

*Worldwide Satellite Magazine — January 2018*

# *SatMagazine*



**Satellites, Reindeers and Trains**  
**Solving Satellite Interference**  
**The Power of Satellite**  
**Worry Time for Satellite Operators**  
**STEM Needed**  
**What's Changing?**  
**Record Breaking Antarctica Journey**  
**Satellite Architecture Evolution**  
**Building a Custom Terminal**

*Iridium NEXT satellite — 10 expressed to orbit by SpaceX.  
Artistic rendition courtesy of Iridium.*





# SatMagazine

January 2018

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# InfoBeam

## Ten satellites a launching — SpaceX Sends Ten Iridium NEXT satellites to orbit...

**SpaceX's launch was a classic — on time and all conditions were at optimum levels — to send off Iridium Communications' fourth set of 10 Iridium NEXT satellites on a Falcon 9 rocket from Vandenberg AFB in California.**

There are now a total of 40 Iridium NEXT satellites in LEO (Low Earth Orbit). The Falcon 9 rocket first stage being used in this launch was previously flown during Iridium's second launch, which successfully occurred in June.

The operational Iridium constellation is comprised of 66 satellites divided into six polar orbiting planes with 11 satellites in each plane.

Destined for Iridium orbital plane two, nine of the 10 Iridium NEXT satellites deployed during this launch will immediately go into service following rigorous testing and validation.

The remaining satellite will undertake a nearly year-long journey to orbital plane one, where it will serve as a spare satellite.

To date, three Iridium NEXT launches carrying 10 satellites each have been completed. This fourth launch will bump the total number of new Iridium NEXT satellites on orbit to 40 in number.

Iridium has contracted with SpaceX to deliver 75 Iridium NEXT satellites to orbit, 66 operational and nine on-orbit spares, through a series of eight launches.

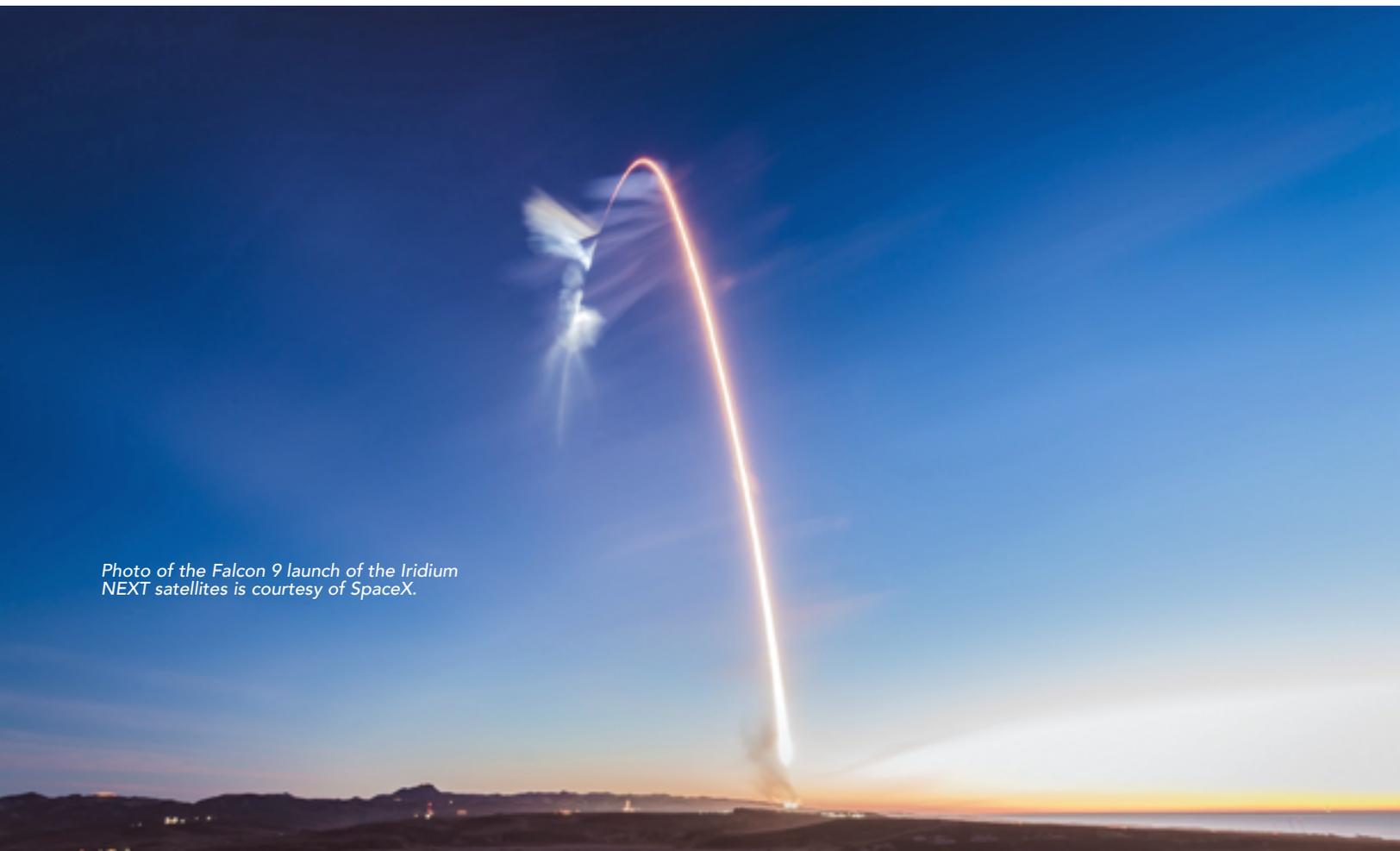
Iridium NEXT is the company's \$3 billion, next-generation, mobile, global satellite network scheduled for completion in 2018. These new satellites are replacing the company's existing global constellation in one of the largest technology upgrades ever completed in space.

The network represents the evolution of critical communications infrastructure that governments and organizations worldwide rely upon to drive business, enable connectivity, empower disaster relief efforts and more.

According to the company, the Iridium NEXT satellites will enable and introduce new services such as the company's next-generation broadband service, Iridium CertusSM.

[www.spacex.com](http://www.spacex.com)

[www.iridium.com](http://www.iridium.com)



*Photo of the Falcon 9 launch of the Iridium NEXT satellites is courtesy of SpaceX.*



# InfoBeam

## Four SSTL-built Galileo satellites launched by Arianespace

**The launch was a “go” on an overcast day from the Spaceport in French Guiana as the last launch of 2017 — VA240 — was successful for Arianespace with the latest cluster of four Galileo spacecraft heading to orbit.**

The Ariane 5 was used to transport the latest additions to Europe’s civilian-run satellite navigation constellation.

2017 was to be remembered, as that was the year that included a shutdown of the Arianespace facility due to political unrest. This launch was the 11th launch of the year, and the sixth Ariane 5 liftoff from the Guiana Space Center (CSG) in French Guiana during 2017.

The satellites had a liftoff mass of approximately 715 kg. each, and will be injected into a Medium Earth Orbit (MEO) at an altitude of 22,925 kilometers. To achieve this goal, the Ariane 5’s storable propellant upper stage performed two burns during the mission.

As with the workhorse Ariane 5 launcher itself, the multi-passenger dispenser for the four Galileo satellites was developed and built by ArianeGroup.

Flight VA240 marks the second time that Arianespace is using the

Ariane 5 ES and dispenser system to orbit payloads for Europe’s satellite navigation system, following other flights that employed medium-lift Soyuz vehicles carrying two Galileo spacecraft per mission.

Flight VA240 closed out Arianespace’s 2017 launch activity, which involved 10 flights from the Spaceport: five performed with Ariane 5, three using the lightweight Vega and two with the medium-lift Soyuz.

Flight VA2450 was performed on behalf of the European Commission under a contract with the European Space Agency (ESA).

For the second time, an Ariane 5 ES version will be used to orbit satellites for Europe’s own satellite navigation system. At the completion of this flight, designated Flight VA240 in Arianespace’s launcher family numbering system, 22 Galileo spacecraft will have been launched by Arianespace.

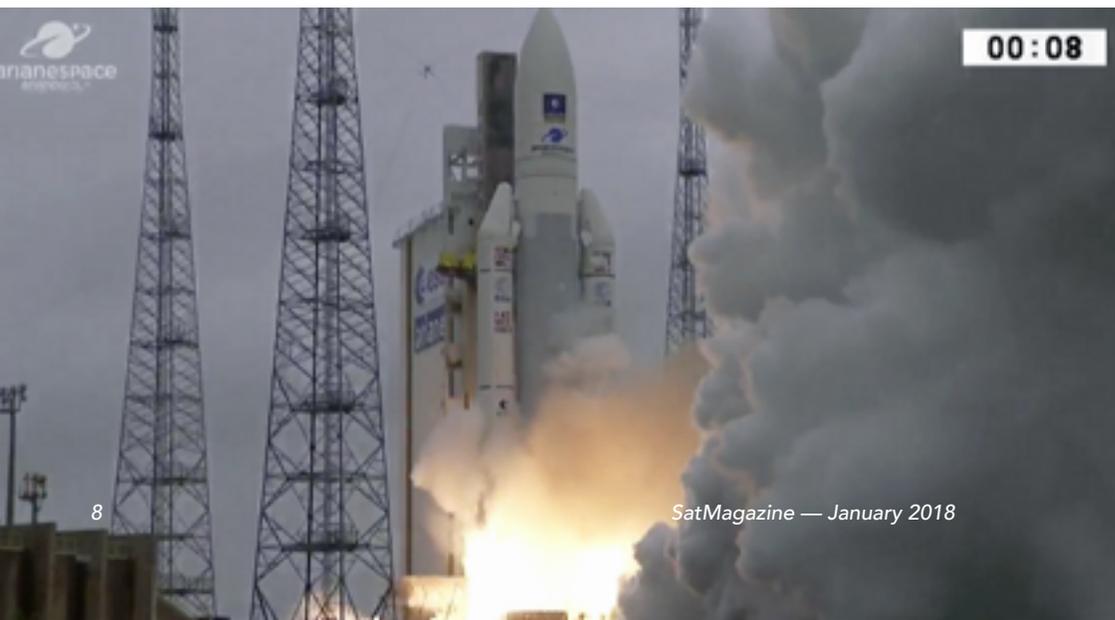
The launch vehicle was an Ariane 5 ES version, which has an upper stage powered by the re-ignitable Aestus engine, already successfully deployed for the launches of all five European ATV space freighters as well as for the launch of four previous Galileo satellites in November of 2016.

The launch performance of this Ariane 5 ES was 3283 kg. (including 2855 kg for the satellites) to a circular orbit at an altitude of 22,922 km. — four satellites of around 714kg each. A 428 kg. dispenser system, specially developed and built by ArianeGroup for the Galileo launches, was used for orbit injection of the satellites.

*“2017 has been a perfect year for Ariane 5, which has beaten its own record with its 82nd consecutive successful launch since 2003. These four new Galileo satellites put into orbit testify once again to the unparalleled reliability of Ariane 5, which has already benefited the development of Ariane 6. I would like to thank ESA and the European Commission for having entrusted our subsidiary Arianespace with this emblematic mission, and to be the first to have decided to get on board Ariane 6, entrusting it with the launch of the next Galileo satellites from 2020,”* said Alain Charneau, CEO of ArianeGroup. Ariane 5 ES will launch four more Galileo satellites in 2018 before the rocket is replaced by the Ariane 6.

Two twin-booster Ariane 62s, equipped with the re-ignitable Vinci engine is scheduled to place four new satellites into orbit between the end of 2020 and mid-2021. This decision was made official in a contract signed last September by Arianespace and ESA on behalf of the European Commission (DG GROW) and the European Union.

As the industrial lead contractor for development and operation of the Ariane 5 and Ariane 6 launchers, ArianeGroup coordinates an industrial network of more than 600 companies in 13 European countries, including more than 350 Small and Medium Enterprises.



ArianeGroup oversees all industrial activities, from the performance improvements and studies necessary for Ariane 5 up to its production, the provision of data or software specific to each mission, as well as marketing activities via Arianespace. This chain includes equipment and structures, engine manufacturing, integration of the various stages, and finally launcher integration in French Guiana.

Surrey Satellite Technology Ltd (SSTL) celebrated the twin achievements of a successful lift-off of 4 Galileo satellites from Kourou in French Guiana today, and the start of production of a third batch of navigation payloads for the Galileo Constellation. The new contract, signed with long-term partner OHB System AG, is for another 12 navigation payloads — adding to the 18 payloads already on orbit and completing the constellation.

As with the previous Galileo contracts, SSTL in its capacity as payload provider is responsible for the design, construction and test of the navigation payload panels which are based on European-sourced atomic clocks, navigation signal generators and high power traveling wave tube amplifiers.

In addition, SSTL manufactures the electrical harnesses and electronics to interface the payload to the satellite platforms and provides in-orbit verification support.

SSTL was selected to supply the navigational payloads for the first 14 Galileo Full Operational Capability satellites, in partnership with prime contractor OHB System AG of Germany, in January 2010.

In 2012, the OHB-SSTL partnership was awarded a second contract to supply a further 8 spacecraft for the

program and earlier this year the Batch 3 contract was again awarded to the OHB-SSTL partnership.

To mark the occasion SSTL staff in Guildford gathered for a slice of celebratory cake, a long-standing tradition at SSTL where cakes have fueled many previous test campaigns and 50 previous mission launches.



## Weather forecasts to forever change, thanks to the launch of NOAA's JPSS-1 by ULA and NASA

**NOAA's first of four highly advanced polar-orbiting satellites, equipped with next-generation technology and designed to improve the accuracy of U.S. weather forecasts out to seven days, was launched on November 19, 2017, from Vandenberg Air Force Base, California, at 1:47 a.m.**

Approximately 63 minutes after launch, the solar arrays on JPSS-1 deployed and the spacecraft was operating on its own power. JPSS-1 will be renamed NOAA-20 when on orbit. Following a three-month checkout and validation of its five advanced instruments, the satellite will become operational.

*"Launching JPSS-1 underscores NOAA's commitment to p— greater confidence in weather forecasts up to seven days in advance, including the potential for severe, or impactful weather,"* said Stephen Volz, director of NOAA's Satellite and Information Service.

JPSS-1 will join the joint NOAA/NASA Suomi National Polar-orbiting Partnership satellite in the same orbit and provide meteorologists with observations of atmospheric temperature and moisture, clouds, sea-surface temperature, ocean color, sea ice cover, volcanic ash, and fire detection.

The data will improve weather forecasting, such as predicting a hurricane's track, and will help agencies involved with post-storm recovery by visualizing storm damage and the geographic extent of power outages.

*"Emergency managers increasingly rely on our forecasts to make critical decisions and take appropriate action before a storm hits,"* said Louis W. Uccellini, director of NOAA's National Weather Service. *"Polar satellite observations not only help us monitor and collect information about current weather systems, but they provide data to feed into our weather forecast models."*

JPSS-1 has five instruments, each of which is significantly upgraded from the instruments on NOAA's previous polar-orbiting satellites.

The more-detailed observations from JPSS will allow forecasters to make more accurate predictions. JPSS-1 data will also improve recognition of climate patterns that influence the weather, such as El Nino and La Nina.

The JPSS program is a partnership between NOAA and NASA through which they will oversee the development, launch, testing and operation all the satellites in the series.

NOAA funds and manages the program, operations and data products. NASA develops and builds the instruments, spacecraft and ground system and launches the satellites for NOAA.

JPSS-1 launch management was provided by NASA's Launch Services Program based at the agency's Kennedy Space Center in Florida.

*"This launch is the latest example of the strong relationship between NASA and NOAA, contributing to the advancement of scientific discovery and the improvement of the U.S. weather forecasting capability by leveraging the unique vantage point of space to benefit and protect humankind,"* said Sandra Smalley, director of NASA's Joint Agency Satellite Division.

*"It has been an honor to partner with our teammates at NASA and NOAA in launching this critical Earth Observation mission,"* said Laura Maginnis, ULA vice president of Government Satellite Launch. *"Together, we were able to overcome multiple challenges in the last two weeks, culminating in the successful delivery of JPSS to orbit."*

This mission was launched aboard a Delta II 7920-10 configuration rocket, which includes a 10-ft diameter Payload Fairing (PLF).

The booster for this mission was powered by the RS-27A engine and the second stage was powered by the AJ10-118K engine.

This is ULA's 8th launch in 2017 and the 123rd successful launch since the company was formed in December 2006.

