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SPDM GROUND TESTING OF THE ROBOTIC REFUELING MISSION (RRM) PHASE II AND MAIN BUS SWITCHING UNIT (MBSU) R&R OPERATIONS

Abstract

The Robotic Refueling Mission (RRM) Phase II and Main Bus Switching Units (MBSU) remove and replace (RR) operations require extreme precision with delicate force control and will be among the most advanced and complicated tasks ever performed by the Canadian Space Agency's (CSA) Special Purpose Dexterous Manipulator (SPDM also known as "Dextre") on the International Space Station (ISS); requiring it to operate at or near the performance limits of its capability.

The RRM is an ongoing NASA GSFC experiment which has successfully demonstrated robotic servicing of an emulated unprepared satellite in the zero-g environment of the ISS, as presented in previous papers (IAC-12A5.3-B3,6.4x16033 and IAC-13,B3,4-B6.5,6x19945). A second phase of RRM operations will continue in 2014 with new tools and additional task boards representing various satellite components.

The Main Bus Switching Units (MBSU) act as the distribution hub for the ISS electrical power system. In 2012, one of the four ISS MBSUs (MBSU-1) failed, requiring two long and challenging Extra-Vehicular Activities (EVA) to complete the remove and replace (RR) mission, returning the ISS to full functionality. To reduce demand on EVA crew time and reduce the risk to human life, it would be preferable to perform future MSBU swaps with Dextre, however Ground Testing and mission simulations are required to confirm whether these tasks are within Dextre's capabilities.

With the goal of increasing mission success through tuning parameters, refining flight operating procedures for the upcoming mission and further exploiting Dextre's capabilities, NASA Goddard Space Flight Center (GSFC) and MDA conducted high fidelity ground testing with the SPDM Ground Test-bed (GT) at MDA's Brampton facility. This paper summarizes the results of the Ground Testing operations and discusses the challenges experienced, the results and their impacts to future robotic operations and the benefits of such pre-flight ground testing.