

SPACE OPERATIONS SYMPOSIUM (B6)
Human Spaceflight Operations Concepts (1)

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COSMIC CATCH: CANADARM2'S FIRST CAPTURE OF A FREE-FLYING VEHICLE –
OPERATIONAL RISKS, CONSIDERATIONS AND RESULTS

Abstract

September 2009 marked the first ever free-flyer capture by Canadarm2 onboard the International Space Station (ISS): a cosmic catch. With the impending retirement of the Space Shuttle, transfer vehicles capable of supplying pressurized and non-pressurized cargo to the ISS will play a vital role in maintaining the viability of the ISS. The Japanese-built H-II Transfer Vehicle (HTV) is the first of a new class of automated, unmanned transfer vehicles that require the assistance of Canadarm2 to complete their rendezvous with the ISS.

The culmination of this historic event was preceded by years of work by multi-discipline and multi-national engineering and operations communities to overcome numerous technical and operational challenges associated with free-flyer capture and release operations from the ISS. These challenges continue to exist for future free-flying vehicles, and include, but are not limited to, defining and maintaining the ISS within a tight attitude tolerance; providing Canadarm2 with enhancements to help meet safety and redundancy requirements for the capture operation; addressing free-flyer retreat and rendezvous limitations; ensuring the free-flyer meets rate and loading limitations associated with the Canadarm2; training the crew to successfully execute the operations; and coordinating numerous, interdependent aspects of the operation between multiple disciplines. Resolving these challenges has been an iterative and evolving process further complicated by occasional conflicts between the number one priority of maintaining the safety of the free-flyer, ISS and its crew and the desire for mission success.

This paper will discuss the road taken to develop the operational concepts and techniques used by the Canadarm2 operator and robotics flight control team to safely capture and release the HTV on its maiden flight. Various contingency scenarios that were protected for will be presented, along with their respective solutions. This paper will also highlight the training conducted by the flight control teams and crew in preparation for nominal and off-nominal operations as well as the coordination required between them. Moreover, HTV capture and subsequent release operations as they unfolded real-time will be detailed, together with the subsequent lessons learned, and how those lessons will be applied to future free-flying vehicle operations.