

## Montreal startup NorthStar wants to play traffic cop in space

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Stewart Bain, co-founder and CEO of NorthStar Earth and Space, in their expansion offices that are still under construction in Montreal, on June 2.

CHRISTINNE MUSCHI/THE GLOBE AND MAIL

Last May, while examining high-resolution photographs as part of a routine inspection, the Canadian Space Agency spotted a five-millimetre hole in the Canadarm2, the robotic arm that services the International Space Station.

Space technology company MDA Ltd.

[MDA-T \(/investing/markets/stocks/MDA-T/\)](#) +5.69% ▲ , which built the Canadarm2 at its facility in Brampton, Ont., was tasked by the CSA with reviewing the images and concluded that the arm had been hit by a piece of space debris.

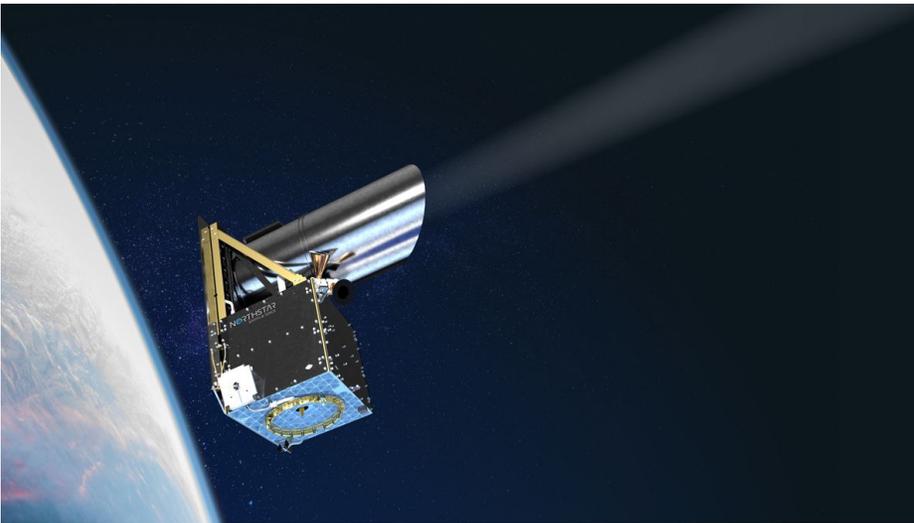
Fortunately the arm's performance was not affected – the space agency called it a “lucky strike” – but incidents such as this one are expected to become more common as the amount of debris orbiting the earth continues to grow.

Orbital debris, also known as space junk, can be anything from a fully intact satellite that no longer works to fragments of an exploded rocket. There are roughly 23,000 pieces of debris larger than a softball orbiting the earth at speeds of up to 28,000 km/h – fast enough for even a small piece of debris to damage or even destroy a satellite or spacecraft, according to NASA.

A Montreal-based company that's raised more than \$80-million from some high profile investors thinks it has the solution.

“The more we use space, the more you can expect that debris will accumulate,” says Stewart Bain, the chief executive officer of space monitoring firm NorthStar Earth & Space Inc. “What you want to do is have a good idea, using technology, of where everything is, so you're not operating blind.”

That's where Skylark, NorthStar's space-traffic-management constellation, comes in. Comprising 12 satellites outfitted with telescopes, Skylark will provide a much more comprehensive view compared with current ground-based monitoring systems. The company's software algorithms, meanwhile, will be able to predict the trajectory of a piece of space debris, giving satellite operators more time to manoeuvre out of the way.



Rendering of a NorthStar Earth & Space satellite. The company is planning on building a constellation of the satellites to monitor the trajectory of satellites and space debris.

NORTHSTAR

With the surge of private sector activity in space, the Canadian company will have a potentially enormous market worldwide. It is already in talks with a number of potential customers, including telecom satellite operators, and plans to start selling subscriptions to its monitoring service in early 2023.

NorthStar's bid to play traffic cop in space has attracted prominent backers. In 2018, the company raised a total of \$83-million from a group of investors including telecom magnate Charles Sirois, the Rogers family trust and the Space Alliance, a partnership between European space firms Telespazio and

Thales Alenia Space. (Thales Alenia is also constructing the satellites for the Skylark constellation.) The total also includes \$13-million from Investissement Quebec and \$13-million from the federal government's Strategic Innovation Fund.

The space race that has captured the imaginations of investors is increasing the congestion around Earth – a problem that Mr. Sirois, who is also the chairman of NorthStar's board – calls “the biggest threat to the space industry itself.” But for NorthStar, the threat also represents a massive opportunity.

## **SPACE BOOM**

For decades, the space sector has been dominated by governments willing to spend vast sums of money in order to strengthen their defensive capabilities and conduct scientific research. But that's beginning to change, thanks to the declining costs of space launches and hardware. “The private sector is entering space at full throttle,” Mr. Sirois says.

