Space TECHNICAL INFORMATION DIGEST

SPACE SYSTEMS INFORMATION BRANCH, GEORGE C. MARSHALL SPACE FLIGHT CENTER

June 10, 1963 Vol. 4 No. 23

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SMALL ROCKET PLAYS KEY APOLLO ROLE. Details of a small but potent solid-propellant rocket that will share the responsibility for safeguarding the lives of America's lunar astronauts have been reported by Lockheed Propulsion Company.

The little-known rocket, called a pitch control motor, will team with its much larger and stronger fellow-lifeguard, the launch escape motor, to hurl the Apollo spacecraft and its three occupants to safety in the event of a malfunction during launch phases of the lunar exploration mission.

The pitch control motor is a comparatively small rocket that was developed specifically to eliminate the need for a conventional steering (thrust vector control) device on the launch escape motor, which is a 4.6-m (15-ft) long solid rocket. Weighing less than 45 kg (100 lb), the motor will save not only weight but also time and money in the Apollo project, engineers said. The burning time is half a second. Mounted in a housing that forms the nose fairing of the escape system, the rocket's purpose is to kick, or pitch, the entire system--motor, connecting tower, and manned spacecraft--into the correct flight trajectory for a successful escape if it should become necessary during an Apollo launch to abort the mission. The pitch control motor, however, can deliver varying amounts of impulse. This is accomplished by a unique motor design that permits easy and efficient loading with differing amounts of propellant. (Source: Data supplied by Lockheed Propulsion Company)

HYPERSONIC TUNNEL USES AIR AS TEST GAS. One of the largest, long-duration hypersonic tunnels in the country that uses air as its test gas is presently undergoing calibration runs in its 2.9-m (9.5-ft) test section.

The first successful run in Cornell Aeronautical Laboratory's Wave Super-heater was made February 8, 1963, at a velocity of 2150 m/sec (7000 ft/sec), 1600°C (3000°F), and at a simulated altitude of 76,000 m (250,000 ft). The tunnel has been used for ablation and other types of hypersonic testing at Mach 6 during the past six months. In March, a full scale nose cone was scheduled to be tested in the facility.

The heart of the device is a drum of 288 shock tubes rotating up to 2700 rpm, which emits superheated air for up to 15 sec. The tunnel will be capable of reaching temperatures of over 3800°C (7000°F). (Source: Cornell Aeronautical Laboratory, Inc. news release)

NEW G.P. COMPUTER ANNOUNCED. A general purpose computer for the military has been manufactured by the Hughes Aircraft Company and is in final testing. Designated the H-330, the first of these devices (Fig. 1) is scheduled to be used for data reduction in the orbiting of the company's Syncom communication satellites, planned for launching early next year.

