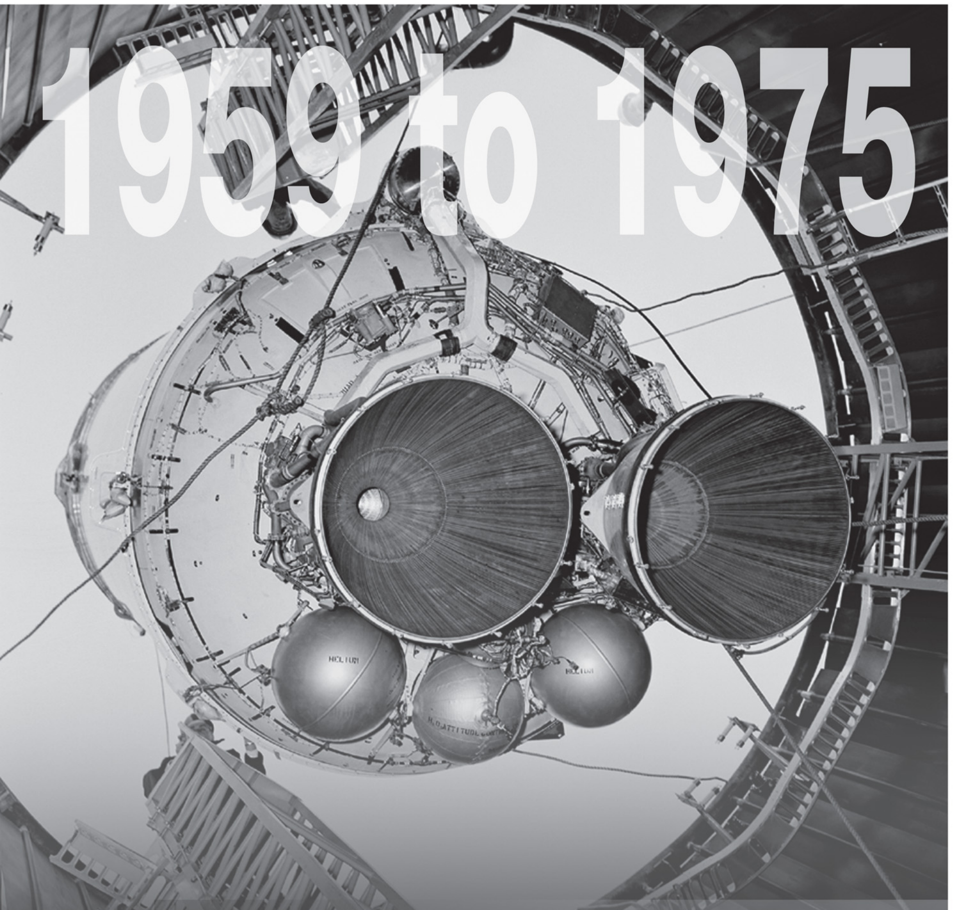
National Aeronautics and Space Administration

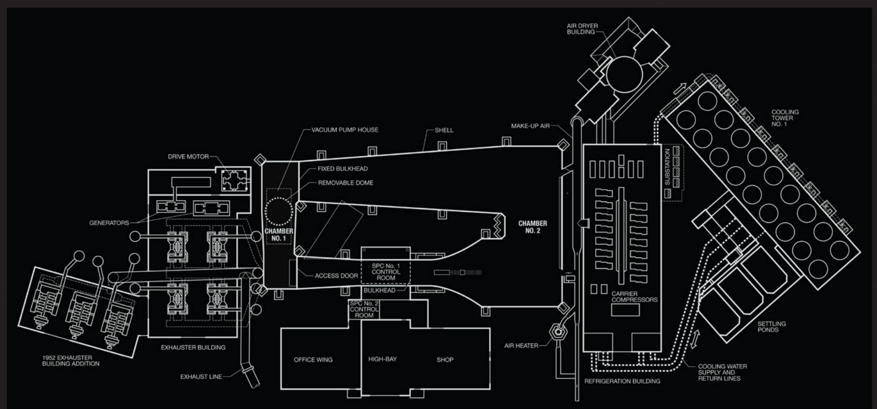
NASA Glenn Research Center Space Power Chambers

1959 to 1975



A Centaur 6A rocket is lowered into the Space Power Chambers' vacuum tank for a series of environmental tests. The chamber could simulate an altitude of about 100 miles, and create the cryogenic temperatures and radiant light of space. The chamber's dome and removable lid were added in 1963 specifically to accomodate the Centaur vehicle.

