RS-34 Phoenix  
(Peacekeeper Post Boost Propulsion System)  
Utilization Study

Abstract

Elizabeth A. Esther  
NASA, George C. Marshall Space Flight Center, AL, 35812, United States  

Larry Kos  
NASA, George C. Marshall Space Flight Center, AL, 35812, United States  

Cy Bruno  
Pratt & Whitney Rocketdyne, CA, United States

The Advanced Concepts Office (ACO) at the NASA Marshall Space Flight Center (MSFC) in conjunction with Pratt & Whitney Rocketdyne conducted a study to evaluate potential in-space applications for the Rocketdyne produced RS-34 propulsion system. The existing RS-34 propulsion system is a remaining asset from the decommissioned United States Air Force Peacekeeper ICBM program; specifically the pressure-fed storable bi-propellant Stage IV Post Boost Propulsion System, renamed Phoenix.

MSFC gained experience with the RS-34 propulsion system on the successful Ares I-X flight test program flown in October 2009. RS-34 propulsion system components were harvested from stages supplied by the USAF and used on the Ares I-X Roll control system (RoCS). The heritage hardware proved extremely robust and reliable and sparked interest for further utilization on other potential in-space applications. Subsequently, MSFC is working closely with the USAF to obtain all the remaining RS-34 stages for re-use opportunities. Prior to pursuit of securing the hardware, MSFC commissioned the Advanced Concepts Office to understand the capability and potential applications for the RS-34 Phoenix stage as it benefits NASA, DoD, and commercial industry.

Originally designed, the RS-34 Phoenix provided in-space six-degrees-of freedom operational maneuvering to deploy multiple payloads at various orbital locations. The RS-34 Phoenix Utilization Study sought to understand how the unique capabilities of the RS-34 Phoenix and its application to six candidate missions: 1) small satellite delivery (SSD), 2) orbital debris removal (ODR), 3) ISS re-supply, 4) SLS kick stage, 5) manned GEO servicing precursor mission, and an Earth-Moon L-2 Waypoint mission. The small satellite delivery and orbital debris removal missions were found to closely mimic the heritage RS-34 mission. It is believed that this technology will enable a small, low-cost multiple satellite delivery to multiple orbital locations with a single boost. For both the small satellite delivery and the orbital debris mission candidates, the RS-34 Phoenix requires the least amount of modification to the existing hardware. The results of the RS-34 Phoenix Utilization Study show that the system is technically sufficient to successfully support all of the missions analyzed.

The results and benefits of the RS-34 Phoenix Utilization Study are presented in this paper.