

## The World of Space and Science ? Space Stations ? Part 2: The Canadian Contribution

By Jim Middleton

Do you have a Canadian \$5 bill handy?

Look at the back. Spoiler alert! Shown is the Canadian contribution to the Space Station Program and I'm going to tell you the story! I'm going to tell it from my perspective, since I led the Spar team who created the Canadian Space Station Program.

Prior to the establishment of the Canadian Space Agency (CSA) in 1989, space activities were under what was called the Interdepartmental Committee on Space (ICS). ICS was mainly made up of National Defence, Communications, Natural Resources, Industry and Finance. The National Research Council (NRCC) was a small player until the Canadarm program came along.

The ICS was mainly interested in communications and earth resource imaging, including weather, as a longer term strategy.

Canadarm was an aberration and not seen as a longer term strategic opportunity. This sets the Canadian space perspective.

When Canadarm was seen operating in space in 1981, it became iconic and established the Canadian space program as a highly visible, technical achievement to the Canadian public. It was the one moving part of the space shuttle, along with the astronauts.

What a great achievement for Canada!

It became a major political irritant, however, to the U.S. A Congressional committee was struck to investigate how NASA had allowed a ?key? piece of robotics technology to be developed outside the U.S. NASA was chastised for allowing this to happen and was put under scrutiny for technology leakage. Robotics was the U.S. domain and don't let this happen again! This was a challenge we were about to face, in spades!

In 1983, the U.S. kicked off the Concept Development Group (CDG) to look at space stations. We entered into discussions with the NRCC program folks that this might be a logical follow-on program to Canadarm. A small contract was put in place which I led, with five other engineers, to come up with a concept for a Canadian contribution to the Space Station program.

In my mind, I wanted something more than an arm. I wanted Canada to have the overall responsibility for the planning and operations of whatever was going to be provided to the program. I liked the idea of a garage. It would have a service bay and, one thing I really wanted to be part of the program; a robotic mechanic with two arms who could repair things. Yes, there would be a new, large, advanced arm which could walk around the space station but the robotic mechanic was to be the crown jewel! We called the garage in space the Integrated Servicing and Test Facility (ISTF).

President Reagan announced the plan to build a space station in January 1984. A plan was in place to have the President meet with Prime Minister Mulroney in March 1985 around St. Patrick's Day. What a great chance to move the Canadian plan forward. We got it on the agenda as a line item, but without commitment. A new space station in orbit by 1992, celebrating 500 years since Columbus discovered the Western World and a major Canadian contribution to the program. Things were looking up!

Meanwhile, the Americans weren't happy. They didn't mind us putting up another big arm (they called it a space crane), but a fancy, two-armed highly capable robot was another thing! No, they weren't going to let that happen.

The Canadian space community wasn't happy. Their goal was a communications satellite called M-Sat, and an advanced radar spacecraft called Radarsat were the priorities, not another robotics program. Spar Aerospace, for whom I worked, was not pleased, since they would be the prime contractor on M-Sat and Radarsat.

Then NASA changed the space station configuration and the ISTF became obsolete. NASA told us to come up with another idea and be ready in a week!

I sat in my office and thought about the problem and an old idea I had came to mind. Instead of a garage to do servicing and repair, maybe a ?tow truck? could drive along a railway going from spot to spot on the station. It would have the big arm and the little robot mechanic. I decided to call it the Mobile Servicing Centre (MSC). I got the group of engineers working on the program, told them about the idea and got them putting ?meat on the bones.?

We took the idea to Ottawa and presented it to the government. They liked the concept, so we would go to NASA and present it the next week. NASA agreed and all seemed well with the world.

Then came the word! The MSC was fine but there was not to be a fancy little robot as part of it. ?The Empire Strikes Back!? NASA, under direction from Congress, was developing their own fancy two-armed robot in 1987 known as the Flight Telerobotic Servicer. It would do all the specialized tasks, being the flagship robotics device on the space station.

