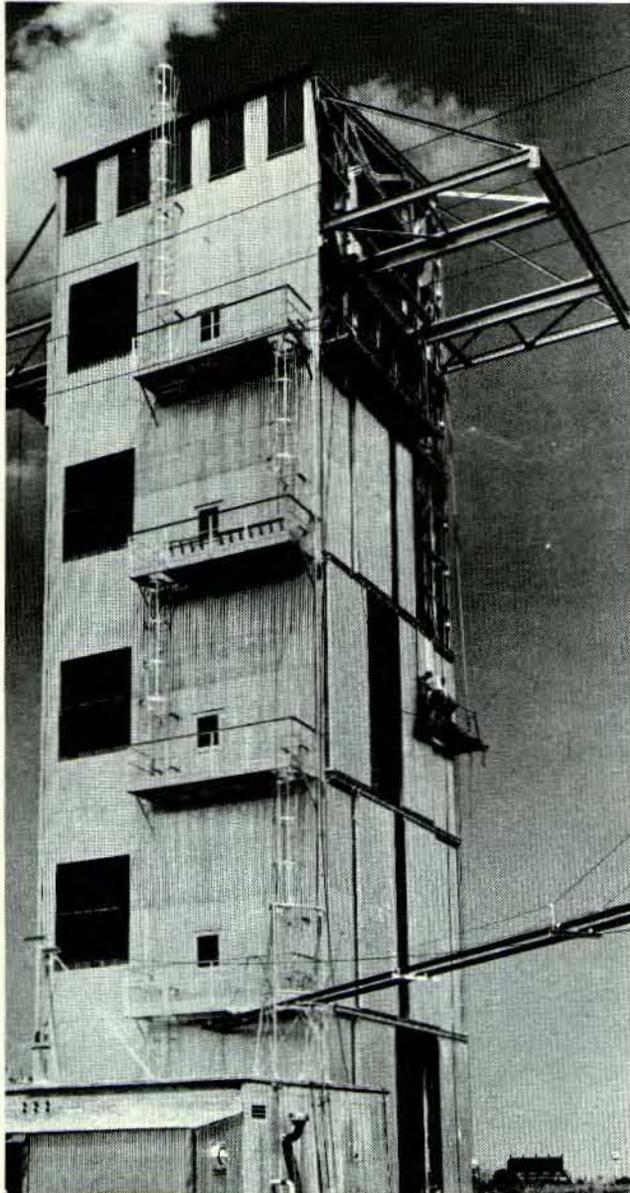




THE PLUM BROOK STORY - A PROGRESS REPORT

(This week ORBIT visited Plum Brook to report on the construction progress of the rocket test facility and the research reactor facility. The first installment is devoted to the rocket project; the second, to appear next month, will cover the reactor. Subsequent stories will be devoted to a number of significant Plum Brook subjects.)



Among the new facilities under construction at Plum Brook is the 117 foot high Dynamics Facility, or "Shake Tower." This silo-like, 30 foot square tower will be used for two types of missile research: structural dynamic testing, and fluid flow investigations.

One of the reasons for failure in missile launchings has been failure of structural components due to compression and bending vibrations of the missile structure which are excited by the rocket motor. For example, steering control gyros, which measure the vehicle attitude can be misled by bending vibrations of the structure. If these bending vibrations are not properly recognized in the design of the steering control the gimbaling motor will re-enforce the bending motion and result in the destruction of the missile.

These vibrations will be simulated in the Shake Tower (left) for study of the problem. The tower is constructed to hold a missile the size of an Atlas, or scale models of larger missiles. Built of structural steel, the tower doors slide open, the beams are dropped out, and the large crane at the top of the tower lifts the missile into place.

Simulating free flight as nearly as possible, the missile will be supported by cables inside the tower and placed on a "soft spring" - one which provides a big deflection with a small weight. The missile will be connected to a large vibration exciter, producing 15,000 pounds force which will excite, or "shake" the suspended missile in a vertical plane. A smaller, 200-pound force exciter will be used for lateral shaking. A power amplifier housed in a concrete block house next to the tower will accuate the exciters.

