mechanism in the cockpit. These signals can accelerate, retard or reverse film movement across the viewing screen to present an accurate fog picture during approach and landing. The other computers, keyed to the attitude gyros, work through servo systems to compensate for pitch and roll by moving the screen in vertical and horizontal planes, so that the fog picture remains constantly in the pilot's direct line of vision.
- **Control pedestal,** situated between the pilot's and copilot's seats and anchored in the housing normally occupied by the autopilot control head. The pedestal contains the servo motors which power the pitch and roll compensators and the main simulator control panel.
- **Film mechanism,** connected to the control pedestal. This section houses the film drive, film rolls and an infrared photo cell. The photo cell is tied into the pitch and roll compensators and a small red lamp attached to the pilot's left headphone. The cell follows his head movements by tracking the lamp and automatically raises or lowers the screen to assure that the pilot always views objects on the ground through the same part of the screen while making his approach and landing.

"This arrangement prevents the pilot from subconsciously 'cheating' by look-

Task's new, lightweight, self-modulating valve regulates the mass flow of cabin air discharged overboard, thereby maintaining stable compartment pressure. The device insures smooth, reliable performance through the use of a butterfly valve with modulating control that adjusts to varying pressure and flow rate without employing electronic servo components. The valve is fully automatic and controls the air flow rate in a smooth, continuous line from 55 pounds per minute at sea level (with virtually no pressure drop), to a maximum of 1 pound per minute when the pressure drop across the valve reaches 2.8 psi. Cam-actuated switches may be provided to indicate valve position. A manual override feature is available for non-automatic operation. For complete specifications, write: Task Corporation, 1009 E. Vermont Ave., Anaheim, Calif.



Shown with manual override.

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for land sea and space applications



hi-shear developed Electro-Combustion Devices serve a dual function. First, they act as high strength fasteners, connectors or as a means of containment. Secondly, on command, the devices are electrically initiated, releasing energies produced by combustion to mechanically push, pull, spin, separate, sever, jettison structure, components or activate other functional systems.

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Standard electro-combustion hardware designed by Hi-Shear may be used, or the Hi-Shear controlled energy principle may be applied to custom applications you may have as exampled by the release of external stores from aircraft, operation of undersea devices, time delay mechanisms, missile tie-down in silo, stage separation or for a variety of applications on space vehicles.



CAPABILITIES A combination of Hi-Shear capabilities are offered: electronic and ordnance talents of an experienced staff; design, manufacturing and quality control skills as a long established precision hardware manufacturer; as well as complete laboratory facilities for ordnance, metallurgical, physical and environmental testing and instrumentation.

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CLAMP SEPARATOR
Provides instant release of ring or circular type clamp. Also imparts a separation impulse to the clamp or band itself to free the latter from the structure. Will carry full tensile loads of MS bolts.



SHEAR BOLT
Fabricated to standard diameter sizes, Hi-Shear's bolt fails a shear pin to produce a controlled, non-fragmenting separation.



THRUSTER
Functions as a mechanical fastener until commanded to separate and then imparts its energy to direct separation of structure or component. is controllable to desired velocity and distance.



ROD OR CABLE SEPARATOR
Used to separate a rod or cable under tension. Eliminates need for guillotine mechanism or fracture ring method. Capable of carrying full tensile allowables of the rod or cable.



POWER CARTRIDGES
Provides combustion energies for the initiation of mechanisms for separation or ejection systems as well as explosively actuated components. Is certified to comply with AFMTC Ordnance Standards, 1 amp, 1 watt, no-fire, for Radiation Hazards.



PIN PULLER
Allows release of pin or rod without need to sever or fragment high tensile strength material.

ing around, over or under the screen," explains Bill Paulsen, a Link senior mechanical engineer. Paulsen and Arnold Dietrich, senior electronics engineer from the company, recently installed and checked out the simulator in the NAFEC aircraft.

Copilot Role

The copilot will be used as the "guinea pig" in lighting system evaluation flights using the simulator. The screen is positioned directly in front of his seat at a range of about 16 in. If necessary, the screen can be quickly swung back into the space between the two seats to leave the forward cockpit windows completely unobstructed.

As the copilot makes his approach and landing through the artificial fog conditions imposed by the Link device, his actions and responses on the plane's controls will be monitored by various types of recording equipment in the plane and on the ground.

This recorded data will be analyzed by psychologists and technicians to determine how quickly and how well the subject pilot was able to detect and interpret different lighting systems—or, more precisely, how much help each system proved to be in a fog approach and landing.

"As it stands now, one man's opinion on what's best in runway lighting is just about as good as any other's," Griffith told AVIATION WEEK. "Now, FAA is saying—prove it."

Training Device

A number of ARDS officials believe the fog simulator also offers definite possibilities as purely a training device —a method of developing and refreshing a pilot's skill in making landing approaches in light or heavy fog cover.

The NAFEC simulator is the only one produced so far by Link. However, the company says some foreign countries and U.S. companies have expressed interest in the device.

Dr. Robert K. McKelvey, chief of human factors research branch in the ARDS research division, feels the simulator has some potential for supporting test flights with automatic landing systems. Such systems are currently under development by several companies.

Another possible application for the simulator could be support of a program, similar to the present one at NAFEC, to evaluate heliport lighting systems. Use of the device in such a program probably would entail extensive modification to reduce the simulator's over-all size and to widen and curve the viewing screen to comply with the configuration of a helicopter cockpit.

NEW AEROSPACE PRODUCTS

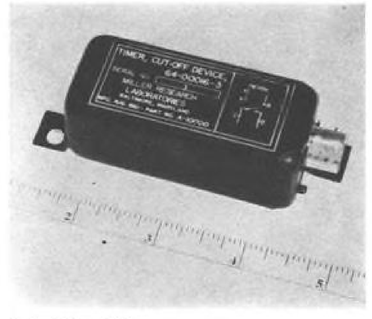


Directional Gyro Indicator

Indicator developed primarily for helicopters and executive aircraft consists of an indicator and a two-axis, self-leveling directional gyro constructed of welded, wrought non-magnetic stainless steel to withstand vibration and shock.

Directional gyro inner gimbal leveling system has a self-contained air leveling arrangement instead of the usual torquer and sensing switch systems. Pickoff device used in the system may be a synchro or potentiometer and is positioned on the outer gimbal to indicate vehicle motion in azimuth as measured from a heading reference.

Electronics Division, Iron Fireman Mfg. Co., 2838 S. E. Ninth Ave., Portland 2, Ore.

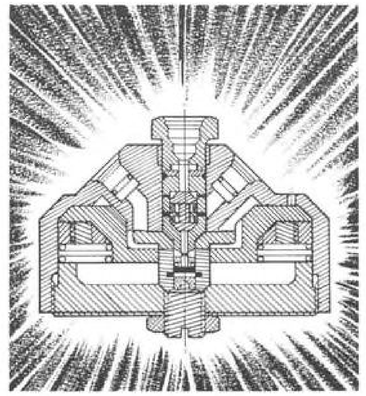


Satellite Timer

New electrochemical timing device is designed to turn on satellite and space vehicle circuits or other functions at predetermined times and to shut down these systems once they have completed their useful operation.

The manufacturer says the timer has a reliability of 99.9% and useful delay time of several hours to as much as three years. The device occupies 4 cu. in. and weighs 120 grams. Power requirements vary from approximately 25 milliwatts for delays of several hours to about ½ milliwatt for a delay of more than one year.

Miller Research Laboratories, 2832 Maisel St., Baltimore 30, Md.



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RELIABILITY?

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REGULATORS
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The Model 4890 Pressure Regulator (illustrated above) is a single-stage, pilot-operated device intended to control pressure in a gas-filled reservoir.

Advanced design features include: (1) All valve poppets and seats are metal; (2) No dynamic, leak-tight seals are required other than a metal diaphragm; (3) No sliding seals, rubber gaskets or rubber diaphragms are used; (4) No lubrication is required.

Operational Data — Regulated pressure range: **100** to **300** psig. Regulated pressure tolerance: **±2 percent** with inlet pressure to **500 psig; ±4 percent** over full inlet pressure range. Inlet pressure range: **325** to **3500 psig.** Flow rate: **0.025** pounds per second of nitrogen at **100 psig** and **80°F.** Temperature range: **—325°F.** to **+300°F.** Vibration range: **0-2000** cps at **65 g's.**

The Model 4890 has the following important advantages over conventional regulator designs: (1) Relatively small for a unit with its capacity and capability; (2) No vibration damping devices used, thus permitting use of very minimum number of parts. This provides high degree of reliability; (3) Simple temperature compensation system minimizes set point drift . . . providing wide usable temperature range.

This basic design is adaptable to many applications.

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Telstar Facility in Maine Nears Operation



CONTROL CENTER contains master consoles (foreground) to display received TV pictures, to control satellite operation and monitor its internal performance via telemetry. At far end is IBM 1620 computer which will calculate ephemeris data and predict satellite arrival times over the $10-million communication satellite ground terminal.



NEW BELL SYSTEM ground terminal for communication satellite tests of Telstar and Project Relay satellites, located near Andover, Maine, includes (1) control center, (2) acquisition and telemetry antenna, (3) precision tracking antenna and (4) large horn antenna for transmitting and receiving voice and television signals. New facility is slated for operation shortly. Horn antenna, largest precision antenna of its type ever built, will be used to transmit and receive signals to and from the satellite. The 177 ft. long 340 ton structure, built by McKiernan-Terry, and identical to one now being constructed in France to participate in the tests, currently is being used as a radio telescope to track stars.



By Philip J. Klass

Andover, Me.—Bell System's new $10-million communication satellite ground terminal nearing completion here is expected to be fully operational by June, when its Telstar satellite is scheduled to be launched.

A nearly identical facility is under construction at Lannion, France, and is expected to be completed by August.

The new facility here, situated in a natural bowl created by low mountains approximately 80 mi. north of Portland, was located in this remote site to minimize interference from existing microwave facilities and other man-made sources.

The 340-ton horn antenna, housed in a 210-ft.-dia. air-inflated radome (AW Feb. 12, Cover and p. 75), currently is being used as a radio telescope to track stars as a means of checking out its performance and the operation of an IBM 1620 computer, which will be used to orient the antenna during communication satellite tests.

Project Relay Function

The new Andover terminal will be used in tests of the National Aeronautics and Space Administration's Project Relay communication satellite, under construction by Radio Corp. of America, in addition to the Telstar satellite.

The huge horn antenna, which will both transmit and receive satellite communications signals, will be controlled and directed from a one-story building located approximately a quarter of a mile away.

The control center has two small tracking antennas. One, a quad-helix type, will be used to acquire the satellite initially by means of its low-power, continuously operating minitrack beacon transmitting on 136 mc.

This antenna also will be used to transmit commands to the satellite to turn on its 4,080 mc. precision tracking beacon.

Once this has been accomplished, the satellite will be tracked by a precision 8-ft.-dia. antenna, the second located at the control center, which is designed to establish satellite position to within 0.02 deg., according to Bell System officials.

Signals from this antenna can be used to orient the huge horn into approximate alignment with the satellite, but precision alignment is achieved by a vernier auto-track system operating directly from signals received from the satellite's main transmitter. Any slight misalignment changes the propagation mode through a waveguide attached to the throat of the horn, producing an error signal used to shift horn position slightly.

Satellite position data from the precision tracking antenna also will be fed to an IBM-1620 digital computer which will calculate ephemeris data on the satellite.

When the satellite's orbital parameters have been determined with sufficient accuracy, it is expected that the computer will then be used to orient the horn antenna based on the predicted position of the satellite on the next pass.

Minimizing Noise

The Andover facility will transmit to the satellite on a frequency of 6,390 mc. using a radiated power of 2 kw. over a 25 mc. bandwidth. The receiver will use a ruby maser (low-noise amplifier) cooled to −456F. To minimize the pick-up of external noise, the ground terminal uses a narrow-band receiver with a frequency modulation feedback circuit which enables it to automatically tune very rapidly to the particular frequency being transmitted by the satellite at any instant.

Equipment Location

The transmitters and receivers are located in a 28 x 30 ft. metal house located at the apex of the horn antenna (AW Feb. 12, p. 75).

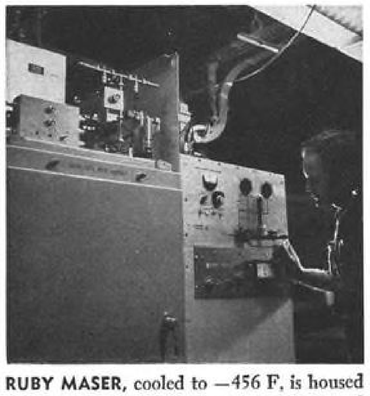
The control center, in addition to its tracking and computing facilities, contains consoles and displays which will enable Bell Telephone Laboratories scientists to control the operation of the Telstar satellite and to monitor its internal performance via telemetry.

The facility is linked by microwave to the Bell System's regular telephone landlines and microwave network, which will permit a direct link between this facility and a smaller receiving station at Holmdel, N. J. Voice and television signals can be transmitted simultaneously via both the satellite and direct land routes for side-by-side comparisons of quality of received signal. (For details on the Telstar satellite itself, see AW Mar. 26, p. 73).