This is the penultimate launch of the Delta II rocket, first launching in 1989 with 154 launches to date. The final Delta II mission is scheduled





for 2018 and will put ICESat-2 in orbit for NASA.

*"The Delta II rocket has truly created a legacy throughout its history, and has proven to be an industry workhorse," said Maginnis. "After almost three years since our last Delta II mission, it was great to see it flying and delivering mission success for our customers once again."*

ULA's next launch is the NROL-47 for the National Reconnaissance

In addition to the JPSS-1 payload, this mission includes five cubesats which launched from dispensers mounted to the Delta II second stage.

These smallsats will conduct research in 3D-printed polymers for in-space manufacturing, weather data collection, bit flip memory testing, radar calibration and the effects of space radiation on electronic components.

Ball Aerospace designed and built the JPSS-1 satellite bus and Ozone Mapping and Profiler Suite instrument, integrated all five of the spacecraft's instruments and performed satellite-level testing and launch support.

Raytheon Corporation built the Visible Infrared Imaging Radiometer Suite and the Common Ground System.

Harris Corporation built the Cross-track Infrared Sounder.

Northrop Grumman Aerospace Systems built the Advanced Technology Microwave Sounder and the Clouds and the Earth's Radiant Energy System instrument.

To learn more about the JPSS-1 mission, visit [www.jpss.noaa.gov/](http://www.jpss.noaa.gov/)

[www.ulalaunch.com](http://www.ulalaunch.com)

[www.ball.com/aerospace](http://www.ball.com/aerospace)

[www.raytheon.com](http://www.raytheon.com)

[www.harris.com](http://www.harris.com)

[www.northropgrumman.com](http://www.northropgrumman.com)

# InfoBeam

## SSL's Restore-L satellite servicing spacecraft completes NASA review

**SSL, a business unit of Maxar Technologies (formerly MacDonald, Dettwiler and Associates Ltd.) has announced that the Restore-L mission to provide satellite servicing in LEO has completed an extensive NASA review called the Mission Preliminary Design Review (PDR) and is on track to meet the next development milestone, which is called Key Decision Point C (KDP-C).**

The on-schedule progress and successful reviews for this mission, which will develop and demonstrate key technologies essential to future NASA missions and commercial activities, are tangible evidence of SSL leadership, experience, and commitment to space innovation.

As announced last year, SSL is working with NASA Goddard Space Flight Center's Satellite Servicing Projects Division (SSPD) to build a spacecraft that will — for the first

time in history — refuel a satellite in LEO not designed to be serviced.

In addition to demonstrating refueling capability, Restore-L will validate the use of tools, technologies and techniques developed to enable future space exploration missions and satellite servicing in LEO.

To meet the requirements for high-performance and reliability, Restore-L's design is based on the world-class SSL 1300 spacecraft platform, which has the flexibility and power to enable a broad range of missions, including satellite servicing, space exploration and advanced communications.

The SSL-built spacecraft bus will provide the structural support, propulsion, attitude control, data and communications interface, and power to support the Restore-L robotic payload for the on orbit demonstration.

NASA missions undergo multiple rigorous technical and programmatic reviews as they proceed through the phases of development prior to launch.

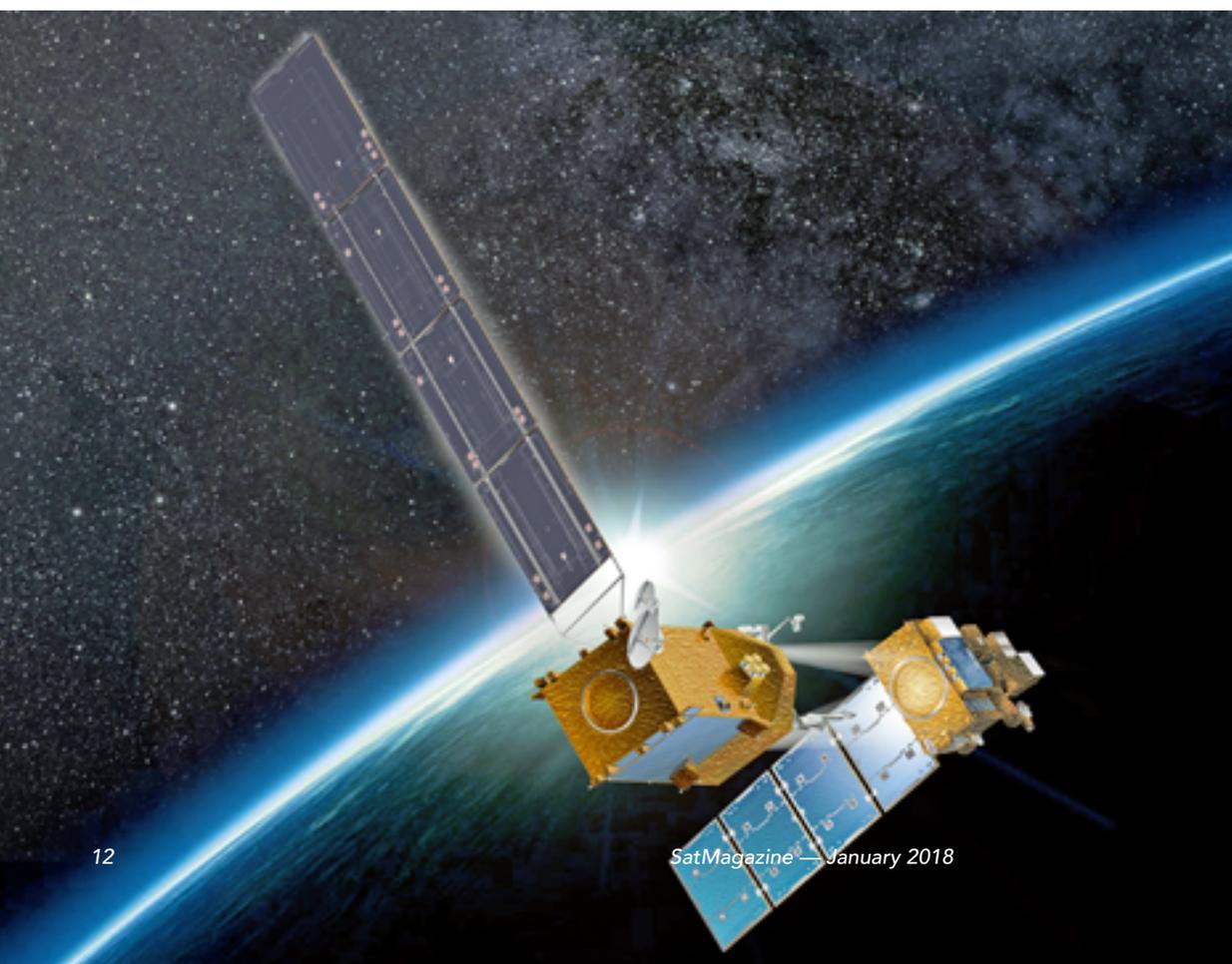
With the Mission PDR complete, Restore-L is on track toward KDP-C, which is scheduled to take place in early 2018. This is the third of six major NASA mission milestones, culminating in the final design and fabrication of the spacecraft.

NASA is also leveraging SSL's capabilities and experience to help reduce cost and schedule on a variety of next-generation missions that use groundbreaking commercial technologies.

These include a NASA Discovery Mission to explore the asteroid Psyche, and the Dragonfly program to develop robotic satellite assembly on-orbit, which SSL recently demonstrated on the ground.

Richard White, the President of SSL Government Systems, said that the satellite servicing technologies that Restore-L will demonstrate are critically important to our nation's security, commercial development of innovative activities in LEO and fundamental to future NASA missions to cislunar space and Mars.

[www.sslmda.com](http://www.sslmda.com)





## Microsemi debuts new options for their SyncServer S600 series

**Microsemi Corporation has released new hardware and software options for the firm's popular SyncServer S600 series of time servers and instruments.**

The recent enhancements improve time synchronization over enterprise Ethernet networks and supply timing signals for satellite uplink communications as well as improved military radar operations.

*"The SyncServer S600 series provides highly accurate, reliable and secure time for a variety of applications, not the least of which are the extremely precise low phase noise 10 MHz signals used in military radars and satellite uplinks,"* said Paul Skoog, senior product line manager at Microsemi. *"We're committed to helping our customers improve the performance of their systems by improving the performance of ours. These high-quality timing signals enable radars to track difficult targets as well as to improve the quality and data throughput of satellite communications systems."*

Enterprise and financial customers also look to the SyncServer S600 series to meet the timing and synchronization needs of their rapidly evolving networks, particularly for compliance purposes such as the European MiFID II directive, which specifies highly stringent time accuracy requirements for stock trading systems.

Also applicable for laboratories and test and measurement companies, this latest release of Microsemi's S600 hardware and software includes support for the IEEE™ 1588 multi-port, multi-profile Precision Time Protocol (PTP), which allows the S600 to operate as an independent grandmaster clock on each Ethernet port — delivering cost savings and network deployment flexibility to customers. This is coupled with a new 10GbE interface to easily interoperate with a wider variety of network and stock trading topologies.

The newly enhanced SyncServer S600 and S650 can be equipped with two 10 GbE Ethernet small form-factor pluggable (SFP+) ports ideal for customers needing to maximize PTP grandmaster performance in a cost-effective 1 rack unit (1U) chassis.

In addition, the S650 can measure the accuracy of PTP hardware slaves that are synchronized to the S650 grandmaster by way of a new external 1 pulse per second (PPS) measurement option.

The combination of these devices' new hardware and software features support Microsemi's expanding leadership position as a cost-effective enterprise PTP grandmaster provider delivering accurate and reliable time to critical systems.



Microsemi's SyncServer S600 series meets the time and frequency requirements of multiple vertical markets, particularly the global military radar market, which is estimated to reach \$10 billion by 2024 with a compound annual growth rate (CAGR) of 2.6 percent between 2016 and 2024 according to market research firm Variant Market Research.

The firm also identifies how radar in military applications is widely used for air traffic control, early warning detection of missiles, navigation at sea and surveillance of air and ground. The versatile SyncServer S600 series meets the needs of today's demanding timing requirements and scales to meet the needs of the future.

[www.microsemi.com](http://www.microsemi.com)





## InfoBeam

### Clyde Space acquired by AAC Microtec AB

**The Swedish space tech company AAC Microtec AB (“AAC”) has entered into a share sale and purchase agreement to acquire 100 percent of the shares in UK based Clyde Space Ltd (“Clyde Space”) (the “Transaction”), a leading player in the global, high-growth smallsat market.**

The acquisition will be paid for with 30,466,326 newly issued shares in AAC and GBP 2 million in cash, equivalent to approximately SEK 294 million (at a share price of 8.90 SEK/share).

After completion of the acquisition, Clyde Space owners will hold 49 percent of AAC.

Being a fast-growing forerunner in the “New Space” market, Clyde Space has supplied complete platforms as well as more than 2,000 subsystems for small spacecraft.

In the cubesat sector, Clyde Space is a market leader, supporting between 30 and 40 percent of all current and past missions.

For the period Q1-Q3 2017, Clyde Space’s revenues amounted to approximately GBP 3.98 million, corresponding to approximately million SEK 45 million. EBITDA for the same period amounted to approximately GBP -0.03 million, corresponding to approximately SEK -0.3 million[1].

The company employs 77 individuals in Glasgow, Scotland.

[aacmicrotec.com](http://aacmicrotec.com)

[www.clyde.space](http://www.clyde.space)

## InfoBeam

### Smaller than small smallsats — Microns

A veteran of the industry known for bringing Emerging Markets Communications (EMC) from a start-up to a successful company is announcing a new project with AST&Science that will create satellites that weigh only seven ounces for government and commercial use.

Abel Avellan has launched a venture to manufacture a new generation of ultra-small satellites.

The manufacturing plan for AST&Science Lic.™ is to build a new kind of ultra-small satellite which is designed to be placed into Low-Earth Orbit (LEO). The satellites, called Micron, by the company, weigh approximately seven ounces and are designed to work in concert with larger nano and micro satellites.

AST&Science has already completed the system design of its proprietary technology and has filed patents for key elements of its intellectual property in the United States, Europe, Japan and other countries.

The company is preparing to commence manufacturing in mid-2018 and is actively investing in related technologies of ultra-small satellites. The firm is currently bidding for the first launch partner in the U.S. and across the globe.

Avellan said that the satellite industry has been slow to adopt miniaturization technologies, and that what happened to mainframe computers will happen to current and future satellite architectures based on today’s technology.

AST&Science, with its proprietary technologies, will be at the forefront of this miniaturization revolution in space, enabling them to create a totally new business model that will dramatically change the way satellites are designed, manufactured and launched.

Abel Avellan is the Founder, Chairman and CEO of AST&Science. He is a 25-year veteran in the global satellite communications sector who created and built EMC, which was sold for \$550 million in 2016.



Avellan was named Satellite Teleport Executive of the Year in 2017 and was the recipient of the Satellite Transaction of the Year award by Euroconsult in 2015.

[ast-science.com](http://ast-science.com)



## EO imaging distribution partnership signed by UrtheCast and SI Imaging Services

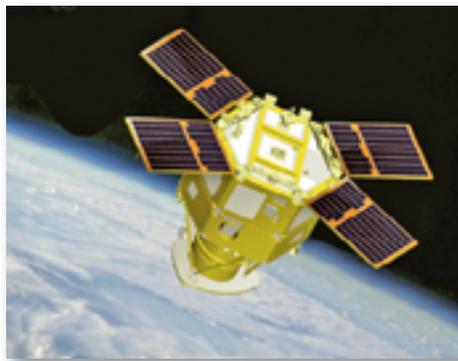


**UrtheCast Corp. and their subsidiary, Deimos Imaging, have signed an agreement with SI Imaging Services (“SIIS”) for the mutual, global distribution of their respective product portfolios.**

The space assets of Deimos Imaging and SIIS include Deimos-1, Deimos-2 and the KOMPSAT series KOMPSAT-2, KOMPSAT-3, KOMPSAT-3A and KOMPSAT-5, resulting in a wide portfolio of X-band SAR and optical data in a wide range of resolutions, from 22 m to 0.4 m per pixel.

The combination of radar with very high-resolution optical imagery will allow observation of the Earth day and night, regardless of weather conditions, and is intended to provide a constant asset monitoring service.

This is key for a wide range of applications, especially those requiring frequent monitoring over the same area of interest and real-time response, such as emergency services, border and maritime surveillance and defense and security.



*Artistic rendition of the Deimos-2 satellite.*

Additionally, this collaboration is expected to provide customers with an exceptional level of decision making data, and to create a unique and crucial benefit for users in various sectors while strengthening the positions of both companies in their respective markets.

The assets of SIIS now combine with the recent strategic partners aligned with Deimos Imaging, resulting in a multi-satellite, multi-resolution virtual constellation, to deliver imagery services and geo-analytic applications to customers globally.

These strong partnerships are designed as ‘win-win’ to secure the success and sustainability of all the partners involved in the ever developing and growing Earth Observation industry.

Mr. Wookhyun Choi, VP at SIIS, stated that the company is delighted to be an authorized distributor for Deimos Imaging.

Choi said that this is a great opportunity to broaden the firm’s reach and widen geospatial data distribution options, as the company is introducing Deimos Imaging’s imagery to the firm’s resellers while presenting KOMPSAT to their networks. This will allow SIIS to provide customers with more precise answers to their needs.



*Artistic rendition of the KOMPSAT-5 satellite.*

Fabrizio Pirondini, CEO at Deimos Imaging, added this collaboration supports and strengthens the company’s data strategy to meet a growing range of customer needs by providing them with fast, customized and ready-to-use solutions.

Pirondini added that this agreement confirms the importance of partnerships and alliances with other stakeholders to significantly accelerate decision making in a great variety of fields. In addition, this joint service increases the company’s portfolio of sensors and market reach with new geo-intelligence products, thanks to the combination of SAR and very high resolution optical data.

[www.urthecast.com](http://www.urthecast.com)

[www.si-imaging.com](http://www.si-imaging.com)



## Now operational — NOAA's GOES-16



Artistic rendition of NOAA's GOES-16 satellite.

**Now in its new GOES-East position, the advanced GOES-16 satellite has officially joined NOAA's operational observation network, providing forecasters with sharper, more defined images of severe storms, hurricanes, wildfires and other weather hazards in near real-time 24/7.**

Since its launch in November of 2016, NOAA's GOES-16, even in its testing stage, showed its potential to improve weather forecasts and brought new levels of situational awareness to forecasters, emergency managers, and the public. The satellite covers most of North America — all of the continental U.S., Mexico and most of Canada, from 22,300 miles above the Earth.

