VEHICLE ASCENT AND DESCENT PRESSURE PROFILE SIMULATION

SUMMARY

Payload fairings, payloads, and other equipment transported to and from space must sometimes be tested to ensure they are not damaged by rapidly changing pressures. The White Sands Test Facility (WSTF) has a unique capability for simulating ascent and descent pressure profiles in vacuum test cells that can accommodate very large test articles.

DISCUSSION

Equipment that is not designed to hold positive or negative pressures must be vented when transported to and from the vacuum of space. Often the vent capability must be verified to ensure the hardware will not be damaged. This is particularly true of honeycomb construction and multi-layered or open cell foam insulation commonly used in space applications.

WSTF's uniqueness in this area is due to its large test article capability. Test Stands (TS) 401 and 403 can accommodate test articles up to 25 ft tall and 15 ft in diameter in their standard configuration. A cell extension can be added to provide an additional 20 ft in height, or a test article envelope of 30 ft diameter and 25 ft tall. TS-405 provides a horizontal envelope of 7 ft in diameter, 20 ft long; a slightly larger envelope is provided by TS-303.

The ascent pressure simulation in the 400 Area is provided by evacuating the cells using the altitude simulation systems. The flow of air from the test cell is controlled either by opening and closing sonic air load nozzles, or by controlling the position of a vacuum valve between the cell and the altitude system. The shuttle payload bay ascent pressure profile has been demonstrated in both TS-403 and TS-405. Calculations indicate these cells could be evacuated to a simulated altitude of 85,000 ft in approximately 10 s if a quicker launch vehicle is to be simulated. Descent pressure simulation is provided by admitting atmospheric air into the cell through sonic nozzles and positioning of vacuum valves.

Ascent pressure simulation in the 300 Area is provided by a combination of sequencing the ejector stages of the altitude simulation system and introducing a high-rate purge into the vacuum ducting. Descent pressure simulation is accomplished by reversing the procedure. The ascent and descent pressure profiles are routinely demonstrated in conjunction with the shuttle Auxiliary Power Unit testing.

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