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ROBOTIC REFUELING MISSION, PAVING THE WAY FOR IN-SPACE ROBOTIC REFUELING AND REPAIR

Abstract

The purpose of this paper is to provide a description of NASA's Robotic Refueling Mission (RRM), give an overview of the operations on the International Space Station (ISS) and discuss how this technology is applicable to future in-space servicing. Robotic refueling is challenging. Before a satellite leaves the ground, its technicians fill its fuel tank through a valve that is then triple-sealed and covered with a protective blanket—designed never to be accessed again. RRM paves the way for a future robotic servicing mission by demonstrating that a remote-controlled robot can overcome these obstacles to service and refuel a satellite on orbit. RRM will also prove other robotic servicing tasks during its two years of operations. Utilizing ISS for this mission provides a unique location to demonstrate this hardware in the harsh environment of space and show that remote-controlled robots can perform servicing and refueling tasks in orbit via ground commanding. RRM is an external ISS experiment designed to demonstrate and test the tools, technologies and techniques needed to robotically refuel and repair satellites in space, especially satellites that were not designed to be serviced. RRM is a joint effort between NASA and the Canadian Space Agency (CSA) and is the first in-orbit attempt to test robotic refueling and servicing techniques for spacecraft not built with in-orbit servicing in mind. RRM demonstrates robotic satellite-servicing technology and techniques using the Special Purpose Dexterous Manipulator (SPDM), also known as Dextre (the twin-armed Canadian robotic handyman on the ISS), four unique RRM tools, and an RRM module containing satellite piece parts, refueling components and a series of interface testing activity boards. As an ISS investigation, RRM reduces the risk associated with performing robotic servicing tasks in-orbit and lays the foundation for a future robotic servicing mission to a free-flying satellite as well as advancing space robotic capabilities. The ISS's accessibility, unique location and well-established capabilities make it an ideal test bed for demonstrating satellite-servicing technologies. RRM will take advantage of Station's power, communications infrastructure, and robotic Dextre arm to demonstrate RRM's functions.