Navy Rear Adm. Timothy Gallaudet [Ret.], Ph.D., acting NOAA administrator, stated that GOES-16 has proven to be one of the most important tools ever developed for weather and hazard forecasts. From its impressive first image of Earth last January to monitoring tropical storms and wildfires, GOES-16 has and will continue to greatly improve our ability to visualize potential threats, and enhance forecasts and warnings to save lives and protect property.

GOES-16 provided critical data which enabled emergency preparations and response during this year's extremely active hurricane season. The new satellite

delivered experimental imagery with detail and clarity never achieved before. Its high resolution — four times higher than previous NOAA satellites — and views of Earth taken every 30 seconds allowed forecasters to monitor how and when storms developed.

Data from GOES-16 allowed forecasters to better assess and predict how much rain Hurricane Harvey would produce over Texas and see its rapid intensification, along with hurricanes Irma, Jose, and Maria.

GOES-16 data helped monitor and detect wildfires, and gave forecasters detailed images of wildfire smoke, enhancing their air quality forecasts. Imagery from GOES-16 helped forecasters spot new wildfires in California, Kansas, Oklahoma, and Texas, and determine which fires were hottest and where the fires were spreading. This critical information was shared with and used by firefighters and emergency managers.

GOES-16 testing showed potential improvements for aviation weather forecasting and airport operations. Forecasters are now able to predict with greater accuracy than before when fog and clouds will form and clear. The new satellite can also detect turbulence, enabling forecasters to issue timely advisories, aiding in aircraft and passenger safety.

Data from GOES-16 has been available to NOAA forecasters and the national and international weather modeling and forecasting community during the satellite's testing phase and will continue to do so.

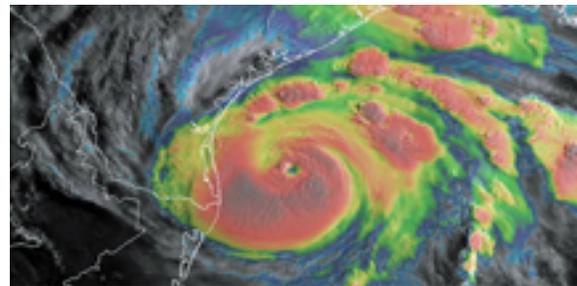


Image of Hurricane Harvey captured by GOES-East (GOES-16) on August 15, 2017. Image is courtesy of NOAA.

GOES-16 is the first in the series of next-generation geostationary satellites to provide valuable data in support of NOAA's Weather-Ready Nation initiative.

The next new NOAA satellite, GOES-S is scheduled to launch March 1, 2018 followed by GOES-T in 2020 and GOES-U in 2024. These satellites will enable NOAA to more closely monitor weather systems over North America, South America, and the Atlantic and Pacific Oceans, to help protect lives and property.

Secretary of Commerce Wilbur Ross added that the GOES-16 satellite provided invaluable data on deadly hurricanes long before they touched the shore this season. As it becomes fully operational, GOES-16 will continue to monitor extreme weather events, safeguarding American lives and property from its perch thousands of miles above the Earth.

National Weather Service director Louis Uccellini, Ph.D., noted that his organization is using the GOES-16 data in a variety of ways, planned and unplanned. GOES-16 has been a game changer for monitoring hurricanes, wildfires, severe storms, and lightning. Now that it is operational and the data is incorporated into the forecast process, we will be able to use it across all our service areas, starting with winter storms.

[www.noaa.gov](http://www.noaa.gov)



# Satellites, Reindeer and Trains

## Satellite IoT and geo-fencing to the rescue

By Corry Brennan, Regional Sales Manager EMEA, Globalstar

**The Internet of Things (IoT) and the power of satellite communications are fueling the imaginations of innovators all over the globe.**

While we have heard of tracking collars protecting sheep via geo-fencing, hackathon participants in Norway came up with the idea of combining connected collars on wild roaming reindeer with train GPS data to reduce collisions.

The combination of satellite communications and IoT has captured the imaginations of some of the world's most inventive minds. Globalstar customers are benefiting from these "light bulb" moments, thanks to solutions with capabilities that are as diverse as monitoring the condition of craft beer and potentially explosive chemicals.

IoT is also being used to track and monitor the health and welfare of animals — livestock and wildlife — including more than 30,000 sheep and cattle across the Nordic region.

Inspired by these developments, in 2016 the Norwegian mapping authority, Kartverket, held one of the organization's regular hackathons to determine if a solution could be found to reduce the number of reindeer that are killed by collisions with trains in the remote north of the country.

A company called FindMy emerged the winner from Kartverket's hackathon and *SaveMyReindeer* was developed as a proof of concept.



Norwegian Reindeer wearing the FindMy collar.  
Photo is courtesy of Globalstar.



*Globalstar's IoT solution protects Norwegian reindeer from deadly train encounters. Photo is courtesy of Globalstar.*

Scandinavia's reindeer are valued for their meat as well as for breeding — these animals can have a high monetary value, particularly if they are used as breeding stock, which can span many years.

Each year, trains kill approximately 6,500 of the Nordic region's 600,000 reindeer — that's an estimated loss of 8.5 million euros of livestock. In just a single week in November of 2017, 100 reindeer were killed on the tracks after being hit by freight trains — 65 reindeer on a single day.

As a result, Norway's rail authority — **Bane NOR** — has recently reduced the permissible speed of freight trains traveling in the area but next year, an innovative technology solution should be solving this issue.

Hundreds of kilometers of Norway's railroads, with track laid within the Arctic Circle, traverse territories that are inhabited by the region's indigenous Sami people, for whom keeping herds of reindeer as livestock has for millennia been central to their culture and economy. These animals roam free and often migrate into Sweden and Finland.

### **A Great Idea from a Norwegian Sheep Farmer**

FindMy was set up by *Halvor Mjoen*, who comes from a long line of Norwegian sheep farmers. He knows only too well the importance of safeguarding livestock. His family lost 22 percent of their sheep herd to predators during the 2009 mountain grazing season.

Determined to find a solution to protect livestock in a region where there is no mobile phone network, Mjoen hit upon the idea of a satellite-based collar that acts as a virtual shepherd and alerts the farmer to potential problems. The result was **FindMySheep AS** — and this was the start of a close partnership with Globalstar.

FindMy's roots go back to 2012 when the Norwegian government part-funded an initiative to track farmers' livestock to understand why hundreds of sheep were disappearing each year. They wanted to uncover what was really going on, where the animals were roaming as well as to eliminate any foul play.

This funding enabled FindMy to launch its tracking collar and a back-office application that enables the farmer to visualize the whereabouts of the sheep at any given time. FindMy's geo-fencing capability alerts the farmer when an animal or flock is wandering too far away in order for the animals to be herded back to safety.

The data collected by the FindMySheep collars includes the time-stamped latitude and longitude of each sheep plus a battery status/length-of-life-left notification. The rechargeable long-life lithium ion battery is designed to last all season. Users see an online animated video showing on a map exactly where each animal is and how far it has moved. Using an online portal, the collars are configured to send a pre-set number of messages per day over Globalstar's satellite network.

The FindMySheep system can also detect and report on abnormal animal behavior, which can suggest that something is wrong. This can include unusually wide-range grazing or sudden and unexpected bursts of movement that can indicate either that a grazing ground is close to exhaustion or that predators are harassing a flock. Over time, a data trail is built up showing trouble spots and incidents, which can help the farmer better plan the herd's management in the following seasons.



Norway's train users get better reliability thanks to Globalstar satellite-enabled IoT solution.

### **From Sheep to Reindeer**

SaveMyReindeer builds on this technology but goes one step further — the technology tracks the animals and also uses data from the Norwegian Railway Directorate on the real-time location of each train, as well as open data from Kartverket, to create a moving geo-fence 40 to 50 kilometers around the train.

By comparing the geo-fence area with GPS data from the collars already keeping tabs on reindeer, the system warns train drivers when they are approaching the animals. This allows the engineer to either accelerate to travel out of the herd's way, to slow down or even stop the train.

The reindeer owner simultaneously receives an alert on their smartphone warning them that their animals may be in danger, giving them the opportunity to move the herd out of harm's way. Because reindeer are herd animals, any collision with a train can injure dozens at a time. The advantage of the herd instinct is that only a few reindeer in a herd need to actually wear the collars.

Train conductors have been authorized to carry guns to humanely kill any seriously hurt animals; however, SaveMyReindeer should make this need less of a necessity. Instead, local authorities will be dispatched to deal with injured animals. They will be armed with knowledge of the precise GPS location of the incident in order to reach the targeted location swiftly.

There are additional benefits — as well as fewer reindeer deaths, preventing collisions reduces the impact of trauma on train staff and improves the reliability of the train service. The SaveMyReindeer system is now being considered for testing elsewhere on the Norwegian national railroad system.

Taking this concept one step further, FindMy and Kartverket are now considering how this system could make Norway's highways safer. The solution could feed warnings to smart signs — live electronic displays that indicate optimal speed limits based on current weather conditions and traffic as well as mitigating the dangers of animals roaming onto highways.

*"Reindeer husbandry is an ancient and important element of Norway's economy and also hugely significant in the culture of our indigenous people,"* said Kristin Skjerven, Senior Advisor with

Kartverket. *"FindMy's IoT solutions are already proven in protecting sheep and cattle and SaveMyReindeer holds even more potential to prevent needless incidents, while helping the nation's railway users suffer fewer disruptions and improving train staff welfare."*

Halvor Mjoen, Founder of FindMy, added, *"When designing SaveMyReindeer, we knew that only satellite would give us the reach we needed in remote regions. Other requirements were low power consumption and minimal maintenance since reindeer live outdoors year-round. Low cost was also a key requirement to drive higher volumes of collars, and allows us to develop new international markets - Globalstar plays a big part in making all of this possible. We have only just scratched the surface as to how IoT can be used; we believe there will be many more meaningful and practical applications."*

**[www.globalstar.com](http://www.globalstar.com)**

**[findmy.no](http://findmy.no)**

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*Earlier in his career, Corry held senior sales roles at major enterprises that included Eircom where, from 2000 to 2010, he successfully held several key operational and managerial roles such as Head of Order and Fault Management. He then moved on to become the Head of Key Account Management and later the Head of Marketing at that firm.*

*Corry holds a BA and an MBA from Trinity College Dublin, where he was a Brendan McDonald Scholar.*



# Solving Satellite Interference

## An IRG Perspective

By Martin Coleman, Executive Director, Satellite Interference Reduction Group (IRG)



**T**aking stock of where the industry currently stands is important and to acknowledge where the organization is having a positive effect on the issue of interference.

However, interference is the problem that simply won't just go away unless the fix is in. This is particularly true for broadcasters, as interference effects the user experience as well as the generation of revenue. Users expect efficiency and reliability from satellite — ignoring the problem only compounds it further, which, in turn, damages the reputation of the industry.

There are some who might claim incidences of interference happen so rarely that this does not warrant industry attention. This is undoubtedly not the case and actually points to the challenging work of satellite operators who usually move transmissions to another space to immediately restore service to the user.

In the short term, such moves do ensure continuity, but that will result in vast amounts of unusable spectrum.

Fortunately, and on the back of various initiatives, the IRG has seen many new technology solutions which look promising in terms of solving, or at least lessening, the problem of interference. It's important that all industry stakeholders make investments into the mitigation of interference, to uphold the validity of satellite itself. Broadcasters need to play a collaborative role in this effort, to ensure that solutions reach their full potential.

### **Carrier ID — Is This the Solution All Have Hoped For?**

The creation of Carrier ID (CID) was very much the result of the satellite industry attempting to find a solution for broadcasters who were struggling with disruption-causing interference.



In fact, it was the IRG in league with the manufacturers that successfully lobbied the DVB to create a specification and allow CID capabilities to be implemented in all new modems and modulators as standard.

At present, IRG has also encouraged operators to integrate CID detection across networks, but there remains much work to complete when it comes to users replacing legacy equipment and switching Carrier ID on — although CID enabled, most equipment is shipped with the setting turned to 'off.'

As an embedded code containing contact information, CID enables satellite operators to rapidly and easily identify the source of an interfering carrier.

IRG is now working on a Carrier ID alternative, a "dongle" of some description that simply connects externally to any modulator and caters for all types of services, including those less than 128 Kbits — that should appeal to the military and broadcasters alike. In addition, IRG aims to work with manufacturers to default CID to be turned "ON" when the unit is shipped.

To answer the question in the subhead, that would be a partial "yes," Carrier ID has been a solution all hoped for, but the take-up is slow. On one hand, in regular cases of interference caused by human error or equipment failure, CID is a quick way of resolving interference. Let's not forget that most cases of interference are caused by those very reasons. In an instance where interference is affecting a transmission, a simple call is all it takes to alert a user to a problematic carrier and to resolve the issue.

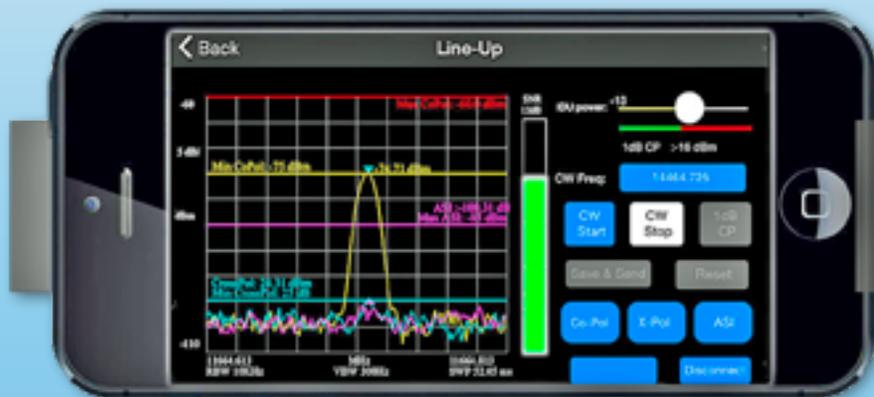
The real by-product of CID is that the technology and methods to detect CID have led to more products being developed to mitigate interference directly, from cancellation to automatic avoidance. This has also led

engineers to develop ways to resolve burst-mode VSAT transmission issues quickly.

**VSAT Interference —  
Have New Tools Had the Desired Effect?**

The inception of burst-mode networks using Very Small Aperture Terminals (VSATs) was a double-edged sword for broadcasters and certainly presented unique opportunities for Satellite News Gathering (SNG). However, at the same time, the VSATs themselves have contributed to higher occurrences of satellite interference than any other system. Many of IRG's members over the years have reported endless cases of interference when mobile VSATs are in the area.

Naturally, mobile VSATs are prevalent in all parts of the industry, especially given the growth and size of the networks provided. This now includes Outside Broadcast (OB) trucks which present a significant problem, mainly because the terminal is constantly on the move.

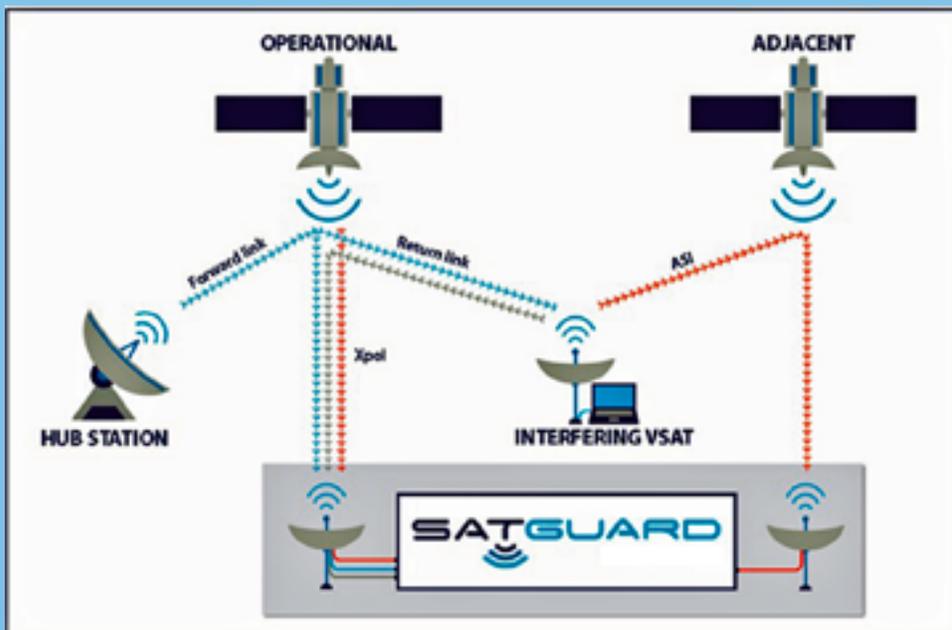


*Integrasys' SatMotion.*

Most cases of VSAT interference stem from misaligned terminals, where the margin for error during setup is small, resulting from human error or manufacturing standards being reduced to keep costs low. For broadcast professionals with minimal training, this combination of underlying issues is quite problematic.