After significant push-back from Canada, NASA agreed that we could provide the small robot, but it couldn't have the words ?robot? or ?robotic? in its name. It would be very limited on the tasks it would be allowed to do. We decided to name it the Special Purpose Dexterous Manipulator, or SPDM for short.

How was the Canadian dilemma solved? The Canadian government initiated a program called Regional Development, which required government-funded programs to be distributed along the following lines: 10 per cent ? British Columbia; 10 per cent ? remaining western provinces; 35 per cent ? Ontario; 35 per cent ? Quebec; and 10 per cent ? Atlantic Provinces.

We met with companies across Canada to get them involved in the Canadian space station program, and it worked! They got excited to be part of the program. Hence, when the government plans for space were announced, the Canadian Space Station program was the top priority, thanks mainly to regional development.

So, all once again seemed right with the world. The Canadian team was coming on board and we were working to a fairly tight schedule. The U.S. program was slipping, and changing, and we had to change with it. The 1992 goal was a long-lost one. The final change came when the U.S. combined its program with the Russians and the International Space Station came to be.

By the way. You may ask ?what happened to the Flight Telerobotic Servicer, the flagship U.S. robotics program? It was cancelled as the U.S. program costs rose.

We were not immune to the vagaries of cost growth. The program became known as the Canadian Space Station Program and costs started to rise significantly. When the Chretien government came to power in 1993, reviews were under way to get the program costs back in line. A casualty of this cost cutting was my beloved robot, the SPDM. We worked hard to keep it alive, but to no avail. We filed the drawings away.

Meanwhile, my tenure as program manager of the Mobile Servicing System came to an end at the completion of the design phase in 1993. A new program manager was appointed to take the program through manufacturing and assembly to launch and operations. I went on to become vice-president of marketing (not my favourite job by far). Always lurking in my mind was how to bring the little robot back. I had allies at the Canadian Space Agency. In 1995 an idea arose along the ?pay it forward? lines. I wanted to convince Spar to fund the development and construction of the SPDM and have the government pay for its operations in space. We put a proposal together for a fixed price program which interested the Space Agency. Coming up was the visit by Prime Minister Chretien with President Clinton April 8, 1997. I was sent to Montreal with four others to negotiate a deal with the CSA. We worked through the nights from Friday to Sunday and reached agreement at 3 a.m. Monday morning. The prime minister presented a model of the SPDM to President Clinton during the speeches on the White House lawn. President Clinton's speech acknowledging the SPDM can be found at [www.presidency.ucsb.edu/ws/?pid=53964](http://www.presidency.ucsb.edu/ws/?pid=53964)

The first element of the Canadian program, Canadarm-2, was launched to the Space Station April 19, 2001 with Chris Hatfield on board to install the arm. Other elements of the Mobile Servicing System were launched over the following years.

The SPDM, renamed DEXTRE, was launched March 11, 2008 and has become the ?handyman? in space. NASA and CSA have developed the capability to operate DEXTRE through ground control, freeing up the on-board astronauts to perform their important tasks on the space station. DEXTRE does his/her job just as intended; replacing failed components and installing new and improved features. It can work along with the astronauts as a robotic assistant.

Let's get that \$5 bill out again and look at the back. In the background to the left beside the astronaut is the tow-truck, called the Mobile Base System. There's Canadarm-2 right in the middle. Lo and behold, there is DEXTRE, the SPDM, being held at the end of the ?big? arm.

To learn more about DEXTRE go to [www.asc-csa.gc.ca/eng/iss/dextre/](http://www.asc-csa.gc.ca/eng/iss/dextre/)

My next article will cover why one could possibly want to spend money on a space station and what are they really doing up there. Jim Middleton is a ?semi-retired? aerospace engineer with more than 50 years of experience in the U.S. and Canadian space programs. He has worked on the Space Shuttle and Space Station programs for over 25 years. He is currently involved in the operations of Canadensys Aerospace Corporation, a space company located in Bolton.