SECURING THE BORDER

Building Critical Mass with Commercial Satellites

Government balances need for greater capability in a tight funding environment with how to take advantage of new commercial assets.

by Anne Wainscott-Sargent

FEATURE

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Border security continues to dominate the headlines especially in Europe, which is experiencing the most dramatic refugee crisis in modern times spurred by massive upheaval from war-torn Syria. Other border hot spots include Russia and the Ukraine, North and South Korea and the U.S.-Mexico border. At a time when virtually all governments are facing tight fiscal budgets, the push to leverage commercial satellite assets along the border has never been stronger. In this environment, how is commercial satellite technology driving greater capability? What has changed today compared with five or even 10 years ago?

"One thing that has changed is the speed of information getting into the hands of end users," says Kumar Navulur, senior director of strategic initiatives at DigitalGlobe, a high-resolution Earth imagery and geospatial solutions provider that collects 4 million square kilometers of data every day. "Ten years ago, you would take a picture and it might take a few days or a few weeks before information was processed and provided to end users; today, … within two hours, they will have the information either in their mobile units or on their computers."

That speed, adds Navulur, will continue to shrink as the industry builds "a lot more satellites," including small sats. "If you couple that with [Unmanned Aerial Vehicles] UAVs and aerial assets, we are getting to that critical mass where you can actually monitor borders on a more frequent basis," he says.

More Eyes in the Sky

New satellite launches are evident at every turn:

- In August, Inmarsat's third satellite in its Global Xpress (GX) High Throughput Satellite (HTS) constellation launched;Orbcomm plans to launch 11 more satellites before the end of the year — adding to its network of two dedicated Automatic Identification System (AIS) satellites, five dual-mode AIS/Machine-to-Machine (M2M) OG2 satellites, and 25 OG1 M2M satellites;
- Low-Earth Orbit (LEO) operator Iridium is scheduled to launch the first of 66 operational spacecraft that will comprise the Iridium NEXT constellation in April 2016;
- DigitalGlobe launched its advanced fourth-generation satellite, WorldView 3, in August 2014, and plans to launch its next satellite, WorldView 4, next year. WorldView 4 will have the ability to capture spectral imagery at 30 centimeters.

"As we put more communications capacity up, including high-data-rate communications for UAVs, that's transformative in terms of the amount of border that is possible to sensibly patrol," says Andy Start, president at Inmarsat Global Government Business.

Start adds that the rollout of Inmarsat Global Xpress will bring much larger data pipes to agencies looking to boost their border surveillance, including the hundreds of coast guard agencies currently relying on Inmarsat L-band links for monitoring.

He notes that a decade ago it took about two hours to do a briefing before an aircraft could take off; now a call

comes in and government first responders simply get in the aircraft and do all their mission briefings in route.

"We have found success operating at a much lower altitude [because] you are able to provide much lower latent communications and because our constellation is truly global, our customers can access it anywhere on the globe," says Scott Scheimreif, executive vice president of government programs for Iridium.

LEO satellites also enable operators to use smaller, more energy-efficient equipment, which is a critical decision factor when providing communications to autonomous or unmanned platforms.

"When you have to send and receive a signal 476 miles up versus 22,000 miles up to a geosynchronous satellite,

Post-SBI, Five Commercial Innovators Poised to Move Border Security Forward

Back in 2011, the U.S. government had just cancelled the Secure Border Initiative (SBI) to create a virtual fence along the U.S.-Mexico border, having spent $1 billion with prime contractor Boeing and only having 53 miles of fence to show for it. The ambitious program called for a mix of security infrastructure and surveillance and communication technologies – and many industry watchers blame the cost overruns and schedule delays on it being too complex and trying to address too many requirements.

Fast forward to 2015, and the U.S. government is still looking to secure the Mexico-U.S. border, tapping Israel-based Elbit Systems as the lead contractor to build a scaled back high-tech virtual fence along the Mexico-Arizona border that will rely on 50 fixed towers equipped with cameras, radars and sensors. Whether this effort will succeed where SBI failed is yet to be seen, but one thing is clear from CBP Congressional testimony last May: the U.S. government will continue to leverage "non-developmental" technology to the greatest extent possible, providing more flexible, less risky, and less costly procurements and deployments.

Here are five innovators poised to reshape border security through satellite connectivity:

– **Blighter:** providing virtual fences using electronically scanned radars, enabling security forces to track small and slow-moving objects even in cluttered environments exactly where they're needed, such as a hot spot on an extensive border.

– **Kymeta:** leveraging its low-profile, electronically steerable antennas that use less power and weigh less than mechanical and phased array antennas, to deliver increased connectivity to a larger variety UAVs, armored ground vehicles, and remote sensors over satellite.

– **NAL Research:** building personal locator beacons and embedding them into unattended ground sensors to provide situational awareness on the border, including imagery.

