LOFTID AEROSHELL ENGINEERING DEVELOPMENT UNIT STRUCTURAL TESTING.

G. T. Swanson[1], C. D. Kazemba[1], S. J. Hughes[2], R. K. Johnson[2], M. C. Lindell[2], R. J. Bodkin[2], J. M. DiNonno[2], and F. M. Cheatwood[2]. [1]NASA Ames Research Center, [2]NASA Langley Research Center.

Brief Presenter Biography: Greg works on a variety of projects as part of the Entry Systems and Vehicle Development Branch at NASA Ames Research Center and is currently the Instrumentation Lead for the LOFTID flight demonstration project. He also spends a large part of his time supporting fabrication and testing of the HIAD aeroshell system. Greg received his Bachelors and Masters from the University of Idaho.

Introduction: NASA's Hypersonic Inflatable Aerodynamic Decelerator (HIAD) technology was selected for a Technology Demonstration Mission under the Space Technology Mission Directorate in 2017. HIAD is an enabling technology that can facilitate atmospheric entry of heavy payloads to planets such as Earth and Mars using a deployable aeroshell. The deployable nature of the HIAD technology allows it to avoid the size constraints imposed on current rigid aeroshell entry systems. This enables use of larger aeroshells resulting in increased entry system performance (e.g. higher payload mass and/or volume, higher landing altitude at Mars).

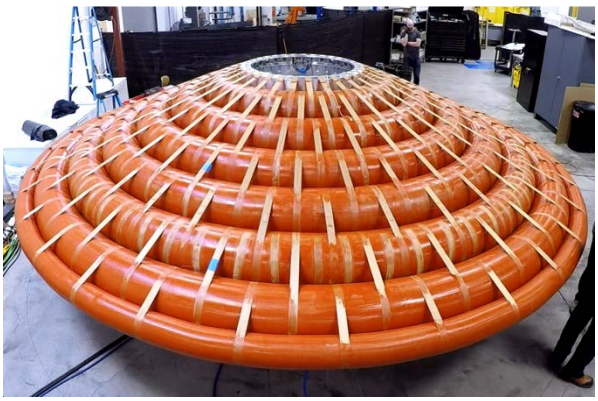
The Low Earth Orbit Flight Test of an Inflatable Decelerator (LOFTID) is currently scheduled for late-2021. LOFTID will be launched out of Vandenberg Air Force Base as a secondary payload on an Atlas V rocket. The flight test features a 6m diameter, 70-deg sphere-cone aeroshell and will provide invaluable high-energy orbital re-entry flight data. This data will be essential in supporting the HIAD team to mature the technology to diameters of 10m and greater. Aeroshells of this scale are applicable to potential near-term commercial applications and future NASA missions.

Currently the LOFTID project has completed fabrication of the engineering design unit (EDU) inflatable structure (IS) and the flexible thermal protection system (F-TPS). These two components along with the rigid nose and centerbody comprise the HIAD aeroshell system. This EDU aeroshell is the precursor to the LOFTID aeroshell that will be used for flight. The EDU was built to verify the design given the subtle differences between the LOFTID aeroshell and past aeroshell designs that have been fabricated under the NASA HIAD project. To characterize the structural performance of the LOFTID aeroshell design, three structural tests will be performed.

The first test to be conducted is static load testing, which will induce a uniform load across the forward surface of the aeroshell to simulate the expected pressure forces during atmospheric entry. The IS integrated with the rigid centerbody will first be tested alone to provide data for analytical model correlation, and then the F-TPS will be integrated for a second series of static load testing of the full aeroshell system. Instrumentation will be employed during the test series to measure component loads during testing, and a laser scanner will be used to generate a 3D map of the aeroshell surface to verify that the shape of the structure is acceptable at the simulated flight loads.

After static load testing, pack and deployment testing will be conducted multiple times on the integrated system to demonstrate the aeroshell's ability to fit within the required packed volume for the LOFTID mission without experiencing significant damage. Finally, the aeroshell will undergo modal testing to characterize its structural response.

This presentation will discuss the setup and execution of each of the three tests that the EDU aeroshell will undergo. In addition, initial results of the testing will be presented outlining key findings as LOFTID moves forward with fabrication of the flight aeroshell.



LOFTID Engineering Design Unit Inflatable Structure