First all-Canadian 'pure science' satellite in 30 years size of suitcase

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on a big-screen monitor back at Mission Control, some 30 kilometres distant from the launch pad. He'd spent a month and a half in Russia preparing MOST for its launch, and says getting the satellite into the right orbit was only the first hurdle. Several worries remained. Would the door over the telescope open properly? Would the computers work? Had the telescope's optics been damaged? If so, the $10 million spent on MOST would have been money down the drain.

"The launch was just the first step," says Matthews. "We had to find out if the satellite was dead or not. It could have been a useless hunk of metal and silicon in orbit."

Seven hours after the launch, Matthews received word from the ground station in Toronto that MOST was working beautifully. It was nearly 1:30 a.m. Russian time, but Matthews and the two Canadians who had remained for the launch cracked open the cognac and celebrated throughout the night.

MOST passes over each of its three ground stations—located in Vancouver, Toronto and Vienna—six times a day. In the approximately 15-minute periods of contact, data is downloaded and commands are uploaded to the satellite's on-board computers. Matthews still feels a thrill every time MOST passes over Vancouver.

"That's my baby up there," says Matthews. "It's a buzz to know that there's this thing that I helped build talking to you six times a day when it passes over Vancouver. I haven't gotten blasé about that."

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> **—Jaymie Matthews**

MOST IS SMALL—about the size of a suitcase and weighing in at about 54 kilos (120 pounds). Its light-gathering device—the telescope—is only 15 centimetres in diameter, about the size of a pie plate. Powered by solar panels, the satellite is expected to remain in service for three to five years, "but 10 years wouldn't be out of the question," says Matthews.

MOST contains a series of "reaction wheels" that are its only moving parts. Similar to gyroscopes, these make continuous, precise alterations to the orientation of the satellite as it moves through space at 27,000 kilometres an hour, keeping the satellite's optical sensors trained on whatever star is its target.

The stabilization system was developed in Canada by Dynacon Inc., a company that specializes in technology for microsatellites. About seven years ago, the Canadian Space Agency put out a call for proposals, looking for possible uses of a microsatellite for space science. The CSA received 54 proposals. Matthews' was the only one that involved astronomy.

Matthews' UBC team designed MOST's optical and electronic detector systems, which were also built by UBC. The University of Toronto's Institute for Aerospace Studies also had a hand in MOST's development.

When MOST was launched, it was the first all-Canadian "pure science" satellite to go into orbit in over 30 years, says Matthews. (Although Canada sent up the first science satellite ever in 1962—Alouette 1, which studied the ionosphere—it hadn't launched a science satellite since Isis 2, in 1971.)

There won't be anything like MOST in space until 2006, the scheduled launch date of the French satellite COROT, also designed to focus on individual stars for long periods at a time.

The one thing MOST can't do is capture images of stars and galaxies. Its optical sensors deliberately "blur" the light they pick up, in order to make the measurements the telescope takes more stable.

"We could never compete with the Hubble space telescope, in terms of pretty images," says Matthews. "The images we make are spread-out mounds of light, in black and white—very unspectacular."

WHILE STUDYING PLANETS around distant stars was not one of its original goals, MOST has a good chance of doing just that. Until MOST, astronomers could detect only those planets massive enough to have a gravitational effect on the star they orbit, or planets whose orbits caused them to "transit" or pass in front of their stars, relative to an Earth-based observer. The dimming of light caused by transits could be measured as the starlight dimmed slightly.

"The problem is that you need to have an alignment where the orbit of the planet around the star is lined up [with Earth], and that's only going to happen in a small percentage of cases," says Matthews.

MOST, however, is sensitive enough to detect the light reflected by a planet itself. So even if a planet has an orbit that doesn't cause it to transit its star, relative to an Earth-based observer, the amount of light coming off it can be measured. The planet goes through phases of illumination much like those of our own moon as it waxes and wanes from a full moon to a crescent moon. These variations in light—tiny, relative to the star, which is pumping out light—can be detected by MOST.

"We really underestimated what we could do with a telescope this size in space," says Matthews. "If we're successful, we may be the first humans in history to ever see light from a planet outside our solar system."

To date, astronomers have surveyed about

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