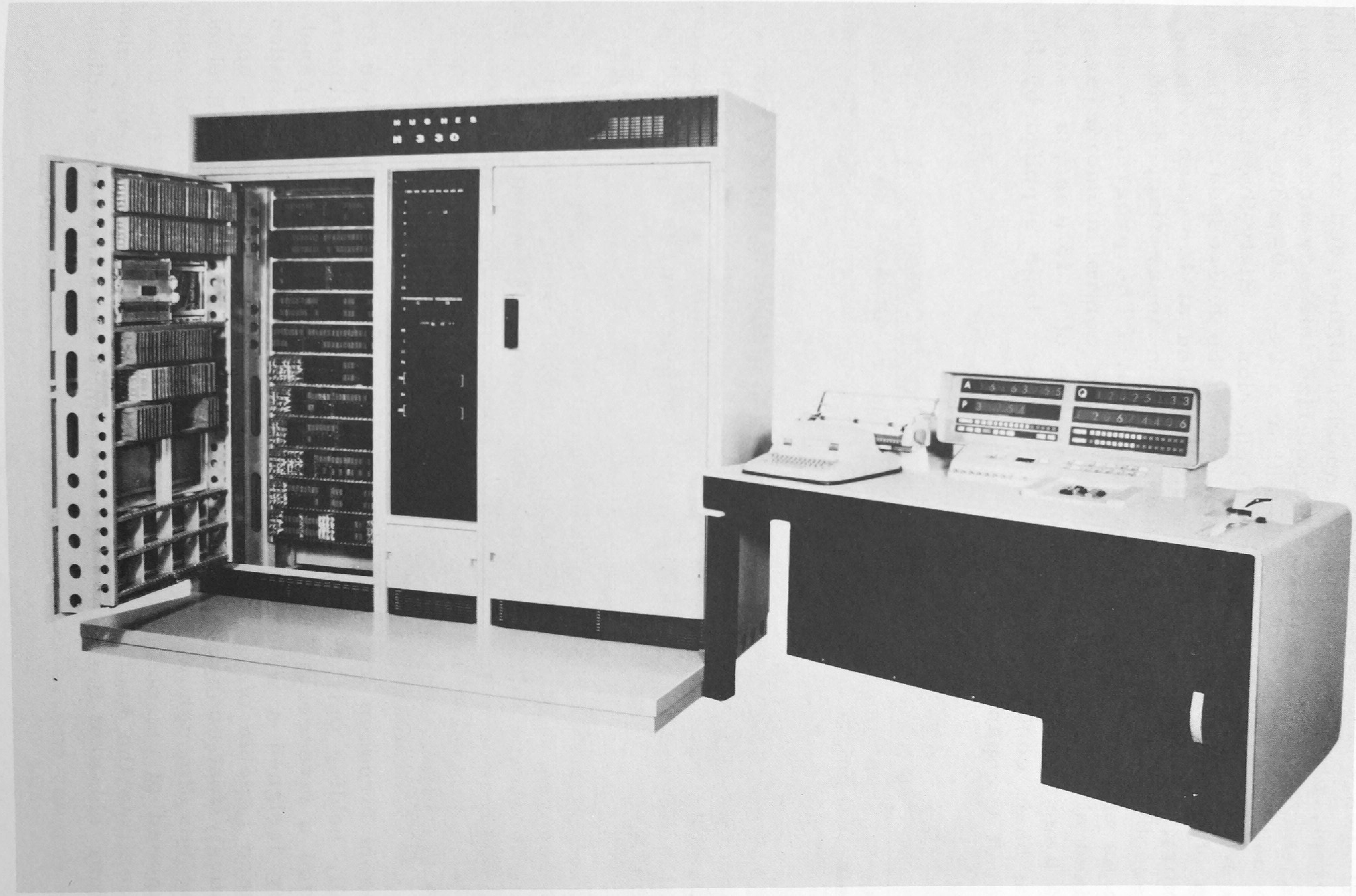

FIG. 1

Thirty-two channels of fully automatic buffered input-output, program interrupt, program protection, modular high-speed memory, look-ahead and real-time clocks characterize this advanced computer. The unit will be available with either a 24-, 30-, 36-, or 48-bit data word length, as suits the application. Sixty-five thousand words each of data and program memory can be addressed. The basic memory cycle time is conservatively rated at 1.8 μsec with an access time of 0.7 μsec. It operates in an overlapped mode to give an effective cycle time of 0.9 μsec. The program word length is fixed at 24 bits. A 128-word, 32-bit control memory, having a 0.45 μsec cycle time and an access time of 0.15 μsec, is used to store basic control registers. (Source: Data supplied by Hughes Aircraft Company)

TEST FURNACE FOR REFRACTORY METALS. Martin Company has designed and built a super-hot oven for testing metals that might be used in construction of heat shields for future spacecraft.

Although the testing volume is only about the size of a shoebox, the unit is one of the largest of its type in existence. It is being used at Martin's Space Systems Division in Baltimore to test refractory metal honeycomb sandwich panels at temperatures up to 2200°C (4000°F).

Refractory metals have not been used to any great extent in the past because they are difficult to form and weld. However, because most are light and would be capable of resisting the extreme temperatures encountered during reentry into the Earth's atmosphere, efforts are being directed toward adapting them to spacecraft construction.

Present furnaces for testing the metals at high temperatures are small, holding only a strip of the material. Company engineers needed a furnace that could hold a piece of a honeycomb panel. They designed a water-cooled, electrically controlled, radiation furnace capable of very rapid heating to test temperatures and relatively fast cooling. The unit consists of a hollow-wall steel outer box through which cold water is pumped. Thermal reflectors composed of six columbium and tantalum sheets inside the box concentrate the heat on the specimen. "W"-shaped heating elements on four sides of the 7100 cm^3 (432 $in.^3$) space provide radiant heating of the box when supplied with a low-voltage, high-amperage current. Forces can be applied to a specimen inside the heated zone by means of rods inserted through bellows at the top and bottom of the box (Fig. 2).