Tourist Attraction

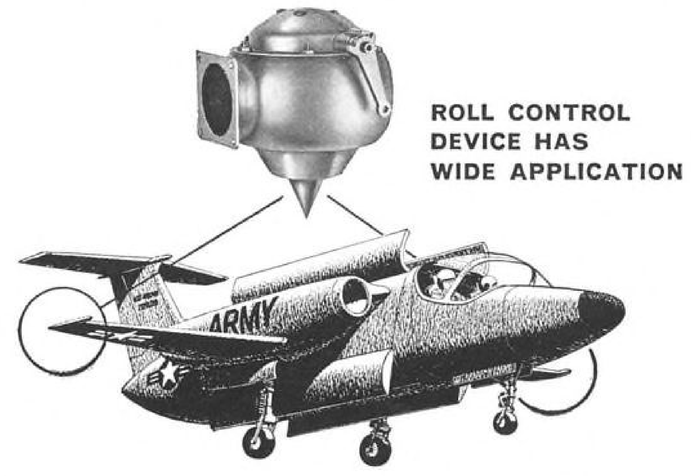
Andover, Me.—Bell System communications satellite ground terminal here is expected to prove a tourist attraction, prompting American Telephone & Telegraph Co. to construct a handsome facility to accommodate visitors and where the operation of communication satellites can be explained to them utilizing dynamic exhibits. Visitors to the control center can also view television pictures as they are being received from the satellite and watch scientists at their control consoles without disturbing the operations.

On the first Sunday that the new facility was open, nearly 1,400 visitors turned out, and another 700 appeared the following weekend.



RUBY MASER, cooled to −456 F, is housed in this cabinet in the upper "house" located at the throat of the huge horn antenna. Receiving and transmitting equipment will be located in upper housing at apex of horn, while lower house will contain electrical controls (see bottom photo, p. 106).

HOLLEY VALVE "ROLLS" THE VZ-10 "HUMMINGBIRD"



ROLL CONTROL DEVICE HAS WIDE APPLICATION

The VZ-10 "Hummingbird", Lockheed's versatile, high-speed research VTOL aircraft now under construction for the U. S. Army, uses a Holley-developed "Roll Control" valve in each wing tip, to provide attitude control during vertical take-offs and landings and in hovering flight maneuvers.

The new design offers several advantages over existing control devices of this type:

1. Thrust versus valve travel is linear.
2. Efficiency is comparable to plug nozzles.
3. Operating forces are very low and uniform, permitting direct manual control.

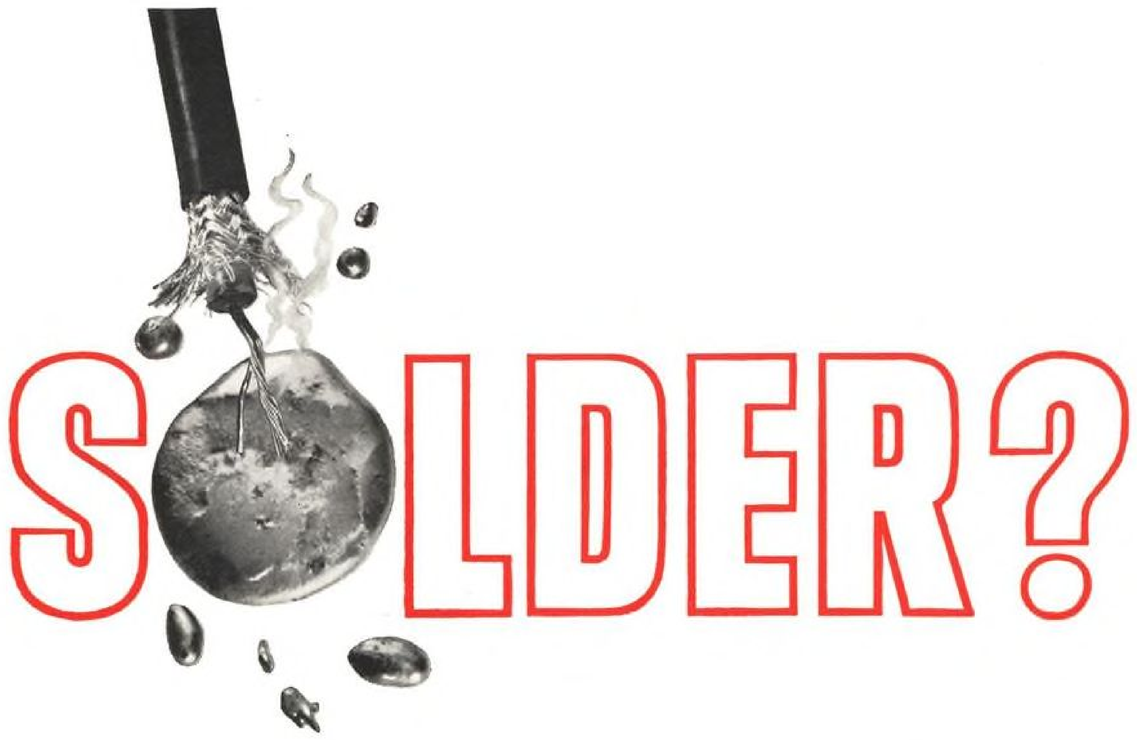
These characteristics, combined with a high tolerance to contamination, make the valve adaptable to a wide variety of applications.

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AMP's new COAXICON* contact line gets rid of the solder. In its place, the COAXICON contact technique gives you the fastest, lowest-installed-cost crimped coaxial wire termination available anywhere in the industry.

One crimp does it — one stroke of an AMP tool attaches a COAXICON contact **simultaneously** to coaxial outer braid and inner conductor.

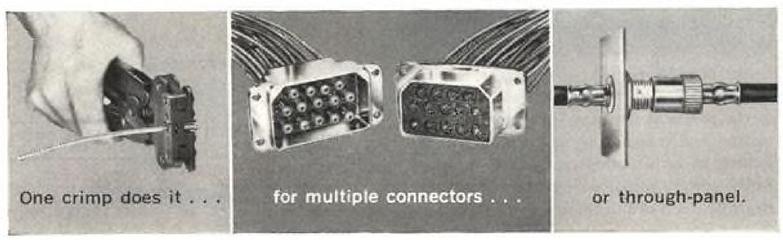
The COAXICON contact line has remarkable depth, for both single and multiple-connector applications. COAXICON contacts will accommodate the popular sizes of coaxial cables from RG 196/U to RG 62/U having stranded and solid conductors and have a very low VSWR in the KMC ranges when used with cables having a nominal impedance of 50 ohms.

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Thermionic Converter Readied for Space

By Barry Miller

Pasadena, Calif.—Experimental solar energy thermionic converter system which may lead to flyable models capable of supplying large amounts of electrical power for spacecraft operating near Mars or Venus is nearing completion here.

The system, called SET (Solar Energy Thermionic conversion system), is being developed for National Aeronautics and Space Administration's Jet Propulsion Laboratory by Electro-Optical Systems, Inc., under a $318,000 contract awarded last year (AW Feb. 20, 1961, p. 33; July 3, p. 67).

Thermo-Electron Engineering Corp., Waltham, Mass., is a major subcontractor, responsible for design and fabrication of a thermionic generator for the system.

Although it is not earmarked for JPL's Mariner program, or any other specific space program, the system was conceived and engineered to satisfy flight conditions. Its design falls within an envelope of parameters suitable for an Atlas-Centaur boosted Mariner spacecraft.

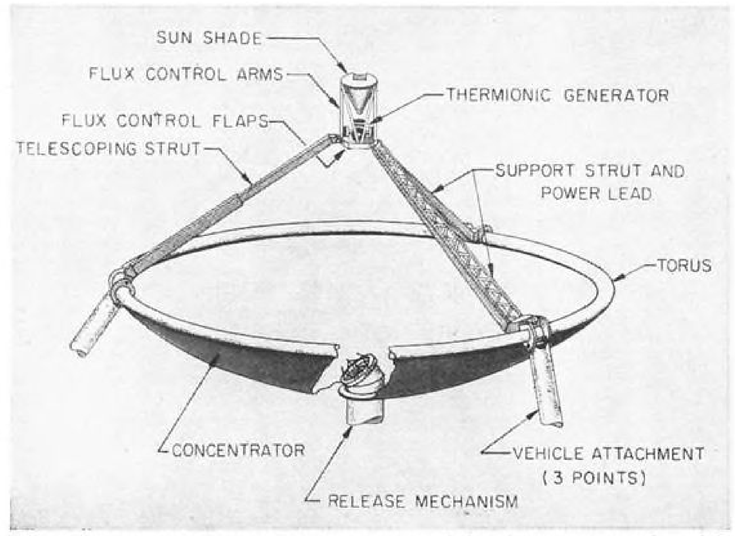
System Components

The system consists of a five-foot diameter rigid, lightweight parabolic concentrator, a thermionic generator, which can be extended from a folded position to the concentrator's focus, and auxiliary equipment. Solar energy is collected and concentrated into the generator where it heats cathodes of cesium vapor thermionic diodes and causes them to emit electrons and deliver current to an external load.

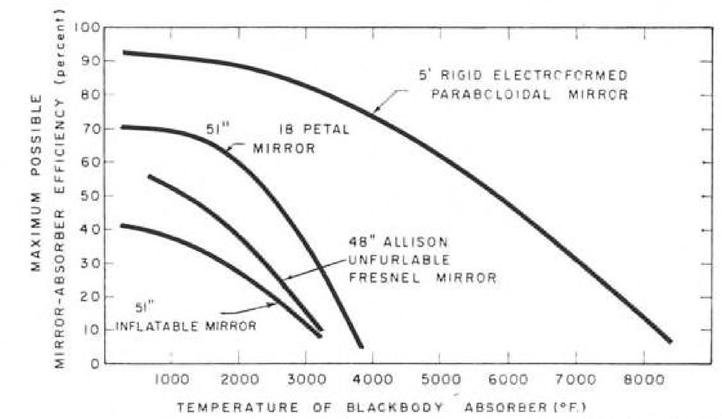
Concentrators of two such systems can be folded together, somewhat like a clamshell, for storage before use in space. Power available from the two systems, or modules, would be double that of a single system. A typical space mission might employ four modules with their concentrators in clamshell configurations on either side of the spacecraft.

For the JPL program, two concentrators have been completed, tested and delivered to JPL by Electro-Optical; the thermionic generator is being assembled by Thermo-Electron and will be tested by Electro-Optical.

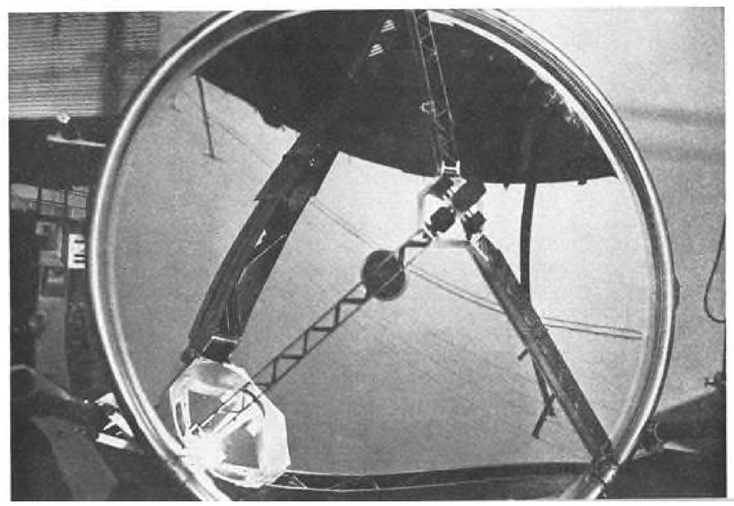
When fully assembled and tested the system is not expected to meet all its goals, including over-all system efficiency and power output, largely because of the inability to push thermionic diode development far enough to meet extremely stringent specifications. The specifications for both the concentrator and the thermionic converter were

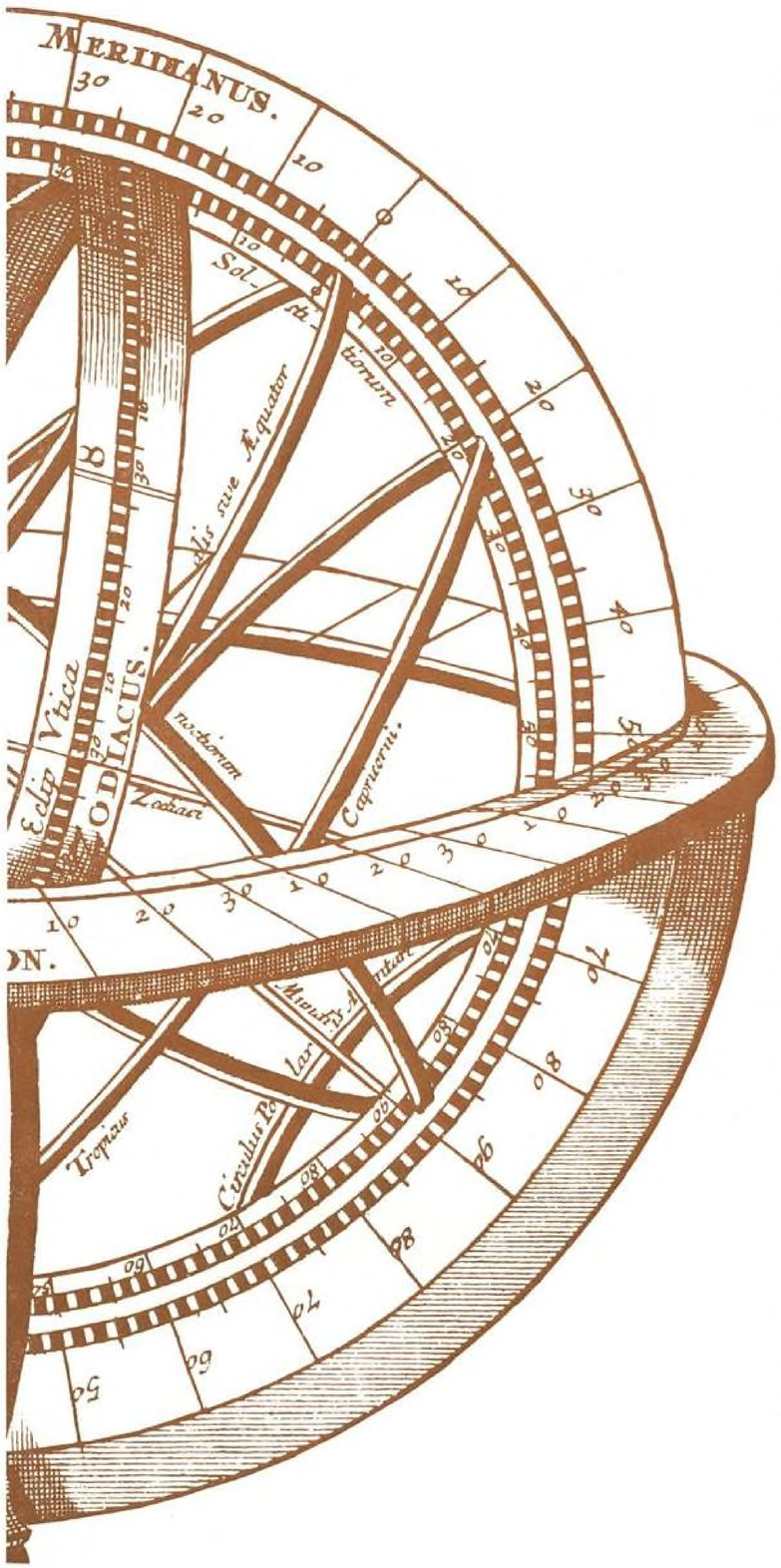


SOLAR THERMIONIC CONVERTER components include telescoping strut, above left. Below, possible mirror efficiencies are shown as a function of temperature.