Also true is that in the competitive broadcast industry, consumers have come to demand news and live events as they happen, meaning that reliance on mobile VSAT is inevitable and looks set to only increase. Happily, IRG members have been pioneering methods and products designed to limit the extent of VSAT interference or, in some cases, solve interference all together.

As is often the case with satellite interference, different methods and tactical choices can be implemented in order to limit VSAT interference. One such tactic is to move to circular polarized higher frequency bands,



## Satellite Geolocation Service Interference Localization – Global Coverage



have Carrier ID switched on, but this is not always the case, particularly in the case of a jammer. As a result, many of the mitigation tools conceptualized recently work to either locate sources of interference or lessen the effects of it when such occurs. Geolocation is one of the former.

In the past, Geolocation was an expensive tool, but has come a long way in a short space of time. IRG member Siemens Convergence Creators recently launched the firm's Satellite Geolocation Service, which now covers practically all of Earth's inhabited land mass ([www.convergence-creators.siemens.com/satellite-geolocation-service.html](http://www.convergence-creators.siemens.com/satellite-geolocation-service.html))

By providing and operating the service, Siemens ensures operators no longer have to invest money into infrastructure and trained personnel to take advantage of this cost-effective solution. The service also boasts localization success rates of more than 60 percent, compared to that of previous localization systems at a hit-rate of around 30 to 40 percent.

*Siemens Convergence Creators' Satellite Geolocation Service reaches unprecedented coverage and success rates in identifying satellite interference sources*

meaning users have no need to manually adjust polarization, thereby reducing one element of human error. Unfortunately, rarely is a solution perfect, and the result of high frequencies is poorer cross-polarization performance. Naturally, a multi-faceted problem needs a multi-solution approach, and this is where the innovative products from IRG members comes to the rescue.

One such product comes from Kratos, called SatGuard (infographic on the previous page) (<http://www.kratoscomms.com/~media/communications/pdf/fact%20sheet%20-%20satguard%20-%20real-time%20vsat%20interference%20monitoring.pdf?la=en>.)

This interference monitoring system can accurately identify and geolocate an interference-causing VSAT, from decoding its terminal ID, which was developed due to the work done with CID. As a result, SatGuard is one of the first mitigation tools which can effectively and quickly resolve VSAT interference for the broadcaster, and other users.

Another product of note from an IRG member is Satmotion Pocket (product image on the previous page) from Integrasys which has proven to be highly successful at preventing the problem of human-induced VSAT interference before that even occurs. The product does this by assisting non-satellite professionals during the setup procedure to correctly install equipment and to prevent any errors during operation. Uniquely, as a downloadable app, Satmotion Pocket feeds back measurements and error alerts to any mobile device via an easily navigated interface, thereby acting as an effective monitoring tool as well.

### Geolocation — Is It Getting Smarter?

Currently, identifying the origin of an interfering carrier could take days, weeks or even months. It also occupies manpower and resources from other revenue-generating activities. One would hope, in most cases, that broadcasters



With others, such as Zodiac Aerospace ([www.zodiacaerospace.com/fr](http://www.zodiacaerospace.com/fr)),

collecting accurate and reliable ephemeris data, as the technology develops, the industry could see geolocation at sub-kilometer accuracy.

Another organization working tirelessly to improve Geolocation is the Space Data Association (<http://www.space-data.org/>). That organization's Space Data Center (SDC) 2.0, which is currently in development, will include geolocation solution sets. This will mean that when an operator needs to perform a geolocation, the system will be able to identify the best match for a neighboring satellite to enable them to perform the geolocation. As most operators are unlikely to always have a second satellite nearby, this will drastically reduce the time to identify the interference and to ultimately resolve the interference.

### Big Data and Machine Learning — Where Will They Take Us?

As the battle of reducing interference continues for the broadcaster, and indeed for all of the satellite industry's stakeholders, looking to the newest and most innovative technological advancements is a "must" in order to stay ahead of the problem.

Big Data is a 'big' concept, no pun intended. Essentially, for IRG, it involves making effective use of the organization's own data as well as referencing the vast quantity of data

captured from around the world. The correct questions must then be asked to help predict and resolve occurrences of interference more efficiently. Machine learning goes hand-in-hand with Big Data as a method of analyzing data using algorithms to find hidden patterns or solutions.

The analyst firm, IDC ([uk.idc.com/](http://uk.idc.com/)), predicts that by 2020, the amount of data on the globe will equal 40 zettabytes ([www.forbes.com/sites/ibm/2015/02/17/where-is-the-world-supposed-to-put-all-of-its-data/#374357cd1483](http://www.forbes.com/sites/ibm/2015/02/17/where-is-the-world-supposed-to-put-all-of-its-data/#374357cd1483)).

Consider that for a moment: Mark Liberman calculated the storage requirements for all human speech ever spoken would be 42 zettabytes if all speech was digitized as audio ([itre.cis.upenn.edu/~myl/languagelog/archives/000087.html](http://itre.cis.upenn.edu/~myl/languagelog/archives/000087.html)).

If retention of every statistical piece of information within the satellite industry is possible, then Machine Learning can be applied to help predict future incidences and ultimately solve them in the first place.

The satellite industry has long been considered a forerunner of new technologies and IRG has definitively recognized the benefits of Machine Learning as the base technology of future tools. Using Big Data can improve satellite communications as well as ensure data reliability by solving interference.

### **Win the Battles to Win the War**

The satellite industry plays an essential role in many operations within numerous sectors — inevitably, the industry must keep up to remain relevant. To ensure satellite communications are consistently seen as the reliable and efficient choice for broadcasters, then mitigation technologies must be applied. If the problem is ignored, broadcasters might look elsewhere for less expensive, better quality and more reliable options.

By continuing to develop viable solutions, interference can be made a problem of the past, or at least lessened in its effect and increase the industry's ability to operate in the presence of interference. In the meantime, celebrate the small victories, all the while ensuring current solutions do not stagnate but continue to advance.

### **satirg.org**

*Martin Coleman is Executive Director, the Satellite Interference Reduction Group (IRG) and is responsible for spearheading a number of significant initiatives that involve introducing new technology and processes to mitigate all types of satellite interference: VSAT TDMA Systems, BIG Data; a reference guide to Interference; sorting out those Difficult Cases including new standards and processes within the Geolocation industry; assisting the ITU in dealing with Harmful Interference; and implementing Carrier ID (CID).*

# The Power of Satellite

## Communication in times of emergency

By Doreet Oren, Director, Product Marketing and Corporate Communications, Gilat Satellite Networks

**T**he fourth largest island in the Caribbean and home to 3.5 million people, the U.S. territory of Puerto Rico is best known for tropical landscapes and resort hotels — the perfect spot for a relaxing vacation.



All of that drastically changed when the island was hit by two Category 5 storms during the first three weeks of September.

The first, Hurricane Irma, passed just north of Puerto Rico, lashing the island with wind and rain without any loss of life or major damage to the island's infrastructure. Unfortunately, the same cannot be said of Hurricane Maria, which caused a level of destruction and chaos paralleled by few storms in American history.

Winds reached 155 miles per hour, causing tornado-like damage, while parts of Puerto Rico saw an unprecedented 30 inches of rain in a single day.



*Gilat's SATCOM support in Puerto Rico for SPRINT's Emergency Response Team mission after the devastating hurricanes.*



*Gilat VSAT in position on St. John for SPRINT's ERT missions.*

Two weeks after the storm abated, most of the island's residents still lacked access to electricity and clean water.

### ***Communications Paralyzed by Hurricane Maria***

Cellular service across Puerto Rico was almost completely wiped out by Hurricane Maria. According to the U.S. Federal Communications Commission (FCC), 95.2 percent of the cell sites in Puerto Rico — or 1,703 out of 1,789 — were knocked out of service, mainly due to widespread power outages.

At the same time, severe flooding, fiber disconnects and windblown microwave antennas brought down the terrestrial backhaul networks used to connect the cell towers to the various mobile service providers' core networks. FCC Chairman Ajit Pai called the storm's impact on communication networks "catastrophic."

### ***Sprint Emergency Response Team Leads the Network Recovery Effort***

Given the magnitude of the damage and required recovery effort, many of Puerto Rico's mobile providers are sharing resources to try to get people back online as quickly as possible.

Among those mobile providers, Sprint has played a vital role in restoring communications on the island, deploying Gilat's satellite communications to restore its cellular backhaul services. Sprint's skilled and battle-tested Emergency Response Team (ERT) specializes in providing critical communications in the toughest conditions.

Prior to hitting the ground in Puerto Rico and the U.S. Virgin Islands following Hurricane Maria, Sprint's tireless ERT deployed satellite communications in the aftermath of Hurricane Harvey in Texas and Hurricane Irma in Florida.

### ***Satellite Backhaul was a Viable Option***

As soon as conditions were safe enough to fly engineers to Puerto Rico, Sprint began to assess damage and restore service.

In spite of the devastation across the island, most of Sprint's towers remained standing and largely intact. This mini-miracle allowed Sprint to focus their initial efforts on restoring backhaul and power, starting with the most populous areas and then building out from that base.

Due to the extent of the damage to the terrestrial backhaul network, Sprint realized that satellite-based cellular backhaul was a quick way to get critical voice and data networks back up and running.

*"Gilat's satellite backhaul gave us the flexibility to bring communications into hard hit areas using SatCOLTs (Satellite Cell on Light Trucks) and Fly Away Kits (FAKs) to provide cellular, LTE and IP data services during times of emergency and disaster,"* said Tanya Jones, National Manager of Emergency Response Team Operations at Sprint.

### **Gilat's Fast, Reliable Cellular Backhaul Deployment**

With millions severed from mobile and broadband services, Sprint could not afford delays in setting up its satellite-based backhaul solution — and that is why the company decided to work with Gilat, an end-to-end satellite connectivity solution provider with proven fast deployment capabilities for emergency scenarios.

*"We are currently working with Gilat on several projects using satellite backhaul in our network. Disaster recovery is an extension of those projects, and Gilat's solution allows us to quickly deploy satellite connections for cell sites without terrestrial backhaul,"* added Jones.

Gilat's satellite-based solution consists of high-speed Capricorn VSATs at each cell site, centrally connected and managed by the SkyEdge II-c hub platform. While Gilat's satellite backhaul solution supports both 3G and LTE networks, Sprint deployed 3G services in most of the affected areas and LTE over satellite services in a handful of areas.

### **High Performance Capricorn VSAT**

Gilat's high-performance Capricorn VSAT transmits data from the cell site via satellite to Sprint's satellite network hub. Designed to work with High Throughput Satellites (HTS), Capricorn's advanced adaptive transmission technologies maximize performance, improve service availability and reduce operational costs.

The Capricorn VSAT eliminates satellite latency concerns by using patented acceleration techniques over GTP/TCP in remote terminals and hubs. Currently used for high-speed broadband services in Sprint's nationwide LTE network, Capricorn supports 4G/LTE networks with speeds of up to 150 Mbps to the handset.

Using Gilat's VSAT, Sprint can provide reliable, high-speed voice, data and video services on a par with terrestrial performance. This includes smooth running of data and video applications with a high-quality user experience.

### **VSAT Comms as a Critical Disaster Recovery Tool**

*"Gilat's satellite backhaul solution allowed us to restore key cell sites within hours in areas where there were no communications,"* said Jones.

Satellite connectivity has been deployed on the main island of Puerto Rico, as well as on Vieques, Culebra and the U.S. Virgin Islands. In addition to restoring cell sites and broadband connectivity, satellite backhaul is also being used to assist emergency management officials.

**[www.gilat.com](http://www.gilat.com)**

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Oren has more than 20 years of industry experience, and has held management positions in R&D, product management and product marketing for international high-tech companies. In this capacity she contributed to next-generation product definition and was responsible for delivering the company's vision to the media and analyst community.

Oren has published thought leadership articles in renowned international journals and has spoken at numerous industry conferences worldwide. Oren received a BSc in Computer Science from George Washington University.

### **Restoring Broadband Connectivity in Schools for the Deaf**

*The effects of Hurricane Maria were not limited to Puerto Rico's mobile communications; many schools, businesses and other institutions also lost their internet connectivity. Using Gilat's versatile Capricorn VSAT, Sprint was able to quickly restore broadband connectivity for some of these users as well.*

*Without a doubt, the most unforgettable installation of these satellite broadband solutions took place at two Puerto Rican schools for the deaf. Sprint's ERT engineers arrived at the schools, unpacked the Gilat equipment and installed a satellite dish on the roof connected to a Capricorn VSAT, providing connectivity for Video Relay Service devices.*

*But that's not all they brought — they also surprised the students with a gift of dozens of brand new tablets. While part of Sprint's team was busy setting up the satellite broadband service, two ERT members gave the children a lesson in satellite communications. In a few hours time, Internet connectivity was restored and the students were busy checking out the apps and features on their new tablets.*



*SPRINT's ERT team springs into action for comms support in Puerto Rico, post hurricane catastrophe.*



# Worry Time for Satellite Operators

## The Forrester Report

By Chris Forrester, Senior Contributor



**A** few weeks from now, in February, the 'Big Three' satellite operators will unveil their latest numbers — those numbers may not look good.

Over the past few quarters, each of the trio have issued extremely cautious expectations for 2018 and the market will be watching intently for signs of recovery, no matter how gentle.

### **The key dates:**

**Eutelsat Q2 results: February 16**

**SES full year: February 23**

**Intelsat full year: About February 26**

However, if December 2017 was any guide, those green shoots of recovery may be extremely stubborn to show. For example, on December 15, Luxembourg-based SES saw their share price — consistently under pressure these

past few months — plummet another 5 percent to a miserable 12.93 euros and perilously close to the company's 'all time low' of 12.40 euros. As a comparison, in the spring of 2015, their price regularly topped 30 euros a share

This steady slippage wasn't helped by a disappointing set of Q3 results on October 27 when SES was given a tough time by many analysts during the company's analysts' call, with some expressing frustration with claims that the company's guidance was far too complex and lacked "absolute growth rates" and revenue guidance for 2018.

SES declined to elaborate any further, at least until the February (and end of year for 2017) results were available and a more stabilized position could be released. Not helping is the position at payout and facilities subsidiary MX1, where the CEO stepped down unexpectedly on October 3 and where revenues are less than expected and a degree of rationalization is taking place.

*"We want to refocus the portfolio of services of MX1 on differentiated growth opportunities consisting mainly in*

*SES disaster recovery communications support.*





offering to our customers kind of unique combination of those traditional broadcast and IP based end to end solutions for those linear and non-linear content distribution," said Ferdinand Kayser, the CEO of SES' Video division.

Distilling management's answers, it would seem — in Sami Kassab's view (media analyst at investment bank Exane/BNPP) — that 2018 will see SES organic revenue 'growth' slip well back to -4 percent.

SES' CFO Pdraig McCarthy said that the downturn at MX1 would not lead to a formal impairment at the play-out business. "Overall this is a very good business, it's a very good strategic fit for us," he said.

However, CEO Karim Michel Sabbagh issued a warning in regard MX1, stating, "As I've said many times in the past, in the areas where we believe [the business] is commoditized, we will deliberately exit if it doesn't make sense for us, so we can refocus on our resources."



SES CEO  
Michael Sabbagh.

(read the sidebar later in this article).

The news was taken badly by the market and knocked another large chunk out of the operator's share price and market capitalization. Back in the spring of 2015, SES shares were trading above 30 euros. The price, as of this writing, is down at the 13 euros level with a commensurate collapse of the company's market capitalization.

A snapshot of SES' numbers reveal that total TV channels at SES grew 6 percent year-on-year to 7,743 TV channels, with increases in all three of SES's major regions — Europe, North America and International. The principal changes compared with Q3 2016 were:

- Seven percent increase in High Definition (HD) to 2,601 HDTV channels, now 33.6 percent of TV total channels (Q3 2016: 33.3 percent)
- The proportion of total TV channels broadcast in MPEG-4 increased from 59.9 to 63.5 percent
- Commercial Ultra HD (UHD) channels on the SES network increased from 17 UHD channels to 24 UHD channels and has since expanded further
- 2+ million homes now viewing SES' HD+ platform over Germany and Austria
- Solid performance with U.S. Department of Defense
- "Progressive dividend" promised

"The business remained solid," said SES, "underpinned by long-term contracts and a substantial contract backlog, including an important capacity renewal with Sky Deutschland, covering 7 transponders at SES's prime video neighborhood of 19.2 degrees East, to continue to deliver content to millions of subscribers."