The unit reaches test temperature within minutes; it is held for about an hour to be sure the specimen is at full temperature. Readings are taken through a small window with an optical pyrometer. A full test from heating to cooling takes about two hours. (Source: Data supplied by Martin Company)

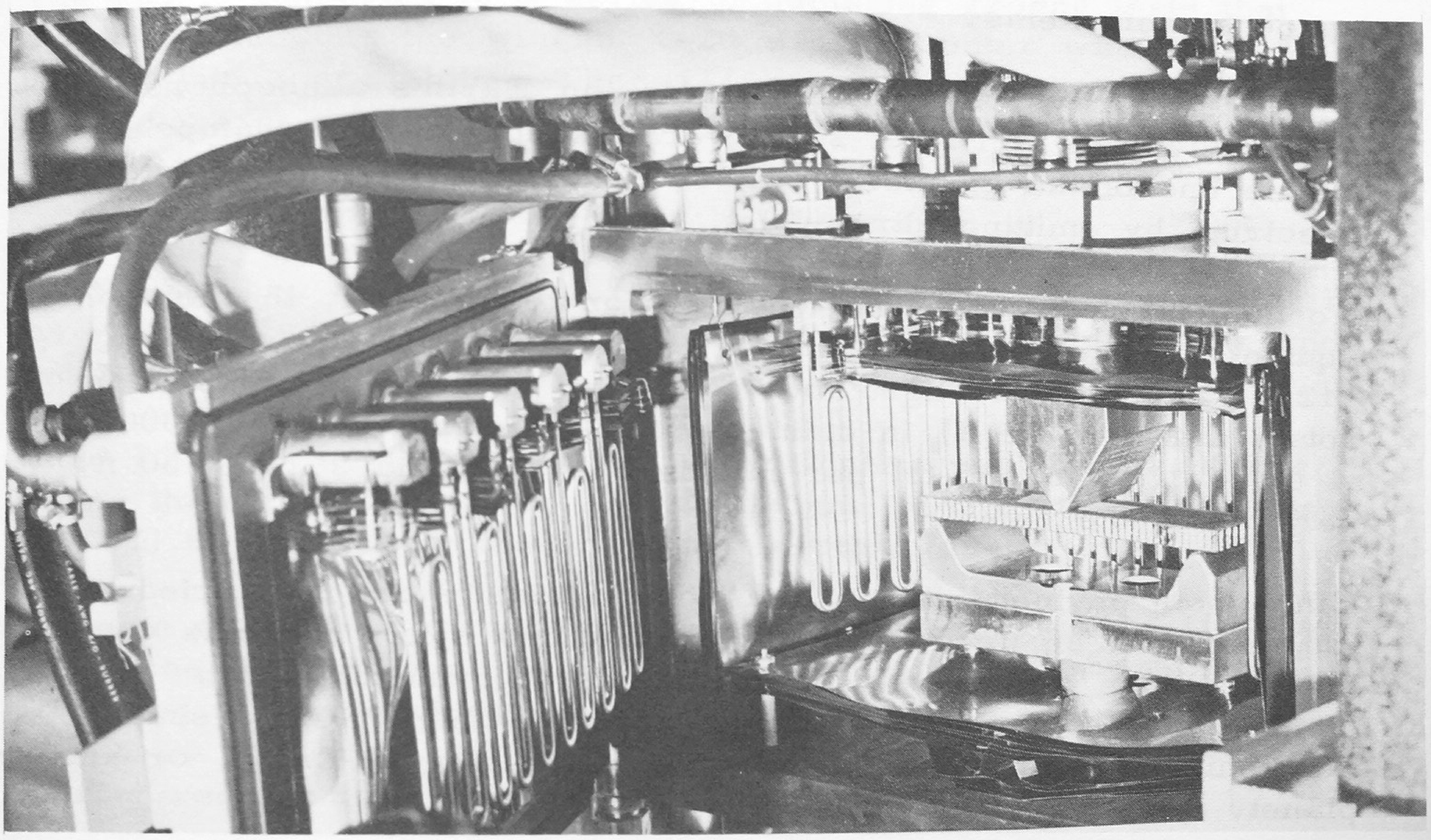

FIG. 2

<u>OUTER SPACE SIMULATOR DEVISED</u>. A new facility that captures some 36.8 m^3 (1300 ft^3) of outer space for space systems research here on Earth has been unveiled at Ling-Temco-Vought. The facility--a space environment simulator--realistically duplicates the actual conditions that a spacecraft, satellite, or space station would encounter: the extreme cold background of space, the high vacuum existing far above the Earth, and intense solar radiation.

The main body of the space environment simulator is a thick-walled, stainless steel chamber 3.7 m (12 ft) in diam and 3.4 m (11 ft) long. Evacuated by powerful pumps, the chamber can simulate the extremely low pressures of space at altitudes up to 322 km (200 mi).

