Flight Servicing of Robotic Refueling Mission 3

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ABSTRACT:

The Robotic Refueling Mission 3 (RRM3) payload launched aboard a SpaceX rocket en route to the International Space Station on December 5th, 2018. The Goddard Space Flight Center designed payload carried approximately 50 liters of liquid methane onboard, with a mission to demonstrate long term storage and transfer of the cryogenic fluid in microgravity. Kennedy Space Center (KSC) was tasked to design, fabricate, test, and operate a system equipped to fill an RRM3 dewar with liquid methane prior to launch. Though KSC has a rich history of fueling rockets and payloads, no such operations had previously been accomplished using liquid methane. As such, all of the hardware and processes had to be developed from scratch. The completed ground system design, along with the verification and validation testing will be outlined in this paper. Several challenges that were met and overcome during procurement of the high purity methane are described. In addition, budget restrictions prohibited fueling operations from occurring in traditional processing facilities. The unique and creative solutions which were required to maintain payload cleanliness during cryogenic servicing are also detailed.

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