There is potentially more good news to come. For example, SES is investing in fleet expansion for their O3b division in what it describes as new 'mPower' satellites. The company is ordering up seven MEO craft from Boeing at a cost of around \$1 billion. The first of the "mPower" satellites should be flying by 2021.

The order prompted a note to investors from investment bank Jefferies, where satellite analyst Giles Thorne said, "mPower is a material expansion on the initial O3b concept, taking many of the commercial proof points from O3b since launch in September 2014 and building upon them. This is not some foray into a new "build it and they will come" fantasy. In many ways, it couldn't be more de-risked: SES knows who its customer is; what they value; how



SES "Beyond Frontiers"  
satellite launch.



to service them; and how much they'll pay. At the same time, being the apotheosis of the "distributed network" concept (i.e., flexible capacity that can morph to service any customer, anywhere, at any time) then productivity of the constellation should be far higher than traditional "stranded" geostationary configurations. This further de-risks the investment, in our view."

An October 27 report from Jefferies headlined as "Growing Pains" and then bluntly said that it was the evident "lack of growth" was the problem and that confidence in SES was now "fragile."

Thorne stated that he was in a "quagmire" as to the operator's Video division. "The deterioration in growth (now, -5.6 percent from -2.0 percent / -4.2 percent) was well flagged at Q2, given the anomalies on AMC-9 and the y-o-y impact of periodic revenue — but we now have a new headwind disclosed — the SES choice not to renew some legacy MX1 contracts ("we have chosen not to renew low value legacy re-seller contracts as we want to re-focus on differentiated growth opportunities"). The underlying performance is certainly improving (-0.3 percent in 1H17, -0.2 percent in 3Q17) and management said will improve further in 4Q17. Other bright spots are that the channel count, HD channels and UHD channels are trending in the correct direction and, separately, SES has now contracted some of the transponders that were handed back by a number of FTA customers in 4Q16 following a compression migration. But, until SES can put together a coherent and unequivocal y-o-y growth performance, without caveats, then we expect sentiment will remain hugely constrained."

Berenberg Bank was similarly downbeat. "As the share price indicates, the market has lost faith in SES's ability to deliver on its promises of long-term growth, and, given the sustained period of disappointment, it will take more than just meeting expectations to restore confidence. We think SES must show a sustained return to growth before investors will give the company credit for its ambitious plans. This suggests that the stock is unlikely to go anywhere for a year or so (we forecast that the company does not return to organic growth until Q3 2018, and even then it will be very modest growth, with the real pick up being in Q4 2018), particularly as the declines that the company will report for Q1 and Q2 will likely be sequentially worse than in Q4 2017."

Moving over to Intelsat, that company's worries have been well-flagged over the past couple of years. However, thanks to some savvy financial restructuring of debt and an on-going application (with Intel) to the FCC as to how its valuable C-band frequencies are used over metropolitan areas of the USA, has helped build some confidence. The FCC news prompted a near-instant doubling of Intelsat's share price to a spectacular \$7.35 (on October 12, 2017) only for the initial enthusiasm to fall and a more typical \$3.30 level was in place by mid-December.

However, the C-band news only prompted an outcry from Intelsat's rivals. SES, for example (although there were plenty of other grumbles) argued strongly that the proposed "close co-existence" of telco and satellite-based services "was impossible," adding,

- Numerous and undisputed evidence demonstrates that a coexistence of terrestrial mobile services with incumbent satellite networks in C-band in the same area is extremely challenging, not to say impossible
- C-band Earth stations, receiving signals from satellite, are highly vulnerable to terrestrial interference and must be separated from terrestrial transmitters by tens or even hundreds of kilometers to prevent the degradation of the satellite signal
- The deployment density of satellite C-band operations makes it extremely difficult to add new terrestrial operations into this system without disrupting dramatically the satellite operations
- Any plans to let terrestrial wireless systems enter the ecosystem could cause massive disruption, substantial cost for current operators and destabilize entire and well-established services

Since those early C-band responses, it seems that the likes of SES — and even Eutelsat — might be prepared to modify their attitudes. "We have invested billions of dollars into C-band space capacity over decades, and our customers have invested hundreds of millions in ground infrastructure and earth stations on top. Even if we are open to use parts of the spectrum differently, any plan to change this highly efficient ecosystem and let terrestrial wireless systems enter risks to cause massive disruptions and substantial cost and therefore needs the most careful analysis."

SES is now saying — perhaps — there could be some flexibility. The company, in a November 2017 statement, said that the firm is open to exploring any approach to a joint use of C-band, but only if it meets two essential criteria: "It must create appropriate financial incentives to justify the extremely high cost of such an approach, and it must ensure that we can continue to deliver services to our customers without any disruption. We cannot achieve this unless we open only a limited portion of the respective band."

Indeed, on December 14, 2017, SES announced they were involved in an European Space Agency-backed experiment designed to demonstrate how satellites can be used in the growth and management of 5G telephony.

The testbed infrastructure will comprise SES's fleet of GEO and MEO satellites, which will be integrated with terrestrial networks. In addition to providing the space segment, SES's headquarters in Luxembourg will also host a SATis5 testbed node with prototypes of networks for satellite integration, along with other nodes located in Berlin and Erlangen, and an additional portable node.

Intelsat, in its November 15 supplementary filing to the FCC, admitted that existing spectrum and the services that depended on C-band would have to be protected, and that there were complex problems to be solved.

However, the FCC filing stated, *"The Intelsat-Intel proposal best achieves the ultimate goal shared by many commentators of making mid-band spectrum available for 5G services. The Intelsat-Intel proposal will harness market incentives to make highly-valuable mid-band spectrum available where it is most needed to support terrestrial mobile demand voluntarily, at least cost to society and existing FSS customers, quickly (within 1-3 years)."*



*Intelsat's headquarters at Tysons Corner... complete with a shopping mall.*

Paris-based Eutelsat is somewhat immunized from these C-band arguments, but is not wholly impervious to assorted challenges. The company's February 16 half-yearly financial report (to December 31, 2107) will show whether there's been any positive movement from the company's Q1

position (reported on October 26). Q1 noted a 9.3 percent fall in reported revenues to 349 million euros (although 6.7 percent when 'like for like' numbers were measured) and including a 11.7 percent tumble in its 'Fixed Data' division when compared to Q1/2016.

Video revenues were flat, with a 0.8 percent fall (from 226.5 million last year to 223.3 million euros in Q1/2017-18). The market for Professional Video was said to be "tough."

The overall fall was not helped by last year's Q1 buoyant position due to termination revenues received from channels pulling their services off Eutelsat (notably France's 'tv d'Orange'). Future prospects on Video are better and will be helped by an improving revenue picture on Eutelsat's Hot Bird orbital slot, where five transponders are being marketed with a new rate-card pricing structure.

Prospects have also been impacted by a delay in the launch of its 'Konnect Africa' broadband service, which now slips back to 2019-2020 (the Al Yah-3/YahSat-3 satellite which supplies the capacity will not launch until late-January 2018).

YahSat-3's launch has now slipped twice and is more than four months later than Eutelsat's most recent assumptions and a half-year later than was originally expected. The satellite will now not enter service until June of 2018 (and the last month of Eutelsat's financial year) and will have little influence on Eutelsat revenues.

Eutelsat's Q1 (July-Sept) channel count grew by a very healthy 6.6 percent — since last year — to 6,755 channels. HDTV channels grew from 14.8 percent of that total to 17.9 percent (to 1,210 channels from 940 last year). However, the decline in video revenues only showed that the average price per channel (or per MHz) carried has also fallen over the past year. Eutelsat's all-important contractual backlog fell back from 5.4 billion to 5.2 billion euros and represents some three-and-a-half years of business. Eutelsat's Video division represented 86 percent of that backlog.

Berenberg Bank admitted they were disappointed by Eutelsat's Q1 numbers and said, *"It is true that Q1 was a touch soft, and perhaps there is an immaterial underlying downgrade, as detailed above. There were, however, promising signs from Video and Government. Q1 revenues are tracking below the new "between -1 and -2 percent" full-year expectation, meaning that the company has to play catch-up (which it should) through the remainder of the year. Management did well on the [analyst] call, in our view, to suggest that excluding the delay in Fixed Broadband, the other segments are all on track and that growth should improve throughout the year. With Eutelsat 172B only becoming operational in November, with a high pre-sell rate and the removal of SES revenues out of the comparables in Q3, we fully expect growth to progressively improve from here."*

Eutelsat now has a superb 'ace' up its sleeve in the shape of Noorsat, a Dubai-based capacity reseller that Eutelsat acquired on October 13, 2017 for \$75 million and where revenues can now be consolidated. Noorsat has some 30 transponders under overall contract at the Nilesat/Eutelsat 'hot spot' at 7/8 degrees West as well as capacity co-located with Arabsat at its 'hot spot' at 25/25.5 degrees East. This capacity is used by Eutelsat on the Es'hail 1 satellite.

Indeed, with significant access to these two positions alone, Eutelsat is now even more directly involved in the ever-expanding Middle East television landscape, which shows absolutely no signs of contraction. Noorsat is a prize catch. Ultimately owned by the powerful Saudi Arabia-based Mawarid Holdings conglomerate, Noorsat has, since its formation in 2004, built up a very useful portfolio of clients under CEO Omar Shoter (who used to run Arabsat).

Eutelsat also has a powerful friend in the shape of ViaSat, headquartered in California and the joint-venture for the current exploitation of Eutelsat's broadband-by-satellite Ka-Sat craft and the prospects for a ViaSat-3-class satellite over Europe. Also helping is a French government initiative to use satellite to supply broadband to homes in France. The new initiative includes funding 150 euros per home to equip satellite or 4G reception. The intent is to reduce the number of households with low-quality (or zero) internet access from today's typical 15 percent to only 6 percent by 2020.

Investment bank Exane/BNPP says this will help Eutelsat, and j-v partner ViaSat, in filling some of its available capacity. "Assuming 10 percent of the 2 million French households take a Eutelsat satellite access package, we estimate that Eutelsat would generate 30 to 40 million euros of additional annual revenues, or about 2 to 3 percent of group revenues. Consensus expects around 30 million euros [overall] revenue growth for Eutelsat's Fixed Broadband division, including Russia, Sub-Saharan Africa and other countries. These expectations [as a result of the French initiative] could be met by France alone." The bank added, "In other words, we take this announcement as a positive for Eutelsat. It underpins its residential broadband strategy and offers support to consensus expectations."

In summary, the February results season should be an interesting time for all three giant players — and the industry. Some insight into progress across all of the key 'verticals' will be gained as well as how the In Flight Connectivity market is progressing, a technology of key importance to each of the three companies (as well as Inmarsat, not covered in this report). No doubt, we live in interesting times.

*Senior Contributor Chris Forrester is a well-known broadcast journalist and industry consultant. He reports on all aspects of broadcasting with special emphasis on content, the business of television and emerging applications. He founded Rapid TV News and has edited Interspace and its successor, Inside Satellite TV, since 1996.*

## Fraud allegations, writs and counter-writs

SES has a few problems to solve with its former SES Platform Services division, renamed MX1. SES President/CEO Karim Michel Sabbagh, speaking October 27, 2017, was blunt in saying that MX1 was being rationalized and refocused and that SES would exit the business if margins could not be maintained. At the core of the problem are unexpected non-renewals during Q3 at MX1 which cost SES some 7 million euros in lost revenue.

MX1 came about with the SES purchase of Tel Aviv-based (but NASDAQ listed) facilities outfit RR Media and which closed in July 2016. SES paid a bullish \$242 million in an all-cash deal for RR Media, a 52 percent premium to the company's market valuation and a price that surprised many in the industry.

In the previous few years prior to the sale, RR Media's value had slumped to as low as \$117 million. RR Media was floated in 2006 with a value of \$210 million, and at the time of the SES purchase, enjoyed a market capitalization of \$148 million. RR Media was led by Avi Cohen and he was appointed CEO of the merged MX1 unit. At the time of the purchase, RR Media was said to have had full year revenues for 2015 of \$140.3 million.

RR Media was said to supply digital services to "more than 1,000 media companies globally" and populating content to more than 100 VoD platforms.

Earlier in 2017, MX1 opened up a legal action against three former senior employees at RR Media. The case alleged "concrete deceit and fraud." The three were alleged to have "conspired to steal MX1's customers and use its commercial secrets in order to [establish] a competing business. They did this not only after leaving their jobs in the company (during which they received huge sums of money), but also when they were still employed by MX1," according to Court filings.

The case alleges these three accused individuals transferred some customers to a competing company they had founded in the British Virgin Islands and Switzerland and "for which they work to this day." The company is the iKO Media Group AG, registered in Switzerland and operating a teleport near Rome.

The accused former staffers responding with their own counter-action, alleging in March of 2017 that the company's CEO Avi Cohen "made sure to put money into the pockets of those close to him at the expense of the company."

There were also serious allegations that before the company was acquired by SES, MX1 paid bribes under the table to various agents and organizations close to its customers that "took care" of ongoing dealings between the sides and, they allege, bribes that continued.

Mr. Cohen left SES in October of 2017. SES said that the ongoing litigation between former staff at MX1 and the company was continuing and that the counter-writs placed on SES were without substance.



## PERSPECTIVES A Dynamic Commercial Space Industry Needs STEM Skills

**T**he world's first satellite, **Sputnik 1**, went into orbit 60 years ago and was about the size of a beach ball.

Sputnik 1's four antennas transmitted radio pulses. The most recent Intelsat Epic<sup>NG</sup> satellite that went into orbit this past September is as big as a school bus and can deliver 45 Gbps of broadband to an area that covers Africa, Europe and South America.

The evolution from Sputnik 1 to Intelsat 37e required the energy, hard work and brain power of tens of thousands of scientists, technicians, engineers, and mathematicians.

To maintain that technological transformation, the commercial space industry needs to recruit the best and brightest in those four disciplines, now commonly known as STEM.

Finding the next-generation of space leaders can be challenging, due to both the demanding academics of STEM college classes and also because the growth and cache of space companies in the past few years has made hiring talent more of a challenge for all.

Intelsat General Corporation (IGC) has invested in an active internship program and works with groups such as *The Future Space Leaders Foundation (FSLF)*, a tax exempt 501 (c)(3) non-profit organization dedicated to the career development of young space and satellite industry professionals in an exciting and growing field.

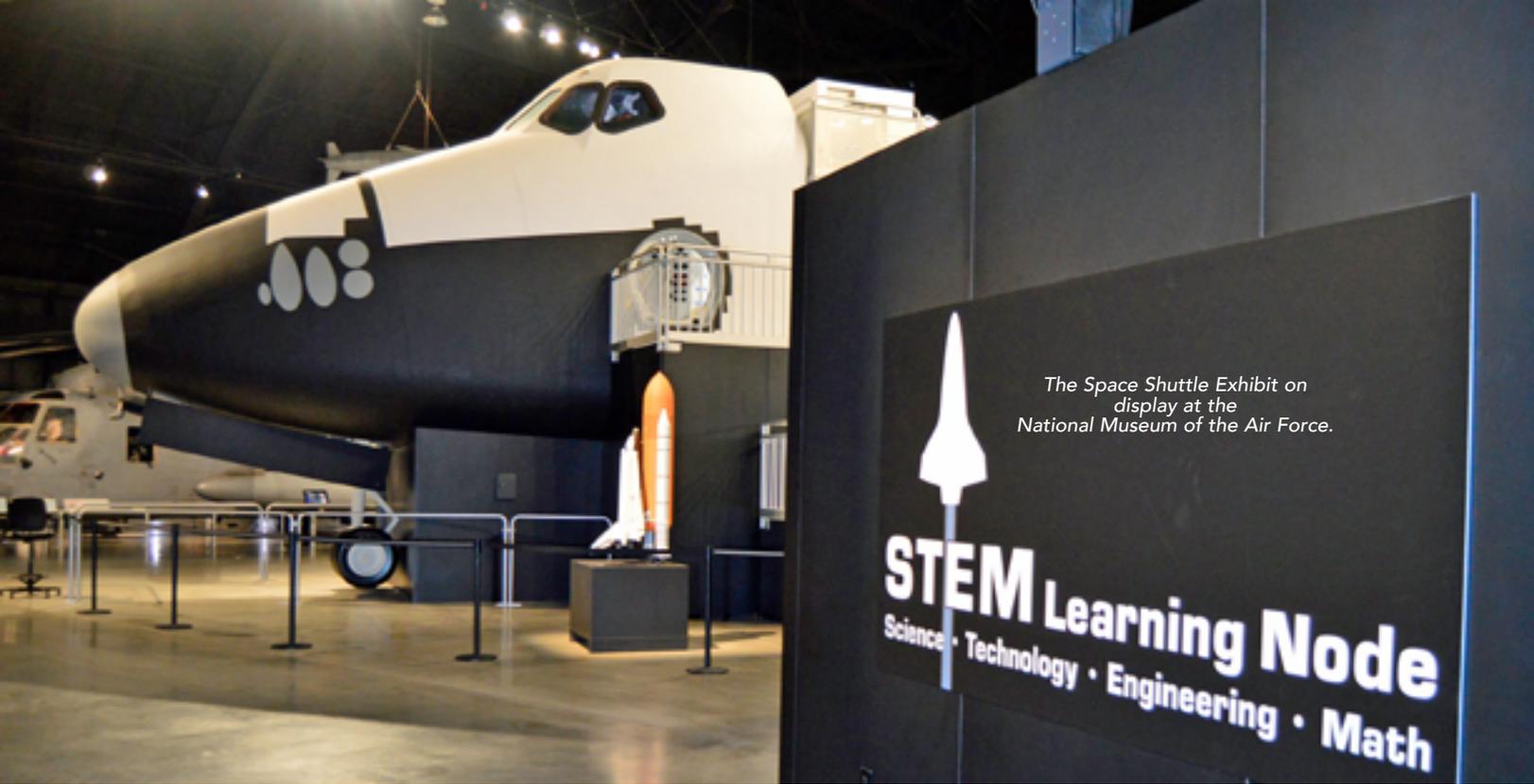


IGC also works with the Space Foundation and Space and Satellite Professionals International (SSPI), with both of these organizations offering scholarships to students in the field.