– **Satelles:** overcoming spoofing and jamming of GPS using its much stronger precision navigation and timing technology signals over LEO that can even penetrate buildings.

– **Securiport:** taking the technologies currently applied in airports and applying them to much smaller border posts, allowing border agents with minimally deployed hardware to do image recognition and passport verification remotely anywhere in the world, including the middle of a desert.

you are able to operate with a device that is less power hungry and with a much smaller antenna," he says. "For those platforms or applications that don't have the luxury of continuous power, whether it's a handheld device or a sensor or a UAV, obviously size, weight and power are critical."

Reliance on Commercial Innovation

Greg Flessate, Orbcomm's SVP and GM of government and AIS services, says government users today are embracing commercial satellite-led innovation, rather than building systems on their own. "The government is slowly figuring this out — leveraging commercial capability and reaping the benefits of letting the systems come to them." That, says Flessate, is where the commercial sector has made the breakthrough: demonstrating a Return of Investment (ROI) to commercial users and transporters to implement these systems. "Ultimately, the data collected benefits the government without them having to build it and regulate it themselves," he adds. Orbcomm, has embraced that approach with its satellite AIS data service launched in 2008 with the U.S. Coast Guard. Today, the system serves both commercial and government customers and tracks 150,000 unique vessels daily.

"M2M communications and even our AIS technology is being used extensively in the commercial world for things outside just border security. By doing that, you embrace a technology that provides benefits to the government without governments having to make steep investments," he says.

Satellite has always been a must-have in areas without terrestrial coverage. For example, it's the only option for the U.S. Coast Guard for longer range communications as it tracks maritime vessels through its National Automatic Identification System (NAIS) operating over the continental U.S. and territorial waters. It combines vessel location, source and speed with other government information and sensor data.

"Our system has a requirement to receive messages up to 2,000 nautical miles. Terrestrial sites can only reliably give us 50 miles of coverage from the coast, so satellite really becomes the coverage method for long-range communication," says Lieutenant Commander Sam Edwards with the Office of C4 and Sensor Capabilities in the U.S. Coast Guard.

Satellites' Importance in Arctic, Australia

Satellite technology, he adds, is particularly critical to the Coast Guard's Arctic strategy — a remote region seeing much more vessel traffic due to oil and gas exploration. According to the Coast Guard's Arctic strategy report, shipping traffic through the Bering Strait increased 118 percent from 2008 to 2012. The region contains 13 percent of the world's undiscovered oil and 30 percent of undiscovered gas. "As current events push us toward sensitive environments like the Arctic where you can't put up towers, satellites are crucial for giving us maritime

Robert Barron site in September (left) and in April (right). This tower, which depends exclusively on satellite, is well-below the Arctic Circle (Juneau, AK) but represents the extreme conditions which any Arctic tower should expect, as well as logistical difficulty of repairs/supplies. Photo courtesy of the Coast Guard.

domain awareness," Edwards says.

Another challenging geography is along the border of Australia, which has a vast coastline, covering some 37,000 kilometers. According to a spokesperson for Australia's Department of Immigration and Border Protection, its search and rescue region is similarly vast, covering nearly 10 percent of the world's oceans. "The biggest challenge is the constant deterrent, detection and response capability to various border security threats, including illegal maritime arrivals, illegal exploitation of natural resources, prohibited imports and exports, and maritime terrorism," the spokesperson says.

"Satellites can provide a cost-effective means of coverage — both in the visual and electronic spectra — to enhance situational awareness if deployed sensibly and in a well-coordinated and planned approach," the government spokesperson explains, adding that it must be done "in conjunction with other existing maritime-surveillance capabilities."

To address such a vast geography, Australia has had to increase the level of satellite integration, says Start. Inmarsat supplies satellite communication to the

Department's main coast vessels. Recently, it extended the capability to the agency's inflatable boats.

"So, instead of having here very expensive vessels searching the sea, they have one expensive and a series of small ships that can extend your eyes across a much wider area," says Start. Given the vast land border and coastline of the country, Australia has augmented its tracking beyond just its maritime fleet to include aerial surveillance. DHC-8 aircraft are outfitted with observation sensors that are integrated back into Inmarsat's SwiftBroadband network.

"Once they are on station they can access the imagery directly from the aircraft ground stations. Using satellite communications significantly increases the likelihood of detection because you're integrated into a common operational picture for all your maritime vessels," Start says.

Future – Smaller Sats for UAVs

What satellite-based innovations are coming down the pike that could help border security agents gain more situational awareness? Australia's Department of Immigration and Border Protection says it continues to monitor advances in satellite observation, particularly the expansion of multi-sensor payloads and hyperspectral imaging.

"The commercial satellite industry has been very willing to listen to our needs and unique challenges, and has responded well," a department spokesperson says.

