

Powerpack Testin of the J2-X Oxidizer Turbopump

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The J-2X PPA-2 (Powerpack 2) test series was conducted from February through December 2012 on the A1 test stand at NASA Stennis Space Center in a joint effort between Pratt & Whitney Rocketdyne (PWR) and NASA Marshall Space Flight Center (MSFC). The series consisted of 13 tests for a total hotfire duration close to 6500 seconds. Among the chief test objectives was characterization of the capabilities of the new J-2X turbopumps. This paper concentrates on the test results pertaining specifically to the Oxidizer Turbopump (OTP) operation in liquid oxygen (LOX).

The two bladed inducer configuration that was tested had a 0.81% blade height tip clearance and incorporated the “B-groove” modification to the inducer tunnel outboard of the inducer leading edge. Data was collected on inducer suction performance, pump radial loading, and the pump dynamic environment in LOX. Comparisons were made to prior data collected on two geometrically similar subscale inducers tested in water at NASA MSFC (70% scale) and Concepts NREC (52% scale).

In overview, the results of the powerpack testing were consistent with the radial load assessment from the water tests. The inducer performed differently in the other two categories, however. The inducer suction performance capability in LOX was notably improved. This was expected and is probably attributable to thermal suppression head (TSH) effects. While the dynamic environment was similar in most aspects to water test observations, the higher order cavitation (HOC) during the powerpack testing was much more benign.