Propulsion Systems Laboratory No. 1 and 2 (PSL)

HISTORY

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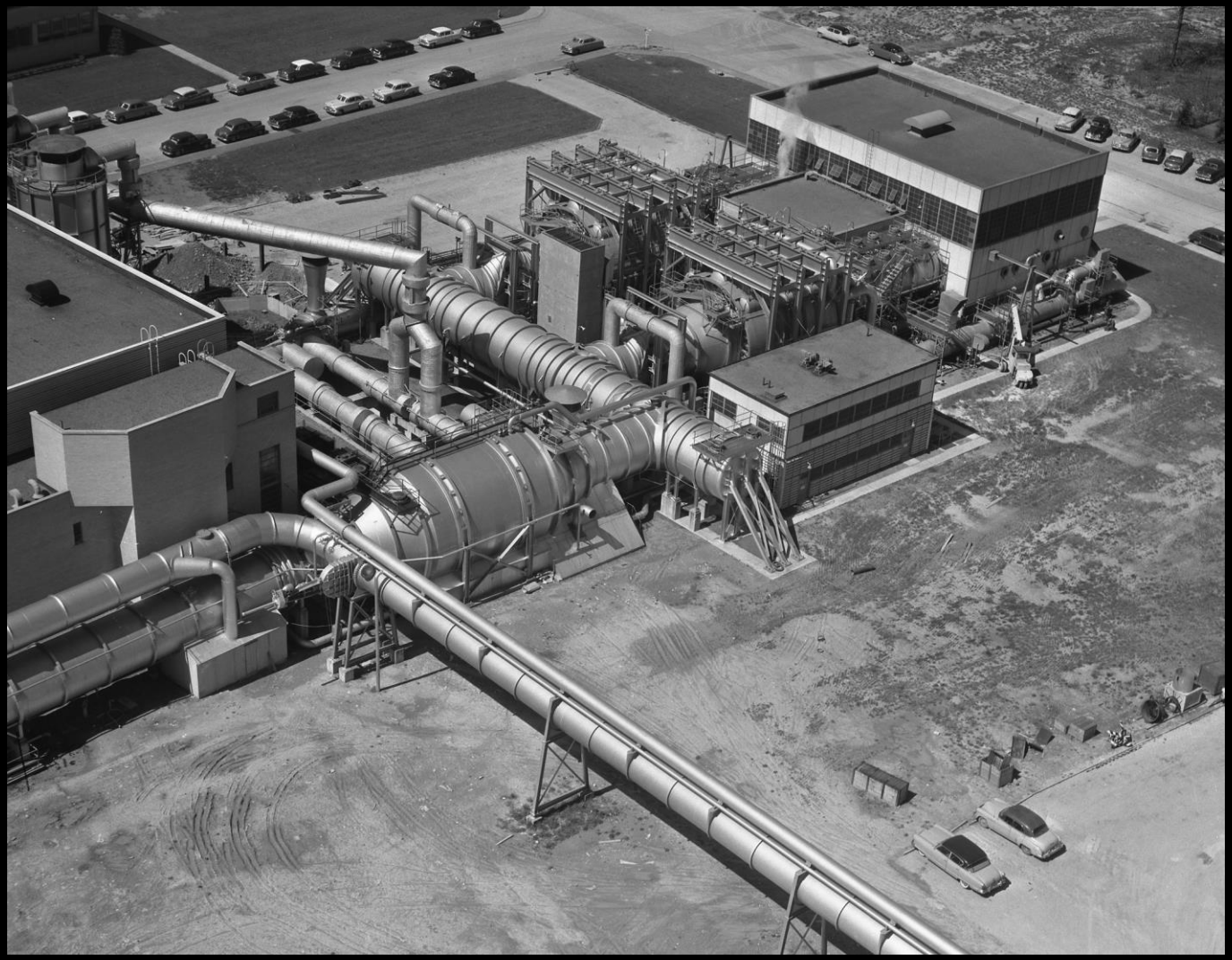
NASA Glenn Research Center has been at the forefront of jet and rocket engine studies in general, particularly under altitude conditions. The Altitude Wind Tunnel and the Propulsions Systems Laboratory were primary components of the center's research. The ability to test full-size engines instead of just a single cylinder, as was previously done, resulted in a more rapid transition from design to flight testing.

