By the late 1950s research engineers and scientists working at Lewis Flight Propulsion Laboratory believed that hydrogen was the optimum fuel, and oxygen the ideal oxidizer for upper-stage rockets. However, before NASA researchers could achieve the theoretical advantages of hydrogen/oxygen propulsion, they had to develop practical solutions for the engineering problems involved in deriving such a propulsion system. The first major issue was that hydrogen is a powerful fuel that must be handled carefully to minimize the risk of explosion. In addition, large quantities of hydrogen were not available during the early years of the rocket research program.

From a practical standpoint, many rocket engineering design problems could be resolved using other, readily available fuels. In addition, the testing and operation of prototypical rocket engines would be useful regardless of which reactants were used. Consequently, the first experimental engines tested at the Rocket Engine Test Facility were gasoline-fueled and run on the 39-kilowatt (20,000-hp) high-thrust vertical test stand.

Researchers followed standard operating procedures to prepare an engine test. Gasoline was pumped from a mobile tank-car trailer into cylindrical tanks housed in the fuel pit. These tanks were located in a framework that contained load cells in the suspension. The load cells weighed both empty and full tanks. The weight was measured before fuel was being drawn from the tank. By computing the weight of a fuel tank, the weight of the tank after fuel was used in a test, researchers could accurately determine the amount of fuel consumed during the test. They could then calculate the rate of fuel use by plotting the weight against time. Variable-positioned hydraulic valves regulated the amount of nitrogen gas flowing into the fuel tanks. The pressure of this gas forced fuel from the tanks and into the rocket engine being tested.

Liquid oxygen was transferred from a mobile tank-car-trailer into a double-walled, vacuum-insulated tank called a " Dewar." These liquid nitrogen baths around the piping and tanks caused the oxygen to remain liquid. Helium gas under pressure forced the liquid oxygen from the tanks and into the engine being tested.

Either a high- or low-pressure tank supplied water that cooled the rocket engine under test. This water was transported using a 1,450 - 2 or a 600- gallon-per-minute pump.

There was always some risk that an engine would explode during a test. The test stand itself was constructed with blast doors and louvers that remained open during tests. In addition, a frame of Building 20 was used to support the "frame" section of the test cell. Water pipes with several nozzles were installed on three sides of the cell, and this pipe was connected to the 500,000-gallon water reservoir located next the test cell. Carbon dioxide could be released to extinguish any fire that started during a test.

The primary cooling, hydrocarbon fuel, and liquid oxygen systems were rated at 5,000 psi working pressure. On-site storage systems for liquid nitrogen could hold 28,000 gallons, while the capacity of liquid oxygen storage was 2,000 gallons. After 1979, 18,000 gallons of liquid nitrogen could be stored on site. The pumping facilities could supply gaseous helium at 6,000 psi and gaseous nitrogen at 3,000 psi for the gas pretreatment systems.

The rocket engine being tested would be instrumented with load cells, strain gages, thermocouples, and pressure gages. These sensors (which were connected by wires, pressure and sensor output lines) to terminal blocks and amplifiers. These sensors would then be amplified before transmission to the control room located 1600 feet away. The sensors would be transmitted over data transmission cables to the control room recording and readout devices (Building 100 data recording).