

Twenty five years with CANADARM

-Canada's ticket to the Space Shuttle and ISS

Human participation is necessary in order to build large constructions in space – that is a fact, to put it mildly - but without the use of the right tools it will be impossible.

When the plans for a shuttle system first were introduced, a manipulator system was introduced as a necessity, a robotic arm that could deploy and retrieve space hardware from the payload bay of the shuttle. Canadian industrial companies accepted the challenge, and the manipulator system, Canadarm, made its space debut in November, 1981. The design and building of the Shuttle Remote Manipulator System also marked the beginning of Canada's close collaboration with NASA in manned space flight.

But the development did not stop there. A similar system for the space station was developed, and in April 2001, Space Shuttle Endeavour delivered a package that was Canada's key contribution to the International Space Station, the Canadarm 2.

Developing a manipulator system for use in space is not an everyday activity for industrial companies, but based on robotic arms developed to load fuel into nuclear reactors some Canadian companies agreed to build the first Shuttle Remote Manipulator System in 1974. There were no existing blueprints or off-the-shelf components for machines that work continually in the harsh environment of space. NASA had stringent demands for weight, dexterity, manual and automatic operations, versatility, and precision of movement, safety, and reliability. From scratch, Canada had to build a tool to function flawlessly in space with the dexterity of a human arm.

Like a human arm

With nerves of copper wiring, bones of graphite fibre, and electric motors for muscles, Canadarm is like the human arm. It has rotating joints: two at the shoulder, one at the elbow and three at the wrist. At 15 metres and weighing less than 480 kilograms, Canadarm can lift over 30,000 kilograms in the weightlessness of space-or the mass of a fully loaded bus, using less electricity than a teakettle.

The brain of the system is a computer that controls the arm while providing essential guidance information to the astronaut. It can be operated manually by an astronaut at the controls or programmed to function automatically. Its hand is a wire-snare device that fits over a special grapple fixture on the payload.

What has the investment provided in return?

Canadarm1 gave the Canadian space research community access to using the Space Shuttle at different tasks and



Canadarm2 gives Canadian scientists access to the Station's laboratory facilities to conduct experiments.

It also entitles Canada to send an astronaut to the Station every three years for a tour of duty lasting three to four months.

The contribution of Canadarm2 buys Canadians the right to use 2.3%

"In fact, the Station could not even have been built without the two versions of Canadarm. Every single mission will need it," said Savinder Sachdev, Director General of Space Systems for the Canadian Space Agency.

of the laboratory space in the non-Russian part of the Station, as well as access to a platform outside that exposes experiments to open space. CSA will provide another robotic system, known as the Special Purpose Dexterous Manipulator (SPDM), to pre-pay part of these user fees.