The space economy is projected to generate more than US\$1-trillion in revenue in 2040, up from US\$350-billion currently, according to U.S. investment bank Morgan Stanley. Several U.S. companies in the sector have rushed to go public by merging with special purpose acquisitions corporations, or SPACs, including reusable rocket maker Rocket Lab, satellite imagery provider BlackSky and Virgin Galactic, which recently took its founder Sir Richard Branson on a landmark space flight. In Canada, MDA raised \$400-million in its initial public offering on the Toronto Stock Exchange earlier this year.

Companies such as Elon Musk's SpaceX, Amazon's Project Kuiper, London-based OneWeb and Ottawa's Telesat are spending billions on satellite constellations in a race to beam high-speed broadband to remote parts of the globe. While some of the planned constellations are small – Telesat will deliver its service using a fleet of fewer than 300 satellites, and OneWeb has plans to launch 648 – others are massive. SpaceX's Starlink project is looking to launch up to 42,000 satellites, while Amazon has got the green light for 3,236. The Chinese government, meanwhile, has proposed a 13,000-satellite constellation.

If even a handful of all of the proposed low-Earth orbit (LEO) projects get built, there could soon be tens of thousands of communications satellites orbiting the Earth multiple times a day. Add to that a boom in space tourism, ushered in by high-profile flights such as Mr. Branson's and Amazon founder Jeff Bezos's trip aboard his company Blue Origin's rocket on Tuesday, and the space around earth is likely to get more crowded.

Not everyone is thrilled about the explosion of commercial activity in space, however. “It's good to provide internet to everyone, but these mega-

constellations can cause serious problems,” says John Crassidis, SUNY distinguished professor in the department of mechanical and aerospace engineering at the University at Buffalo.

In addition to the possibility of collisions, satellites that reflect the sun can obscure astronomers’ views of the night sky and limit scientific discoveries, Prof. Crassidis adds. “I believe that the bad outweighs the good, so I wouldn’t allow them.”

#### **THE KESSLER EFFECT**

In the 2013 film *Gravity*, a harrowing scene depicts Sandra Bullock in an astronaut suit wildly careening through space, her feet still attached to a fragment of a robotic arm, after her shuttle has been hit by orbital debris.

Before communications go dark, mission control in Houston explains to the Explorer’s crew that the volley of space junk is part of a chain reaction set off by the Russians hitting one of their own satellites.

Such a scenario was first proposed by NASA scientist Donald J. Kessler, who posited that once the amount of debris orbiting the planet reaches a critical mass, a chain reaction could occur as collisions create more debris, which in turn leads to more collisions. The Kessler Effect could take down GPS satellites and cut off our access to space for many generations.

GPS satellites are needed for more than just navigation – they are also equipped with highly precise atomic clocks that are used to time-stamp financial transactions. “If you lose the GPS satellites our financial system collapses,” says NorthStar’s Mr. Bain. “The world’s economy depends on those satellites. We need to protect them.”

Currently there are few regulations governing space traffic management, aside from the United Nations Space Treaty of 1967 that says all spacefaring governments are responsible for monitoring activity. But while governments work to catch up, Mr. Bain says that commercial enterprises like NorthStar have a role to play in protecting the space environment.

Mr. Bain, an engineer who helped design the Canadian Earth observation satellites Radarsat-1 and Radarsat-2, first came up with the concept for NorthStar’s Skylark constellation about a decade ago. Currently, space traffic management is done from the ground, which provides only a limited view. “When you’re stuck on the ground and you’re looking up into space, you have to wait for the objects to fly over you for you to see where they are, and your accuracy depends on how frequently you see them,” he says. Skylark, in contrast, will be able to view the space around earth from multiple angles.

The second phase of NorthStar’s project is a separate constellation of 40

earth-observation satellites that will use hyperspectral imaging, a technique that analyzes a wide spectrum of light, to perform tasks such as monitoring pipelines and predicting the trajectory of forest fires. While Skylark aims to be protect the space environment, the earth-observation project will provide new tools in the battle against climate change, Mr. Bain says.

Mr. Bain started working in 2015 with Telesystem, a Sirois family-owned technology holding company that provided some of the funding to launch NorthStar. The company has raised enough money to build the first three Skylark satellites and launch its space-monitoring service, but it will need additional financing. NorthStar's eventual aim is to go public, but it will need to start generating revenue first, Mr. Sirois says. In the meantime, its financing options include private investment and government funding.

“Access to capital is something we need to focus on, because it determines how fast we’ll be able to deliver our completed infrastructure – and I believe our completed infrastructure is very important for maintaining the sustainability of space,” Mr. Sirois says. “If there is no high-quality space traffic control system ... that’s a very big problem for the whole space industry.”

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