The Propulsion Systems Lab (PSL), which could test engines at altitudes up to 70,000 feet, began operating in 1952. In 1972, two new, upgraded chambers, PSL No. 3 and 4, were added to the facility. Use of the original PSL chambers was reduced until they were shutdown in 1979.



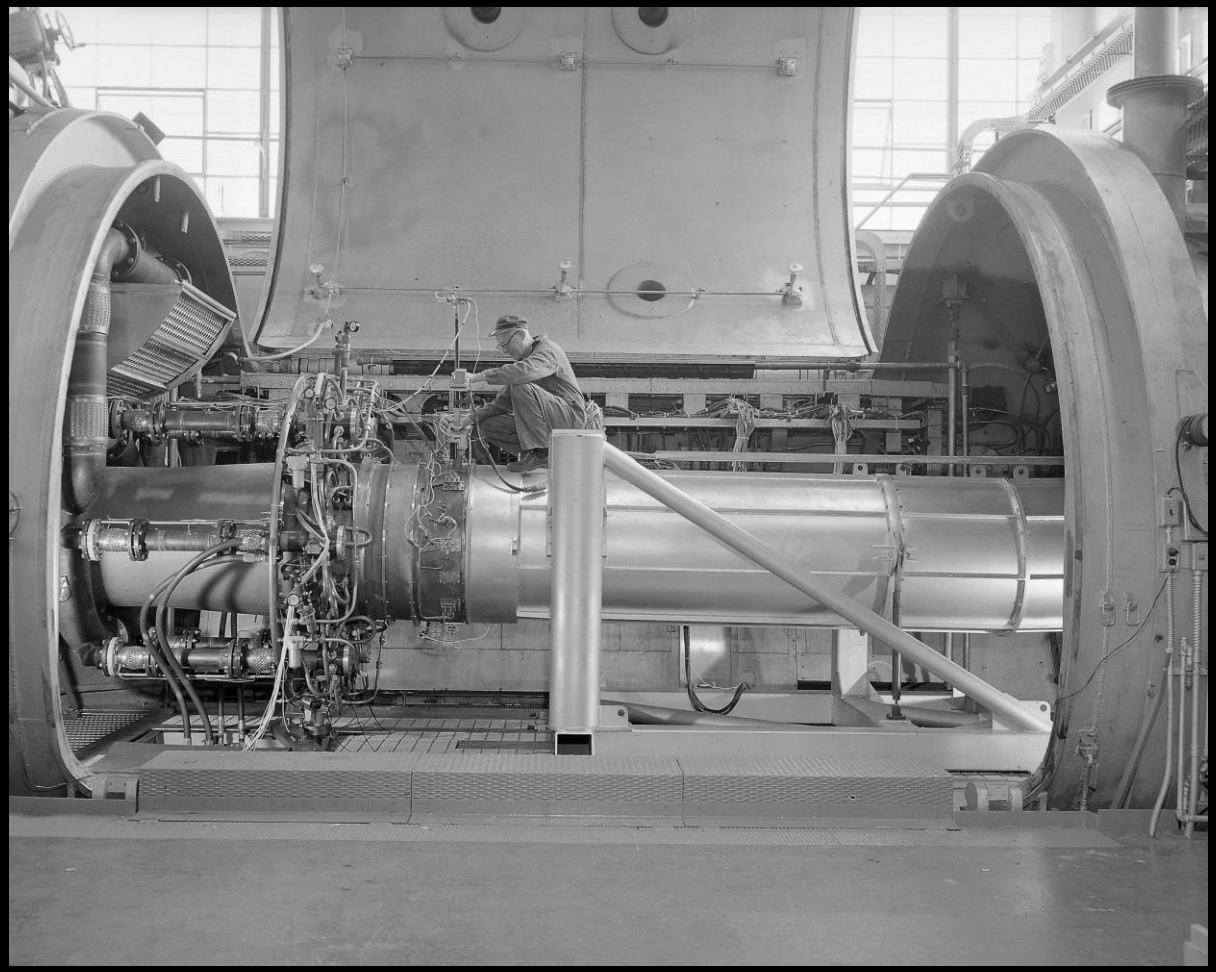
Propulsion Systems Lab No. 1 and 2

Construction of PSL No. 1 and 2