SOLAR ENERGY THERMIONIC CONVERTER designed to convert sunlight into electrical power for a spacecraft operating near Mars employs 5 ft. dia. parabolic mirror (below) which focuses sunlight onto cathodes of thermionic diodes.





SCOPE

Throughout the spectrum of the scientific disciplines the Giannini Scientific Companies are making major contributions to the nation's vital aerospace programs. Major areas of interest encompass plasma technology, photo data instrumentation, electronic communications, radar, video techniques, vehicle balancing and applied physics.

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New lightweight microwave space receiver for the K_u Band developed by Giannini Research Laboratory has exceptionally low signal to noise ratio. Production capability is supplied by Hammarlund Manufacturing Co., Inc., a firm of more than fifty years' standing in the communication field.

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pegged beyond what had been achieved in the past and beyond what some companies which originally bid for the contract believed would be possible.

Nevertheless, when viewed as an effort to stretch the state of the art—to rapidly bring thermionic diodes and solar concentrators to the point where they could be combined into a practical, static thermionic conversion system for use in space—notable progress has been made. The concentrators have met specifications, and cesium vapor diodes of given efficiencies were operated for longer periods than had previously been reported, according to engineers at Electro-Optical and Jet Propulsion Laboratory.

Fully assembled, the system will weigh 27.5 lb. and probably be capable of delivering about 60 watts for a spacecraft in the vicinity of Mars. This compares favorably with approximately 52 watts available from an equivalent weight solar cell array (calculated at 1.9 watts/lb. near Mars), although falling short of the 135 watt design goal.

System's Future

The future of this system, regarded as an experimental model of a flight prototype, and the pace of its development may depend partly on the success of Mariner R shots later this year. Primary electrical power for avionic equipment and instruments aboard Mariner R spacecraft will be derived from solar cell panels, the performance of which may be subject to degradation in interplanetary space from solar protons. Should this occur, the development of the solar thermionic conversion system may be hastened as a potential backup power source.

Since SET uses solar heat as a source of energy, it requires a vehicle which can orient, or point, its collector toward the sun to an accuracy of plus or minus 6 minutes. If this accuracy can be achieved by a Mariner B vehicle in 1964, an advanced version of SET could be a suitable Mariner B experiment.

As fabricated at Electro-Optical, the concentrator is an electroformed parabolic mirror, 5½ ft. in diameter and with skin thickness of 10 mils (plus or minus ½ mil). A nickel torus is mounted around the facing circumference of the mirror for structural rigidity. The technique of fabricating the mirror is similar to that used by the company in making a petal collector for the Air Force (AW Aug. 14, p. 18). For flight purposes, the torus would be removed and backmounted.

Diameter of the reflective area of the mirror is five feet. The two mirrors made under JPL contract are, like the torus attached to each, made of nickel but have a deposited silver coating with an aluminum overcoating.

The efficiencies of both mirrors were measured under cold calorimeter conditions (with walls of generator cavity kept cold to reduce thermal reradiation) and were found to exceed the design goal of 82.5% for a generator cavity aperture of ½ in.

Vibration Tests

One of these mirrors was subjected to flight approval vibration tests for Atlas-Centaur (vibration from zero to 1,500 cps., for example) after which its efficiency dropped 1% but remained above the specified level. Efficiency here is defined as a measure of the sunlight entering the cavity or absorber divided by the sunlight striking the reflective surface.

When the absorber is run at 2,000K, its design level, the efficiency will drop about 7.2% to a 75% level because of cavity reradiation.

Weight of the concentrator and its torus is 19.5 lb., the generator will be 3.5 lb. and the support arms, which extended will hold the generator at the mirror's focus is 4.5 lb., adding up to a system total of 27.5 lb.

There are three support arms, two of which contain an electrical lead from the generator to the load while the third is a telescoping arm that enables the



TESTING TAKES EQUIPMENT

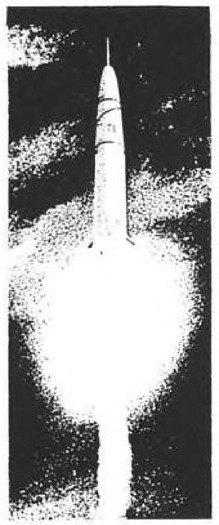
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three to pancake and be held in place by a locking device.

In space, the mirrors are expected to suffer a 1% per year degradation in efficiency as a result of proton erosion and collisions with micrometeoroids.

To achieve its original goal of 133 watts, with an over-all system efficiency of 15%, the thermionic generator would have had to operate at a generator efficiency of 21%, a figure in excess of known thermionic capabilities. The generator design requires five series-connected cesium vapor thermionic diodes, each of which was expected to develop over one volt and deliver approximately 26 watts to a load.

The generator being assembled will employ diodes operating at efficiencies of roughly 10% or 12% and deliver a total of about 60 watts.

Lifetimes Extended

Lifetimes of the thermionic diodes are being extended by Thermo-Electron. Subjected to thermal cycling, one diode operated for a total of 960 hr. in two separate continuous runs before a failure, which Thermo-Electron attributes to the testing technique, not an inherent fault of the diode. Another diode has operated for 835 hr. after two or three month storage. Company says diode life may be pushed to 10,000 hr.

A flux control mechanism which can control temperatures inside the generator cavity to ±1% is undergoing preliminary experiments. A control device of this type is necessary to maintain the temperature of the emitters within the cavity at a constant temperature over the wide variation in intensity of solar energy on a planetary mission. The flux control has flaps which will open and close as a function of the solar energy being received.

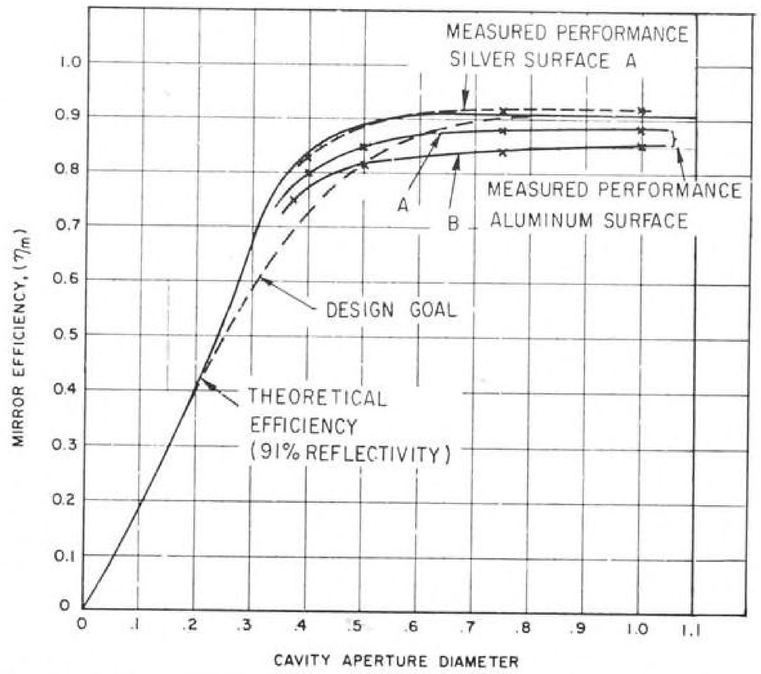
The generator radiators are shielded from the sun by a sun shade to prevent them from being heated.

Three Requirements

To perform successfully in space, the solar thermionic converter must have three important requirements satisfied. These are:

- **Pointing accuracy.** Spacecraft must be capable of orienting the collector toward the sun, for this system to an accuracy of plus or minus 6 min.
- **Cesium control.** Cesium supply for the diodes, which lowers cathode work function, should be at controlled temperature.
- **Solar flux control.**

In a system of this type, there are several types of energy losses. These include energy absorbed by the reflector (reflective loss), energy lost due to geometric imperfections of the collector (geometric loss), reradiation from the cavity absorber and losses associated with the generator. The choice of cavity aperture size is a tradeoff of some of these losses to the extent that reradiation is minimized as the hole is made smaller and geometric losses can be eased as the hole is made larger to capture more reflected energy.



PERFORMANCE of two mirrors for solar thermionic conversion system shown against a theoretical efficiency and a design goal curve. Measured performance is for silver coated mirror (A), same mirror coated with aluminum (A), and another coated with aluminum (B).

The relative magnitude of these losses is indicated by the system specifications which permitted a mirror absorber efficiency (sunlight into the cavity less thermal reradiation all divided by sunlight on reflective surface) of 75% and a generator efficiency (electrical power output divided by sunlight into the cavity less thermal reradiation) of 21% to give over-all system efficiency of 15%.

FILTER CENTER

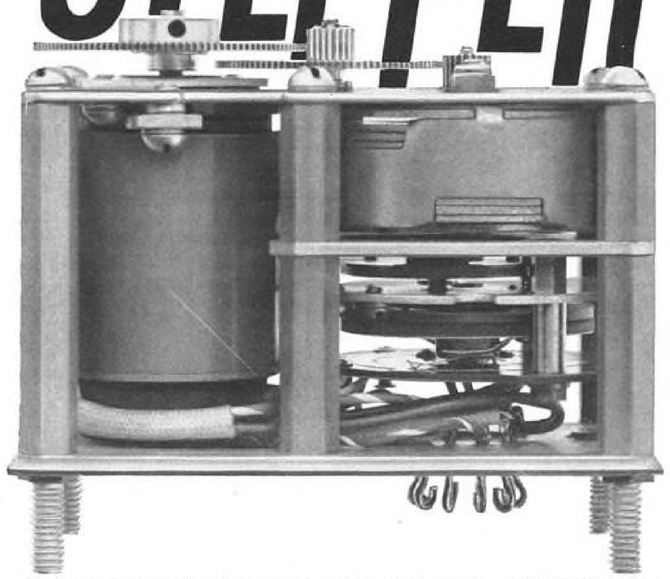
►Ballistic Missile Radar Cross Sections—Air Force's Ballistic Systems Division will brief industry Apr. 19 on an upcoming program to determine radar cross sections of a large number of reentry body shapes. The program will be handled out of the Nike Zeus support branch of the re-entry vehicles directorate.

►Traveling Wave Masers for Space Tracking—Three broad-band, low-noise traveling wave masers will be fabricated for Jet Propulsion Laboratory by Microwave Electronics Corp., Palo Alto, Calif. The masers will be used to increase sensitivity of JPL's Deep Space Instrumentation Facility receivers.

►Avionics Companies Shun Comsat Study—A number of aerospace and avionics companies, active in current government-funded communications programs and other satellite efforts, have declined to bid on an 18-month Army Signal Corps communication satellite program originating at Ft. Monmouth, N. J. The study is to cover every type of communication satellite, active and passive, high and low altitude. Feeling among many companies which might normally be expected to bid but which have declined to do so is that the study is arriving too late to have practical meaning for comsat programs.

►USSR Cites Science Coordination Problems—Recent Soviet scientific journal concedes that there is a certain amount of duplication ("parallelism") going on in Soviet laboratories and it calls for its elimination and the combination of scientific research with production. The article says there are now about 140,000 scientists and technicians employed in about 2,000 scientific research organizations in the Soviet Union. English translation, entitled "New Problems in the Coordination of Scientific Research Work," identified 62-11105, can be obtained for 50 cents from Office of Technical Services, Commerce Dept., Washington 25.

FANCY STEPPER



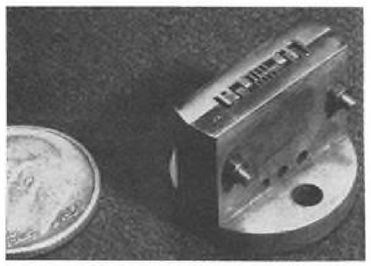
Stepping devices from A. W. Haydon Co. can do wonderful things to pulses ...with pulses...and for pulses. For instance, one precision gated stepping switch acts as a pulse divider for a random or variable pulse source—or as a frequency divider if the pulse source is constant. Another works in conjunction with pulses, supplying single or multiple switch closures with an accuracy virtually equal to that of the pulse source itself. Still a third will count a predetermined number of pulses, rotate a stepper switch, return the counter to 000, and cut off the pulse source. ■ The remote positioning device illustrated is but one of A. W. Haydon Company's fancy steppers. Here a precision gated stepper switch has been coupled to a synchro transformer. Similarly, precise angular positioning of rotary components such as potentiometers, dials and indicators can be controlled. Based only on the number of pulses received (not incremental changes in voltage or phase angle), it will hold a set position whether power is on or off, and will home the synchro to the zero reference on demand—ready to accept another setting. ■ All A. W. Haydon Co. stepper motors are all-electric—no ratchets, linkage, contacts or other mechanical crutches are used. Their power consumption is low, accuracy is extremely high. ■ Send for technical brochure SP9-1 and find out more about pulse driven steppers and their application.