Customs plane off the coast of Australia. Photo courtesy of Inmarsat.

Inmarsat's Start says that a key future technology trend for border security over land and sea will be the increasing use of UAVs. Already, UAVs can operate longer on station compared to a helicopter and still provide a similar level of imagery. "I was on a U.K. Navy vessel recently and they explained that a relatively small UAV was able to give them positioning data for 10 to 12 hours. Helicopters can be on station two or three hours at most."

Inmarsat is starting to provide imagery over its L-band network using smaller and smaller terminals. Start says the direction they are headed will soon allow them to field a terminal that weighs around 3lbs (1.5Kg), which provides 1-200kbps across their global satellite network.

One of the main challenges of high-altitude UAVs today

is they rely on Ku-band, and tend to operate "under a patchwork of different satellite operators, which makes it quite difficult for those UAVs to transit from one satellite provider to another." He adds, "What Global Xpress allows us to do because it is a completely ubiquitous network is allow those UAVs to go up and provide persistent aerial surveillance," says Start.

> We do see that the cost and capability of putting satellites up is now getting to the point where it is economical to build some of these systems that have a more focused purpose, and do it on a commercial scale without having to rely on the government to heavily invest.
>
> — Greg Flessate, Orbcomm

Inmarsat, he adds, is investing in greater levels of integration to shrink the terminal down to a very small module. "The underlying technologies are software modems and improvements in the miniaturization of electronics. They are the key drivers to being able to make smaller and more capable UAV antennas," Start explains.

More Multi-Mode Capability

Orbcomm's Flessate says there are now many more hybrid systems out there that can do multi-mode communications. His company offers three satellite systems and seven terrestrial systems to serve their customers' connectivity requirements. "The advantages of satellite are ubiquitous coverage and cost has come down considerably. But there are times that terrestrial communications may make more sense," he says. "We recognize the benefits of all systems to provide the best value and meet our customers' unique coverage and operational requirements."

Faster Access to Commercial R&D through DISA Contract Vehicles

Some of the innovation from commercial is coming through contract vehicles such as Iridium's Defense Information Systems Agency (DISA) Enhanced Mobile Satellite Services (EMSS) contract vehicle, which it renewed for a five-year term in 2013. Several U.S. government agencies are taking advantage of this fixed-price contract, including the U.S. Coast Guard, U.S. Custom and Border Protection (CBP), U.S. Immigration & Customs Enforcement, and the U.S. Drug Enforcement Administration (DEA).

Iridium's Scheimreif explains that these agencies gain unlimited access to the Iridium network for a set of agreed-upon services.

"What this has resulted in is several of our partners

who do a lot of research and development in building new applications to meet government needs can take advantage of this network without worrying about service fees. The United States government is now taking advantage of industry's R&D investments, which is resulting in cost savings for the government and quicker access to technology instead of … having to wait three or four years for this capability. Industry is providing real-time solutions that can be immediately deployed using commercial off-the-shelf technology to address critical problems today."

For example, Satelles, an engineering company and exclusive Iridium partner, has leveraged the network contract to develop its positioning, navigation and timing systems over Iridium's LEO constellation to provide an alternative to Global Positioning System (GPS) in environments where it is unavailable or threatened. Satelles hopes to offer its commercial service next April over the continental U.S. while demand for the broadcast signal anywhere on the globe continues to grow. The company sees a major market for its technology in unattended ground sensors along borders.

"Our signal is strong, coming from a low-earth orbiting satellite, and it's using a channel that is just harder to disrupt," says Gregory Gutt, president and CTO, describing the signal as "1,000-times stronger than GPS," which uses Medium-Earth Orbit (MEO) satellites at an altitude of approximately 20,000 miles that require the signal to travel much farther to Earth.

Big Data, Cloud Computing and 3-D Gaming

DigitalGlobe's Navulur says that handling geospatial big data — from imagery, to aerial data from satellites, UAVs, or GPS and Geographic Information System (GIS), as well as Computer Aided Design (CAD) and Building Information Modeling (BIM) — is the domain of the computing industry, including the Googles and Oracles of the world. That's why his company is looking at innovation occurring in high-performance computing, specifically cloud computing and 3-D gaming, to take their imaging capabilities forward.

"We're actually generating high-performance computing from 3-D gaming into our image-processing application," says Navulur.

To accelerate the speed by which data goes from satellites to the ground and back, DigitalGlobe is making the data available on the cloud.

"We [also] are creating an ecosystem where, if an end user has technology to process this data, the customer can download APIs that we are developing. We are bringing an ecosystem of partners onto this platform."

Navulur says it's not about satellites — it's about "how you get information to the end user so they can take action on the ground."

"For me, most of the innovation has already been done [on satellites]. A lot of the innovation happening now is around how to digitally capture data to solve customers' problems," he adds. VS

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