A low temperature of -196°C (-320°F) simulates the bitter cold of space by means of a cylindrical, black cold wall that lines the interior of the chamber and is cooled by liquid nitrogen. Inside dimensions of the cold wall provide a working space 3.0 m (10 ft) in diam by 3.0 m in length, making it capable of handling large satellites and components, space station sections, and other sizable space system items.

The intense rays of the Sun outside the Earth's atmosphere are simulated by an array of 20 powerful xenon-mercury lamps located at one end of the chamber. These duplicate the Sun's radiation spectrum by emitting ultra-violet, visible, and infrared rays.

To duplicate payload attitude in relation to the Sun, the chamber is equipped with a two-axis motion device. Mounted on a 3.7 m (12 ft) in diam, air-tight door to the chamber, this gimbal can rotate a 2.4 m (8 ft) in diam payload weighing 454 kg (1000 lb) at up to 16.8 m (55 ft) per min in one axis and 9.1 m (30 ft) per min in the other.

Since both payload attitude and solar intensity can be varied, the chamber can be used to simulate advanced space vehicles on planetary missions as well as Moon and Earth orbit missions. The lamps can also be turned off and appropriately timed to simulate the vehicle passing into the shadow of the Moon, Earth, or another planet.

As a test payload makes its "flight," electronic devices and instruments located in the facility record in detail the effects of the space environment on the system being tested.

The simulator can be used for basic research and development of new spacecraft concepts, for testing of systems and components, and for reliability of complete astronautics payloads and supporting systems. Specific examples of the numerous items which can be tested or developed using the simulator's space environment include space suits, reaction control systems, optical and electronic systems, biological and life support equipment, materials, temperature control systems, leak detectors, coatings, instruments, and many other devices for satellites, manned vehicles, or space stations. (Source: Data supplied by Ling-Temco-Vought)

DYNA-SOAR NOSE CAP PERFECTED. The X-20 (Dyna-Soar) spacecraft has a new nose cap. Developed by Ling-Temco-Vought, the cap is described as a long-lasting radiation-cooled structure far different from the short-lived ablative types used by ballistic missile cones and Mercury-type space capsules.

The cap is subjected to a series of punishing ground tests that simulate conditions the winged X-20 will encounter when it is boosted into space atop a Titan III booster and reenters the atmosphere at searing speeds of approximately 27,000 km/hr (17,000 mi/hr).

Unlike today's space capsules that plummet rapidly into the atmosphere and then depend on parachutes for a safe descent in water, the winged X-20 will reenter the atmosphere in a single long glide and maneuver to a landing under the pilot's control.

While ICBM's and capsules encounter higher peak temperatures during their brief reentries, the total heat load for the X-20 nose cap will be five to six times as high as that for the other vehicles.

Because of their short reentry times--a few minutes for ICBM's and perhaps 15 min for capsules--these vehicles can use heat protection systems which ablate, or boil off, to carry away heat. The X-20 nose cap, on the other hand, must remain intact against searing reentry temperatures for as long as half an hour.

The X-20 nose cap protects the glider by radiating heat from its surface back into the atmosphere. It must retain its shape to preserve the aerodynamic characteristics of the vehicle. Failure to do so could cause serious control problems or permit excessive temperatures to reach and destroy vulnerable parts of the glider.

Insulation for the cap had to have high heat emittance, a melting point above 1700°C (3000°F), efficient insulating qualities, freedom from chemical reaction at high temperatures, and thermal shock resistance. These requirements limited the choice to one of the metallic oxides classed as ceramics.

One of the test facilities is a 20-cm (8-in.) diam ramjet engine that burns jet fuel with compressed air supplied from a high-speed wind tunnel. Fired at the nose cap, the ramjet duplicates or exceeds stresses that the cap will encounter during phases of rocket boost and the latter portion of a reentry.

To simulate the extreme temperatures of reentry on a full-scale nose cap, an oxy-propane torch facility, fed by 30 oxygen-propane torches exhausting into a zirconia-lined nozzle or shroud, produces temperatures up to 2800°C (5000°F).

The cap is subjected to a series of seven tests in proving its design. These include load tests, boost vibration, high noise levels, boost temperatures, peak reentry heating, dynamic pressure, and reentry vibration. (Source: Data supplied by Ling-Temco-Vought, Inc.)

TINY ICE BOX BEING DEVELOPED. General Electric Co. is working on a small cryogenic refrigerator that will operate maintenance-free for periods of one to four years and will be able to produce a continuous environment below 4°K (-453°F). The device will weigh about 22.7 kg (50 lb), which is less than one-tenth the weight of present apparatus. It will occupy a volume of about 0.04 m^3 (1.5 ft^3).

