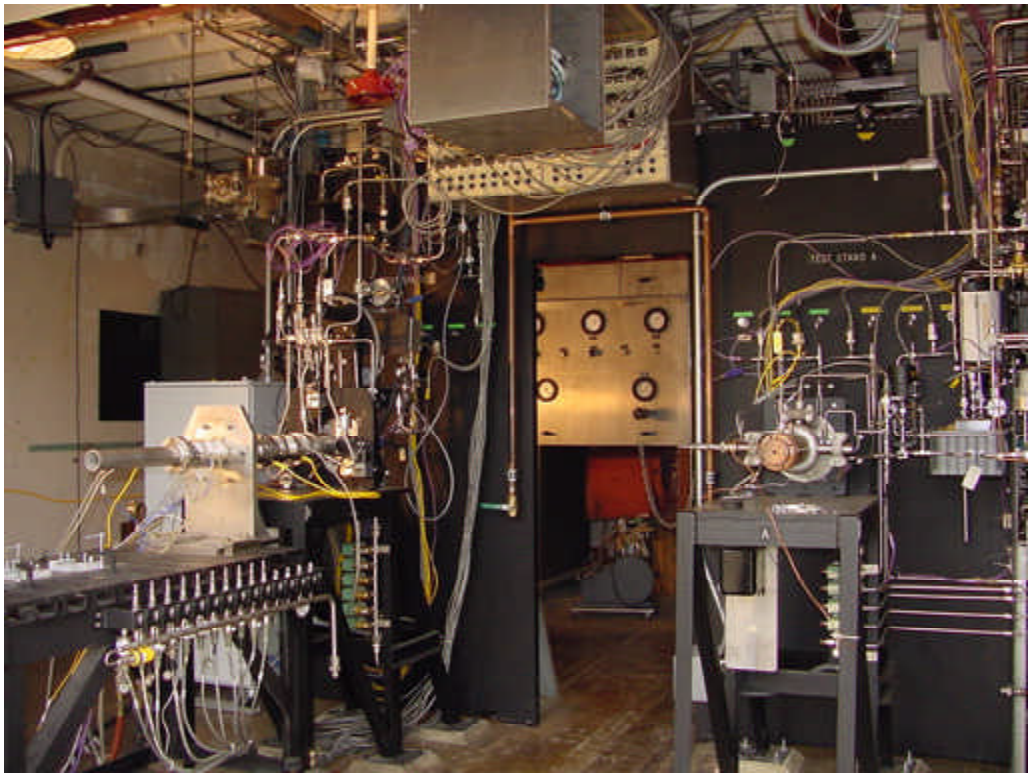
Research Combustion Lab Facility Capabilities and Throughput Enhanced by New Test Stands

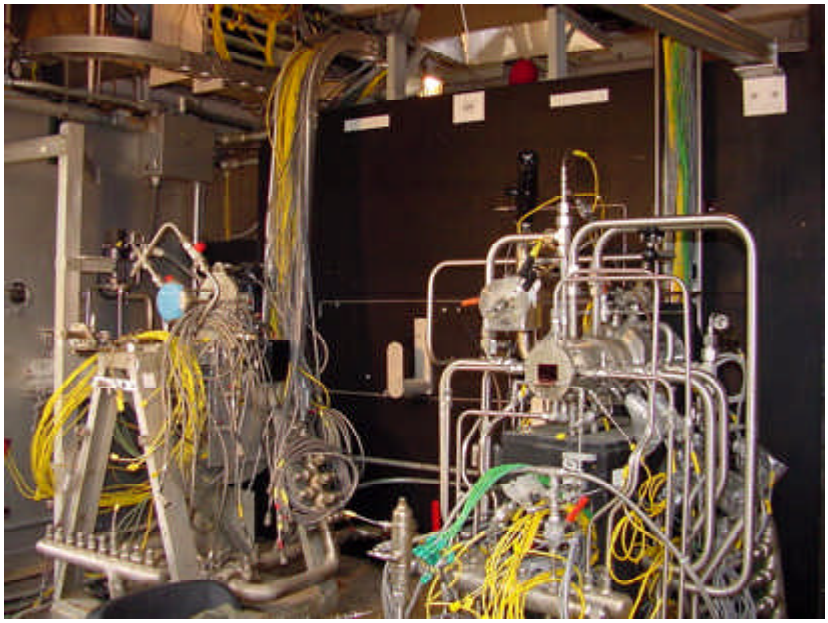


Test Cell 21: The original stand position is on the right. The new second stand is on the left, ready for pulse detonation engine testing.

Long description of figure 1 A view of cell 21 looking into the test cell toward the two test stands. The original test stand location on the right has a small copper rocket engine mounted on the stand. The new stand, located about 4 feet to the left, has a long pulse-detonation combustion engine mounted on it. To the rear of the two stands can be seen a bulkhead with feed line outlets that can be switched at common valves behind the bulkhead to supply either stand. A gauge panel is visible through a doorway in the bulkhead at which various purge pressures are set. A connection panel for instrumentation wiring can be seen above the stands.

A second test stand has been added to each of two test cells in the Research Combustion Laboratory at the NASA Glenn Research Center. This increased capacity will allow for faster buildup and transition between test programs supporting propulsion research, combustion studies, and advanced materials and structures evaluation. Cell 21 now has two stands capable of supplying gaseous or liquid oxygen, gaseous hydrogen, and gaseous or liquid hydrocarbon propellants (see the preceding photograph). It provides smaller flow rates to support ignition system testing and subscale propulsion research. Cell 22 has two

larger stands providing gaseous hydrogen and oxygen propellants, and also can supply high-pressure cooling water (see the following photograph). It is used primarily to support research testing of high-temperature composite materials and structures at typical rocket engine operating conditions.



Test Cell 22: Left: Original stand. Right: New stand being prepared for an advanced materials nozzle extension test.

Long description of figure 2 A view of cell 22 looking into the test cell at the two test stands. Both stands are about 46 inches high. The original stand is on the left, and there is a typical small engine injector mounted on it, about 5 inches in diameter. The new stand to the right has an engine assembly with a square chamber and nozzle mounted on it. This engine generates high-temperature exhaust for composite material structure exposure tests. Many cooling water supply lines to the engine chamber can be seen. Behind the two stands is a common bulkhead, which separates the stands from the control valves. Large bundles of instrumentation cables run from the overhead down to the test stands along the face of the bulkhead.

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In each cell, common controls operate the majority of the valves feeding the two stands. Feed line switching is done downstream of the main control valves by changing the connecting lines from the valve to the test article. Cell 21 also has auxiliary valve actuation on each stand to allow for close coupling at the test article. Each cell has a single data system that uses a central patch board to switch between the two test stands' instrumentation configurations. Switching between stands can be done rapidly, in some cases on a daily basis depending on the complexity of the individual test.

The two cells share gaseous oxygen and hydrogen supply trailers, and are typically run on alternating days or sometimes weeks. With the addition of the second stands, each cell can now accomplish more test preparation activity while the other cell is running. The new

stands allow for greater flexibility in scheduling tests and provide for more efficient means of utilizing "unplanned" downtime. If a particular test program is delayed because of test hardware delivery or operability problems, another program can be ready and waiting to take advantage of the available time.

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