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LOW-COST TENSEGRITY DROP MODULE

Abstract

The Tension Adjustable Network for Deploying Entry Membrane (TANDEM), developed by *CRASH* Lab, is a low-cost, lightweight concept designed to be efficiently stowed for transport and deployed to capture data over a wide area during EDLL. This probe consists of a tensegrity frame connected to a centrally located payload. Through topological design the orientation and size of the compression and tension members can be set to achieve desired decent aerodynamic effects. By adjusting the level of pretension in the tension members the shape of the tensegrity frame can be set to a minimum volume configuration for storage in a vessel capable of surviving entry. Sensors on the module are programmed to release the probe at a specified altitude, which then gathers data during its decent to the surface. The probe will be designed to survive impact on a rigid surface at terminal velocity, allowing for an extended recording of atmospheric and surface composition data. Design of this probe will begin with establishment of a nodal matrix defining the connections between compression and tension members. A parametric study on the effect of adjusting tension member length coefficients will be used to create aerodynamically stable shapes. Detailed numerical models will be implemented to characterize the lift, drag, and rotation of a selected shape in a freefall scenario. Using the estimated terminal velocity, a high-fidelity computational simulation will characterize the response of TANDEM during impact to determine its survivability. A proof-of concept storage module will be designed to store a scaled TANDEM prototype in its minimum volume configuration and deploy it at a specified time. Verification of these system will occur through a series of physical tests that will be carried out at the University at Buffalo, The State University of New York. The facilities of the CRashworthiness for Aerospace Structures and Hybrids Lab includes a drop tower capable of repeatable drop testing into a variety of mediums.