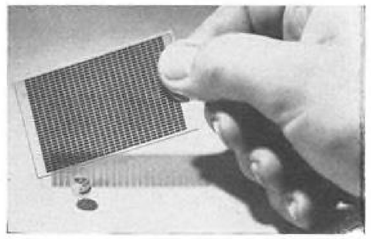
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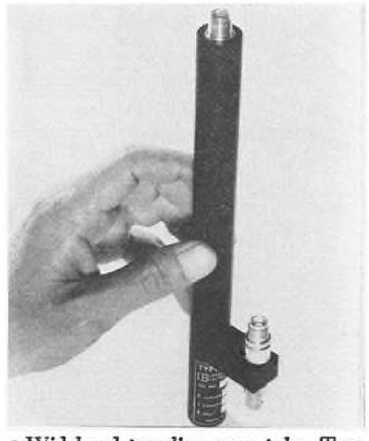
NEW AVIONIC PRODUCTS



• **Infrared detector** for use in 2 to 14 micron region has peak sensitivity at 10 microns, employs mercury doped germanium crystal. When operated at a temperature of 38K, detector has peak specific detectivity of $3x10^{10}$ cm/watt, according to manufacturer. Martin Co., Electronic Systems and Products Div., Baltimore, Md.



• **Thin film memory,** type BIP-1001, with capacity of 3,072 bits, has a cycle time of only 0.2 microseconds, making it suitable for high-speed storage. The new 5 mc. thin film plane can be driven by single polarity pulses. Price is $1,500. Manufacturer: Burroughs Corp., Electronic Components Div., Plainfield, N.J.



• **Wideband traveling wave tube,** Type L-3711, provides 36 db. minimum small-signal gain in the 4 to 8 kmc. band. The tube measures 12¼ in. long and ⅝ in. in diameter, weighs 21 oz., uses all metal-ceramic construction. Manufacturer: Litton Industries, Electron Tube Division, San Carlos, Calif.

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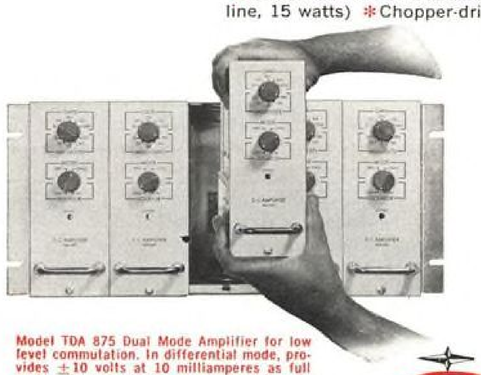
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Federal Role in Aerospace Labor Studied

By Russell Hawkes

Los Angeles—Representatives of both aerospace industry management and the labor unions functioning within the industry are closely scrutinizing the role of government in labor negotiations this year, according to an AVIATION WEEK poll which included industry executives, union leaders and outside labor experts.

Consensus view is that growing dissatisfaction with the unofficial influence of Defense Department and National Aeronautics and Space Administration upon collective bargaining may make this an open issue of great importance this year. Counterpoint to this is the national International Assn. of Machinists-United Auto Workers program to induce government to guarantee proposed employment security measures.

Union demands for severance pay and increased supplemental benefits were major issues in the recent failure of IAM Lodge 1987 and Republic Aviation Corp. officials to agree on a new contract at the Long Island, N.Y., plant. About 9,000 production workers struck at Republic on Apr. 1 when negotiations reached a stalemate (AW Apr. 9, p. 37).

All union leaders and many of the company officials canvassed said the contracting agencies sometimes use their control over the reimbursability of additional costs on defense and space contracts to determine the settlement of key points in labor-management bargaining. IAM President Al Hayes said that his union is prepared to make the unofficial intervention of contracting agencies a high priority issue if there is evidence of it in 1962 bargaining.

Hayes said the government is violating the intention of the Taft-Hartley Act by denying to management representatives the freedom to bargain in good faith when a contracting agency rules on the allowability of additional costs resulting from collective bargaining. He said that in some cases, companies have used the uncertain allowability of additional labor costs as a mere excuse to oppose union proposals but in many other cases they have been genuinely bound by cost restrictions imposed by defense agencies.

Also for the record, UAW Vice President Leonard Woodcock said that if contracting agencies of the government do not withdraw their influence upon labor-management bargaining, action must be taken to make them a formal party to negotiations. The industry spokesmen were unanimously opposed to making the government take sides at the bargaining table.

Fundamental issue appears to be an unresolved conflict between the Taft-Hartley Act and the basic government procurement laws. None of the sources contacted had any suggestions about how military procurement officers can meet the requirement that they decide on the reimbursability of costs on certain contracts without also influencing company-union contracts. A union official said the detailed mechanics of government contracting are not a proper subject for organized labor to make recommendations upon. Labor Secretary Arthur Goldberg has established an inter-department government task force to study the problem.

Defense Department plans to pay United Aircraft Corp. $7.5 million to cover strike costs are being cited by union officials as another example of intervention by a contracting agency. Since the strike cost payment is being regarded as an allowable cost increase, the unions are construing it as an argument that the government must also regard union gains in collective bargaining as allowable costs.

They claim that government buys 90% of the output of the aerospace industry and supplies over half its equipment and facilities, therefore it has a special responsibility for the security of aerospace employes.

At a recent aerospace industry-labor conference sponsored by Douglas Aircraft Co. to discuss the general background of future industry-labor problems, U.S. labor agencies were invited to participate but military representatives were specifically excluded. One labor relations expert said, "If military procurement people had attended, the unions would have cut them to ribbons and the peaceful nature of the conference would have been ruined." The conference was similar to a type of round-table meeting proposed by President Kennedy to enable labor and management to find areas of general agreement and compromise.

Some observers believed the Douglas conference was intended to forestall government initiation of conferences which would have compulsion overtones. Douglas is likely to sponsor similar conferences in the future but most interviewees agreed that the usefulness of such conferences is compromised when they are sponsored by a single private company. No major systems contractor from outside the Los Angeles area attended, though a number of important subcontractors from the East Coast were represented.

The role of government acting through its labor agencies was the subject of speculation among the industry and labor representatives questioned by AVIATION WEEK. The government's major role in recent steel industry negotiations has been carefully noted by aerospace industry and labor officials. The government's strong influence in settlement of the steel industry dispute indicates that it will also figure heavily in negotiations within the aerospace industry as contracts come up for renewal (AW Feb. 19, p. 33).

Several company industrial relations officers say they will watch labor contract negotiations at ballistic missile sites for an indication of Administration attitude as well as for direct repercussions at the home plants of the missile contractors. To halt jurisdictional strife between unions employed on the missile sites last year, the government organized "Missile Sites Committees" at each site which are made up of labor, management, and public representatives.

The committees are directed to prevent stoppages by the voluntary action of the participants and have no power to compel obedience. But unlike the Federal Mediation and Conciliation Service which can act only as an aid to communication between the parties, the committees can bring some pressure to bear in favor of a specific solution. Union officials and FMCS mediators say there is no plan to call the committees into contract negotiations. However, if a dispute should arise it is quite likely to be done.

Labor and industry officials cautiously

TRW Earnings Drop

Thompson Ramo Wooldridge, Inc., reported net earnings of $6,459,000 in 1961 on sales of $409,077,000—a decrease from 1960 net earnings of $10,177,000 on $420,421,000 sales. Net income per common share outstanding in 1961 was $1.88 compared with $3.13 for the previous year.

Board Chairman J. D. Wright attributed the decline in earnings to unexpected problems in the company's electronics area, including cutbacks in Minuteman ICBM diode orders and terminated or reduced funding of several military electronics contracts.



Forged titanium cylinders prior to welding into body-sections of Minuteman casings at Lycoming Division of the Avco Corporation.

In Minuteman second stage

Titanium rocket case reduces weight 30%, boosts rigidity and reliability

Aerojet General Corporation has selected titanium for second stage Minuteman rocket motor cases as the fastest, most economical and reliable way of reducing the inert weight of this massive part.

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predicted a year of labor peace in the aerospace industry; however, government labor officials questioned by AVIATION WEEK disagreed. They predict difficult negotiations and possibly strikes but refuse to discuss what action they might take if work stoppages threaten.

Those who anticipate easy negotiations say labor-management relations in the aerospace industry have grown steadily more placid in recent years and the obvious national interest in defense and space is causing pressure in favor of peaceful settlement. A management official said both the IAM-UAW program and industry programs appear broad enough to leave ample room for negotiation. However, some specific demands will remain veiled until bargaining begins for tactical reasons. Absence of a big national issue may make purely local issues the hardest to solve. Continuing drive for union shops could be a big national issue but at present it appears to be a secondary objective for IAM and UAW.

Woodcock conceded that declining union membership is reducing the raw power that organized labor brings to the bargaining table. In some important aerospace industry jurisdictions, only 40% of eligible employes belong to the union. Since 1956, white collar workers, who have proven hard to unionize, have outnumbered blue collar workers in U. S. industry and the disparity is growing larger because of advancing technology which is most evident in the aerospace business. This may account, in part, for the growing tractability of aerospace unions.

The joint industry-wide program of the unions stresses protection of workers against unemployment due to local fluctuations in the business volume of aircraft, missile, and space firms. The unions are asking for industry-wide Supplemental Unemployment Benefits (SUB) which would guarantee a laid-off worker a cushion of 60-70% of his previous take-home pay to continue for a period to be settled by negotiation.

A union official said this was the original level of basic unemployment benefits established during the Roosevelt Administration but he said the actual percentage value of these had decreased over the years. An alternative objective is an industry-wide fund to be established by uniform contributions from employers for the purpose of providing cash benefits to unemployed aerospace workers. Government would be asked to reimburse payments out of the fund or insure it in an arrangement analogous to the insurance of bank deposits by the Federal Deposit Insurance Corp. There is general agreement that the plans are too big to be run without government participation. Industry representatives are firmly opposed to the proposals and a union leader admits that they are "a long-term proposition with only a moderate chance of being accepted this year." Prosperous aerospace companies are unwilling to assist less successful competitors and say the plans are too unwieldy to be possible.

IAM and UAW leaders are discussing other job security measures including an employment pool of laid-off aerospace workers who would have priority rights to any new jobs created in the industry by redistribution of government business according to geography or the needs of private industry. As an aid to mobility of labor, they favor government payment of transfer expenses, including per diem between jobs.

An industry labor relations executive said adoption of the IAM-UAW job security ideas could be a step toward a massive federal program to relieve the long-term rise in unemployment due to automation and other factors. A more obvious precedent is the three-year program now before Congress to retrain 680,000 unemployed workers for new jobs. Aerospace industry spokesmen questioned were all pessimistic about the outcome of any large-scale federal program to retrain jobless workers in higher skills required by the advance of technology. One said, "philosophically, the idea of retraining and relocation to cope with automation and higher technology is excellent, but even assuming a large number of workers with adequate talent, it may take four or five years to raise an unskilled man to a new, higher skill."

Wage increases to be asked this year are based on the Administration estimate that in the total economy, worker productivity is rising at the rate of about 3% per year. Organized labor contends that wages should match this increase. First bargaining demands in the aerospace industry will be larger than this because unions say that wages in the aerospace industry are lagging behind the upward trend of wages in other industries.

Demand for a union shop will again be part of the national union program but the prospects of acceptance are slight. There will also be continuing pressure from each union to prevent each company from subcontracting work to firms outside the jurisdiction of the union certified to the prime contractor.

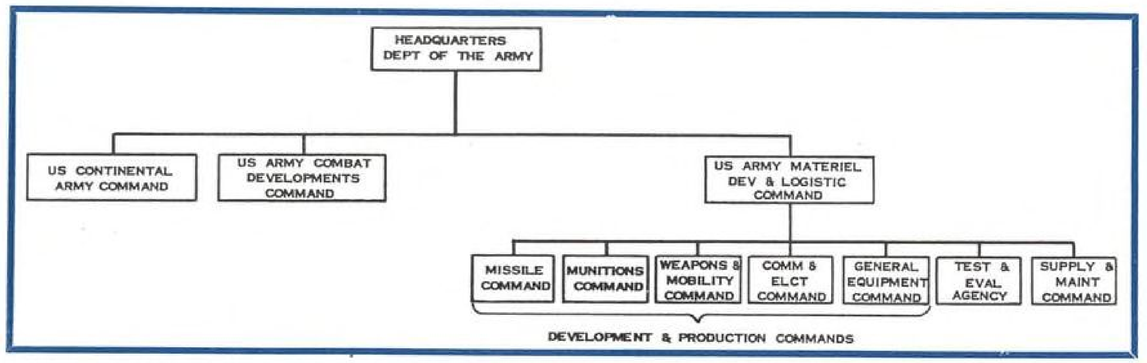
Justification for this position is that if National Labor Relations Board certifies an industrial union to represent all workers doing production and maintenance work for a company, subcontracting outside union jurisdiction is a violation of the certification. However, government contracts often specify that a certain part of the value of each contract must be subcontracted. A company industrial relations expert argued that his company must do some subcontracting when work volume exceeds a certain level to smooth out peaks and troughs in the size of the work force and the amount of tooling.

