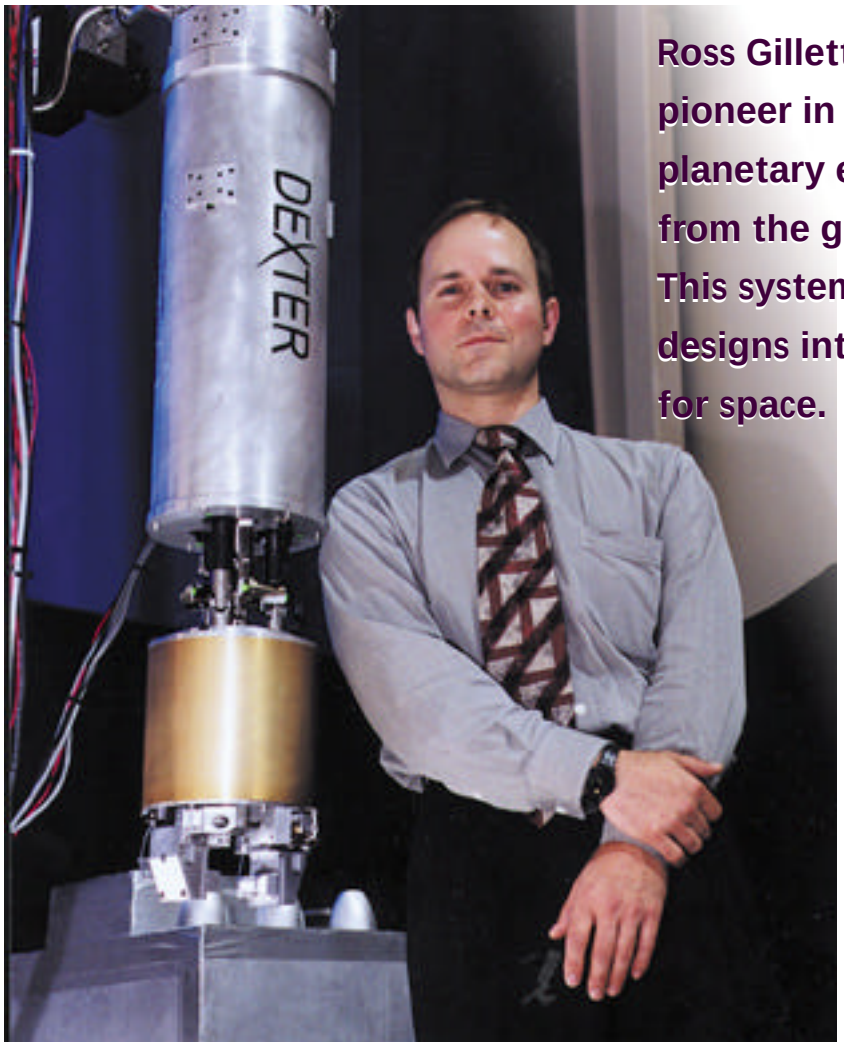
Robots in space



Ross Gillett, P.Eng., is a pioneer in lunar and planetary exploration from the ground up. This systems engineer designs intelligent robots for space.

Despite fewer than six hours' sleep, Ross Gillett, P.Eng., is beaming upon his return from the National Research Council of Canada laboratories in Ottawa. And rightly so. The demonstration of Project IIRO–Interactive Intelligent Remote Operations–was a complete success after 18 long months of collaborative R&D, with some $2 million invested.

"This is great," he says, kind and unassuming inside the research lab at his Brampton, Ontario, employer, MD Robotics, formerly Spar Aerospace. "This is probably the first time this sort of thing has been done with this kind of a complex distributed system, and we're feeling like pioneers here."

Project IIRO is a prototype system-level approach for remote-controlled planetary excavation, something that has yet to be achieved in space because of the communication time delay over extreme distances. It takes roughly 20 minutes for commands to reach space operations, making the time latency debilitating. That is, until Gillett, one of the top guns at Spar Space Systems since 1988, headed up a team to develop IIRO.

A Canadian first, this electronic power and data management system enables ground-control personnel to direct space shuttle robots to dig in non-terrestrial soil and collect samples for study and analysis. A series of "sample return" missions to Mars is planned for the next decade, and Gillett would like to see Canadian technology at the forefront.