(Continued on page 2)

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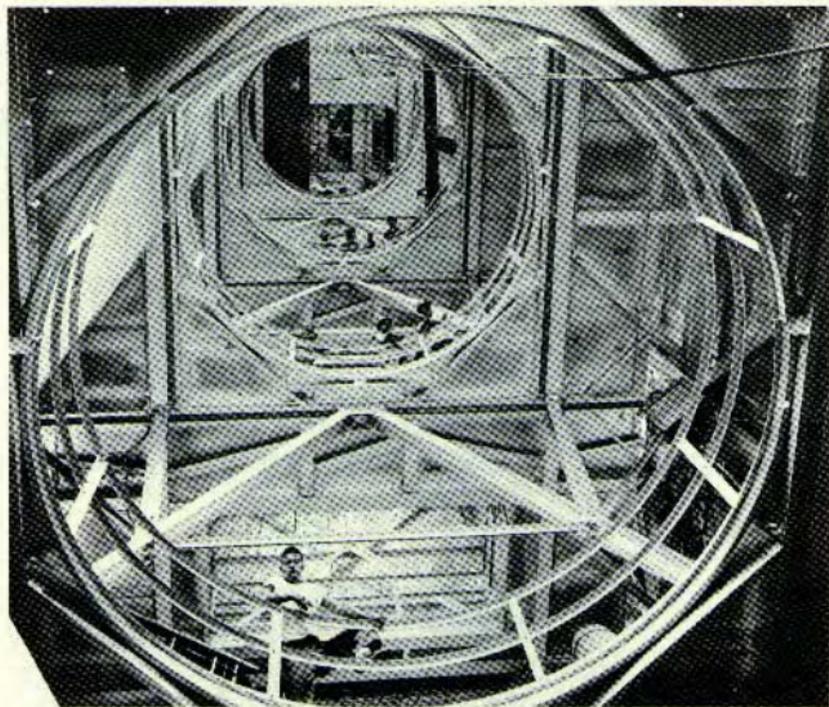
Editor.....Marjorie Hyre

Reporters.....NASA Employees

plum brook (Continued from page 1)

The central control building, which will control all operations, will be located 1000 feet away.

The Dynamics Facility will also be used to study complete rocket systems. The tankage and related pressurization and flow systems, including the turbo pumps, will be investigated. The propellant will not be burned. Combustion chamber pressure will be simulated by a controls device. This will permit studies of the effect of changes of combustion pressures on the flow dynamics. Designed for cryogenic fuels liquid Hydrogen and liquid Oxygen, complete safety features have been incorporated in the design.



Inside the Shake Tower - looking up.

Centaur-Surveyor Tests Underway At Plum Brook

Testing of an Atlas-Centaur-Surveyor configuration is underway at the Plum Brook Station.

Mating of a dynamic model Surveyor payload to the Atlas-Centaur rocket combination in Plum Brook's gantry-like Dynamics Research Testing Stand, known as "E" Stand, was accomplished late last month.

The current ground tests are part of a series designed to prove the capability of the Atlas-Centaur-Surveyor to withstand the flight environment.

The Centaur vehicle is being developed under technical direction of a project office at Lewis. Ted Gerus heads the "E" Stand Section for the project office. In charge of the Plum Brook side of the work is Al Schultz.

Centaur, a high-energy-fueled second-stage rocket using an Atlas booster as its first stage, is slated for a variety of missions — the primary one being to loft the Surveyor spacecraft to the moon. The heavily-instrumented Surveyor will return data to earth about the lunar surface; these data will assist

Project Apollo.

In the first tests of the complete launch vehicle — spacecraft configuration, engineers are using an electromagnetic "shaker" to test lateral and longitudinal dynamics.

In these, the vehicle is made as free as possible by means of a cable suspension system. The "Shaker," attached to the base of the Atlas, vibrates the vehicle and imposes simulated flight stresses.