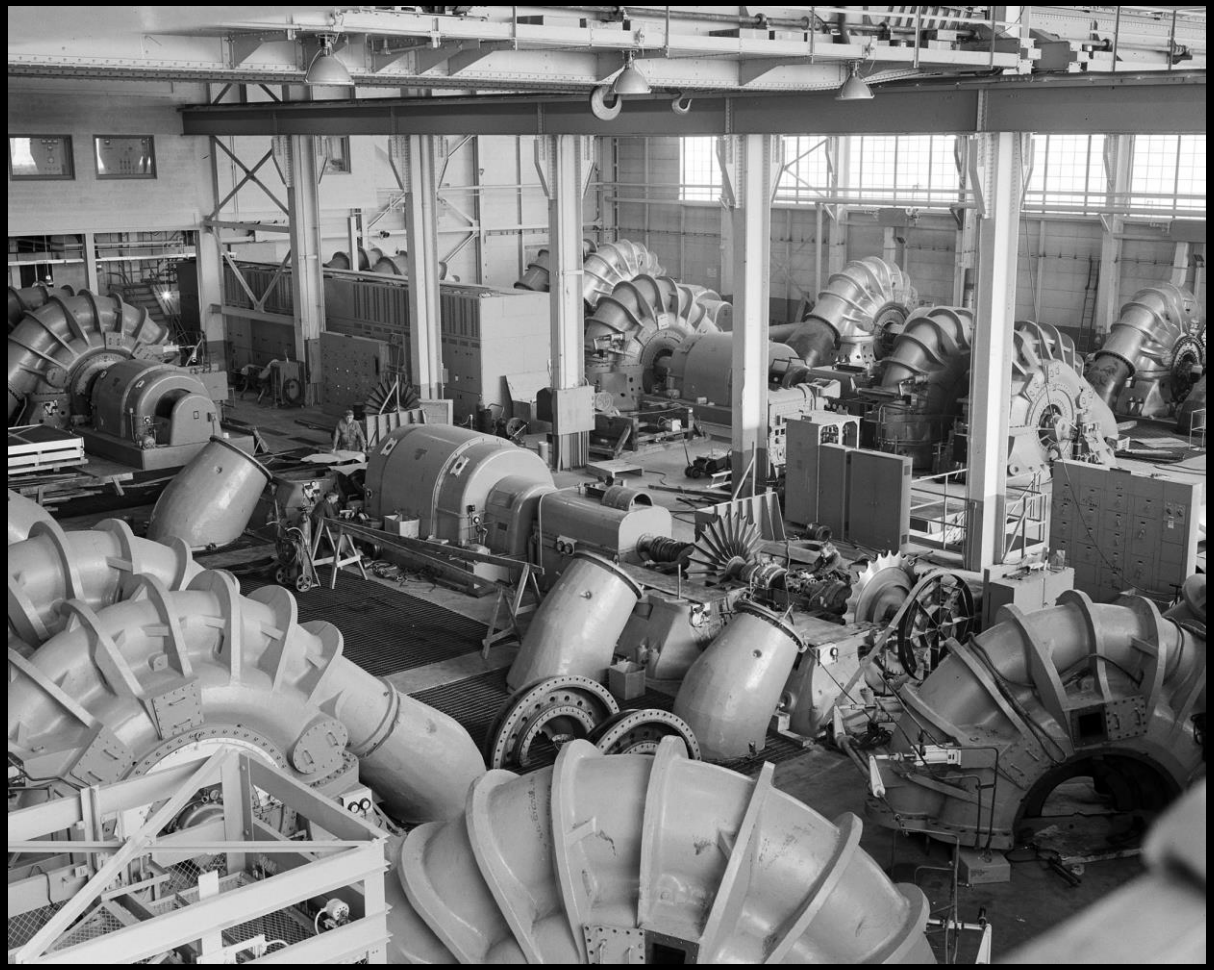
PSL Construction

By the mid-1940s it was clear that the power of the turbojet would require new test facilities. Almost immediately after the war, design work on the 8-By 6-Foot Supersonic Wind Tunnel began. Once that facility began operating in 1949, NACA Lewis engineers began planning the Propulsion Systems Laboratory, or PSL.

