# Facility
## B-1 and B-3 Test Stands



## SUPPORT BUILDINGS

*B Complex*

The B Complex included a number of components housed in external structures which allowed the B-1 and B-3 facilities to study rocket engines in an altitude environment. Elements of this infrastructure were also used by the Hypersonic Test Facility (HTF) and Space Propulsion Research Facility (B-2). The main components were the B Control and Data Building, Steam Plant, Pump and Shop Building, and propellant storage tanks.

## B CONTROL AND DATA BUILDING

The B Control and Data Building was constructed in 1960 to remotely control the operation of the B-1 test stand. By January 1963 plans were made to expand the facility to include control rooms for B-3 and HTF. Later, when B-2 began operating, its control room was also added. The reinforced concrete structure was located approximately 2300 feet southwest of B-1, and 2600 feet west of B-3. The distance protected the staff from possible explosions at the test site.

*B Control*

The B-1 control room was an L-shaped room that was separated off the eastern corner of the building. Two operators at the main facility control panels ran the test. Three technicians at the servo control panels monitored the pumps, servo controllers, amplifiers, servo control programmer, and over-speed indicators. B-3 and HTF shared a large area for both of their control rooms. The responsibilities and control panels were similar in nature to those of B-1.

Eventually the B Control and Data Building contained five control rooms, a terminal and instrument room, an office, equipment storage, a utility room, and a turret-like observation tower to view the test facilities. After being shutdown in 1974, the B Control and Data Building was reactivated in the late 1980s for B-2 and HTF testing. In the mid-2000s the B-2 control room was modernized as part of an overall modernization of the B-2 facility.

The H Control and Data Building, 5500 feet from B-1, contained the data acquisition equipment for all the Plum Brook facilities. The tapes from the analog and digital recording systems were sent to NASA Lewis' main campus to be processed. There an IBM 360 computer transformed the signals into plots and columns of tabular arrays.

**Documents:**

B Control Floor Plan (JPG, 3.62MB)
B Control Elevation Drawing (JPG, 1.09MB)

*B-1 Control Room*

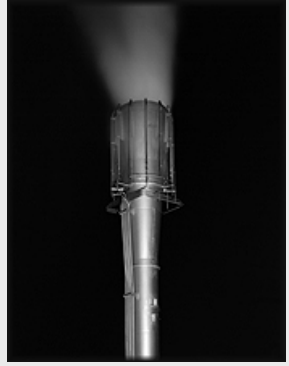
*B-3 Control Room*

*B Control Exterior*

## STEAM SYSTEM

A large steam-powered altitude exhaust system reduced the pressure at the exhaust nozzle exit of each test stand. This allowed B-1 and B-3 to test turbopump performance in conditions that matched the altitudes of space. The steam system included boilers, accumulators, valves, and ejectors. The Boiler House, located approximately 1000 feet west from the B-1 test stand contained four boilers that were similar to those used on World War II era battleships. A second boiler building was added during the construction of the new B-3 test stand.

Three 53.5-feet-long steam accumulators could store 42,000 gallons of steam and hot water. The steam stored in the accumulators was used to operate two large steam ejectors located outside B-1's southeast wall. A pressure regulating system in the nearby Valve House reduced the pressure at the exhaust duct to simulate



*Venting Ejector*

the altitudes of space. The steam system could furnish approximately 100,000 pounds mass of steam to the B-1 ejector system at B-1 which could support ejector operation at B-1 facility for approximately 6 minutes. A 54-inch diameter vacuum line was extended from to the ejector to the B-3 test stand. The B-2 facility was later connected to the system. B-1's steam system was rehabilitated in the early 1990s for B-2 testing.

**Documents:**

Steam Accumulator Drawing (JPG, 2.25MB)

*Boiler House*

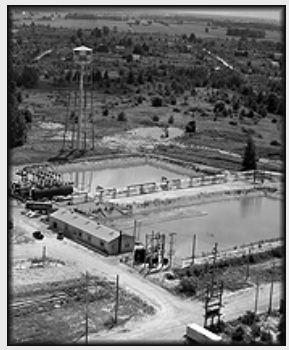
*Steam System*

*B-1 Exhaust Line*

## WATER SYSTEM

The Pump and Shop Building was a rectangular structure at the eastern edge of the two large water basins. The 142- by 300-foot pond to the west supplied fresh water and the 136- by 200-foot one to the east was used for waste water. Water from the basin entered the structure through gates in three concrete bays. Two pumps were located in the southern half of the basement. Their 12-inch diameter intake lines were tied to a single inlet bay. Water was pumped through these lines then a single 18-inch-diameter line to the test equipment. Two larger pumps were located in the northern half of the basement. Each of these had its own 42-inch-diameter intake line and bay. The exit lines merged into a 54-inch-diameter pipe.

The B-1 test stand was originally designed to hot-fire rocket engines, but it was never used in this capacity. The Pump and Shop Building and the two rectangular basins were intended to cool the rocket exhaust, but they were never utilized



*Pump and Shop Bldg*

**Documents:**

Pump House floor plans (JPG, 3.93MB)
Retention Ponds drawing (JPG, 3.79MB)

*Steam venting*

*Pump House*

*View from B-1*

## PROPELLANT STORAGE

A number of ground level semi trailers, fixed gas storage bottles, and mobile liquid dewars were used to store the gaseous and cryogenic materials for the B-1 and B-3 test stands. The cryogenics were used primarily to fuel the rocket engines, and the gases were used to pressurize and inert the system. The liquid hydrogen was pumped through a vacuum-jacketed line to the tank at the top of B-1. It was pumped from the tank through the engine during the test runs. Initially B-1 used two trailer truck dewars and 100,000 cubic feet of permanent storage to supply each test run with cryogenic fuels. An external pump was used to transfer the fuels to the top of the test stand.

Vacuum jacketed lines could supply 800 gallons per minute to the test stands. A 200,000-gallon dewar, the world's largest liquid hydrogen dewar at the time, was installed at the B Complex in 1963. The $382,000 tank was 37 feet in diameter with a volume of 26,800 cubic feet.


*Hydrogen Dewar*

Four 4500-gallon tanker trailers supplied the liquid nitrogen for B-3. They connected to a manifold at the test stand's base. Gaseous nitrogen was used to purge the liquid nitrogen lines and electrical equipment after each test run and to pressurize the shroud payload area and valve operators. B-1 included a large nitrogen system to purge the exhaust duct, a vent stack, a pump, a reactor, and a terminal. A single helium trailer was used for each test run to purge the test equipment and keep the reactor and observation windows free of frost. At B-3, two 780,000 cubic foot railroad car tanks and four 70,000 cubic foot trailer tanks were used for each test. A gaseous nitrogen bottle farm was a backup for the valve operators. A similar setup was used for gaseous helium. The helium was used to pressurize the shroud tank section and to inert the liquid hydrogen lines.

*New Tank*

*Hydrogen Trailers*

*Propellant Lines*