A regenerative compressor will probably be selected for a successful rotating machine. There is also a miniature expansion turbine coupled to a miniature electric alternator that will absorb the power delivered to the turbine by the expanding gas.

A major problem with conventional cooling apparatus is that oil, a necessary lubricant for moving parts, plugs small passages in the system and coats heat transfer surfaces with insulating films. The new refrigerator uses gas bearings that need no lubricating oils and are capable of long operation without measurable wear. The use of gas bearings was permitted by employing rotational rather than reciprocating elements in the refrigeration unit.

The new unit is expected to be in operation within two years. (Source: Computer Design, April 1963)

TECHNICAL REPORTS AVAILABLE. The following listed technical reports can be requested through the NASA library, M-MS-IPL, Bldg. 4481.

NOTE: Those reports with an AD number may be on file in the local DDC branch in Bldg. 4484. Readers can save time by calling 876-6088 and inquiring if such reports are available before ordering them through NASA.

1. DEVELOPMENT OF ROLL-FORMED TUNGSTEN NOZZLE COMPONENTS. AD 289 363
2. DESIGN CONSIDERATIONS IN SELECTING MATERIALS FOR LARGE SOLID-PROPELLANT ROCKET-MOTOR CASES. AD 294 695
3. METALLIZED TEFLON CAPACITORS (SUBMINIATURE 200°C), D. H. Smith et al. AD 294 583
4. MINIATURE THIN-FILM INDUCTORS. AD 294 768
5. HIGH TEMPERATURE TESTING OF METALS, USSR. 63-21622
6. SOVIET REPORTS ON METALLURGY, NOVEMBER-DECEMBER 1962. 63-21627
7. STUDY AND PRELIMINARY DESIGN OF A HERMETICALLY SEALED HYDRAULIC SYSTEM. AD 294 577
8. THEORY OF CORRESPONDENCE BETWEEN FLUID DYNAMICS AND PARTICLE-AND-FORCE MODELS, F. H. Harlow. LA 2806
9. ALL PURPOSE PLATING APPARATUS FOR RESEARCH ON VAPOR PHASE COATINGS, Iwan Marinow, C. A. Gellar and Robert Bakish. AD 288 862
10. DEVELOPMENT OF PYROLYTIC REFRACTORY MATERIALS FOR SOLID-FUEL ROCKET MOTOR APPLICATIONS, R. Francis. AD 291 401
11. WORK HARDENING MECHANISMS IN BODY CENTERED CUBIC METALS, D. P. Gregory et al. AD 289 859
12. APPLICATION OF THE FAST CYCLOTRON WAVE OF A MAGNETICALLY FOCUSED ELECTRON BEAM TO FREQUENCY MULTIPLICATION, D. T. Davis and Shizuo Mizushina. AD 291 784
13. LINE WIDTH MEASUREMENT ON SINGLE CRYSTAL YTTRIUM-IRON GARNET, A. D. Krall. AD 285 272
14. RESEARCH ON TECHNIQUES OF ESTABLISHING RANDOM TYPE FATIGUE CURVES FOR BROAD BAND SONIC LOADING, J. R. Fuller. AD 290 799

15. THE EFFECT OF SIZE AND STRESS HISTORY ON FATIGUE CRACK INITIATION AND PROPAGATION, W. Weibull. AD 287 962
16. DIFFUSION BONDING OF TUNGSTEN ALLOYS. AD 289 366
17. SHORT ARC WELDING OF HASTELLOY N (INOR-8), H. B. Harland and V. B. Gritzner. Y-1409
18. THIRD STATUS REPORT ON FUEL CELLS, H. H. Hunger, F. R. Franke and J. J. Murphy. AD 286 686
19. EFFECT OF VARIATION OF THE DRIFT PARAMETER ON CONTROL OF A STOCHASTIC PROCESS, W. H. Pearson. AD 292 144
20. ATTENTION LEVEL AND VISUAL AND AUDITORY MONITORING PERFORMANCE, L. T. Pope. AD 291 951
21. HANDLING QUALITIES IN SINGLE LOOP ROLL TRACKING TASKS: THEORY AND SIMULATOR EXPERIMENTS, T. S. Durand and H. R. Jex. AD 293 236
22. ORDNANCE TECHNICAL TERMINOLOGY. PB 181 465
23. A BIBLIOGRAPHY OF REPORTS ON SANDWICH CONSTRUCTION FOR ORDNANCE DESIGN ENGINEERS, M. H. Matigian. AD 276 962
24. INVESTIGATION OF MAGNETIC AND ELECTRIC FORCES FOR ROTATING SHAFT SUSPENSION. AD 277 202