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"PARIFFIN-BASED HYBRID ROCKET TESTING AT THE BUTTE AEROTEC FACILITY"

Abstract

Pariffin-Based Hybrid Rocket Testing At The Butte AeroTec Facility
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The classical hybrid rocket systems developed to date have suffered from two major shortcomings: 1) complex multiport fuel grains as a result of the poor regression rate performance of the classical polymeric fuels and 2) low frequency instabilities. In the past, the mitigation methods for these problem areas have introduced significant complexity to the motor design, compromising the simplicity advantage of hybrids. For example, the 250 klb motor developed by American Rocket Company (AMROC) was based on a complex 15 port wagon wheel configuration (resulting in poor fuel utilization and expensive fabrication) and the motor stability was achieved by the continuous injection of a hazardous pyrophoric substance, triethylaluminum (TEA). SPG's paraffin-based/LOX hybrid rocket technology, which has an inherently high fuel regression rate, allows for the use of a simple single circular port fuel grain design approach. SPG has also developed a unique proprietary technology to eliminate the low frequency instabilities in LOX-based hybrids without resorting to external heat or pyrophoric liquid addition at the fore end of the motor. These two technological advancements are crucial in keeping the hybrid concept cost effective, simple and safe compared to the state of the art liquid and solid rocket systems.

In March 2009, SPG and the Montana Aerospace Development Association (MADA) initiated a test campaign for SPG's paraffin-based/LOX hybrid rocket technology at the Butte AeroTec Facility, located near Butte, Montana. Since that time, over 30separate tests of an 11 inch (7,000 lb. class) version of the SPG hybrid rocket have been conducted, including a "Flight-Weight" version that utilizes a filament-wound composite material for the motor casing. SPG and MADA also plan to initiate testing of a 22-inch "Flight-Weight-Hybrid-Rocket-Motor" in February 2012.