"4-for-4!": Successful X-33 Rocket Engine Tests Continue at Stennis

A NASA and Boeing test team at NASA's John C. Stennis Space Center has successfully completed the fourth of the first four tests on the powerpack for the XRS-2200 linear aerospike engine for the X-33 reusable launch vehicle (RLV) technology demonstrator.

This test of the powerpack -- which includes the turbomachinery and gas generator -- ran a program duration of 45 seconds, with a start to the 80% power level, transition to mainstage operation at 100% power and then throttling down to 57% power. Preliminary test data indicates normal shut-down with no anomalies.

"A string of four successes in the first four tests of a new engine powerpack is unheard of in this business and is a major milestone in bringing the X-33 aerospike engine to flight readiness," said Steve Bouley, Program Manager for the Linear Aerospike Engine at the Rocketdyne Propulsion & Power segment of The Boeing Company. "Our success here, combined with the progress we are making back at the Canoga Park facility in the fabrication and assembly of the engine is a significant achievement for the entire team. I am proud of the work they have done and I am grateful for the tremendous support we have received from our NASA teammates."

The progress that has been made to this point is a tribute to the ability of the design and manufacturing teams to meet technical challenges presented by the uniqueness of the aerospike configuration and a new development reality that requires engineers to design and develop engines at less cost and in far shorter cycle-times than ever before. The linear aerospike engine actually utilizes a design first developed at Rocketdyne in the early 1970's and incorporates hardware from Apollo-era J-2S engines.

"We took on an exciting challenge," said Bouley. "We are developing 21st Century propulsion technology from a combination of 1960's hardware, several decades of engine designs, and 1990's design/analysis tools and fiscal realities in a new era of commercially-driven space flight."

The team located suppliers who more than 30 years ago had manufactured the original J-2S heritage engine hardware, on which the aerospike's turbomachinery design is based. Suppliers that were still in existence were contracted to provide the program with newly built J-2S hardware. In cases where suppliers were no longer in business, a new generation of suppliers was identified to produce new hardware to heritage designs.

The panels that make up the unique aerospike nozzle also presented a significant design challenge. The aerospike nozzle is in the form of a large curved ramp -- unlike the traditional bell-shaped nozzles characteristic of most rocket engines. The thermal and structural loads experienced by the nozzle required the development of new manufacturing processes and tooling to fabricate and assemble the nozzle hardware. The team found a way to accommodate the significant thermal expansions and induced mechanical forces in the mechanical and brazed joints of the assemblies. Appropriate materials and attachment techniques were identified and effective manufacturing processes were developed.

"We have successfully completed braze of the first flight ramp and we have fabricated and assembled the parts for the first thrusters," said Bouley. "With completion of these milestones the the engine is proceeding through fabrication, test and delivery to support the planned first flight in 1999."

While progress continues on the fabrication and assembly of the engine components, the test team at Stennis will complete the remaining 3 tests for this powerpack assembly. Three additional powerpack assemblies and four full-up engines, including two flight units, are planned for testing during the remainder of the development program.

The X-33 team at Rocketdyne anticipates delivering the first flight engine in September 1999. An industry/government team at the Lockheed Martin Skunk Works in Palmdale, Calif, is developing the X-33 suborbital technology demonstrator. First flight of the X-33 from Edwards Air Force Base is now scheduled for December 1999.

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