SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS (D2)
Future Space Transportation Systems Verification and In-Flight Experimentation (6)

Author: Dr. Michael Gilbert
National Aeronautics and Space Administration (NASA), Engineering and Safety Center, United States

Mr. Timmy Wilson
United States
Ms. Dawn Schaible
United States
Mr. Tod Palm
Northrop Grumman Corporation, United States

# THE NASA "MAX" LAUNCH ABORT SYSTEM FLIGHT TEST AND RESULTS

**Abstract**

On July 8, 2009, the "Max" Launch Abort System flight test vehicle was launched from the NASA Wallops Flight Facility, successfully demonstrating aerodynamically stable coast flight, parachute reorientation, fairing/crew module separation, and crew module recovery of an alternative launch abort system concept for the NASA Constellation Orion project. Unlike the single abort motor tower-configuration crew escape systems designed during the 1960's and used for the NASA Mercury and Apollo (and Russian Soyuz) vehicles, the "Max" Launch Abort System (MLAS) concepts, so named in honor of Maxime Faget's pioneering work on early crew escape systems, utilize multiple abort motors integrated into an aerodynamic fairing covering the crew module. In one such integrated fairing concept, deployable grid fins are used to achieve and maintain passive aerodynamic stability of the abort vehicle during and after the abort motor burn until the crew module attains suitable parachute recovery flight conditions.

The MLAS Flight Test demonstrated the feasibility of an aerodynamically stabilized MLAS concept and collected important performance, stability, and aerodynamic data to validate analytical methods and tools. A full-scale flight test vehicle, including a full-scale crew module simulator with recovery-parachute system, was designed, built, integrated, tested, and launched within two years of project go-ahead. The flight test vehicle consisted of a custom design fiberglass/foam core sandwich composite fairing system, mass simulators representing expended boost motors, four planar aerodynamic fins on a supporting ring structure providing the equivalent stability as four deployed grid fins, a separate boost stage powered by four inventory solid rocket motors, and a full scale boilerplate crew module mockup. Flight test conditions were achieved at boost stage burnout and separation. Once at flight test conditions, aerodynamic stability was demonstrated through an extended coast flight phase, followed by parachute induced reorientation and stabilization, release of the crew module from the forward-fairing, and deployment of the crew module parachute recovery system.

The proposed paper will address the basic attributes of the passively-aerodynamically stable MLAS concept and outline the derivation of specific flight test objectives from the associated key technical risks. The development process of the flight test vehicle will be described, and flight test results will be summarized. In addition, the paper will discuss the unique benefits afforded to the project and NASA by including junior engineers (5-10 years experience) and Apollo-era veterans as part of the project team.