"To go and dig on Mars would be a very useful thing to do," Gillett says, taking off his suit jacket and posing beside the latest robotic equipment, Dexter, in the lab for a photo opp. "To my knowledge, no one has the kind of control that we have been working toward."

Although it may sound like science fiction now, these tasks could ultimately lead to the construction of Martian habitats for human residence. The immediate objective, however, is to have astronauts con-

by Karen Hawthorne

"I love to produce things that are going to be used in space. I was a kid who watched *Star Trek* in the '60s. That's something that you can't get out of my blood."

centrating on scientific research in space, and people on the ground controlling robots to do routine maintenance of the space station and planetary excavation. It makes sense to have robots do these tasks because the risk factor skyrockets when astronauts gear up in their space suits and leave the pressurized module to do extra vehicular activity, Gillett explains.

The IIRO prototype is earthbound for the moment. But Gillett hopes "buy-in" from the project's participants, including the Canadian Standards Association, Syncrude, RSI Technologies and GasTOPS, will lead to further development and a contract from either the Canadian government or NASA to build a system for lunar and planetary excavation—before someone else does.

"I think that it's tough in Canada. We don't have a lot of money behind [aerospace research]," says Gillett, a staunch patriot and winner of PEO's 1999 Engineering Medal for engineering excellence. "At the same time, we're known as a leader in space robotics. We'll continue to do that if we can get money behind it, like this project here. If we sit back and rest on our laurels, we'll be overtaken. The Japanese are already starting to do this [space robotics research], and the Germans are very much into it."

His recent demonstration saw an operator at computer controls in Ottawa command Dexter to move a mock space station component in MD Robotics' Brampton lab and, at the same time, manipulate a construction site excavator in Edmonton. The control system uses 3-D camera imaging and scripted technology, a set of directions or artificial intelligence that the operator sends to the machine, thereby overcoming the challenges of communication time delay.

"The darn thing worked and, more importantly, the ideas worked. That's the really thrilling thing about having achieved that," says Gillett, no stranger to ambition and success in the aerospace industry.

The Etobicoke resident has already made significant contributions to the International Space Station, with the design for the Space Station Remote Manipulator System, a large, seven-jointed manipulator that can relocate itself, inchworm-like, along the space station, as well as a two-armed robot for station maintenance.

A second home for team members at MD Robotics: Gillett at the computer.

In the space lab: Ross Gillett mounts the 3-D imaging camera, part of a robotic system prototype for missions in space.

His work has the mystique of futuristic, high-tech design, but Gillett talks about the need for simplicity. Systems have to be as simple, reliable and low-tech as possible, because the higher the technology, the more complex the system, and the more likely something can go wrong. Components have to be qualified, tested and rated for space flight, which is expensive and time-consuming. Demands of the aerospace industry today, he says, come in stark contrast to the Apollo program when "safety took a back seat to getting to space, and everyone knew that. They had test pilots doing the flying who were used to risking their lives with new technology all the time."

As for Gillett himself, he juggles family life–he has a 19-month-old son and a second baby on the way–with artistic pursuits like sculpting, painting and recording electronic acoustic music. His goal back in grade six was to build the smallest violin in the world and make the *Guinness Book of World Records*, although he couldn't convince Guinness that a 13-year-old could do it.

A self-proclaimed "closet artist," he also designed and built furniture as a teenager, and ended up going to the University of Toronto for electrical engineering because, at the 11th hour for applications, it seemed like the best fit on the advice of a family friend.

"A lot of people think engineering is like accounting; it's very rigid or very mundane. Not at all. It's a creative process that requires a spark of intuition—you can do something in a very pedantic way or you can do something with a spark of inspiration and get the same result with a lot less trouble and probably a better result."

Whether working in the lab, sketching a fixture or writing a document at the computer, discussing budgets at meetings, or lecturing on electrical system design at the University of Toronto, he's got the creative juices flowing.

Not surprisingly, what he likes best is a good brainstorming session with the team. It's also been the most challenging part of his engineering career, he says: "Looking at the structure, how we can solve the problems, looking at the alternatives. I find that exciting." ◆