The fuel and oxidizer tanks of the Atlas and Centaur are filled with simulated propellants at ambient temperatures. Various Atlas propellant levels are used to simulate stages in flight.

A later test will involve using cryogenic liquid nitrogen in the Atlas' liquid oxygen tank.

The Surveyor model being used in the assembly is not an actual spacecraft. It has the same physical and clearance dimensions, mass and center of gravity as a flight article. Demonstrating that the spacecraft can ride within a nose cone through flight stresses without damage is one testing objective.

Centaur Propellants Simulated by Water And Styrofoam Balls

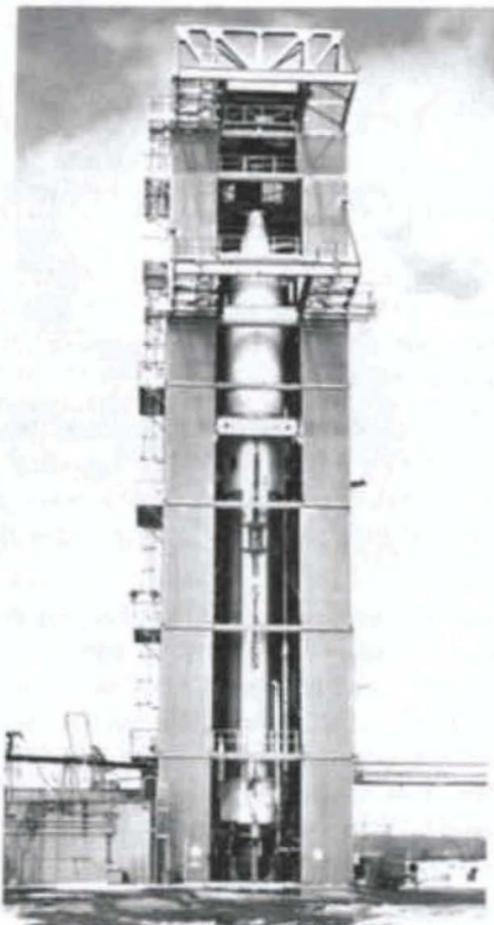
Rocket fuels have been replaced by water — 35,000 gallons of it — and small styrofoam balls — 193,000 of them — for testing of a rocket vehicle in Plum Brook's "E" Stand.

These substitutes are being used as simulated propellants in a series of ground tests of the Centaur space launch vehicle.

