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SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
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NAV SKIP: DESIGN AND TESTING OF A STEERABLE ULTRALOW BALLISTIC COEFFICIENT ENTRY VEHICLE (PARASHIELD) CONCEPT

Abstract

During the history of the Aerospace industry minimal research and development has been done in the field of ultralow ballistic coefficient entry vehicles, specifically ParaShields. Nav Skip reopens and expands ParaShield advancement and development to include innovative concepts for earth reentry. Nav Skip is designed to address the challenges of low risk human return and sensitive sample recovery. New aspects of the mission capability and vehicle performance include high accuracy steer-ability and modular capacity across a wide range of payloads.

In order to accomplish a low temperature, controllable trajectory, the aeroshell design for Nav Skip incorporates a light weight fabric supported by a high strength skeletal structure. This structure occupies a minimum volume while maximizing payload coverage. Upon deployment of the shield in orbit, no further activation of reentry systems is required. In order to provide accurate navigation and direction during reentry, steering systems including drag surface alteration, cold gas propulsion, and lift vector variation are being analyzed and tested. Modular design for mechanical and electrical payload connections allow for multiple mission criteria and requirements.

Current ParaShield testing designs incorporate critical components of the space vehicle structure and multiple steerable concepts. The primary subsonic testing method for these concepts employs high altitude balloon flights providing realistic conditions of low density flow. A secondary test method involved flow tracking and analysis of the dynamics of an underwater drop simulation. This test provided conclusive data allowing for refinement of cg positioning. Preliminary balloon flights have also yielded successful demonstrations of stability in true atmospheric conditions. Subsequent test flights are scheduled to further test ParaShield design and steerable capabilities. These flights will yield critical data on vehicle body dynamics, allowing for control system optimization of rotational and translational steer-ability.

These and other tests will yield a highly stable and controllable vehicle which will safely return sub-orbital and low earth orbit payloads while opening the door for continued development and testing of innovative ParaShield designs.