Hypervelocity Impact of Composite Overwrapped Pressure Vessel (COPV) and Comparison to a Numerical Model

Matthew Garcia1; Bruce Alan Davis2; Joshua Miller, Phd1
1CASSMAR, University of Texas at El Paso, 500 W. University Ave., El Paso, TX, 79912
2Jacobs, NASA Johnson Space Center JETS contract, 2224 Bay Area Blvd., Houston, TX, 77058

Objectives
- Expose COPV to hypervelocity impact (HVI) testing in pressurized and unpressurized condition.
- Assess overall COPV damage incurred by HVI.
- Identify impact conditions likely to result in catastrophic rupture.
- Broaden the conclusions made from experiment by numerical analysis.

Model

![CAD model based on CT scan](image)

Experimental and Modeling Results

![HTF16163, Pressurized test, Pass](image)
- Density at t=16 seconds
- 1.54 g/cm³

![HTF16169, Pressurized test, Venting failure](image)
- Density at t=16 seconds
- 1.54 g/cm³

![HTF16162, Pressurized test, Rupture failure](image)
- Density at t=16 seconds
- 1.54 g/cm³

![HTF 16212, Unpressurized test, Pass](image)
- Density at t=16 seconds
- 1.54 g/cm³

![HTF 16394, Unpressurized test, Perforation](image)
- Density at t=16 seconds
- 1.54 g/cm³

![HTF 16211, Unpressurized test, Perforation](image)
- Density at t=16 seconds
- 1.54 g/cm³

Conclusions
- Experiments demonstrate COPV has capacity to withstand hypervelocity impact.
- Failure mode appears to be related to impact energy.
- A numerical model was designed to broaden the scope of this effort.
- Pressurizing of COPV in numerical impact simulations will be the next effort.

References