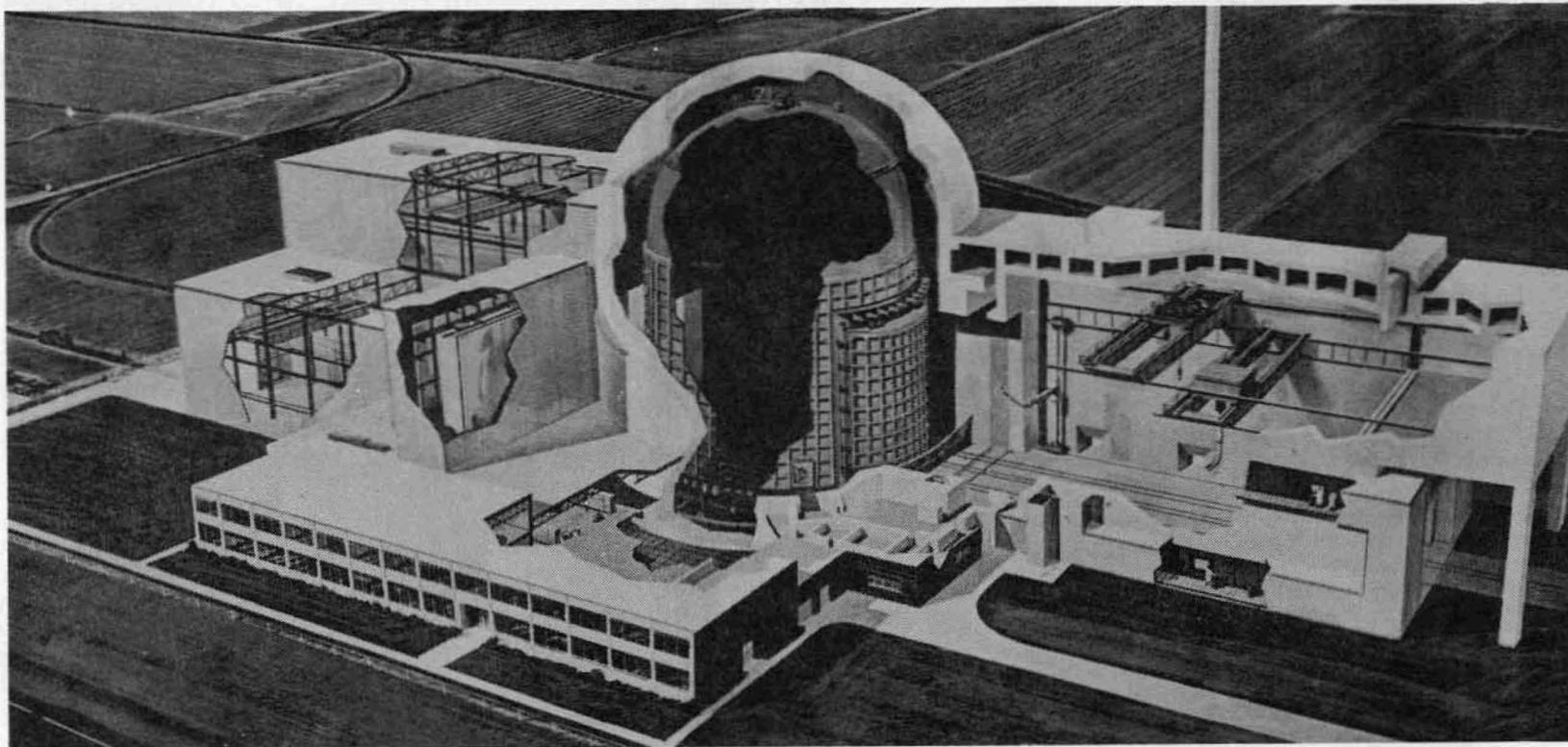
Water fills the tanks of the Atlas booster in place of RP-1 fuel and liquid oxygen. It is also used in the oxidizer tank of the Centaur.

Simulating the mass of liquid hydrogen in Centaur's fuel tank are styrofoam spheres — 4,650 pounds of the 1 and 7/8-inch diameter balls.

Gaseous nitrogen is being used for tank pressurization. In later tests liquid nitrogen will be placed in the booster's oxygen tank.



***ATLAS-CENTAUR-SURVEYOR
in Plum Brook's "E" Stand.***



ARTIST'S CONCEPT of the Space Propulsion Facility.

LEWIS NEWS

The Lewis Research Center
National Aeronautics and Space Administration
Cleveland, Ohio

Vol. 1, No. 4

April 10, 1964

Two Contracts For M-1 Engine Awarded

Two contracts totaling \$238,625,709 have been awarded by NASA to the Aerojet-General Corporation, Sacramento, Calif., for development of the M-1, the nation's largest liquid hydrogen-liquid oxygen rocket engine.

The M-1 Program is under technical direction of the Lewis Research Center. Walter F. Dankhoff is M-1 Project Manager.

Development of the M-1, designed to produce 1.5 million pounds of thrust, is planned to meet the space program's need for a high-thrust, high-energy, upper-stage propulsion system.

It is being designed primarily for upper stage use on advanced and post-Saturn type launch vehicles. Other versions of the engine may also be applied to the large booster stages.

Aerojet was selected by NASA to build the M-1 in January 1962. Since that time, the company has been working under two letter contracts valued at about \$84 million. These contracts are included in the \$238.6 million figure.

The first of the newly-awarded contracts, for \$190,075,635, provides for the research and development work. The second, for \$48,550,074, provides for necessary test facilities.

Development, testing, and fabrication of the M-1 will be performed at Aerojet's Sacramento facility. Some in-house research will be conducted at Lewis.

