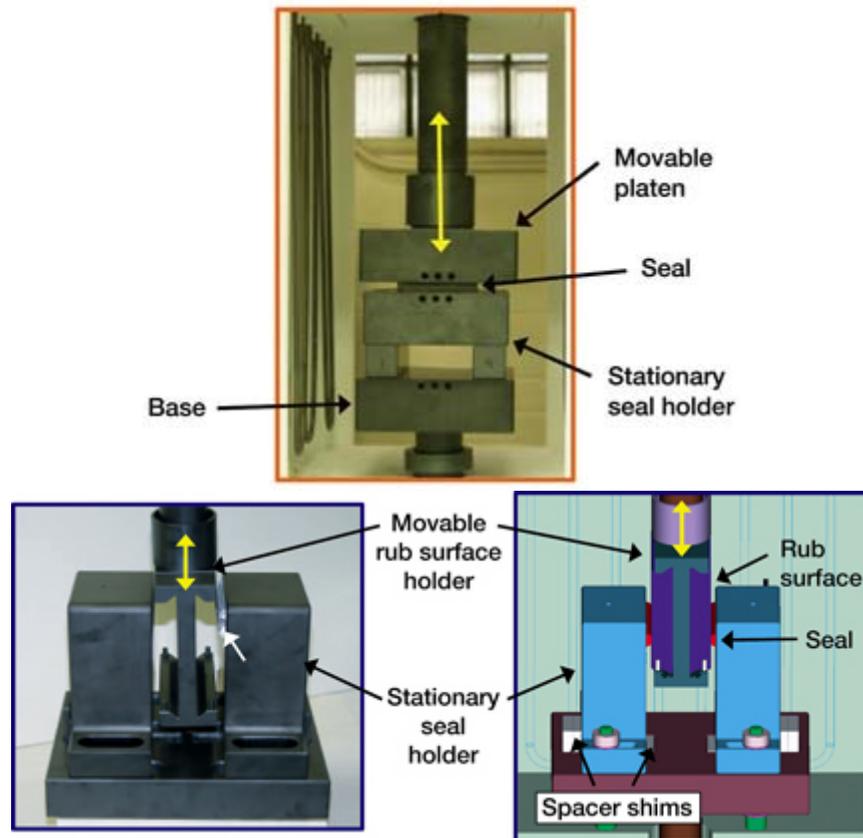


# NASA Glenn's Seals Group Inaugurated a New State-of-the-Art High-Temperature Test Rig

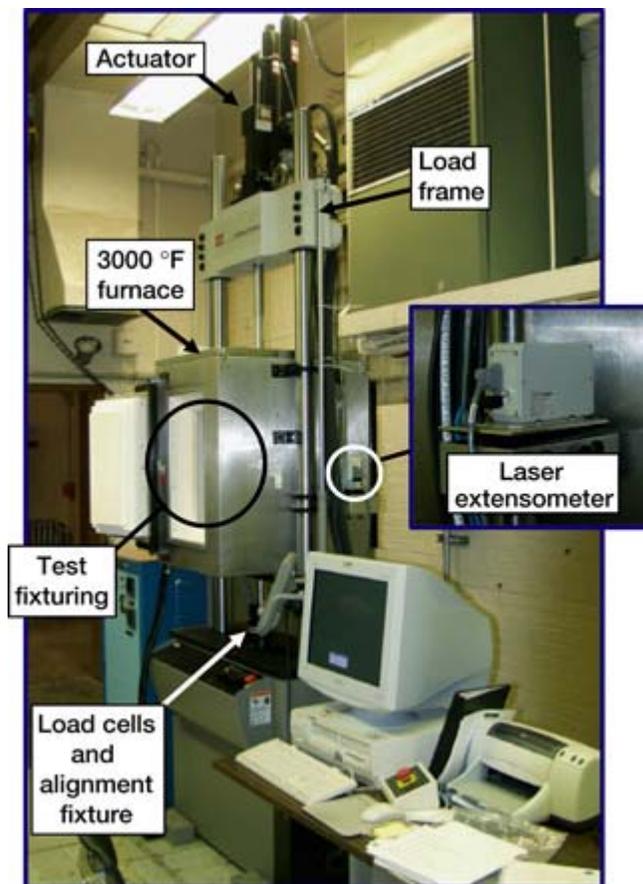
The NASA Glenn Research Center is developing advanced control surface seals and propulsion system seals for future space and launch vehicles. To evaluate new seal designs, the Glenn Seals Team recently inaugurated a new state-of-the-art high-temperature seal test facility. The Hot Compression/Hot Scrub Rig can perform either high-temperature seal-compression tests or scrub tests at temperatures of up to 3000 °F by using different combinations of test fixtures made of monolithic silicon carbide (Hexoloy  $\alpha$ -SiC), as shown in the following figures. For lower temperature tests (up to 1500 °F), Inconel X-750 test fixturing can be used.



*Top: Compression test fixturing used in Glenn's Hot Compression/Hot Scrub Rig.  
Bottom: Photograph (left) and schematic (right) of scrub test fixturing used in Glenn's Hot Compression/Hot Scrub Rig (rub surfaces not shown on left).*

The main components of this test rig are a servohydraulic load frame, an air furnace, and a noncontact laser extensometer (see the final photograph). The load frame has a top-mounted actuator that is connected to the appropriate fixturing and that can generate a

load of 3300 lb over a 6-in. stroke. Dual servovalves control movement of the actuator at rates from 0.001 to 8 in./sec. This allows the actuator to move very slowly for the compression tests or quickly for the scrub tests. Computer control of the hydraulic system permits several loading profiles to be used, including monotonic, cyclic, stress relaxation, and mission-simulated duty cycles. A box furnace with a working volume that is 9 in. wide by 14 in. deep by 18 in. high is installed between the columns of the load frame. Kanthal Super 33 (Kanthal AB, Hallstahammar, Sweden) molybdenum disilicide ( $\text{MoSi}_2$ ) heating elements heat the furnace to temperatures up to 3000 °F. The stationary base for each set of test fixtures rests on a tube that passes through an opening in the bottom of the furnace. A load cell (either 500 or 3300 lb) is attached to the base and stationary fixturing. The load cells are used to measure compressive loads applied to the seals during a compression test or frictional loads on the seals during scrub testing. Underneath the load cell is an alignment fixture that permits precise alignment of the load train.



*Major components of Glenn's Hot Compression/Hot Scrub Rig.*

Over the past year, the Hot Compression/Hot Scrub Rig was used to support many projects, including the testing of advanced preloader concepts (canted coil springs and  $\text{Si}_3\text{N}_4$  compression springs) and evaluation of next-generation seals for propulsion applications. In addition, the Glenn Seals Team conducted tests on advanced thermal protection system seals for the Boeing/Air Force Air Vehicles Technology Integration Program and provided testing support for Glenn's Supersonic Parametric Inlet Project.

**Find out more about this research:**

**Structural seals and thermal barriers** at  
<http://www.grc.nasa.gov/WWW/structuralseal/>

**Glenn's Mechanical Components Branch** at  
<http://www.grc.nasa.gov/WWW/5900/5950/>

***Bibliography***

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