

COM DEV Launching its Satellite Data Services Portfolio

Canadians are not well known for blowing their own horn. How fortunate then, that in Ontario we now have the Premier's Innovation Awards to celebrate current achievements in medicine, health technology, clean tech, communications and digital media - and in the process stimulate ongoing innovation in these fields. Each year since 2008, three categories of awards have been presented: Discovery to showcase individual research activity; Catalyst to celebrate entrepreneurship; and Summit to support medical researchers and help build Ontario's profile as a major medical research centre.

This year, the [Catalyst award](#) for the company with the best innovation went to [COM DEV International](#) for its new work in maritime satellite communications, which was built on the company's research strength, willingness to take risk, and its ability to improvise with the business models needed to commercialize research innovation – the key to entrepreneurship and construction of Dalton McGuinty's "[Innovation Agenda](#)" for development of Ontario's knowledge-based economy.

Established in 1974, COM DEV is a Cambridge, Ontario-based designer and manufacturer of space hardware that now boasts 1,100 employees at facilities in Canada, the UK and US. The company's core business is manufacture of integrated multiplexers that decipher microwave signals based on radio frequency, ancillary microwave components, electromechanical switches and space electronics for clients in civil, military and commercial markets - COM DEV counts many of the major satellite builders, including the Canadian and European space agencies, NASA and NATO, among its customers.

COM DEV's Catalyst award was presented to mark the company's pioneering development of a signal processing algorithm that enables highly accurate detection of ships from microsatellites which has the potential for application in emergency response, environmental intelligence, coast guard operations, surveillance and security. According to CEO John Keating, the award has been especially appreciated as it provides recognition for the brilliant research effort made by COM DEV scientists such as project leader Richard Colacz and Dr. Robert Peach, possibly the most significant scientific contributor to the research team that developed COM DEV's award winning signal technology and for Canadian talent in general that "tends to sell itself short, though we are world leaders in lots of areas."

COM DEV's foray into the field of maritime signal identification started with a plan to grow the business by leveraging expertise in space subsystems to move up the space value stream – which begins with subsystems and moves through payload delivery, satellite manufacture, mission prime to the provision of data services. According to Keating, COM DEV "had a hankering to move up the value chain by manufacturing satellites," however, the satellites COM DEV builds subsystems for are huge – the size of a truck, costing between \$250 million and a couple of billion dollars – and outside the company's financial wherewithal and facilities capabilities. With the advent of miniaturized technology, though, COM DEV saw an opportunity to build a smaller sized satellite that "may be the size of toaster and cost in the range of 10-15 million dollars, and which does not tread on the toes of our customers." Armed with the technology design for the smaller satellite, COM DEV next approached the Canadian government to explore potential use cases. As Keating explains, the federal government identified no shortage of applications for this satellite technology, including carbon, environmental, weather and agricultural monitoring. The use case which won government support for the COM DEV satellite, however, was the monitoring of Arctic security and sovereignty, which involves identification of all ships that sail off Canadian Arctic shores. COM DEV's identification system is based on the reading of Alarm Indication Signals (AIS) that each ship over 300 tonnes is required to transmit on a continuous basis to avoid collision on the high seas. Through

testing of signal receiving equipment in boxes placed in Hamilton Harbour, in aircraft, and ultimately in a COM DEV owned nano-satellite, the company established the AIS as a reliable means to detect and track ships. While government departments ranging from the Department of Defence to the Ministry of the Environment expressed interest in buying the new satellites and signal technology, Canadian government procurement procedures and protocols proved too cumbersome: Keating notes that purchase approval could literally take years and “we found ourselves in this awkward position of having invested several million dollars and having invented this clever technology of discovering that even though people in government wanted to buy it, they had no capacity to buy it in a time frame that made sense.”