Aerojet has completed construction of a number of facilities to support the program. These include test stands for thrust chamber injector evaluation, long duration turbopump testing, and thrust chamber and gas generator testing with thrust measurement capability.

New M-1 facilities to be built by Aerojet include three test complexes for ground testing the complete engine. These include a transient start stand, two position stand for long duration ground firings with altitude simulation and pre-start conditioning, and a stand for extended duration runs to provide reliability determinations and a tool for improving the engine prior to vehicle usage.

Propulsion Facility Bid Requests Issued

Requests for bids for the basic construction of a unique space environment facility have been issued by the Lewis Research Center.

Known as the Space Propulsion Facility, it will be built at the Plum Brook Station.

The heart of the facility will be a cylindrical tank 100 feet in diameter by 120 feet high. Inside, temperature and pressure conditions existing at altitudes up to 100 miles above the earth will be produced.

The simulation of this environment in a tank of such tremendous size will permit evaluation and developmental testing of complete spacecraft, as well as nuclear electric power generation and propulsion systems. Problems that may occur in space during ignition, power setting changes, long term operation, and shutdown will be studied.

Reinforced concrete, six feet thick, will surround the vacuum chamber and provide shielding against nuclear radiation. This enclosure will be approximately 130 feet in diameter with a hemispherical dome, flat floor, and two 50 by 50 foot portals. The enclosure walls will be 150 feet high and will include an air-tight steel membrane. The two portals will be closed by concrete doors moved into position by hydraulic actuators.

Adjacent to the enclosure will be an office building, control building, assembly building, and disassembly building. A vacuum equipment building, refrigeration building, and shop also will be included.

Harold E. Friedman, project manager, said the facility is scheduled for completion in early 1967.

Other contracts will be let for the test chamber, instrumentation, and equipment as construction progresses.

The facility was designed for Lewis by Kaiser Engineers Division of the Kaiser Co., Oakland, Calif.

Center Co-Sponsors Conferences

Lewis was the co-sponsor of educational programs held yesterday at two central Ohio colleges.

They were the Annual Career Opportunities Conference at Wilberforce University, Wilberforce, O., held in the afternoon; and the Science Forum at Central State College, Xenia, O., an evening meeting.

Participating in the programs were Lewis staff members Dr. Albert C. Antoine, Jerry H. Malone, Cleveland O'Neal Jr., and Ernest Roberts Jr. Dr. C. D. Ferraro, Lewis placement officer, was coordinator for the projects and also appeared on the programs.

Science, space projects, careers, and job techniques were discussed.

Co-sponsorship of the conferences was another step in the Center's continuing program of encouraging aerospace careers and explaining space projects.

LEWIS NEWS

The Lewis Research Center
National Aeronautics and Space Administration
Cleveland, Ohio

Vol. 1, No. 10

July 2, 1964

Awards Presented to Forty-One Employees

Plum Brook Team's Achievement Cited

NASA's Group Achievement Award — given in recognition of outstanding teamwork and group efforts — was presented June 23 to Centaur "E" Stand Project personnel at the Plum Brook Station.

This was the first time the award has ever been given to a Lewis group.

The citation was presented to the 12-man team by Dr. Abe Silverstein in ceremonies held at the Sandusky station.

The citation reads: "For significant contributions resulting in the successful completion of research testing of the Atlas 116 D booster under simulated loading and environmental conditions and providing data vital to the first flight of the Centaur vehicle." It was signed by James E. Webb, NASA Administrator.

A large framed certificate was presented to Alan D. Johnson, Plum Brook Director, and Glen Hennings, Chief, Rocket Systems Division, by Dr. Silverstein. The certificate is to be placed prominently in a public location at Plum Brook.

The 12 men received miniature certificates and cash awards ranging from \$50 to \$275 for their efforts which resulted in tangible savings of \$30,000 and many intangible benefits to the Government. The awards totaled \$1,800.

