SPACE SYSTEMS SYMPOSIUM (D1)
Cooperative and Robotic Space Systems (6)

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WEDGE MATING INTERFACES FOR COOPERATIVE SPACE ROBOTIC USE

Abstract

Payload and module mating interfaces that can be robotically or crew operated are essential for versatile and efficient space vehicle operation architectures of the future. The Wedge Mating Interfaces (WMI) developed by MacDonald Dettwiler and Associates (MDA) for the Canadian Space Agency (CSA) have recently garnered interest for use on the International Space Station (ISS).

The WMI is one of a set of robotically cooperative mating interfaces developed for use by the Canadarm2 and Dextre. These mating interface designs followed thorough systems engineering design methodologies to address not only the characteristics of each payload, but also the capabilities of the robot manipulator and the features of the worksite. The resulting system has proven to be reliable and effective in transferring and replacing ISS instruments in the past decades.

Payloads featuring a WMI can be launched either hard mounted in logistic vehicles or soft-stowed as internal cargo to the ISS. For payloads launched as internal cargo, adapter plates allow safe transfer of the payload through the Japanese airlock or hand-carried through the Quest airlock to the external environment on ISS and vice versa. Transfer of the payload to its worksite can be done by Extra-Vehicular Robotics (EVR) or by crew Extra-Vehicular Activity.

The WMI supports the transfer of power, data, and video to a payload while mounted at a worksite or while being manoeuvred via EVR. Potential future uses of the WMI include: a) technology demonstration / development missions for i) rendezvous/docking sensors ii) robotic refueling tools, iii) vision systems; b) jettison of micro-satellites, and c) replacement of aging hardware.

An example of a future architecture for next generation space vehicles that can benefit from the WMI includes a robotically relocatable rendezvous/docking sensor system. In this way, a single high reliability/quality relocatable sensor can be re-located as needed to support operations, thus avoiding the need for multiple sensors at permanent locations. This can increase the system versatility, functionality, and facilitate easy upgrades while decreasing the end-to-end system mass. During station assembly, a sensor can be robotically positioned at a docking port to provide independent monitoring of an incoming module, and then be repositioned to a vacant port to await the next.

The WMI is currently used to maintain hardware as well as demonstrate new technologies on ISS. This favourable architecture will lead to the increased overall system functionality, efficiency, reliability and flexibility of future space vehicles.