The PSL, which first operated in 1952, consisted of two 24-foot diameter and 14-foot long test chambers capable of firing full-scale turbojet, ramjet, and rocket engines at altitudes of up to 70,000 feet. Its massive exhaust system improved overall capacity of the Engine Research Building and Altitude Wind Tunnel, as well.



PSL Tank No. 2



Exhausters in PSL Equipment Building

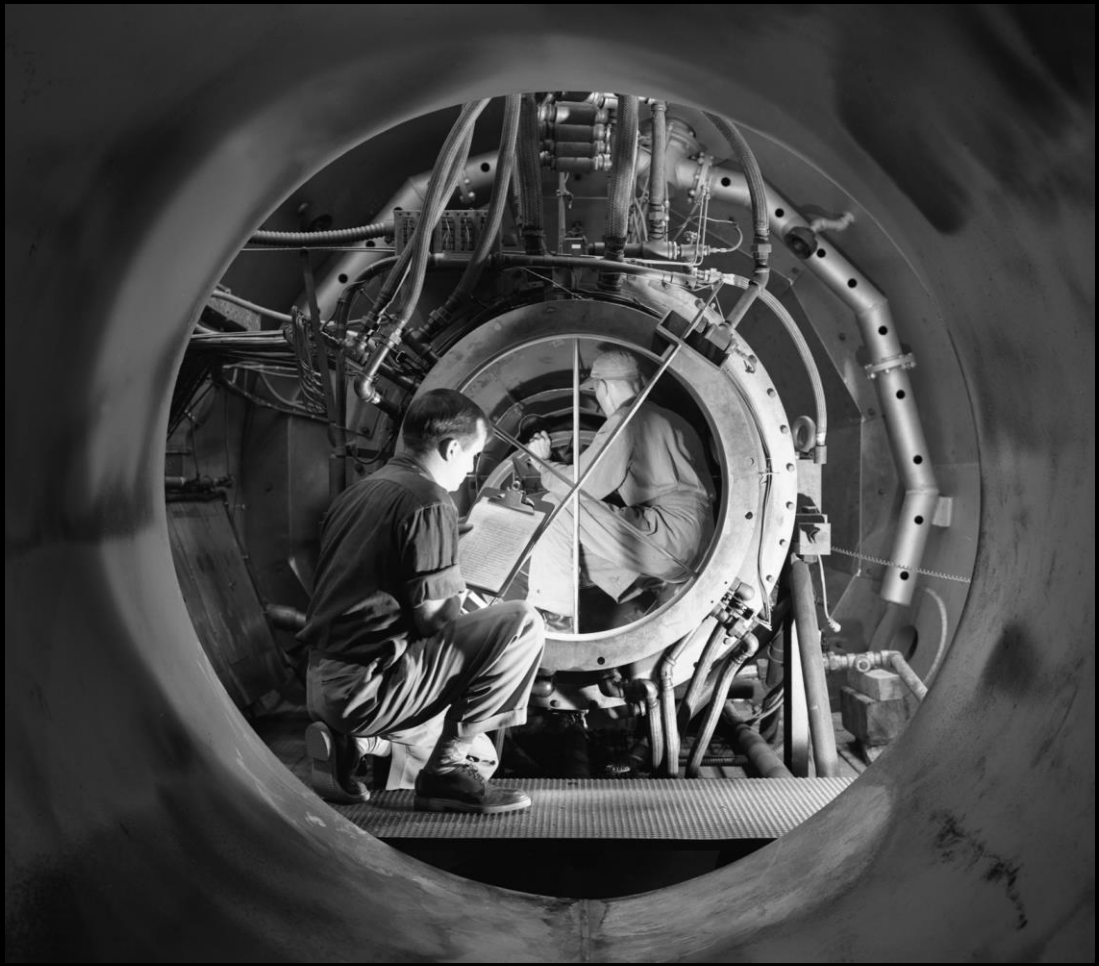
48-inch Ramjet in PSL No.1

PSL Testing

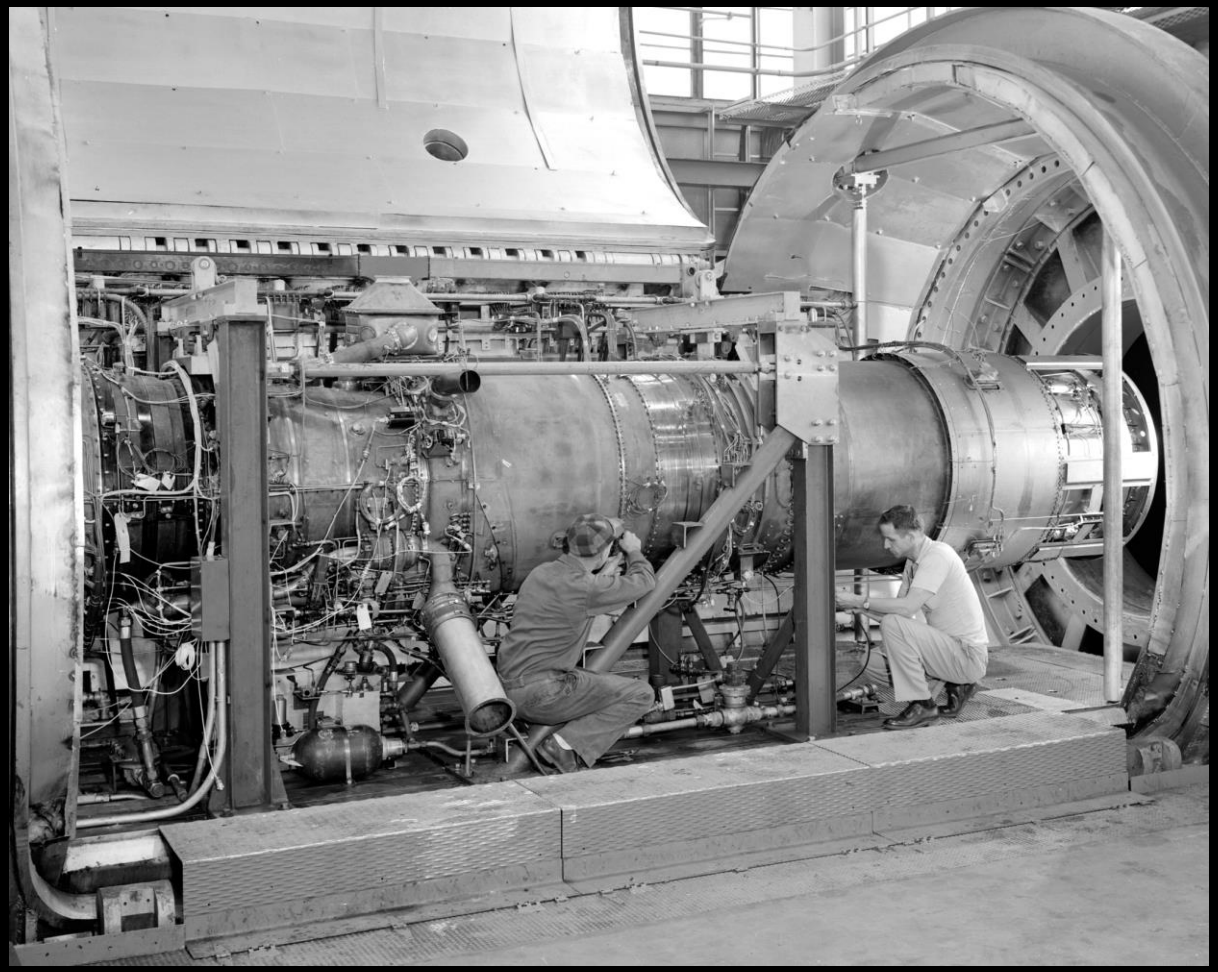
PSL No. 1 was initially used to examine turbojet engines, but after the Sputnik I launch, it was used for mainly missile studies. From the beginning, PSL No. 2 was used for ramjet and rocket studies, but later became involved in more complex rocket systems.

One of the first PSL tests investigated a 48 inch ramjet for the Navajo Missile Program. These ignition and inlet tests lasted for several years. By that time the need for such a missile had diminished, but the research improved future ramjets.

Other early tests included the Bomarc ramjet, the J79 engine, and 2.5k and Isentropic rockets.