NASA LEWIS SPACE POWER CHAMBERS



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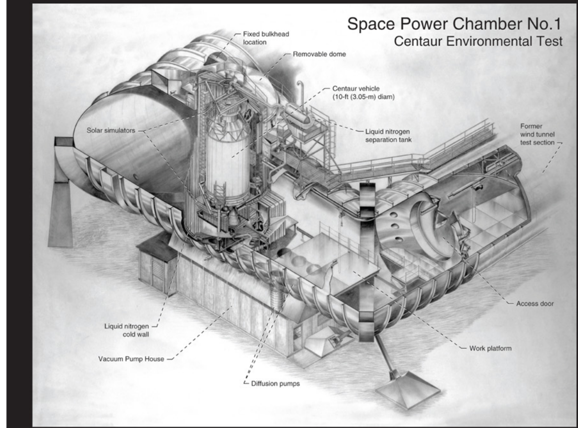
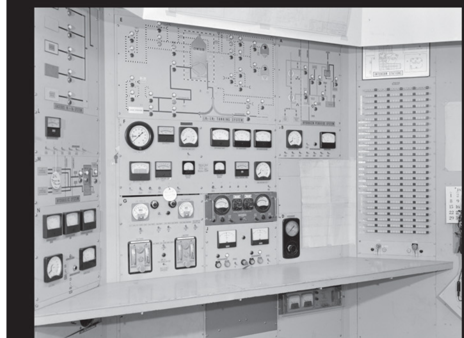
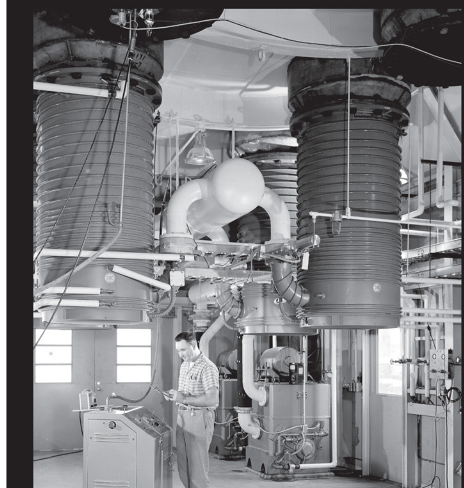


The Space Power Chamber facility was among the nation's first wave of large vacuum chambers that could simulate a space environment. Initial space flights during the late 1950s and early 1960s showed the behavior of engines, flight systems, and hardware was affected by the conditions encountered in space. Although larger chambers would later be constructed, the rapid conversion of the Altitude Wind Tunnel (AWT) into a space tank allowed the facility to play a vital role in the early years of the space program. The AWT had already served as the first engine research wind tunnel in the United States. In 1959 and 1960 the cavernous interior of the tunnel was used for a series of Project Mercury qualification tests and training sessions. Afterwards the tunnel's remaining internal components were removed. Bulkheads were placed inside creating two test chambers: one could simulate the vacuum, temperature, and radiation of space, and the other, the conditions experienced in the upper levels of the atmosphere. The space tank was used to conduct a series of long-term systems tests on a full-scale Centaur and nose cone separation tests for multiple Surveyor missions. The other chamber's investigations included Atlas/Centaur separation tests, shroud jettison studies for the Orbiting Astronomical Observatory missions, and a number of liquid hydrogen propellant management studies. Use of the Space Power Chamber declined after the Space Power Facility, the largest vacuum tank in the world, came online at Plum Brook Station. The Space Power Chamber was idle from the mid-1970s until its demolition in 2008.



Centaur tanking controls in the Space Power Chambers' space tank control room, which was located underneath the former wind tunnel test section. This new control room was intended to replicate the Centaur controls in the launch room at Cape Canaveral. The former wind tunnel control room, located above on the mezzanine level, was used to control the tests conducted in the larger test chamber.

During the conversion process, three bulkheads were placed inside the tunnel to create the two test chambers. This 31-foot-diameter bulkhead was located near the southeast corner of the tunnel. A man examines a viewing portal that allowed researchers to film the tests inside the space tank on the opposite side of the barrier.



