



## CANADARM

### A Great Engineering Achievement in Canada

The full title for the Canadarm is the Shuttle Remote Manipulator System (SRMS). Although the first one flew in the space shuttle *Columbia* in 1981, it and its 'brothers' performed with conspicuous success in the over 50 shuttle missions that ended in 2011. The arms performed many tasks associated with the International Space Station and with the launching and retrieval of satellites in space. In all, five arms were built and delivered to NASA, one of them being lost in the *Challenger* accident. They were a significant part of Canada's contribution to the United States' Space Program.

The Canadarm project was initiated by the National Research Council under contract with SPAR Aerospace Limited of Toronto who designed, developed, tested and built the arms. The development program as a whole involved the building of three systems: the engineering model; the qualifying model; and the flight unit. This program cost an estimated \$110 million. Dynacon Inc. of Toronto, CAE Electronics Ltd. of Montreal, DSMA Consultants of Toronto and General Dynamics in the United States were also involved in the system design. The first 'production' Canadarm was a gift from Canada to the NASA Space Shuttle Program. NASA subsequently ordered four more units, together with engineering and operations support, to the value of \$400 million. The project contributed to the prestige of Canadian manufacturing in world markets. There have been a variety of spin-off projects involving the development and construction of land-based remote manipulator systems for other purposes.

The Canadarm was 15 metres long, with a maximum diameter of 38 cm. It had six degrees of freedom, weighed on earth 410 kg, and functioned like a human arm with six joints instead of three. It was operated from the flight deck control station of each shuttle, the software for which was developed in the United States. TV cameras were installed at the wrist and the elbow. The software for the arm's operation was developed in the United States. At first, it could deploy/retrieve payloads up to 30,000 kg in space. In the 1990s, it was redesigned to increase the payload capability significantly in order to support the assembly of the Space Station.

Canadarm's immediate successor - Canadarm 2 (SSRMS), launched in 2001 - was designed and built for installation on the International Space Station, was installed using an original arm, and was operated in conjunction with it. Their cooperative work became known as "the Canadian Handshake." The surviving Canadarms will become museum exhibits. Spar Aerospace was acquired by MacDonald Dettwiler & Associates of Vancouver, after first going through the hands of an American company. Canadarm is Canada's third engineered space success. The other two are the STEM antenna and the Alouette satellite.

One Liner: *"An outstanding Canadian-engineered space success."*