Intelsat and IGC maintain a regular schedule of recruiting events. The companies average one university or diversity career fair per month.

# СПУТНИК 1 СПУТНИК 1





Company representatives serve as judges for Georgia Tech’s aerospace engineering Capstone event, and have Georgia Tech students regularly visit IGC’s Atlanta offices and teleport.

Intelsat also participates in the *GenesysWorks* program, which has two students from traditionally underserved high schools work half days in the company’s IT department. This provides these seniors real IT work experience and helps them with college applications.

IGC makes extensive use of LinkedIn and other online resources when looking for STEM talent. The recruiting team has three pieces of advice for those looking to work in commercial space:

- *Make certain you have a well-developed resume that stresses your STEM-related activities, including competition and programs. Listing clubs and volunteer work can be helpful as well*
- *Have a professional-looking LinkedIn profile. Talk about the role you’d like to play in your next job, and join relevant LinkedIn groups and communities*
- *Attend community events such as symposiums, STEM job fairs (usually free) and conferences. Work to become comfortable with in-person dynamics, and talking about yourself*

IGC engineers also participate in STEM education through local school programs. Recently, Senior Sales Engineer Howard DeFelice volunteered his time at Thomas

Jefferson High School for Science and Technology in Alexandria, Virginia.

The students at *Thomas Jefferson High School* are constructing a cubesat, both to “learn by doing” and to compare multiple communication methods for the purpose of creating a best-practices document.



Howard said he was amazed at how quickly the students picked up the concepts of space communication. **The web site of the project is located here.**

Those working in the space industry want to stimulate the growth and development that will transform today’s students into tomorrow’s space leaders.

With government clients increasingly looking to commercial providers for a range of space products and services, our participation in STEM education is critical for maintaining our country’s technological edge in space.

STEM graduates who enter the space industry will find that the sky is — quite literally — not the limit as to how far such a career can take them.

**[www.intelsatgeneral.com](http://www.intelsatgeneral.com)**

*The preceding article is courtesy of Intelsat General’s SatCom Frontier infosite and editorial team.*



# What's Changing in the Industry?

## A McObject Focus

By Steve Graves, Chief Executive Officer, McObject



**T**he satellite industry could be said to be facing three challenges: the extreme environment in which satellites operate, the cost of getting the satellites into orbit and the cost of failing to get the satellites into orbit — these three challenges make the data that satellites collect exceptionally valuable.

With the major advances in technology over the last 30 years, satellites, or rather satellite companies, have become more adept at collecting data. This has created a situation where every launch is generating petabits of data, all of which needs to be sorted, stored and, most

importantly, converted into information, from which satellite companies can learn to advance their projects.

satellite does not achieve required orbit, the point at which the error occurs has significant ramifications for the insurance policy, the level of claim and determining with whom the liability lies.

In the event of a failure, having reliable data also means that the project team can pin-point and remedy an issue, and if they can do that quickly, with a degree of certainty, and explain where a problem arose, they are more likely to be able to approach their backers with confidence, and more likely to receive a positive reception.

Either way, having reliable data which can be analyzed relatively easily can help to ensure that an issue is resolved quickly and the project returns to the launch-pad as quickly as feasible.

### What Data is Usually Collected?

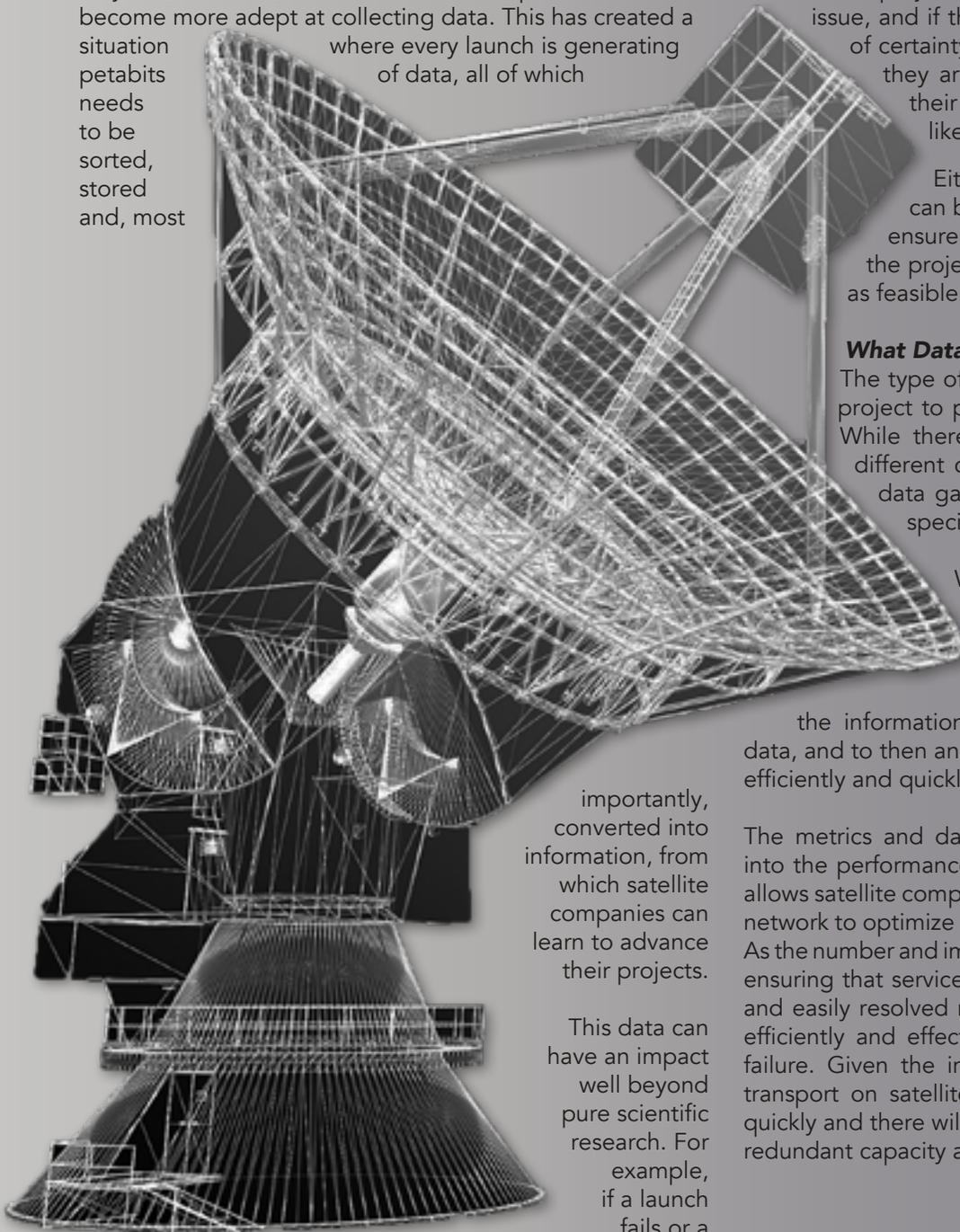
The type of data that satellites collect varies from project to project and can be highly confidential. While there probably is some overlap between different companies and different satellites, the data gathered by each company can be very specific and proprietary.

What is true for all satellites is that data is received at very high rates through multiple channels. This means that it is extremely important that any database that is receiving the information be able to handle vast volumes of data, and to then analyze that data, in any number of ways, efficiently and quickly.

The metrics and data gathered provide low-level insight into the performance of the satellite system, which in turn allows satellite companies to troubleshoot and fine-tune the network to optimize the service provided to their end users. As the number and importance of smallsat constellations rise, ensuring that service issues in a single unit can be isolated and easily resolved means that data needs to be analyzed efficiently and effectively to minimize the risk of cascade failure. Given the increasing reliance of various forms of transport on satellites, any outages need to be resolved quickly and there will need to be certainty that back-up and redundant capacity are not at risk of similar problems.

importantly, converted into information, from which satellite companies can learn to advance their projects.

This data can have an impact well beyond pure scientific research. For example, if a launch fails or a



### **Why Do Satellites Need to Handle Large Quantities of Data?**

Satellite owners need to configure their satellites for optimum data transmission. Every packet from the satellite has data that needs to be analyzed.

These variables change rapidly so must be monitored and used to debug and optimize the quality of the transmission. Data capture rates of around one million metric entries per second are currently possible, a number which is rising rapidly as technology improves.

Due to the extensive testing before a satellite, or a constellation of satellites, is launched, hardware and/or software anomalies are rare. However, when they do occur, the metrics gathered are critical to detection and, ultimately, resolution. Fast resolution is, of course, critical as anomalies can lead to the inefficient use of precious satellite resources, such as bandwidth and power.

One of the key challenges is that the amount of data a satellite can produce doubles each year, meaning that the data increases by a factor of five times every five years and 10x every decade.

This makes data storage one of the key issues for the industry, now and for years to come. Data which might currently be dismissed as mundane could prove to be important in the future, when compared to data collected by future missions — all needs to be stored in a manner that's efficient and easily accessible.

One of the primary objectives of the data analysis is to detect anomalies which would be difficult to detect without gathering, storing and crunching through highly granular data. Storage speed is also quite important, particularly given the amount of data that is being created. Retrieval and analysis of the data is needed to debug and tune the feed, although this might not be done as frequently.

### **What are the Risks?**

The importance and analysis cannot be underestimated. Satellite data is in the process of becoming more and more vital over the next few years for transportation, communications and a myriad other tools and services on which our world relies. As our reliance on satellite services increases, the risk of disruption needs to be minimized.

While the potential for a direct repeat of the Carrington Event in 1859 has been basically negated through massive improvements in terms of technology and knowledge, there is still a great deal that is not understood. The hostility of the environment in which satellites operate, coupled with the potential for unexpected events, means that being able to access and analyze data in real-time as well as historical data inclusion is likely to be extremely important, especially in the event of an unexpected occurrence.

The associated financial risks are also significant and companies that can show they have taken the unexpected into account as far as possible are likely to be the ones that will attract private- and public-sector support.

### **What Role do Third-Party Technology Providers Play?**

There's been a fascinating evolution in the information technology sector. A decade ago, large firms would focus their resources on developing technology services in-house, creating what were — at that time — powerful IT tools that focused on specific activities, whether they were financial, medical and health, energy and power or aerospace services.

There were several problems with these bespoke systems, the most obvious being a lack of flexibility. Because the systems were developed to complete highly specialized tasks, they were difficult to amend and rarely had any application beyond the specific task for which they were created. This also meant that firms were reliant on retaining their human talent to ensure that their systems could continue working.

This has changed over the last few years as, for example, the financial services industry has looked at ways of deploying their resources more efficiently. Additionally, the medical and health services industries have also come to recognize the benefits of data interaction for medical analysis.

This shift has created a generation of software providers who are far less focused on a specific industry. This means innovations developed for one industry have application across numerous verticals. This, in turn, means many industries can benefit from advances in a particular technology.

For the satellite industry, previously exclusive data analysis tools that were developed for other markets are now available and applicable for many. This could have several positive benefits when it comes to getting the best out of the plethora of data that is being generated by every project, every launch and every satellite in service.

Data has little value until analyzed to yield information and insights. The potential for cross-over between industries and the way data is analyzed is likely to be one of the most interesting developments over the next few years and could well create some exceptionally useful advances as well as efficiencies of note for many market segments.

**[www.mcobject.com](http://www.mcobject.com)**

*Steve Graves co-founded McObject in 2001 to provide real-time embedded database technology, which makes embedded systems smarter, more reliable and more cost-effective to develop and maintain.*

*McObject offers real-time data management technology used across a wide range of industries and market segments, including finance, IoT and aerospace.*

# A Record Breaking Antarctica Journey

*A case in point: Satcom Global*

**E**arly in 2017, solo sailor Lisa Blair set sail on her racing yacht 'Climate Action Now' from Albany, Western Australia, with the aim of beating the record for the fastest circumnavigation of Antarctica, solo and unassisted, to raise awareness of the effects of climate change.

Satellite communications provider Satcom Global, supported Lisa on her epic journey, providing an Inmarsat Global Fleet One terminal for voice and data, and an Iridium GO! handheld smartphone to satellite phone hotspot, giving her access to vital communications throughout her epic journey.

Lisa spent more than three years preparing and training for the challenge, covering every sailing and safety scenario that could come her way, which was put to good use during her 104 day journey at sea, as she bravely faced many challenges including sea sickness, isolation and sleep deprivation. Lisa also endured a storm which snapped her mast 72 days into the challenge during extreme weather conditions testing her skills and resilience to the max.

With steely determination, on July 25, 2017, Lisa became the first female to circumnavigate Antarctica — a huge achievement — on her return to dry land, she spoke about the important role satellite communications played in her huge accomplishment.

*How often and why were you required to use satellite communications on your journey?*

## **Lisa Blair**

Satellite communications was my main form of communication whilst at sea. I only used the VHF to raise awareness of my presence to other ships in areas of congestion such as below South Africa and in the Bass Strait around Australia.

Other than that, all my communication was on satellite, which I used to communicate with family and friends, as well as my shore team to check in and let everyone know I was okay. I did have a HF on-board, but it was simply a whole lot easier to send an SMS position update, than to arrange scheduled broadcasts through the HF when I was going through all the different time zones.

Koop's Pic's



*Which features of the Iridium GO! and Inmarsat Fleet One did you use the most frequently?*

**Lisa Blair**

I mainly used the Fleet One for all my phone call conversations as it was easier to hear with. I would also use this for all my data; sending videos, photos and blogs back and downloading weather.

I would use the Iridium GO! for the tracking feature, sending SMS to my family, friends and shore team as position reports or simply to say hi. Occasionally I would make calls over the Iridium GO! or download some weather through it, if I didn't wish to boot up the computer.

*How important was it for you to be able to send content such as blogs back to shore?*

**Lisa Blair**

One of my biggest aims with this

journey was to share it with the world and to take people on the journey with me. This was mostly achieved through my detailed blogs, so without this, I feel that I would have struggled to connect and share my journey.

*How important was it for you to be able to keep in touch with family and friends?*

**Lisa Blair**

Hugely important, not just for me, but for them, as well. I would be thousands of miles from land, completely alone and yet I never felt lonely because my friends and family were only a phone call away.

*How reliable was your satellite connection even in different weather conditions and locations?*

**Lisa Blair**

Overall given the rigors of the ocean that I was sailing, I feel that both the Fleet One and the Iridium GO! go held up really well. I was able to connect almost the entire time.

*What was the most important feature of your satellite communications solution?*

**Lisa Blair**

The SMS feature of the Iridium GO! was one of my favorite things. I didn't need to boot up a computer and go through a lengthy process to connect with someone. I would simply send an SMS and within seconds I would get a reply back from someone. It changed the entire feel of the trip and made me feel always connected, and on such a long solo journey like mine, that was really important.