Honored were: Donald Cooksey, Donald M. Entrikin, Lawrence C. Gentile, Joseph V. Gillette, Ernest King, Russell L. Koger, Norman L. Schroeder, Alvin E. Schultz, Robert D. Siewert, and George L. Thomas, all of the Rocket Systems Division, and,

Darrell H. Baldwin, Engineering Division, and William E. Thompson, Facilities Services Division.

"E" Stand is a towering facility capable of holding an entire Atlas-Centaur-Surveyor configuration. Stress and vibration tests of that configuration are currently being conducted at the stand.

(Continued on page 3)

Contract for Construction of Space Propulsion Facility Is Let

NASA has awarded a \$16,975,000 contract to Blount Bros. Corporation of Montgomery, Ala., for construction of three major elements of the Space Propulsion Facility.

The contract covers general construction and the cryogenic and vacuum systems for the unique space environment facility.

It will be built in the southeastern section of the 6,000-acre Plum Brook Station. Construction is expected to begin in the near future. Completion of the structure is scheduled for 1967.

The facility, designed by Kaiser Engineers, Oakland, Calif., will have the capability to simulate temperature and pressure conditions existing at altitudes up to 100 miles above the earth inside a cylindrical tank 100 feet in diameter by 120 feet high.

The simulation of this environment in a tank of such tremendous size will permit evaluation and developmental testing of complete spacecraft, as well as nuclear electric power generation and propulsion systems.

Problems that may occur in space during ignition, power setting changes, long term operation, and shutdown will be studied.

Reinforced concrete, six feet thick, will surround the tank and provide shielding against nuclear radiation.

Adjacent to the chamber will be an office building, control building, and spacecraft assembly and disassembly facilities. A vacuum equipment building, refrigerator building, and shop also will be included.

Other contracts will be let for the test chamber, instrumentation, and equipment as construction progresses.



Photo by Lloyd Trunk.

GROUP ACHIEVEMENT Award is presented to "E" Stand team — left to right, front row: George L. Thomas, Alvin E. Schultz, Dr. Abe Silverstein, Alan D. Johnson, and William E. Thompson. Back row: Glen Hennings, Russell L. Koger, Joseph V. Gillete, Norman L. Schroeder, Darrell H. Baldwin, Lawrence C. Gentile, Donald Cooksey, and Robert D. Siewert. Missing: Donald M. Entrikin and Ernest King.

Awards . . .

(Continued from page 1)

29 Are Honored for Superior Performance

Twenty-nine Lewis employees received commendations last week for sustained superior performance for six months or longer.

The commendations included cash awards up to \$425.

Employees in administration, development, research, and technical services at Lewis and Plum Brook were honored. Their awards were earned for contributions in fields ranging from pipefitting on a stand for testing the country's first nuclear rocket engine, and outstanding leadership in research efforts on solar cells, to excellence as a truck driver.

Honored were:

Administration — Eugene J. Tomasch.

Research Divisions — Betty J. Hood, Lawrence Schwartz, and Fred F. Terdan.

Technical Services Divisions —

Thomas Buchar, John Cruickshank, Thomas F. Davis, Henry A. Diehl, John T. Flynn, Erwin J. Gutoske, Frank L. Hren, Frank J. Kuchta, Michael M. Modic, Howard A. Molzan, Norman C. Prahst Jr., McKinley Ray, Michael C. Schneider Jr., William G. Spiegelberg, Leonard J. Tesar, and Harold L. Weitzel.

Development Divisions — Harry M. Cameron, William J. Masica, and Joseph A. Ziemianski.

Awards at Plum Brook went to: Rocket Systems — John E. Sholes.

Reactor Division — Robert C. Didelot.

Facilities Services Division — Ivan R. Franks, Lloyd R. Hunt, James H. Hurst, and Ernest L. Rooks.

The awards at Lewis were made on June 24, at Plum Brook on June 23 in conjunction with the Group Achievement Award.

All NASA employees are eligible for sustained superior performance awards under the Government Employees Incentive Awards Act.

July 2, 1964



Photo by Lloyd Trunk.

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