

SYMPOSIUM ON STEPPING STONES TO THE FUTURE: STRATEGIES, ARCHITECTURES,
CONCEPTS AND TECHNOLOGIES (D3)

Novel Concepts and Technologies for the Exploration and Utilization of Space (2)

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THE NEXT GENERATION CANADARM: PREPARING CANADA FOR FUTURE SPACE
EXPLORATION AND SERVICING MISSIONS

Abstract

Consistent with the Canadian Space Agency's long term strategic plan to maintain and enhance space robotic technical expertise and leadership, Canada has begun research and development (R&D) on a Next Generation Canadarm (NGC) system. Building on more than 30 years of flight heritage in space robotics, the NGC program will incorporate state-of-the-art with next generation concepts to advance the technological and operational readiness levels of on-orbit servicing capabilities.

At present, there exist several missions that have demonstrated certain technologies that facilitate on-orbit servicing. Such missions include the Space Shuttle Remote Manipulator System (Canadarm), International Space Station's Mobile Servicing System (including Canadarm2 and Dextre), ETS-VII, DARPA's Orbital Express and DART, along with design concepts including NASA's Hubble Robotic Servicing mission, ASI's FREND and DLR's LWR. All these missions and development have demonstrated the value of robotics and human collaboration, plus a growing ability to deploy remotely controlled robotics when it is less desirable or affordable for human explorers to do so.

The R&D conducted during the NGC program will advance key enabling technologies for a broad range of future on-orbit servicing (OOS) missions as defined by the Canadian Space Agency. Near-range proximity operations and docking of unprepared spacecraft, full motion dexterous on-orbit servicing tasks using a relatively small manipulator, and telescopic boom deployment of larger robotic manipulators will be explored and demonstrated with ground prototypes. NGC is geared towards functional modularity providing a suite of OOS capabilities, thus enabling a range of OOS missions, while reducing non-recurring engineering. It is the intent of this project to promote next generation technology development while pushing greater levels of autonomy above the current standard for extra-vehicular robotic (EVR) activities. The technologies developed under NGC will be implemented on a suite of ground prototypes integrated with simulation capabilities to demonstrate end-to-end on-orbit servicing mission scenarios.

At present, NGC has successfully completed the System Requirement Review (SRR). At the time of presentation (Fall 2010), NGC will have passed Interim Design Review (IDR).

This Paper describes the objectives and progress of the Next Generation Canadarm Project, as well as their relevance to emerging Space Exploration missions.