Technicians install a 48-inch ramjet in PSL No.1

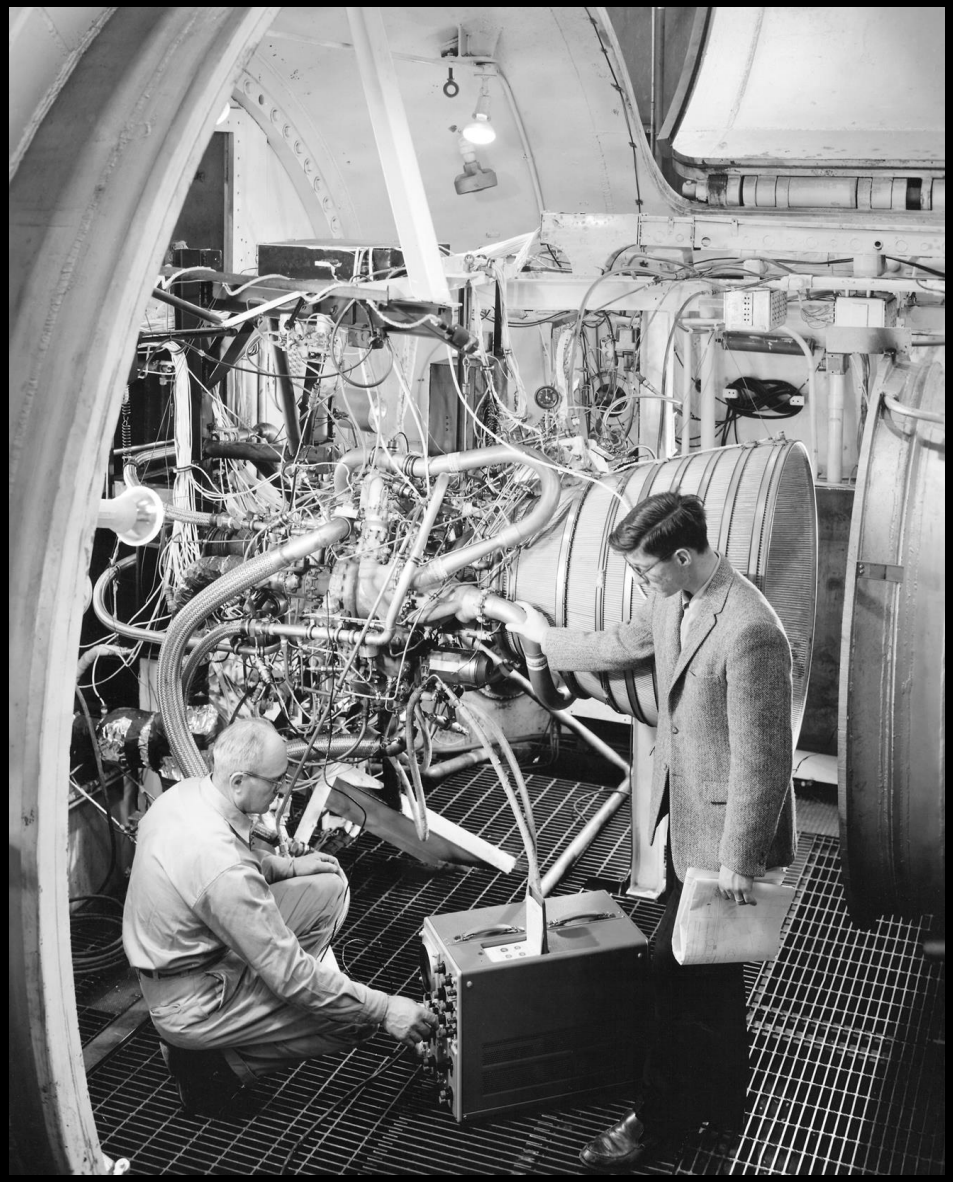


PS–13 Iroquis turbojet engine in PSL

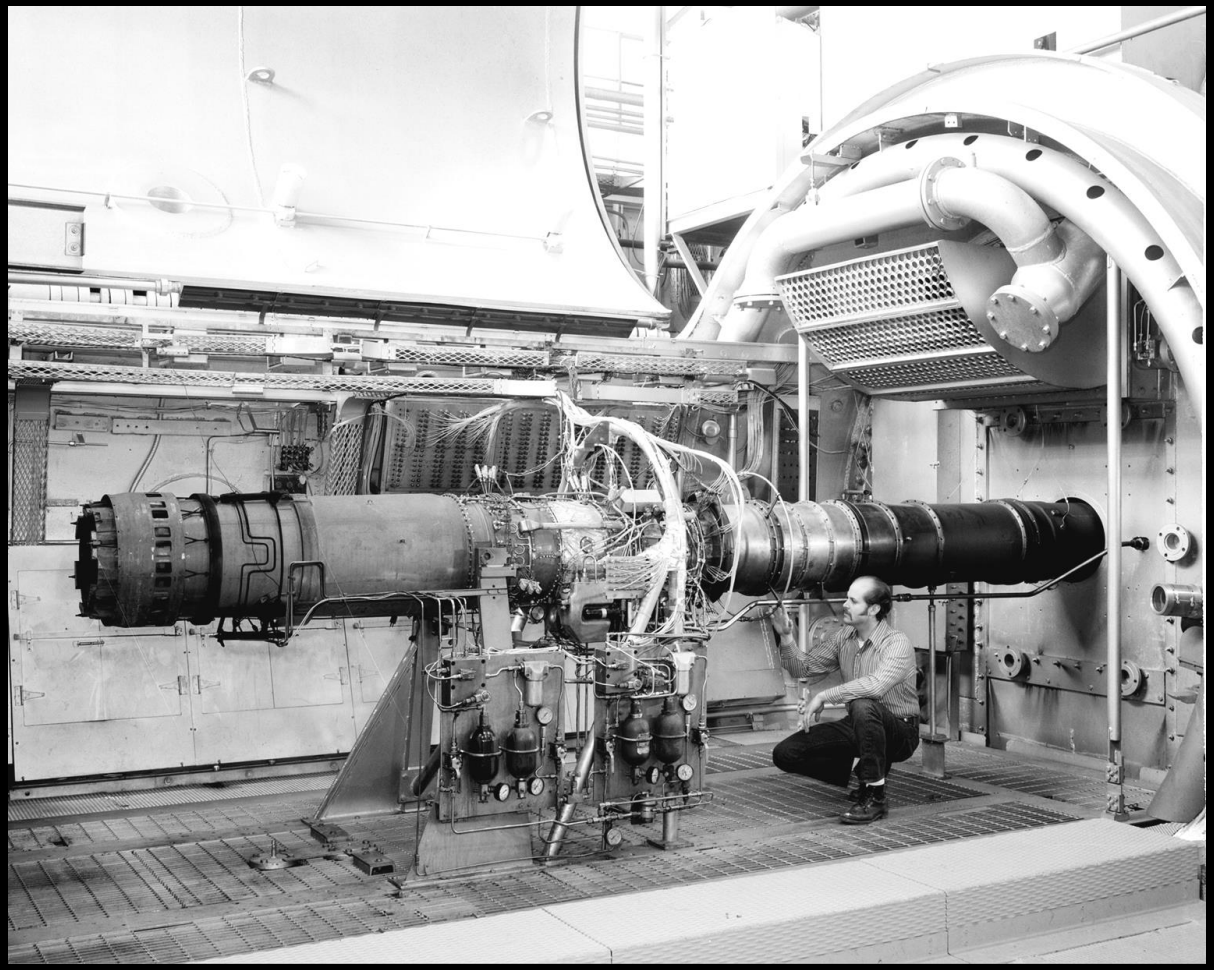
1960s Testing

By the 1960s, both PSL chambers were used for rocket engine studies. Some of the PSL's most important tests were in the mid-1960s on the RL-10 engine, which was used to power the Centaur rocket.

By the late 1960s, PSL research returned to turbojets, including exhaust nozzle and hypersonic tests. The PSL chambers were used to improve the GE 1/10, TF30-P-3, TFE-731, and F-104 aircraft's J85 engines.



