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MODAL PROPELLANT GAUGING: HIGH-RESOLUTION AND NON-INVASIVE GAUGING OF
BOTH SETTLED AND UNSETTLED LIQUIDS IN REDUCED GRAVITY.

Abstract

The Modal Propellant Gauging (MPG) program has demonstrated the infusion potential of a non-invasive, inexpensive, and robust method for gauging both settled and unsettled propellant at gauging resolutions of 1% for settled propellants and 2-3% for unsettled, sloshing propellants. The microgravity environment renders direct volume measurement using traditional buoyancy- and level-based techniques ineffective. Instead, indirect methods are currently employed to establish propellant volume. These methods incur considerable additional mass and expense to mission architectures. Additionally, traditional methods of propellant gauging suffer from decreasing accuracy as the tank empties, so that mass-gauging accuracy is lowest at the end of mission life when gauging accuracy is most important. In this talk we report results from laboratory testing, four parabolic flight campaigns, and a Blue Origin New Shepard mission that seek to raise the TRL of the MPG program to 6. Low gravity gauging resolution data for both settled and unsettled propellant simulants will be shared and we will discuss the infusion of MPG into the Orion/SLS Exploration Mission architecture.