Long-standing effort by labor to synchronize contract dates and issues so as to deal with the aerospace industry as a single national entity has been largely frustrated so far by widely variable bargaining patterns resulting from the differing levels of prosperity enjoyed by aerospace companies, the presence of trade and craft unions in some shops, differing mixtures of government and commercial business, and regional variations in the labor market. However, labor contract renewal dates for many major airframe companies, Boeing, General Dynamics, North American, Douglas, Lockheed, and United Aircraft, along with some other important aerospace companies are beginning to cluster in the months of June and July.



A4D-5 Carries Two Bullpups, 18 Bombs

Navy Douglas A4D-5 Skyhawk attack aircraft's armament consists of two Martin Bullpup A air-to-surface missiles mounted outboard under the wings, 12 bombs weighing 250 lb. each, mounted on multiple racks midwing, and six 500-lb. bombs carried under the belly. The A4D-5 has five external stores attachments, compared with three attachment points on earlier Skyhawks. Radome has been extended 13 in., increasing over-all length of the aircraft to 42 ft. 10 in. Powerplant is a Pratt & Whitney J52 turbojet rated at 7,500 lb. thrust. The A4D-5 is being assembled at Douglas' Long Beach, Calif., plant.



REALIGNMENT OF ARMY research, development, production and logistics functions is shown as currently planned. Sub-commands of Materiel Development and Logistics Command are to be industry-oriented, will control R&D, procurement and production.

Army Changes to Cut Weapon Lead Time

By James D. Hendricks

New York—Reorganization to centralize and streamline Army's research, development, procurement and logistics activities is proceeding toward completion by July, 1963.

Materiel Development and Logistics Command (MDLC), a major new command emerging from the reorganization, will be activated by the end of 1962. Ultimately, it will control about $4 billion annually in research and development and procurement funds, according to Lt. Gen. David W. Traub, Army comptroller, who is directing the entire revamping program.

Traub discussed the reorganization plan (AW Jan. 22, p. 34; Mar. 12, p. 78) at a recent meeting here of the National Security Industrial Assn. He stressed that although the reorganization is not aimed initially at saving personnel or funds, such savings undoubtedly will be realized in the future as the new structure's impact is felt.

Lead Time Reduction

He added that the reorganization probably will result also in significant reduction in lead time necessary to develop, test and produce new weapon systems and bring them to operational status. The average Army lead time in weapon systems developed now is about 10 years, the general said.

The realignment abolishes or radically alters the roles and status of most of the Army's long-established technical services—an attempt to eliminate duplication, consolidate responsibilities and otherwise improve the service's procedures for research, hardware development, procurement and personnel management and training.

Traub credited the technical services with molding the present U.S. Army into the world's finest, but he added that "modern technology and high cost and complexity of equipment have strained the ability of our current organization to do the job in the most efficient manner."

The Army reorganization is similar in some respects to the Air Force's move last year in creating Systems Command and Logistics Command, but it seeks an even greater degree of centralization, Traub said.

Traub said that the reorganization will not significantly affect activities at lower Army echelons, such as arsenals, laboratories, test ranges, depots and installations. Primary effort is directed at realigning Headquarters, Department of the Army and other top staff structures to gain tighter control and more simplified management of R&D, procurement, training and some support activities.

Headquarters for MDLC and Army Combat Development Command (ACDC), another major organization which will be activated this year, probably will both be located in the Washington, D. C. area. "I feel strongly that MDLC headquarters should be in Washington itself," Traub said.

Maj. Gen. Frank S. Besson Jr., now Chief of Transportation, has been named to assume command of MDLC and has been nominated for a third star. Traub said the Army hopes eventually to make the MDLC commander's post a four-star billet. Lt. Gen. John P. Daley, presently deputy commanding general for development of Continental Army Command (CONARC), has been selected to take over ACDC.

Discussing MDLC's functions in detail, Traub said the new command will consist of five industry-oriented subcommands which will control all wholesale level R&D, procurement and production. These sub-commands will direct their attention to weapons and mobility functions, rather than specific commodity assignments.

A test and evaluation agency will be activated within MDLC to integrate all activities of test units now assigned to CONARC and the old technical services. The new agency will combine engineering and service testing wherever feasible to reduce requirements for lateral coordination and thereby cut development lead time.

MDLC also will include a supply and maintenance command responsible for delivery of hardware to Army installations in the U. S. and overseas.

ACDC will consist of all combat research and development agencies now under CONARC, certain technical and administrative services and other related Department of the Army and Defense Department agencies.

CONARC Status

CONARC will continue as the major command of Headquarters, Department of the Army and will inherit responsibility for training all personnel and units within the U. S. CONARC will gain control of three major installations (Ft. Eustis, Ft. Belvoir and Ft. Lee), three training centers and 17 Army schools. It will lose responsibility for combat development programs and doctrine development to ACDC and service testing of materiel to MDLC's test and evaluation agency.

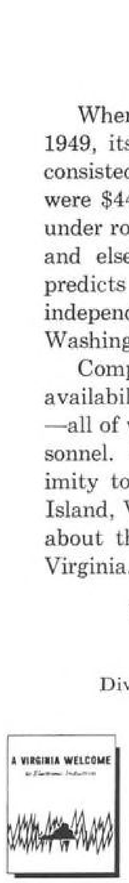
At general staff level, an Office of Personnel Operations will be established to integrate personnel management activities now performed by various staff agencies. A director of programs will be assigned in the Office of the Chief of Staff to implement more positive direction of programs and to strengthen coordination and control.

The Chemical Corps and Ordnance Corps, two traditional technical services, have been abolished in the reorganization plan, and a third, the Quar-

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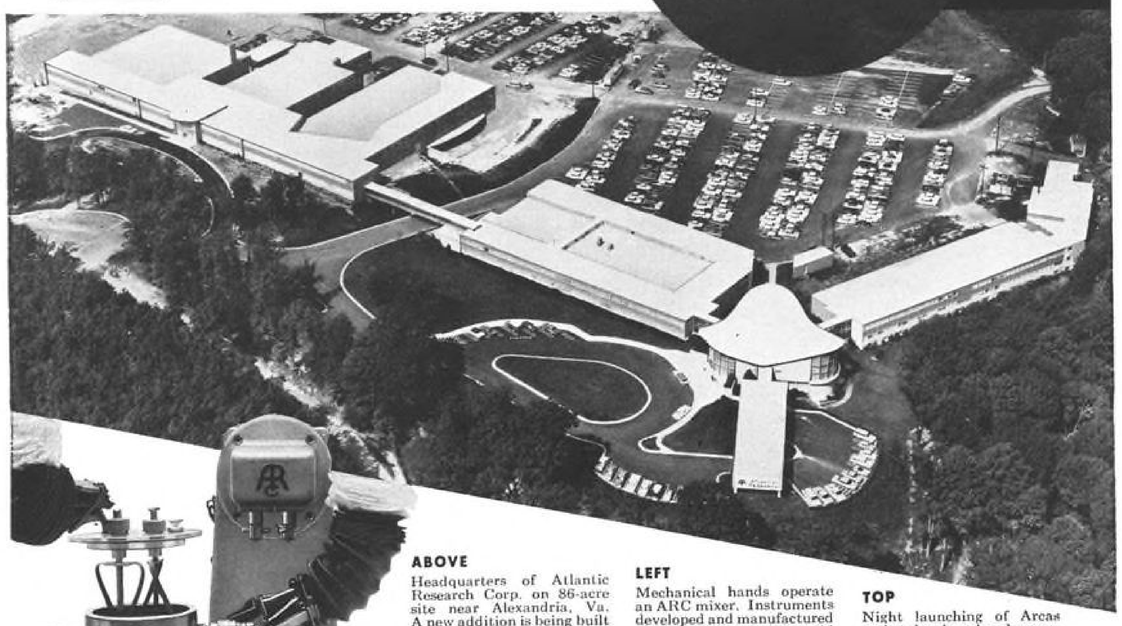
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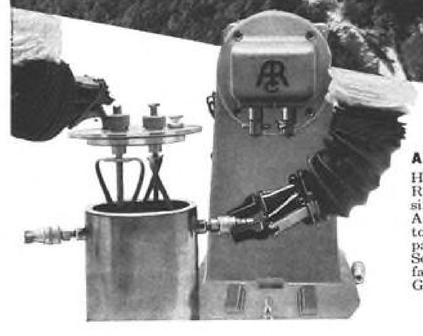


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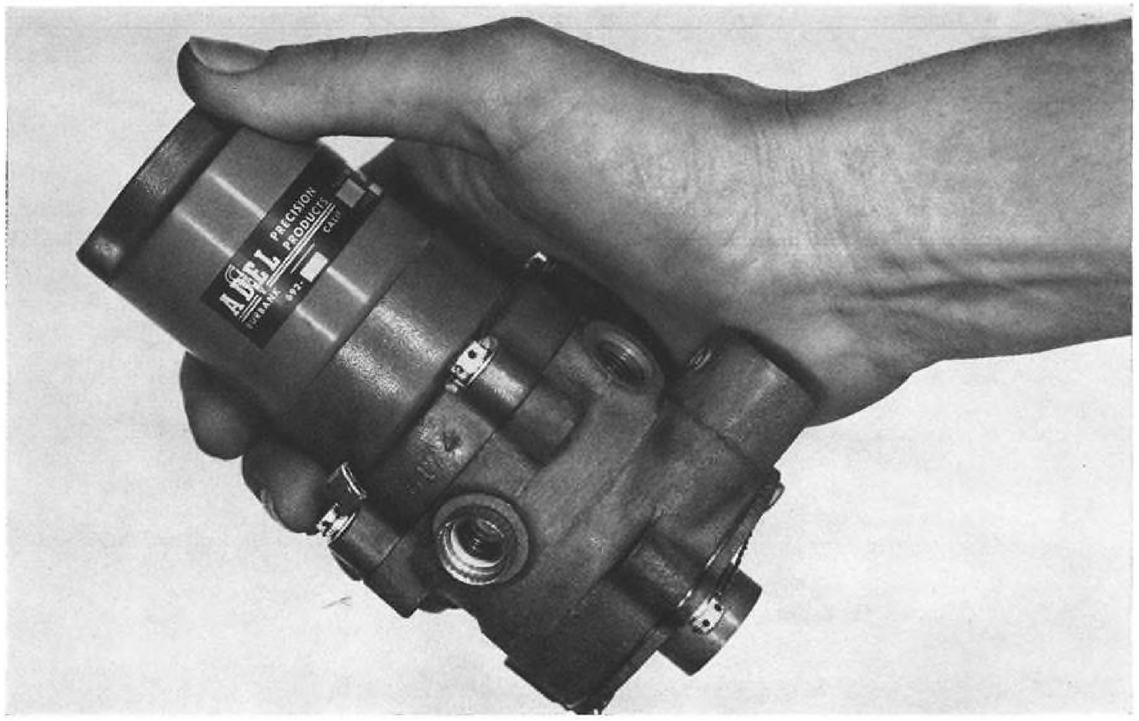




ABOVE
Headquarters of Atlantic Research Corp. on 86-acre site near Alexandria, Va. A new addition is being built to house its subsidiary company in the plastics field. Solid rocket fuel is manufactured in another plant at Gainesville, Va.

LEFT
Mechanical hands operate an ARC mixer. Instruments developed and manufactured by the company are sold largely to other research scientists. Basic research includes work in combustion, plastics, instrumentation.

TOP
Night launching of Arcas rocket developed and manufactured by Atlantic Research. Company is a leader in solid-propellant rocketry.

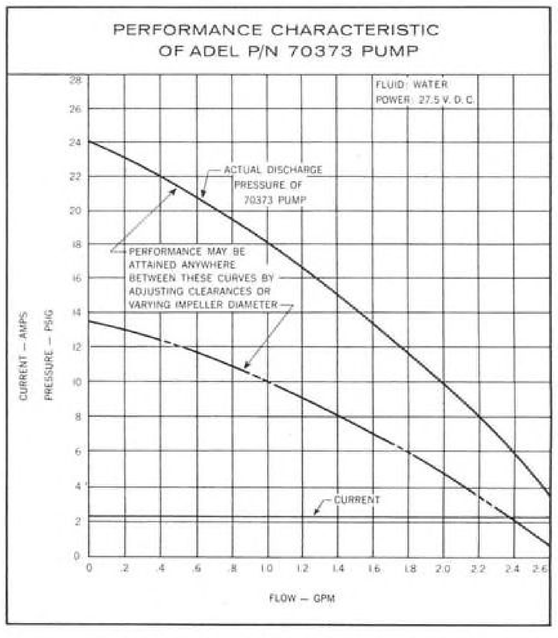


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termaster Corps, will be given greatly reduced responsibility. The Quartermaster General's title has been changed to Chief of Support Services.

Commenting on the scheduled changes in the general staff, Traub said:

"It had become increasingly apparent that the general staff was too deeply immersed in day-to-day activities. Under those conditions, it had become more difficult for the staff to perform its principal roles—development of overall Army preparedness posture, planning of timely advances in weapons systems and insuring of economical commitment and expenditure of Army assets."

Current target dates in plans for implementing the reorganization call for establishment of ACDC and the Office of Personnel Operations by November and establishment of MDLC, the revised CONARC and general staff by July, 1963.

Development Cycle

To illustrate mechanics of the reorganization, Traub outlined a conception-to-reality cycle for a hypothetical weapon system, touching on these steps:

• **Initial impetus** for a long-range system study will come from the general staff with the Deputy Chief of Staff, Operations, having the primary cognizance.

• **General staff** will place the study requirement with ACDC, furnishing general guidelines, including long-range strategic objectives, anticipated money and manpower resources levels, the international situation expected to prevail at the time the system is to become operational, and other pertinent data. From this information, ACDC will develop operational criteria and materiel objectives for general staff review and approval.