While Keating expects federal purchase of COM DEV-built AIS satellites will materialize in the near term, at the time of technology development, the company was reluctant to give up its technological lead to the competition, and hence adopted a new commercialization model – launch of its own satellite fleet and the supply of monitoring services to governments around the world which are signatories to the International Maritime Organization (IMO), which mandates some form of long range tracking and identification of ships. Under the new model, COM DEV is building and launching satellites to track ship movements and will sell ship data on activity in areas of particular national interest to specific country agencies – moving with this new data service to the very top of the space value chain. To support this new service delivery model, COM DEV is building its own space assets, its own operation control centre to control the space craft, its own data centre to “decollide all the signals,” has partnered with Gatehouse, a Danish software firm that provides maritime AIS charts and a customizable mapping interface with filtering capability to sell data to clients (largely government) around the world.

In order to provide full global coverage of all ship movement, COM DEV has needed to launch only three satellites: since each capture a 5,000 nautical mile footprint from each position in space and since the earth rotates on its polar axis, coverage is quite wide. Though the poles are visited more frequently than the equator in a polar orbit, COM DEV has calculated the minimum number of satellites needed to provide the minimum IMO required six hour “revisit time” at three: as Keating explains, “If you put three satellites in polar orbits that takes 100 minutes to complete, 120 degrees apart from one another, then [due to the earth’s rotation] you can see any point on earth within six hours – you may be over the poles once every 30 minutes, but you are everywhere over the equator once every six hours.”

Heavy coverage of the poles is a legacy of COM DEV’s initial interest in serving Canadian Arctic security needs: in future, the company will consider offering more regular coverage which may be needed by different customers through launch of additional satellites, with a corresponding adjustment in service fee. According to Keating, “We have done a tremendous amount of work on figuring out different orbital dynamics with different constellations of space craft and different costs and revenue models. So we have a lot of possible ways of doing this, and some of these involve equatorial orbits, and some involve ‘piggybacking’ our payload on someone else’s satellite. We probably have hundreds of different business plans that change as this thing rolls out.” From a business perspective, the key is to collect information up front from customers in terms of acceptable revisit time, latency and required coverage area and to map this to the satellite constellation that will serve the most customers in a manner that is as efficient as possible.

Phase 1 of the COM DEV service (3 satellites with 6 hour revisit times) has cost the company approximately \$40 million – for the satellites, but also for the space operating centre in Cambridge, for leasing and equipping a ground station in northern Norway that receives the AIS signals and passes them over fibre optic cable to a Bell owned data centre facility in Toronto for ‘decollision’, and the ultimate the sale of data to clients. In Toronto, the company has installed a 448 parallel processing cluster Beowulf supercomputer (designed by Robert Peach) to decipher AIS information, including vessel identification and route, ship speed and GPS location that is transmitted very six seconds from approximately 80,000 ships at sea. Because these signals are transmitted horizontally from the ship’s deck, range is typically limited to 25 nautical miles due to the curvature of the earth. Within that range, the number of ships is also limited; however, with satellite capture, the number of ship signals is vastly increased (could cover 6,000 ships in a 25 mile cell) and the result is an incomprehensible collision of ship signals – or unintelligible noise. COM DEV’s key innovation

(also designed by Peach) has been the development of an algorithm that uses radio frequency tools, some “very clever mathematics” and the COM DEV supercomputer to decollide and make sense of these signals.

To manage its new data services business, COM DEV has set up a new subsidiary, exactEarth Ltd., which recently announced agreement with two major government maritime agencies to provide its space-based Automatic Identification System (S-AIS) service, exactAIS(TM), on a paid trial basis on operational satellites scheduled for launch this September. This brings the total number of clients who have signed on or completed trials on the nano-satellite to five, with a number of other organizations in the wings. Given the level of investment in this project that has already been made (with no guaranteed sales, but some support from Fed Dev and potentially Jobs Ontario), COM DEV has shown a high tolerance for risk – or, it’s corollary, confidence in future prospects. Characteristically, the company has already designed the roll out of future services: in ten years’ time, COM DEV plans to offer several additional new ways of looking at the earth through its satellite fleets – it expect to provide a series of ‘exactServices,’ such as high resolution optical imaging views, low data rate machine-to-machine analysis of the earth, as well as weather, carbon and water data monitoring services.