Jovian Autonomous Sailplane for Persistent Exploration and Research (JASPER). J. Malach[1], E. Luthartio[1], H. Parker[1], S. Kwitowski[1], A. Hertz[1], S. Asif[1], J. Samareh[2], and J. Bayandor[1]. [1]*CR*ashworhiness for *A*erospace *S*tructures and *H*ybrids (*CRASH*) Lab, University at Buffalo - The State University of New York, [2]NASA Langley Research Center.

Introduction: This study details a concept mission to Jupiter with multiple autonomous gliders capable of operating down to 100 bar altitude. Jupiter provides a unique opportunity to study the processes that created celestial bodies in our solar system and how those processes have evolved. The Juno mission highlighted the need for improved remote sensing capabilities and further studies. The Jovian Autonomous Sailplane for Persistent Exploration and Research (JASPER) seeks to address aspects of such limitations by performing an in-situ investigation of the atmosphere.

Figure 1: Aurorae and atmosphere of Jupiter [1].

JASPER presents an opportunity to collect simultaneous in-situ data from multiple locations in Jupiter's atmosphere, something that has yet to be accomplished. An in-situ investigation with multiple probes can provide the most comprehensive analysis of the Jovian atmosphere to date. The scientific objectives are to measure atmospheric structure, in particular chemical compositions, pressure, temperature, and wind speed, and observe the cloud structures and particle characteristics in multiple regions on Jupiter. These measurements aim to provide an accurate map of Jupiter's atmosphere, detailing its properties at multiple locations and depths over time.

Mission Architecture: The primary mission concept consists of four gliders and a relay orbiter. The number of gliders can be varied, which allows for mission architectures at different tiers of cost and mass, and the opportunity to evaluate the use of different system configurations and launch vehicles.

Exploration Vehicles: The gliders are required to be packaged and protected in a single aeroshell during the harsh atmospheric entry. Each of the gliders would then deploy a parachute after the aeroshell is ejected to slow its descent further. The gliders will then unfold their wings and begin flight. Based on the review of other proposed atmospheric explorers, a glider was determined to be an optimal choice for navigating the Jovian atmosphere [2,3]. When compared to traditional drop probes, such as those of Galileo and Huygens, gliders would be mission operational for a longer duration. Flight on Jupiter may have complications. Extreme temperatures and pressures, the potential for hail-like particles, violent storms, and the powerful magnetosphere all present extreme conditions that must be overcome. The autonomous gliders would detect and exploit thermals and adjust to changing atmospheric conditions to sustain flight. The glider, shown in Fig. 2, possesses special features that allow for deployment and operation in the Jovian atmosphere. The gliders shall contain a scientific payload to meet mission objectives.

Figure 2: Schematics of JASPER glider concept [background from 4].

Conclusion: To sustain flight on Jupiter is the first step to unlocking the mysteries of the giant planets. The JASPER mission concept is a proposed solution that is conceptualized and investigated in this study. The concept of operations, subsystem design space, and overall functionality have been explored, with the detail design phase to follow.

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