Interior of the Vacuum Pump House located directly below the Space Power Chambers' vacuum tank. The pump house had 10 oil diffusion pumps that could evacuate the chamber to pressure levels found in space at 100-mile altitude. The tunnel's existing exhausters removed most of the air in the chamber, then these diffusion pumps created the final vacuum levels. The vents, which can be seen in this photograph hanging from the ceiling, fed directly into the bottom of the chamber.

Space Power Chambers' vacuum tank with removeable dome was located near the southeast corner of the former AWT. In 1961 and 62 the AWT was converted into two test chambers. After the acquisition of the Centaur Program in October 1962, it was decided to add this dome to the space tank so that a Centaur rocket could be stood up vertically inside. The addition of the dome delayed the use of the facility for nearly a year.

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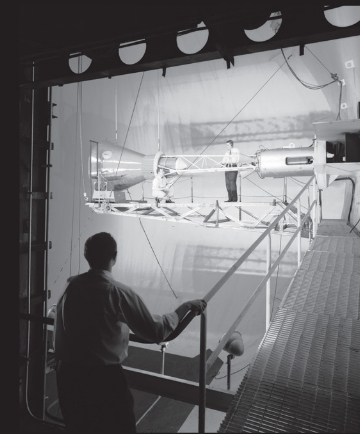
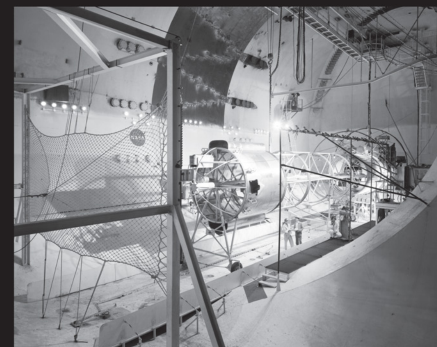
The Multiple Axis Space Test Inertial Facility, referred to as the gimbal rig or MASTIF, was initially installed in the facility to test the guidance system for Project Mercury's Big Joe capsule. It was modified afterwards to train the Mercury astronauts how to bring a tumbling spacecraft under control. An astronaut was secured in a foam couch at the center of the rig. The rig then spun along three axis at up to 30 rotations per minute. Using controls identical to actual flight equipment, they operated small nitrogen jets on the cages to slow and gain control of the rig.



In 1959, an interior section of the AWT was gutted so that several Project Mercury tests could be conducted in altitude conditions. These included the qualification of the escape tower rocket motors, seen in this photograph. The escape rocket could jettison the Mercury capsule away from the booster in case of an emergency. Three different motors were successfully fired in the tunnel, and thrust misalignment was studied on a fourth rocket.

After an error during the separation of the stages on the Atlas/Centaur-3 flight, NASA Lewis researchers conducted a series of shroud jettison tests in the Space Power Chambers' vacuum chamber. A new shroud was designed and the original test procedure was modified. The separation on the December 11, 1964, Atlas/Centaur-4 launch was flawless. In 1965, the SPC was used to qualify a modified shroud for the Atlas/Centaur-6 mission, which would be the first successful placement of the Surveyor model into an elliptical Earth orbit.



The first tests conducted in the new Space Power Chambers were a series of Atlas/Centaur retrorocket studies in September 1963. An Atlas/Centaur mass-model vehicle was placed horizontally on landing gear-type wheels in the larger test chamber with a net at the other end of the chamber to catch the Atlas mockup. After initial runs showed inconsistent behavior of the retrorockets, they were successfully redesigned by the manufacturer and qualified during another round of Space Power Chamber testing in 1964.

A Centaur 6A rocket is lowered into the Space Power Chambers' vacuum tank for a series of environmental tests. The Centaur's auxiliary propulsion, hydraulic, pneumatic, and electrical systems were tested during long periods in a space environment. The chamber could simulate an altitude of about 100 miles, and create the cryogenic temperatures and radiant light of space.

The large test chamber was used to qualify the shroud jettison system for the Orbiting Astronomical Observatory (OAO–1), a predecessor of the Hubble Telescope, in 1965. Both the Agena second-stage spacecraft and the OAO satellite were enclosed by the clam-shell shroud. The shroud consisted of three sections: the fiberglass nose, the aluminum midfarings, which separated when the Agena engines ceased, and an aft fairing which fell away with the Atlas upon separation from the upper stages. The shroud was qualified in the Space Power Chambers at altitudes of 20 miles.

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