*How has the ability to do live interviews from sea impacted your campaign?*

**Lisa Blair**

One of the key goals was to raise awareness of the Climate Action Now message while sailing solo at sea, and the ability to do live radio and TV interviews at sea meant that I was really able to bring my message to the world. It would have been very hard to get across the importance of my message without this.

*What do you think it would have been like not to have connectivity for long periods of time?*

**Lisa Blair**

If I didn't have connectivity, I feel that I would have likely suffered more negative days at sea. When times were tough, it was a call or text from family and friends that kept me going, so the trip would have been a whole lot harder without the ability to connect

*What was the main benefit to having access to satellite communications during your challenge?*

**Lisa Blair**

The main benefit as always was to be able to talk and text with my family. This was a huge benefit for me and them. My poor family would have had a lot more sleepless nights without me being able to send updates that I was okay during the bigger storms of the trip. It was a really important part of the journey

*How vital was the support you received from Satcom Global?*

**Lisa Blair**

Overall by providing me with the ability to connect with my family, friends and shore crew as well as helping me in sharing my journey with the world and continuing to raise awareness of the message Climate Action Now, I feel that the support from Satcom Global was vital. My journey would have been so different without it.

**[www.satcomglobal.com/maritime-satellite-communications](http://www.satcomglobal.com/maritime-satellite-communications)**

**" I feel that the support from Satcom Global was very vital. My journey would have been so different without it."**

# Satellite Architecture Evolution

## An Omnetics Perspective

By Bob Stanton, Director of Technology, Omnetics Connector Corporation



**T**oday's satellite industry has become a mix of what is being labeled as "Old Space" and "New Space" technology.

Older space programs follow long established protocol while the newer space seems to be changing rapidly to meet many advanced expectations. The evolutionary changes are coming from a range of different sources.

Heightened interest in government programs have broadened the company's space project goals from those aimed at deep space exploration to a wider range of Earth orbit and sub-orbital programs. Omnetics has a wide range of interests from mapping, surveillance and observation to control system satellites.

Joint government satellites are also a part of the driving forces of the changes as well. An example is the JUICE Satellite, pictured below, which is a jointly planned international program with NASA and the European Space Agency's (ESA) Cosmic Vision program. The mission's target is Jupiter's Icy Moon and will include a massive array of sensors and monitors for watching electro-magnetic fields to atmospheric mapping. Deep space probe systems must follow long established design methods and testing to insure success and performance.

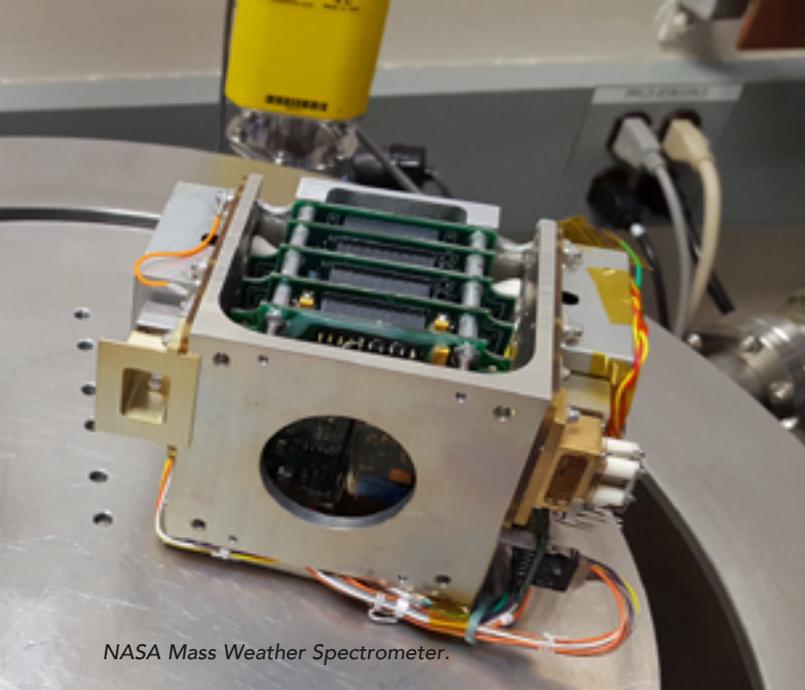
Driving change has also come from newer electronic device technologies that can provide capabilities to coordinate multiple operating systems within the satellite to serve a number of project functions, all from a single orbiting system. In addition, commercially driven changes are coming from renewed interests that range from space travel programs to asteroid mining for unique materials.

University programs have enjoyed significant interest in satellite technologies through their global smallsat programs. Trying to define the blends of Old Space versus New Space is a bit tricky as so many changes are coming from a number of directions and being applied to various programs based upon the controlling agency driving it.

Generally speaking, Old Space designers are working on government programs such as those from NASA and ESA. These projects have previously defined rules, tests and certifications that go into extensive depth to prevent surprises after the vehicle is deep in space. They tended to focus on larger satellites and began years ago with predominately analog signal technology that requires somewhat constant temperature control, tuning and reference circuits.



Artistic rendition of NASA's Juice satellite probe. Image is courtesy of ESA.



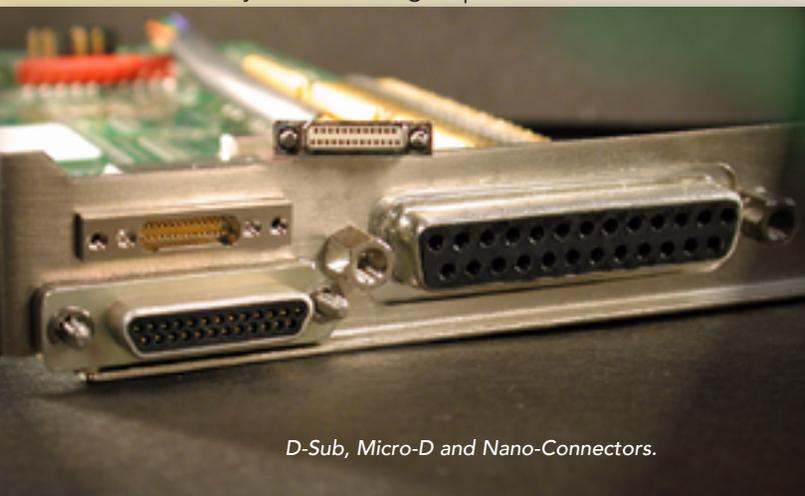
*NASA Mass Weather Spectrometer.*

The power required for those analog circuits is often higher and, therefore, power supplies must be robust and capable to sustain long periods in deep space. Significant testing and retesting of even currently used products is done to insure success.

The pre-testing takes a fair amount of additional investment and time and also follow the rules of NASA- and ESA-type government programs. These procedures are often rewarded with long range success and should not be condemned as they are what has moved the industry so far.

As expected, these OLD Space products were often large and heavy. Mass matters, however, and traveling space products can benefit significantly if the size and weight of each item were smaller — smaller units can result in more technologies due to increased space availability onboard the satellite.

New Space satellite programs are benefiting from the many years of old space investment but appear to be rapidly evolving in their own direction. Many new space programs are funded by commercial groups and individuals.



*D-Sub, Micro-D and Nano-Connectors.*

There is frequently a profit and individual achievement goal behind these projects that give an excitement feature as well. The development-to-launch process is aimed at moving more swiftly and cost competitively.

Components used in New Space satellites are often selected from previously proven devices that have identical materials and processing from earlier programs. This dramatically reduces the time-to-launch, with minimal risk of failure.

During the last few years, the micro chip industry has contributed breakthroughs that have influenced the design and capability of satellite systems. Newer CMOS silicon technology has added quality and speed for digital signal processing, storage and retrieval. This shift away from analog processing has dramatically changed the rules for modern satellites.

Newer chips require lower voltages, and reduced current flow all the while increasing digital signal speeds into the gigabit/second level. The mass of the power supplies, the processor boards as well as cable and connectors are being reduced.

Connectors in early satellites were large and heavy. As the evolution continues, many micro-sized connector and cable routing signals on 26 gauge wires are replacing the older d-sub connectors, set at 100 mil. spaces from pin to pin. Currently, more interconnections use Nano-d connectors that are one-fifth the size and weight of earlier systems, using pin to pin spacing at 25 mil. spaces from pin to pin. By selecting nano-connectors with 32 gauge wiring, the quantity and density of circuits available to the satellite designer allows many more architectural functions within one satellite. This increases the value and payback significantly.

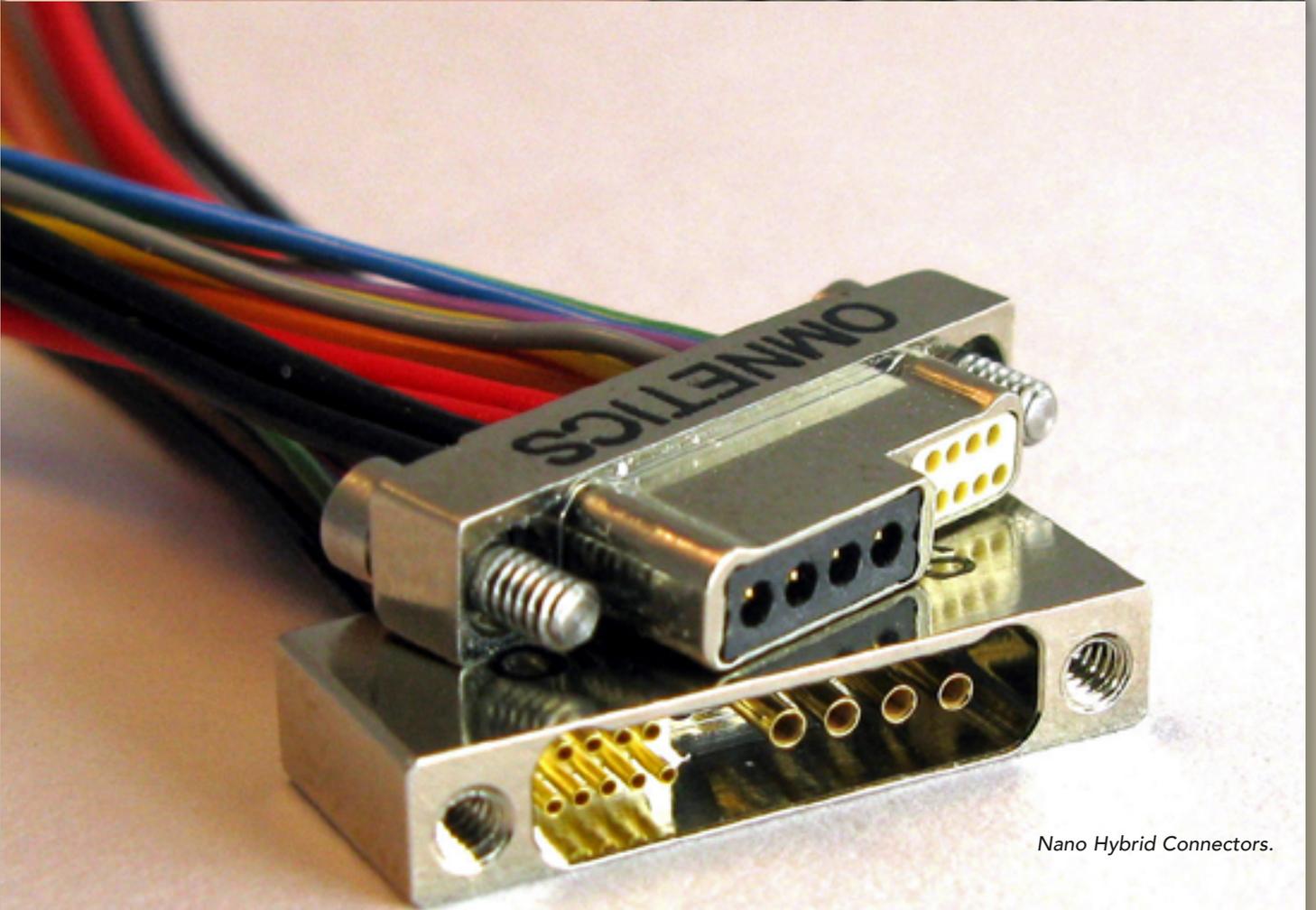
Newer electronic architecture, functions and services are bounding forward in satellites as a result of the digital evolution. Combining features of older subsystems, allow us to design multipurpose modules with electronic flexibility that increase the contributions of each satellite launched.

More on-board buss systems are being considered to route and handle higher speed switched fabric interconnected signals and multiply functional capability of previously single purpose elements. For example, a device that combines many processing modules working together that will help satellites with multiple functions within one unit is the 3U VPX format has been developed by XES Inc.

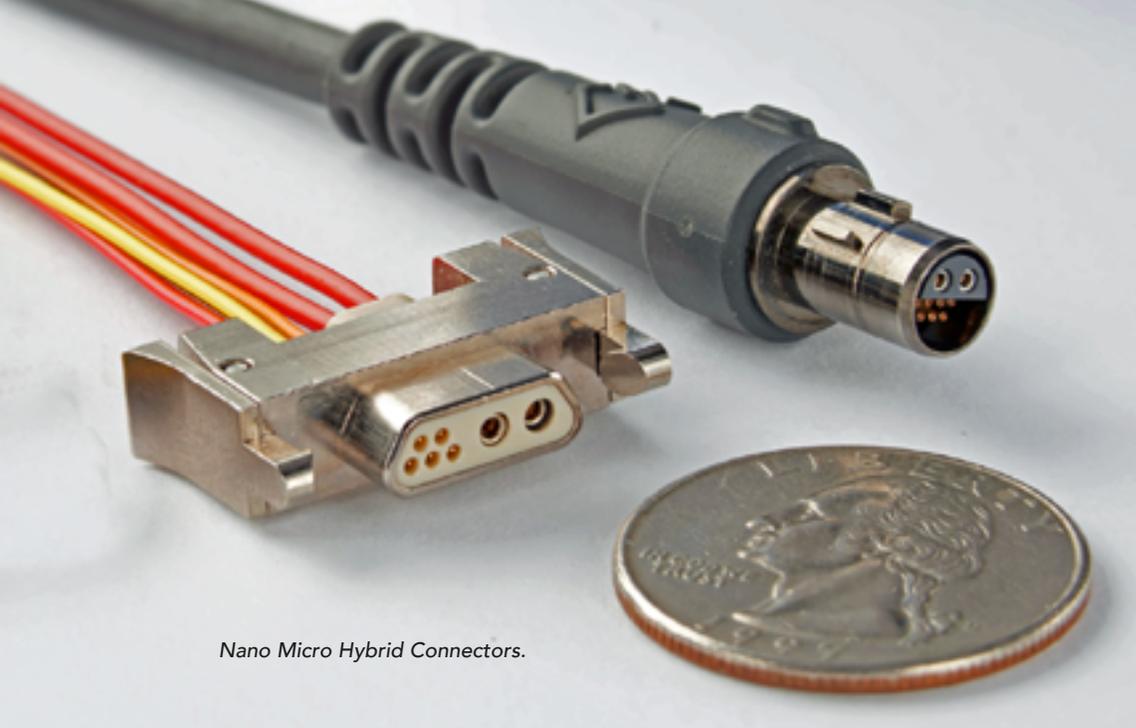
The idea of cramming many high density processing boards that work on their own backplane significantly reduces mass and weight. Satellite designers can work with VPX companies to significantly improve the efficiency of their instruments this way. Functions such as geophysical mapping can be handled simultaneously while communicating with multiple Ethernet systems that each have their own format and



*VPX Processor Board.*



*Nano Hybrid Connectors.*



*Nano Micro Hybrid Connectors.*

Hybrid connector designs are quickly adapted using previously proven connector elements to adjust varying pin counts and power supply demands. When needed circular and rectangular connector shells are in stock or automatically machined at a number of companies. Solid work models are available and provide fast transfer of new designs that can be sent directly to the satellite designer for review.

The use of RF is also going through changes. Micro and nano-sized coax connectors in the portable consumer industry and for military

codes. High definition imaging can be captured, stored and retransmitted at gigahertz speeds.

Using high speed digital circuitry helps keep size and weight down. Routing digital signals through specially designed nano-sized connectors and cable can handle the differential digital signals and power lines within the same unit. Designers often specify these hybridized nano-connectors to include higher amperage pins for power and smaller pins for the digital signals. This helps reduce the use of duplicate cable systems within their modules.