• **Chief of Research and Development,** working through research offices and MDLC, will develop technological forecasts to assist in development of specific requirements. ACDC formulates qualitative materiel requirements as the basis for MDLC's system program.

• **MDLC assigns** the project requirement to an industrial firm.

• **Developmental hardware** is to be tested by MDLC's test and evaluation agency. The agency then recommends changes to MDLC and the general staff. Upon approval of the agency's report, the system is given a type classification.

• **Weapons and mobility** command within MDLC then contracts with industry to produce the item, and, concurrently, ACDC refines its operational concepts for the system.

• **System and doctrine** are field tested, and necessary field manuals, unit organizational tables and equipment tables are prepared.

• **CONARC schools** will prepare training courses for individuals and units working with all aspects of the new system.

• **Supply and maintenance** command of MDLC assumes responsibility for the system when production begins. The weapons and mobility command prepares technical manuals, and supply and maintenance command will be responsible for storage, distribution, supply and depot maintenance.

Procurement Procedures

MDLC development and production agencies will be given sole responsibility for procurement of assigned commodities.

"Our ultimate objective is to place major contracting responsibilities at those installations where technical knowledge exists on the item being procured," Traub said.

Inspection, quality control, pre-award surveys, industrial mobilization planning and other procurement functions will be carried out on a decentralized basis, Traub said. Contracting representatives, working out of major U.S. cities, will be assigned these tasks, but final responsibility for contract administration will remain with the office placing the contract. All orders for the same item, whether slated for R&D or production, will be placed by a single office.

Installation Assignments

Locations of the new sub-commands and the installations which will be assigned to each have not been finally determined, Traub said.

He said that Picatinny Arsenal will become an element of the munitions command and New York Ordnance District will be placed under MDLC control.

The Army's Signal Supply Agency at Philadelphia may have its present functions divided between DOD's Defense Supply Agency and the Army's Communications and Electronics Command.

"Electronics business with the Army will be business as usual as far as the reorganization is concerned," the general said.

"Eventually, there may be a different headquarters to do business with, but that should have no effect on business or the relationship between the Army and the electronics industry."

He indicated that the new headquarters for communications and electronics command might be located at Ft. Monmouth, N. J.

Traub stressed that although the reorganization plan has been approved, it is still basically conceptual in nature and subject to revisions. Findings of other Army and DOD studies may affect the final alignment.

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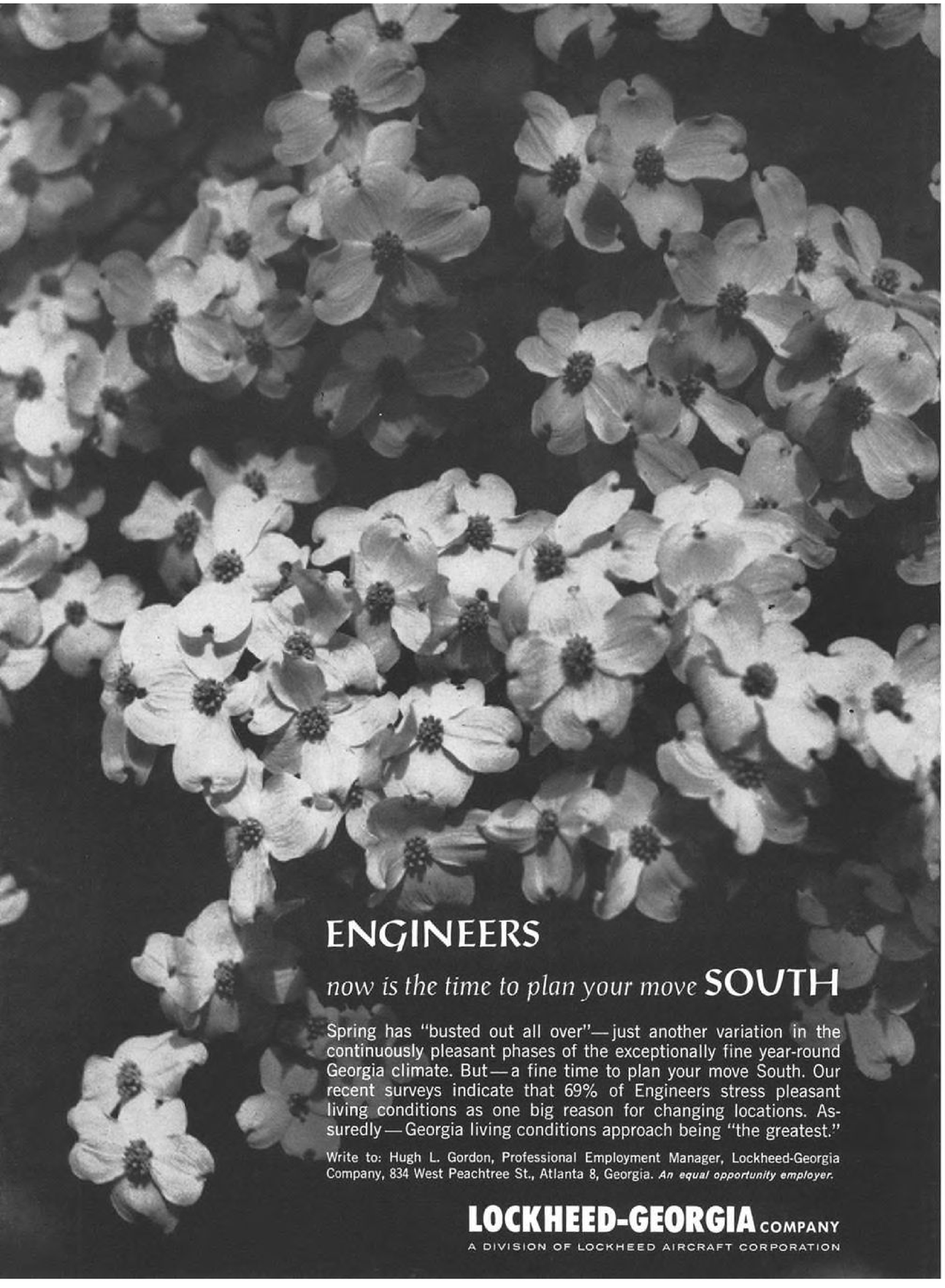
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$15.5 Million Marked By DOD for Rand Corp.

Washington – Defense Department has earmarked $15.5 million for contracts with the non-profit Rand Corp. in the Fiscal 1963 budget, according to testimony before the House Appropriations Armed Services Subcommittee released last week.

Of the total, $12 million is from Air Force, $2.7 million from Advanced Research Projects Agency and $800,000 from Assistant Secretary of Defense-Comptroller.

Annual salaries of Rand officers were listed as: F. R. Collbohm, president, $50,000; J. R. Goldstein, vice president, $43,000; L. J. Henderson, vice president, $36,000; J. S. King, treasurer, $27,000; and S. P. Jeffries, secretary, $27,000. The average salary of Rand's total 1,142 employes is $9,646.

The average salaries of the 515 employes below the top officer bracket were given as: 33 senior scientific supervisors and staff scientists, $24,855; 12 senior executive and administrative personnel, $19,792; 48 group heads and senior project leaders, $18,261; 141 other scientific and administrative personnel, $17,638; 281 other scientific and administrative personnel, $11,060.

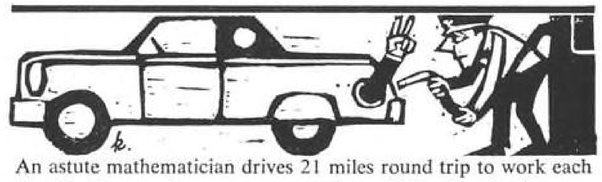
The first Rand contract for work for the comptroller, Charles J. Hitch, in the field of budget management, was let late in Fiscal 1961 and amounted to $125,000. The Fiscal 1962 contract amounted to $985,100. Hitch served as chief of Rand's economics division before becoming an assistant secretary of defense, it was noted.

Other contracts with advisory organizations programed by the Office of the Secretary of Defense for Fiscal 1963:

- **Institute for Defense Analyses,** $3.5 million, for evaluation of weapon systems and war gaming. The contract totaled $2.5 million for Fiscal 1961 and $3.5 million for Fiscal 1962.
- **Logistics Management Institute,** $1.5 million, for procurement and logistics studies. Organized last October by Secretary of Defense Robert S. McNamara (AW Oct. 9, p. 29), the Institute was awarded $600,000 for Fiscal 1962.
- **Operations Research, Inc.,** $250,000, for technical assistance on Titan 3. Fiscal 1962 contract was for $245,860.
- **Management Control Systems, Inc.,** $180,000, for studies of defense contractors' planning report system.
- **Stanford Research Institute,** $200,000, for studies in programing, budgeting.

Salaries of the officers of Institute of Defense Analyses were listed as: Garrison Norton, president, $39,000; Richard M. Bissell, executive vice president, $38,040; Keith A. Brueckner, vice president and director of research, $38,404; D. H. Gould, executive officer, $20,520.

PROBLEMATICAL RECREATIONS 114



An astute mathematician drives 21 miles round trip to work each day. On the way he passes a gas station which advertises free gas if the price at which the pump stops when filling the tank consists of repetitive digits, i.e. $1.11, $2.22, $3.33 . . . $9.99. Gas costs 30c per gallon and our mathematician knows his car delivers exactly 15 miles per gallon. Considering no additional driving, he computes that once he fills his gas tank at the station he can get all his gas free. The station is an integral number of miles from his home. Where is it with respect to his home?

—Contributed

Have you experience in the design and development of inertial guidance systems? If you've been looking for the freedom to turn your ideas into functioning systems, apply at our Guidance and Control Systems Division. Be knowledgeable about sub-miniature electro-mechanical devices, transistorized circuitry and/or computing techniques when you talk to Mr. Don Krause. It helps.

ANSWER TO LAST WEEK'S PROBLEM: It started snowing at 11:30 P.M.

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Guidance and Control Systems Division
Woodland Hills, California

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- Aerodynamicist
- Engineer with interest in dynamics, vibrations and aeroelasticity
- Performance Engineer for evaluation of V/STOL systems . . .

These positions offer both challenge and reward to men interested in analytical and experimental research studies on helicopters and other V/STOL aircraft. Work will be extremely varied and will include preliminary evaluations of novel configurations, as well as long-range research studies on the mechanics of flight at low speeds.

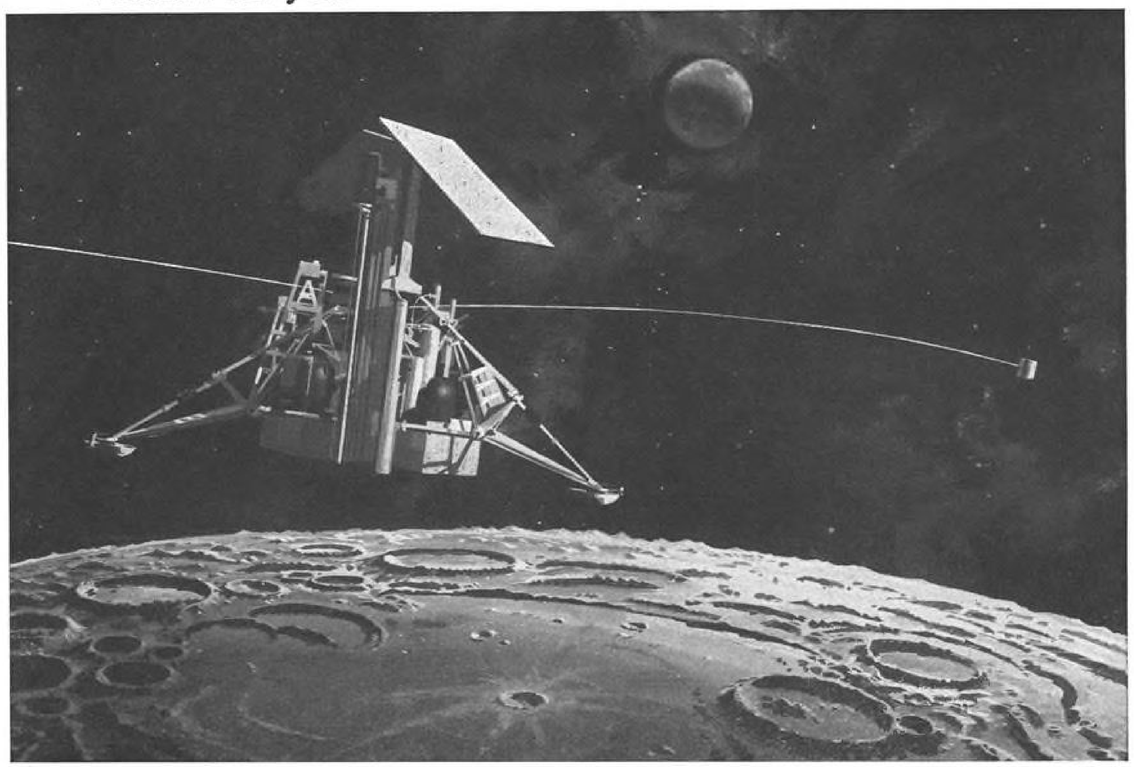
Corporate-sponsored and with strong management backing, this program offers both personal security and advancement opportunities to outstanding men with M.S. degrees. Facilities include a complex of modern wind tunnels, a variety of rotor and propeller test equipment, and the nation's largest industrial computational laboratory. Publication of papers is encouraged.

Since expansion in this program requires that we fill these positions immediately, write today to Mr. W. D. Walsh.