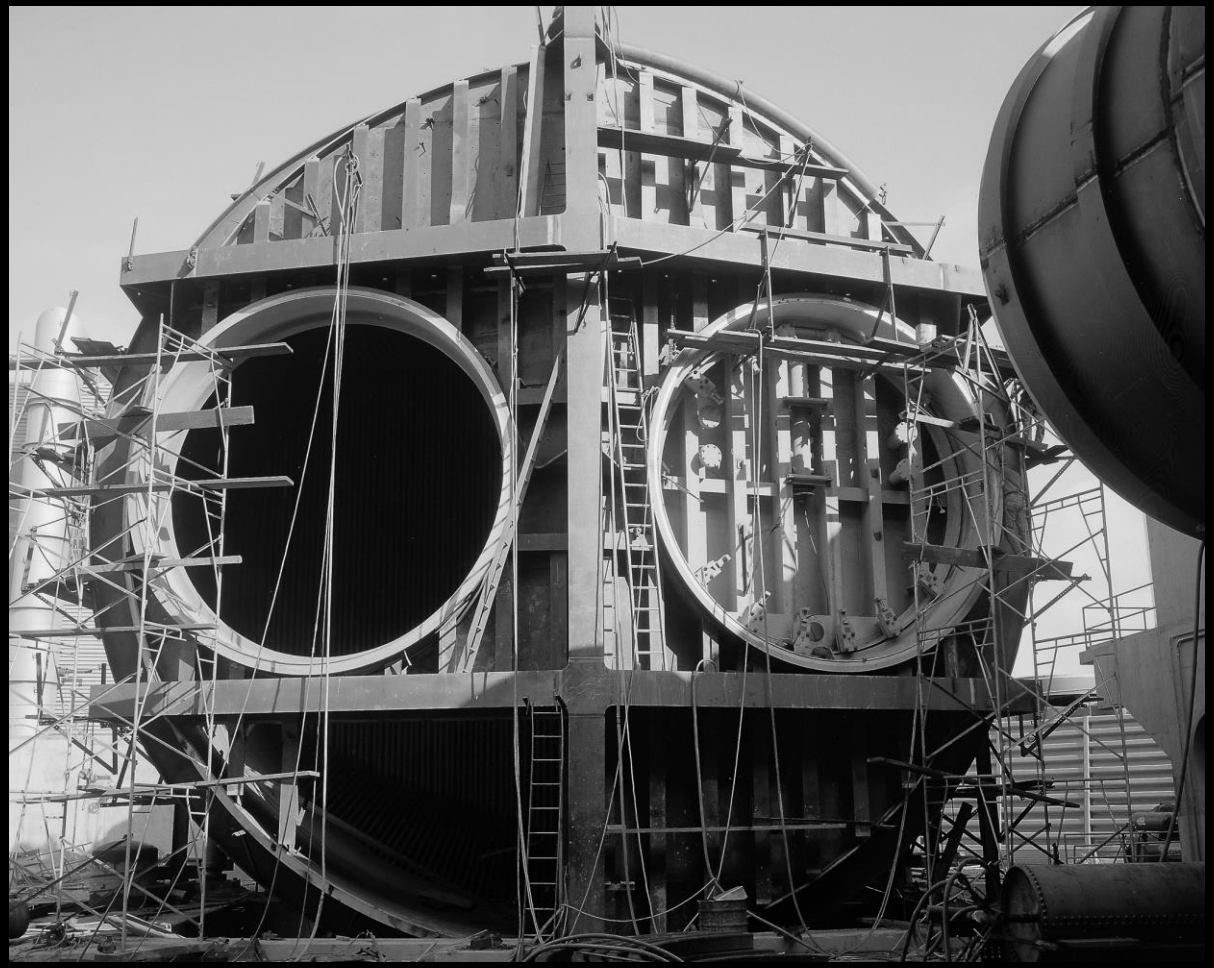
RL–10 rocket engine testing in PSL



General Electric J85 turbojet engine in PSL

Final Years

In 1967, plans for two new and improved PSL altitude chambers were underway. These new cells, PSL No. 3 and 4, began operation in 1973. The new chambers, capable of simulating altitudes of up to 90,000 feet and producing speeds up to six times the speed of sound, continue a busy schedule today. The original two chambers were gradually phased out and ceased operation in 1979. The F-100, J85, and F-401 were among PSL No. 1 and 2's final tests.



Construction of PSL No. 3 and 4

PSL No. 3 and 4

Summary

PSL and the Altitude Wind Tunnel have played a significant role in the improvement and development of turbojet, ramjet, and rocket engines. PSL and AWT were groundbreaking facilities, capable of operating full-size engines in simulated altitude conditions. This was almost unheard of when they were constructed and is unique even today. Unfortunately the capabilities of PSL and AWT are not robust enough to be used for today's engines. Despite the fact that these facilities are being demolished, NASA Glenn is endeavoring to preserve and share their history.

PSL No. 1 and 2 interior today

PSL No. 1 and 2