Inflatable Space Structures

Major Richard Cobb, Assistant Professor of Aerospace Engineering

Abstract:

Currently, to achieve apertures greater than 2.5 meters, deployable structures are required. To reduce the weight of the deployed structures, ultra-precision inflatable-rigidizable space structures have been proposed. This research effort seeks to examine and validate the correlation between ground and space testing of inflatable-rigidizable space structures. A major application for inflatable structures is for use with membrane surfaces, with inflatable rigidizable structures serving as auxiliary structural supports. A major concern and programmatic risk which is being addressed through this research, is the repeatability of the deployed configuration of the rigidized struts, and the correlation with ground tests. The Air Force Institute of Technology has been involved in the analysis and development of a flight experiment to validate the use of rigidizable technology. This work compliments ongoing inflatable structures within the DoD including the funded Innovative Space-based radar Antenna Tube experiment (ISAT) program.

Research Objectives:

- Develop and space qualify a space experiment demonstrating the deployment of rigidizable inflatable structures.
- Experimentally verify the mechanical properties of the deployed rigidized strut in ambient and vacuum conditions.
- Develop and qualify the flight experiment module to be flown as a NASA Get-away special (GAS) experiment.
- Obtain on-orbit data from space experiment and correlate flight data with ground test results.

Results:

A prototype flight article has been designed, and ground characterization of the rigidizable inflatable tubes has been conducted in ambient and vacuum conditions under various temperature conditions. Ground test results will be correlated with space results once available. A space experiment has been designed and prototyped and is referred to as the Rigidized Inflatable Get-Away-Special EXperiment (RIGEX) space experiment.

Publications:

Disebastian III, John D. and Gregory S. Agnes. *"RIGEX: Preliminary Design of a Rigidized Inflatable Get-Away-Special Experiment,"* American Institute of Aeronautics and Astronautics, (AIAA 02-1373) (2002).

Single, Thomas G. *"Experimental Vibration Analysis of Inflatable Beams for an AFIT Space Shuttle Experiment."* Master's Thesis, Air Force Institute of Technology, Dayton, OH, March 2002.

Figure 1. Rigidizable inflatable tubes in the stowed configuration, (*manufactured by L'Garde.*)

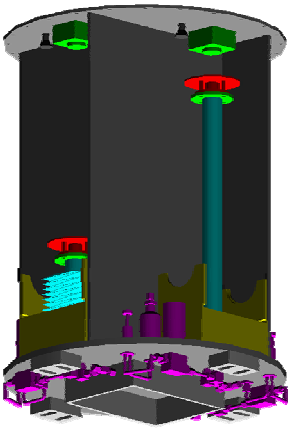

Figure 2. Hardware configuration of the Rigidized Inflatable Get-Away-Special EXperiment (RIGEX) space experiment

Faculty and Staff Researchers

Dr Anthony N. Palazotto, Professor of Aerospace Engineering

Maj Richard Cobb, Assistant Professor of Aerospace Engineering

Dr Richard Raines, Associate Professor of Electrical Engineering

Student Researchers:

Capt Steven Lindemuth
Lt Ray Holstein
Lt Dave Moody

Funding Sources:

AFOSR
NRO