United Aircraft Research Laboratories
EAST HARTFORD, CONNECTICUT

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

Problem for you:



Soft land this vehicle on the moon

This spacecraft is SURVEYOR, one of the many important projects now under way at Hughes. It will "soft" land on the moon sometime in 1963. Its mission: to pierce and analyze the moon's surface; to transmit back to earth high quality television pictures; and to measure the moon's magnetic and radiation characteristics. To accomplish these demanding objectives, Project Surveyor requires the talents of many imaginative junior and senior engineers and physicists to augment its outstanding staff. A degree from an accredited university and U.S. citizenship are required. Experience in Aerospace Vehicles is preferred but not necessary. A few of the openings include:

CONTROLS ENGINEERS. Concerns airborne computers and other controls related areas for: missiles and space vehicles, satellites, radar tracking, control circuitry, control systems, control techniques, transistorized equalization networks and control servomechanisms.

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MILWAUKEE Weapon Systems Program Engineers ▪ Radar Design and Development Engineers ▪ Radar Systems Engineers ▪ Radar Test Engineers ▪ Reliability Program Engineers ▪ Field Service Engineers ▪ Electromagnetic Engineers ▪ Supplier Contact Engineers ▪ Quality Control Engineers/Analysts ▪ Technical Writers and Editors ▪ Scientific Programmers ▪ Ceramic Engineers

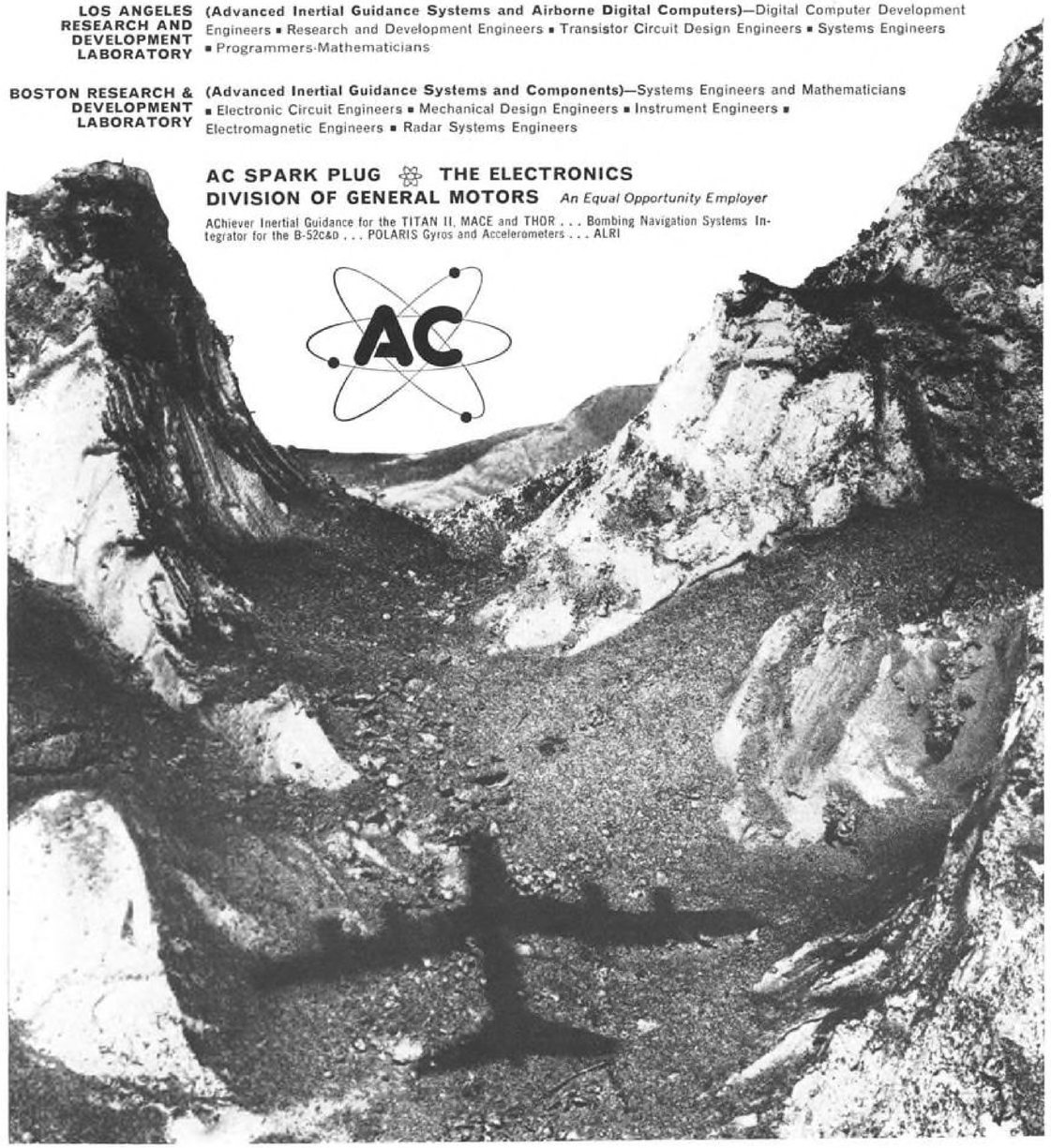
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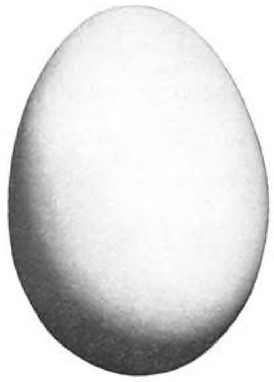
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ENGINEERS & SCIENTISTS — No. 1 in a Series Prepared to Give Insight Into the Scope of R&D Opportunities with Hercules Powder Company at Allegany Ballistics Laboratory



Beating the Egg (AS A PRESSURE VESSEL)

Until engineers and scientists of the Hercules Powder Company conceived, developed, designed and built the revolutionary ALTAIR rocket motor (successful top stage booster for 42 satellites, probes and test vehicles), *"Nature"* was still the shrewdest designer of pressure vessels, with the thin-walled egg.

With the ANTARES rocket motor Hercules pushed mass ratio still higher — to .93. Every point gained in mass fraction means 66 pounds added to payload lofted.

KEY TO THIS PIONEERING ADVANCE, ORIGINATED BY HERCULES AT ABL

...was drastic weight reduction in the rocket chamber. Research engineers at ALLEGANY BALLISTICS LABORATORY discarded the conventional approach — metal cases — in favor of a new concept: a glass-filament, reinforced plastic container, specially wound and bonded to the insulation. The result: a far lighter, chamber, *stronger than pure titanium.*

Today, a new generation of plastic-filament cases is employed in Polaris A-2 2nd stage and Minuteman 3rd stage motors, which Hercules is now building. (Other Hercules-developed rockets and boosters: Deacon, Talos, Terrier, Little John, Honest John, Nike, Bullpup.)

BROADENING R & D PROGRAMS AT ABL OPEN NEW OPPORTUNITIES FOR CREATIVE MINDS

All frontier areas of rocketry are studied at Allegany Laboratory, which Hercules has operated for the U.S. Navy since 1945. These include: solid propellants with extremely high specific impulse; nozzle design optimization; new understanding of internal and external rocket ballistics; broad new concepts in rocket engineering and processing.

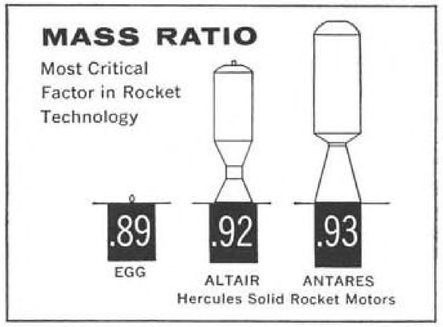
Creative men from many disciplines are sought, men with minds attuned to the Hercules philosophy; *"to find the best, not the most expedient answers"* to the nation's missile and space propulsion problems.

AERONAUTICAL, MECHANICAL, ELECTRICAL & CHEMICAL ENGINEERS... CHEMISTS, PHYSICISTS & MATHEMATICIANS REQUIRED

It takes effective collaboration of investigators trained in many fields to resolve the complex of problems involved in the evolution of a new rocket concept into a reliable propulsion unit on the launching pad.

PREVIOUS ROCKET EXPERIENCE *NOT* ESSENTIAL FOR MANY ASSIGNMENTS

While experience in rocketry is welcomed, demonstrated capability in a man's own discipline is the prime criterion. An indication of the way classical engineering and scientific knowledge may be applied to research and development at ABL will be found at the right. For further information, direct inquiries to Dr. W. R. Lowstuter.



Rocket Research & Development Positions

AE's, ME's, ChE's, Chemists, Physicists (BS, MS, PhD). ADVANCE DESIGN RESEARCH: studies to establish new rocket system concepts; preliminary design criteria.

MECHANICAL DESIGN RESEARCH: materials behavior; exhaust gas control; insulation; propellant combustion; hardware.

DESIGN & DEVELOPMENT: complete rocket motors including pressure vessels, nozzles, accessories. (Must know mechanics.)

SPECIAL STUDIES, ANALYSES: (8-10 years experience essential) heat transfer; fluid dynamics; systems analysis; internal & external rocket and missile ballistics.

AE's, ME's, ChE's, Chemists (BS). Quality Control, Reliability, Test (including analysis static firing stands and associated hardware). Facility Eng., Contract Admin.

EE's, ChE's, ME's (BS, MS). Design & Development instrumentation to obtain test firing data, also D&D process instrumentation.

Mathematicians (MS, PhD). Data Reduction computations & advanced programming for computer systems; statistical methods applied to QC, reliability, research findings.

Physicists (MS, PhD) **Chemists** (PhD) Inorganic, Physical ACOUSTICAL RESEARCH: behavior of burning rockets under different acoustical phenomena. Propellant & High Temperature Materials Research.

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ALLEGANY BALLISTICS LABORATORY, CUMBERLAND, MARYLAND
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WHO'S WHERE

(Continued from page 23)

Honors and Elections

Maj. Alexander de Seversky will receive the Billy Mitchell Award from Aviators' Post No. 743, American Legion, on May 16. The award is presented in recognition of outstanding contribution to the progress of aviation.

Dr. Ernst Stuhlinger, director of the NASA Marshall Space Flight Center's Research Projects Division, and **Prof. Hermann Oberth**, a German rocketry pioneer, have been named joint recipients of the International Galabert Prize for Astronautics in recognition of outstanding contributions to astronautics.

Dr. Donald P. LeGalley, scientific staff consultant for Space Technology Laboratories, has been appointed 1962 Chairman of the American Rocket Society's Guidance and Control Committee.

Changes

Edward J. Cassidy, director of operations, Avionics Division, Bell Aerosystems Co., Buffalo, N.Y.

T. E. Beresford, director of advance planning, Cook Technological Center, Morton Grove, Ill., a division of Cook Electric Co.

John A. Morgan, corporate general manager, Special Devices, Inc., Newhall, Calif.

Dr. Alan D. Sutherland, engineering manager-research, and **James A. Noland**, engineering manager-advanced development, Sperry Electronic Tube Division of Sperry Rand Corp., Gainesville, Fla.

Dr. Frank Herman, consulting scientist to the associate director of research for electronics, Lockheed Missiles and Space Co., Sunnyvale, Calif.

R. C. Handasyde, civil aircraft sales manager, and **J. K. Quill**, military aircraft sales manager, British Aircraft Corp. Ltd., London, England.

C. D. Oberg, marketing manager, Rohr Corp., Chula Vista, Calif.

R. G. McCoy, managing director of S. G. Brown, Ltd., Great Britain, succeeding **Frederick William John Gale**, retiring.

Don S. Burrows has joined The Martin Co., Baltimore, Md., in an executive management position; Mr. Burrows soon will join Martin's Denver (Colo.) Division as executive director of operations management.

Dr. Winston E. Kock, director of research, The Bendix Corp., Detroit, Mich.

Virgil H. Rotroff, director of manufacturing, Omaton Division, Burndy Corp., Norwalk, Conn.