Also noteworthy is that nano interconnects have much lower mass than larger connectors and excel in signal processing performance during high shock and long cycle vibrations. This move from D-sub and Micro connectors to Nano connectors is somewhat natural.

ground troop applications.

UAV surveillance systems need to transmit signals back to ground, but also need light weight transmitters. More often, designers specify micro and also nano-sized coax connectors to fit within their space and weight budget.

Old Space and New Space electronics are constantly moving to meet new appetites for both commercial and government systems. Circuits are fueling a new capabilities long awaited for in the satellite field.

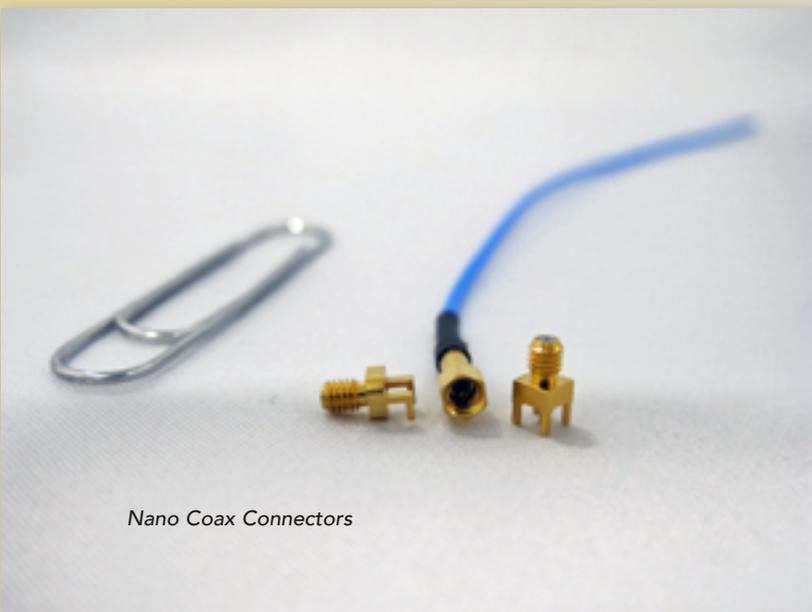
Older design methods are merging with the faster moving new design methods. Deep space research is still the most technologically challenging but the newer commercial orbital and sub-orbital satellites are helping to drive this evolution.

The demand for new functions and satellite services pushes us onward. High density electronics using micro and nano-signal routing systems with high speed digital electronics is providing new platforms for designers.

By combining on board Ethernet, VAX systems and board to board data processing designers are reducing size and weight to allow greatly expanded satellite capabilities while reducing the satellite footprint.

**[www.omnetics.com](http://www.omnetics.com)**

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*Nano Coax Connectors*

# A Case in Point: Norsat International

## Building a customer terminal solution for Kratos Communications SAS

**N**orsat was selected to design a satellite terminal for Kratos Communications SAS' geolocation system, satID®, a component which would then be a part of a larger system called the Advanced Space Radio Monitoring System (ASRMS).

The final design was a customized GLOBETrekker with multi-band functionality that included Ka-, Ku-, X-, C-, and low Ku-bands.

Kratos Communications SAS selected the GLOBETrekker due to the unit's multiband functionality and intuitive user interface and software, LinkControl, which makes satellite acquisition. Kratos Communications SAS was extremely satisfied with the quality of the final product and its ease-of-use.

The GLOBETrekker successfully geolocated C- and Ku-band signals and passed the Site Acceptance with the end-user. Overall, Norsat was

able to effectively customize a product to meet Kratos Communications SAS' unique needs and provide them with their desired end-product.

### Background

Kratos delivers integrated end-to-end enterprise solutions across the ground station to communication service providers.

For this project, Norsat worked with Kratos' European subsidiary, Kratos Communications SAS, which is based in Toulouse, France. Kratos is well-known as the global provider of products, systems and services for satellite command and control, telemetry and digital signal processing, data communications, enterprise network management, and communications information assurance.

### Problem

Kratos Communications SAS was looking to source a multi-band satellite terminal which would be used with their geolocation system, satID®, a component within a larger system called the Advanced Space Radio Monitoring System (ASRMS). The purpose of Kratos Communications SAS' project was to find users who operate satellites improperly, which includes



Norsat terminal in use by Kratos GT in Oman, Jordan.

transmitting on another user's frequency, intentionally jamming signals, or interfering with signals.

Most satellite

interference is unintentional and often results from human or user error including incorrect antenna pointing, too much uplink power, and misaligned satellite terminals.

Figure 1 above. Visual of the custom multi-band GLOBETrekker terminal built for Kratos Communications SAS.

geolocation system can be used to locate the position of the interfering signal (please see **Figure 2, below** — a Visual diagram of a Kratos' satID® Geolocation System. Image courtesy of Kratos and Kratos Communications SAS).

The satID® geolocation system locates interferences and also confirms the location of known signals. The objective of the multi-band satellite terminal is to transmit a reference signal between satellites on all surrounding frequency bands in order for the satID® geolocation system to better pinpoint the location of the signal.

Previously, Kratos Communications SAS used feedhorns with their geolocation solutions as they had a wider beam width than other options. However, with this specific project, Kratos Communications SAS discovered there were limitations and the previously-used feed horn could not be used for Ka-band.

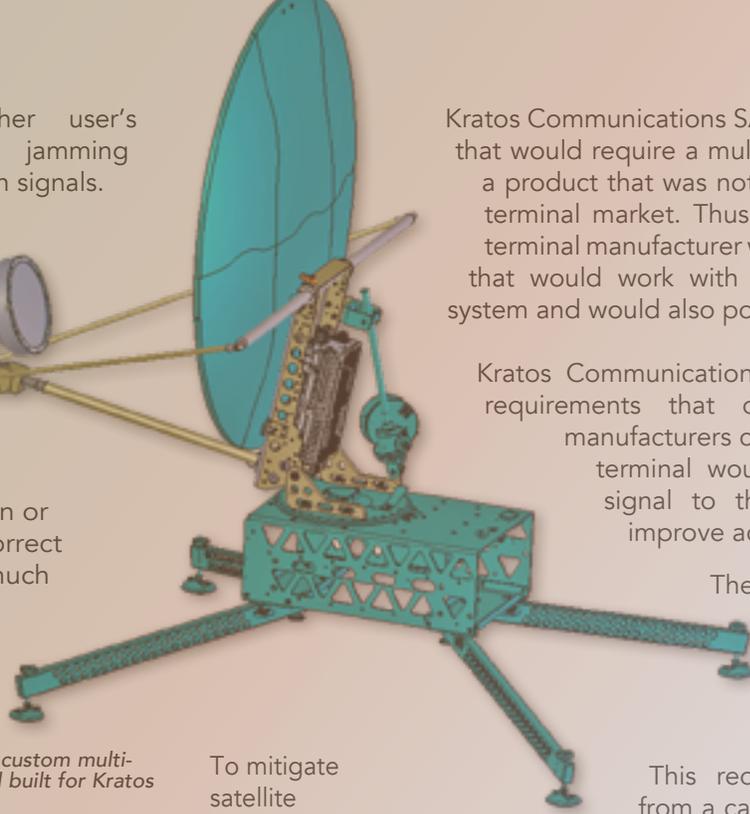
Kratos Communications SAS derived an alternative solution that would require a multi-band ground satellite terminal, a product that was not readily available on the satellite terminal market. Thus, they needed to find a satellite terminal manufacturer who could custom build a terminal that would work with the current satID® geolocation system and would also possess multi-band functionality.

Kratos Communications SAS had specific and unique requirements that only a few satellite terminal manufacturers could fulfill. The proposed ground terminal would transmit a hidden reference signal to the satellites which would help improve accuracy.

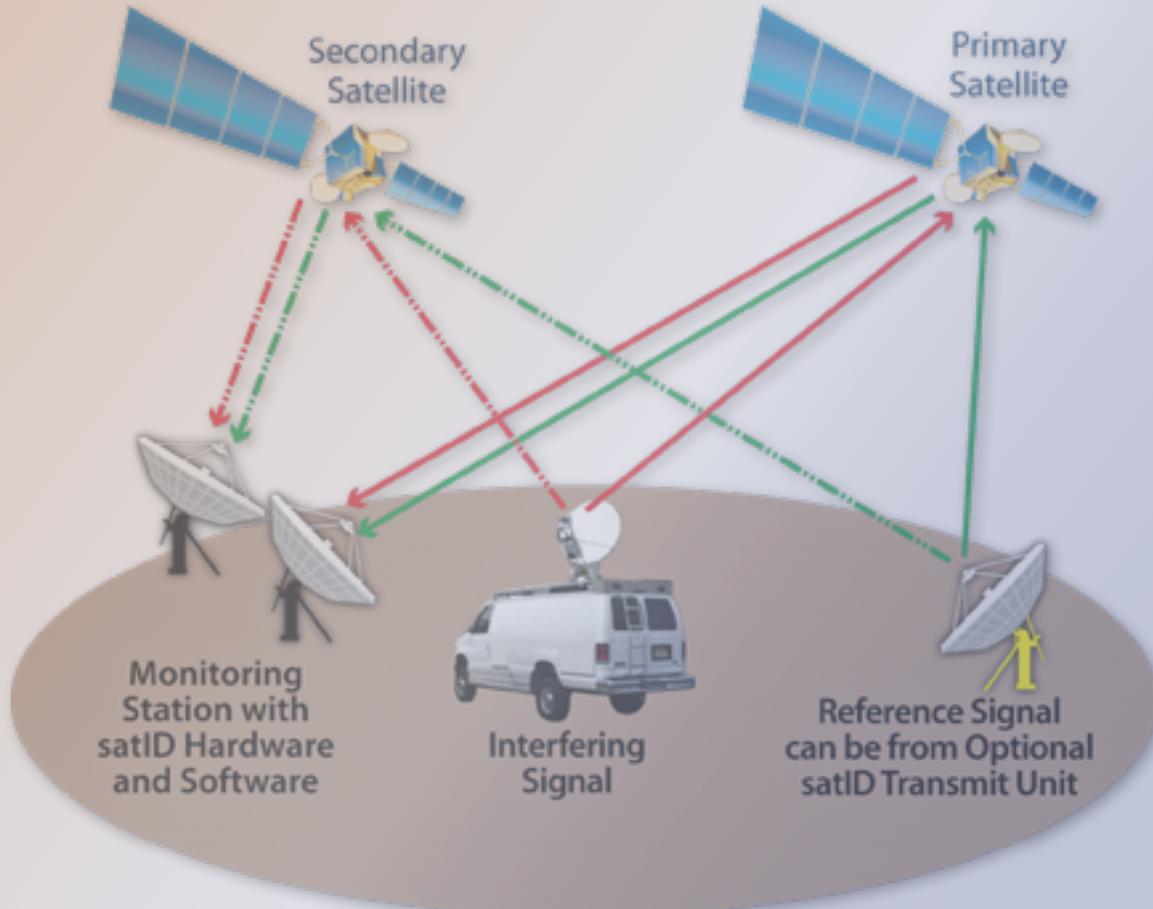
The end-user of the system needed to communicate with all surrounding satellites in all band spectrums — multi-band functionality was the major concern for this project.

This request required a custom build from a capable terminal manufacturer with high technical knowledge.

Secondly, the satellite terminal needed to be lightweight, easy-to-deploy, reliable in remote environments and powerful enough to transmit a signal to two adjacent satellites. Kratos Communications SAS sourced potential



To mitigate satellite interference, a



satellite terminal manufacturers who could build this product on-time and on-budget.

**Solution**

Norsat International was one of two satellite terminal manufacturers that could provide Kratos Communications SAS with their desired product.

After due diligence was completed, Kratos Communications SAS deemed Norsat's GLOBETrekker as the superior option due to the terminal's potential for

multi-band functionality and ease-of-use, all stemming from the GLOBETrekker's one-touch user interface and LinkControl software.

LinkControl offers an intuitive and powerful set of tools for satellite communication professionals and amateurs and seamlessly integrates the various hardware and procedures into user-friendly steps. The easy-to-use software offers auto alignment and can acquire a satellite in less than five minutes.



Figure 3. Breakdown of Features on Norsat's GLOBETrekker terminal.

Also offered are a variety of advanced satellite communication tools as well as full integration with modems, solid state power amplifiers (SSPAs), and other devices. The user-configured profiles of the system enabled operators to quickly shift satellites, equipment or systems in the field.

Kratos Communications SAS identified a need for a satellite terminal that would survive in remote and challenging applications. The rugged GLOBETrekker terminal was designed for durability and could perform in the most intense weather conditions. The structure of the terminal allows for the unit's electronics to be elevated, well above any running water, mud or snow.

The terminal was customized to include multi-band capability to ensure operability with Ka-, Ku-, X-, C- and low Ku-bands, a key element in the final decision making process. The GLOBETrekker also allows for easy and fast switching, moving from one band to another in less than ten minutes. Norsat's ability to manufacturer a custom product that would work with Kratos Communications SAS' existing geolocation system saved valuable time and money.

### Results

Once the GLOBETrekker was completed, a representative from Kratos Communications SAS visited the Norsat office for a four day training session on how to use the new satellite terminal.

The first and second day of training consisted of how to setup the complete system including all six frequency band kits, how to use LinkControl and a general overview on mechanical maintenance.

The final two days were the outdoor tests where the Norsat training team instructed a session on how to use the auto pointing system in the various kits. Final testing was

conducted on the last day where the GLOBETrekker successfully passed the Factory Acceptance Test.

Kratos Communications SAS' representative said that, "... our experience with Norsat was great and it was useful for us to do a Factory Acceptance Test at Norsat. We are very happy with the terminal and the end result."

The end-user's Site Acceptance of the GLOBETrekker also went extremely well. The terminal was successful in geolocating C-and Ku-band signals and in the acquisition of satellites in all bands with LinkControl.

Overall, Kratos Communications SAS and the end-user are satisfied with the quality and ease-of-use of Norsat's custom GLOBETrekker terminal.

"The GLOBETrekker meets our needs for a transportable, easy to deploy and use, multiband reference emitter. Our experience with Norsat was great and we are very happy with the end result," said Mathieu M. Sambuq, Project Manager, Kratos Communications SAS

[www.norsat.com](http://www.norsat.com)

A video detailing how to use LinkControl software is available for viewing at...  
<https://www.youtube.com/watch?v=NE8eUEat-pY>

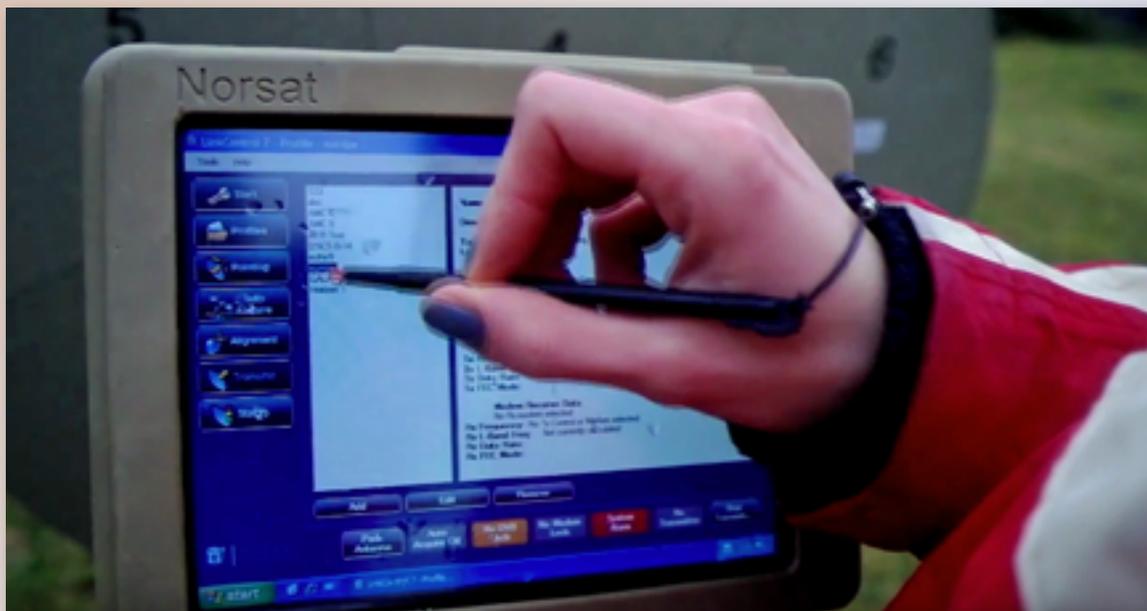


Figure 4. Working with LinkProfiles in Norsat's LinkControl software.