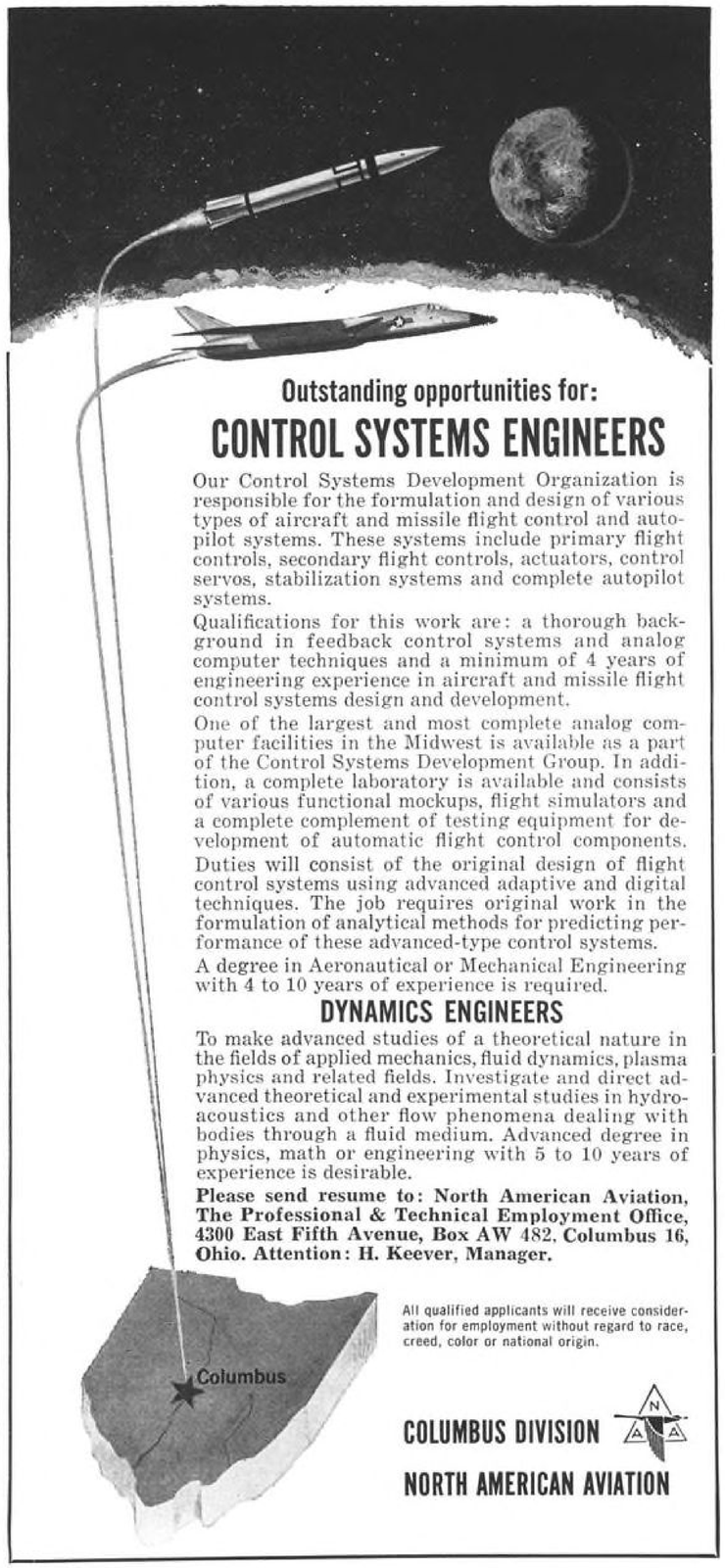
Richard E. Bennett, general manager, Transicoil Division, Daystrom, Inc., Worcester, Pa.

J. Walton Colvin, manager-plans and programs, General Dynamics/Electronics, San Diego, Calif.

Dr. Erwin Naumann, director of systems development, Northrop Space Laboratories, Beverly Hills, Calif.

Edward W. Warnshuis, director of advanced systems, Data Systems Division, Litton Systems, Inc., Beverly Hills, Calif.

Henry Burress, general manager, Vertol Division, Boeing of Canada, Ltd., Arnprior, Canada.



Outstanding opportunities for:

CONTROL SYSTEMS ENGINEERS

Our Control Systems Development Organization is responsible for the formulation and design of various types of aircraft and missile flight control and autopilot systems. These systems include primary flight controls, secondary flight controls, actuators, control servos, stabilization systems and complete autopilot systems.

Qualifications for this work are: a thorough background in feedback control systems and analog computer techniques and a minimum of 4 years of engineering experience in aircraft and missile flight control systems design and development.

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Duties will consist of the original design of flight control systems using advanced adaptive and digital techniques. The job requires original work in the formulation of analytical methods for predicting performance of these advanced-type control systems.

A degree in Aeronautical or Mechanical Engineering with 4 to 10 years of experience is required.

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To make advanced studies of a theoretical nature in the fields of applied mechanics, fluid dynamics, plasma physics and related fields. Investigate and direct advanced theoretical and experimental studies in hydroacoustics and other flow phenomena dealing with bodies through a fluid medium. Advanced degree in physics, math or engineering with 5 to 10 years of experience is desirable.

Please send resume to: North American Aviation, The Professional & Technical Employment Office, 4300 East Fifth Avenue, Box AW 482, Columbus 16, Ohio. Attention: H. Keever, Manager.

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Consultant. Fire prevention and control. Air ground or sea. Full or part time. PW-8733, Aviation Week.

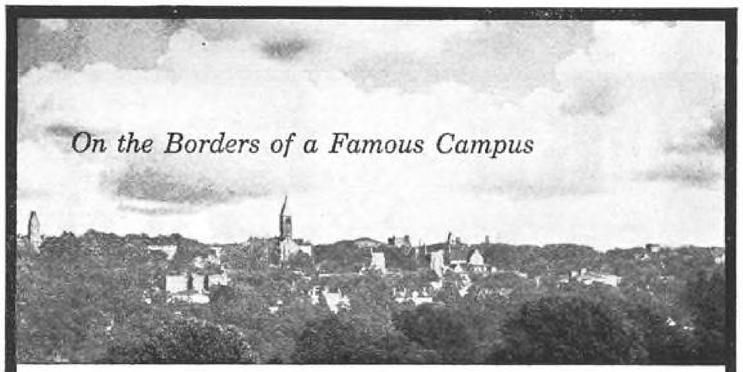
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Please write in full confidence to Mr. George Travers, Div. 64-WP

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LIGHT MILITARY ELECTRONICS DEPARTMENT
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i) Sonar

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And because our engineers are most frequently dealing with state-of-the-art systems concepts, we simply cannot adopt a passive attitude toward a components technology which might not arrive at the necessary stage of sophistication at the right time.

As a result, if you went on a tour of our facilities today, in addition to systems program and extensive manufacturing areas, you would observe a host of applied research and development programs under way in special laboratories devoted to cryogenics, TIMMS, Microminiaturization, advanced inertial guidance, etc. Some of these "component" programs would be linked directly to a system development timetable; others, independent studies with applications yet untried, or unknown.

If your degree is in EE, Physics or Math (Bachelors' to PhD) and any of the above areas interest you, write us in full confidence. We promise you a prompt reply. Address your letter or resume to Mr. D. F. Kline, Div. 64-WP.

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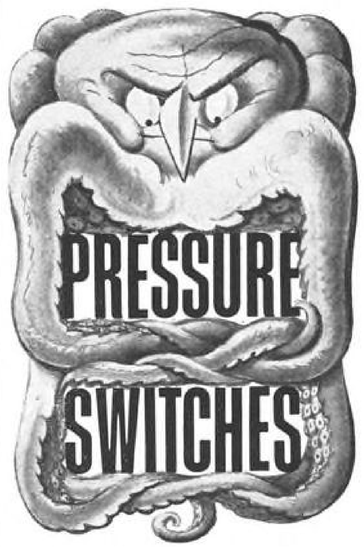
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LETTERS

Ode to Mercury

Thru three short days and comparable nights
In the first of the Mercury orbital flights
Soared Friendship 7 with a payload of Glenn
A tremendous experience for us earthly men.

In the second month of sixty-two,
On the twentieth day this history grew
As an Atlas rose forth from the launching site
To thrice orbit a capsule thru day and night.

Twas the thrust of the rockets and the Grace of God
And proper stagings of the Mercury Hot Rod.
Then thirteen minutes after lift-off took place
Was the capsule in orbit for a five hour race.

Historic accounts from orbit commence,
The following are milestones of important events
In eighty-one minutes twas first orbit complete
At five miles per second, Glenn still in the seat.

In ninety-two minutes, second orbit now past
They ordered the third for they felt she would last.
Just eight minutes prior to the end of the third,
At eighty-six minutes the retros were spurred.

Then ten minutes after three orbits complete,
Two parachutes blossomed and slowed down the fete.
Five minutes then lapsed before splash down occurred
And in eighteen short minutes U. S. Noa was heard.

It all happened so fast that it seemed like a dream
Just like Orville and Wilbur's first flying machine.
So thanks to the effort preceding this flight
Twas a booming success and John Glenn is all right.

PAUL I. NEUENSWANDER
Administrative Engineer
General Dynamics/Astronautics

Viscount Upheld

Reference Robert W. Clack's letter (AW Apr. 2, p. 98):

Suggest he either stick to nuclear engineering or check the facts before denigrating such a tried and proven aircraft as the Viscount. If Viscount was responsible for Capital's demise why did United not only retain 41 Capital planes but also repurchase six from Vickers? And can Mr. Clack name any one of 48 airline operators who regret the decision to buy Viscount?

ROBERT BLACKBURN
Vickers-Armstrongs (Aircraft), Ltd.
Weybridge, 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.

DOD Interference

The Renegotiation Board's case against Boeing and the opinion handed down by Judge Craydon G. Withey based on the inefficient operation of the contractor is without sound reasoning. The inefficient operation of Boeing or any other aerospace defense contractor can be traced directly to DOD and their direct interference in the management of these companies. By this direct interference they have removed the responsibility of the company's officers, directors and stockholders to monitor the company's operation for greatest efficiency. The contractors are told how many technical personnel to assign to a program, how many subordinates a supervisor may have, how many and what forms are to be used to produce, release and maintain control of all operations, how many signatures are required to release a technical report or drawing, and innumerable other directives on the contractor's operation. Now, the Renegotiation Board claims excess profits based on this very inefficiency as depicted in your report (AW Jan. 22, p. 32).

Today DOD actually dictates the organization under which a project is to be carried out and then requests organizational changes during the life of the project. Most contractors are now required to operate under the project group system which duplicates the whole organization for each project, from top management down. Separate purchasing and clerical departments, engineering staffs and, in some cases, manufacturing facilities are created for each project.

Based on the above operating restrictions placed on the contractor, how can the Renegotiation Board state that the contractor is inefficient? Also, how can Judge Withey place a figure of worth on the contractor's technical and engineering know-how or management skill and add that to the contractor's net worth? To claim this know-how as part of the contractor's net worth is to open defense negotiations to all kinds of pressures. In the past, a company's engineering skill could be evaluated by the estimated value of the patents the company had, but the present confusion as to the ownership of patents, under present laws, has removed this yardstick.

The only way we are going to get the operational weapons and space systems we require without additional huge increases in the national budget is to return responsibility to the contractor and judge him by results. The companies in turn will have to return responsibility and authority to their engineering staffs and judge them by their accomplishments.

SAMUEL BRAND
Aerospace Engineer
Van Nuys, Calif.

Taxing Problem

As you know, one of the problems which we have fought in regard to getting the AEROCAR into production has been the matter of capital. This difficulty has been greatly influenced by a completely unsuspected difficulty which the development of the AEROCAR did not envision, and that is the matter of excise tax. While the FAA has classified the AEROCAR as an aircraft which must be certificated, the IRS has classified it as an automobile and it is, therefore, subject to the 10% manufacturers excise tax. When you add this obviously discriminatory tax to the other unknowns that you face when you try to interest the money people in getting into the project, you can see that we are really up against about three strikes before we start.

In our effort to get relief from this tax classification, it has been necessary for us to go through Congress to get a special bill enacted which will exempt any automobile that is also certificated by the FAA for flight from the tax. This has been done through our district representative, Mrs. Julia Butler Hansen, who has introduced HR 8374 which is currently being considered by the House Ways and Means Committee (right now). While the first reaction of most people might be "let them work it out themselves," we believe that the whole aviation industry has much at stake in this matter, since our own studies have shown that the Bureau of the Budget is not interested in helping us get this bill passed and has indicated that it is even looking at the possibility of adding the excise tax to all aircraft.

We do not believe that the industry can afford to let the tax people get their foot in the door on this matter, and we are seeking every assistance we can muster in an effort to show the Ways and Means Committee that this bill is definitely in the national interest as well as a support to the very laws which created the FAA since they are supposed to be aiding the development of the aviation industry rather than trying to kill it as such a tax would do.

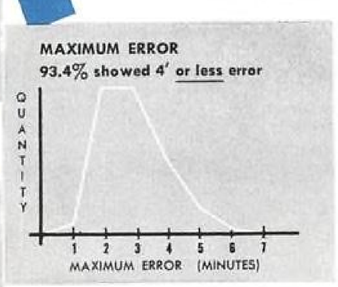
Accordingly, we would like to enlist the assistance of AVIATION WEEK in this matter and ask that you alert the industry to this bill and suggest that all people in the industry support its passage. While it might apply only to AEROCAR right now, it could apply to the future products of any of the builders who might, in the future, develop a roadable aircraft or "flying automobile." Certainly flying chariots are going to be the mode of transportation in the future and, while the AEROCAR is one of the first, we certainly do not believe that the possibilities of development in this field should be stifled by such a tax rule. We would like to suggest that you alert your readers to this matter and urge them to write to either Mrs. Hansen or the Ways and Means Committee right away and urge favorable action on the bill. More later.

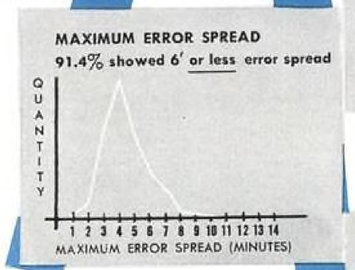
M. B. (MOLT) TAYLOR
President
AEROCAR, Inc.
Longview, Wash.

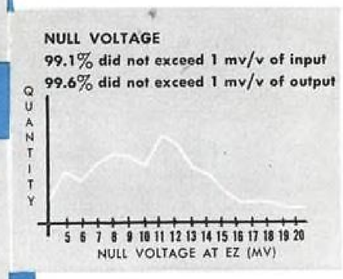
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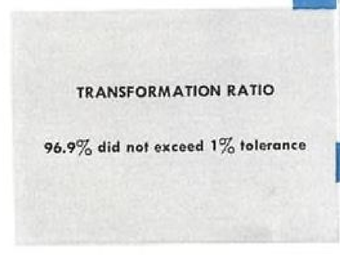
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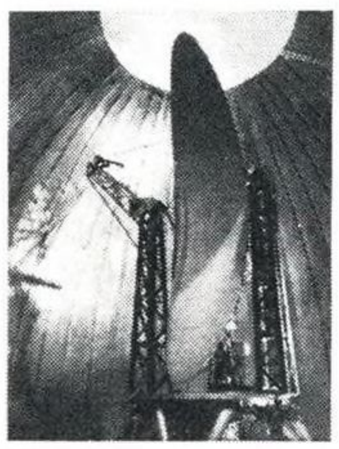
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