Worldwide Satellite Magazine – April 2016

SatMagazine

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SatMagazine

April 2016

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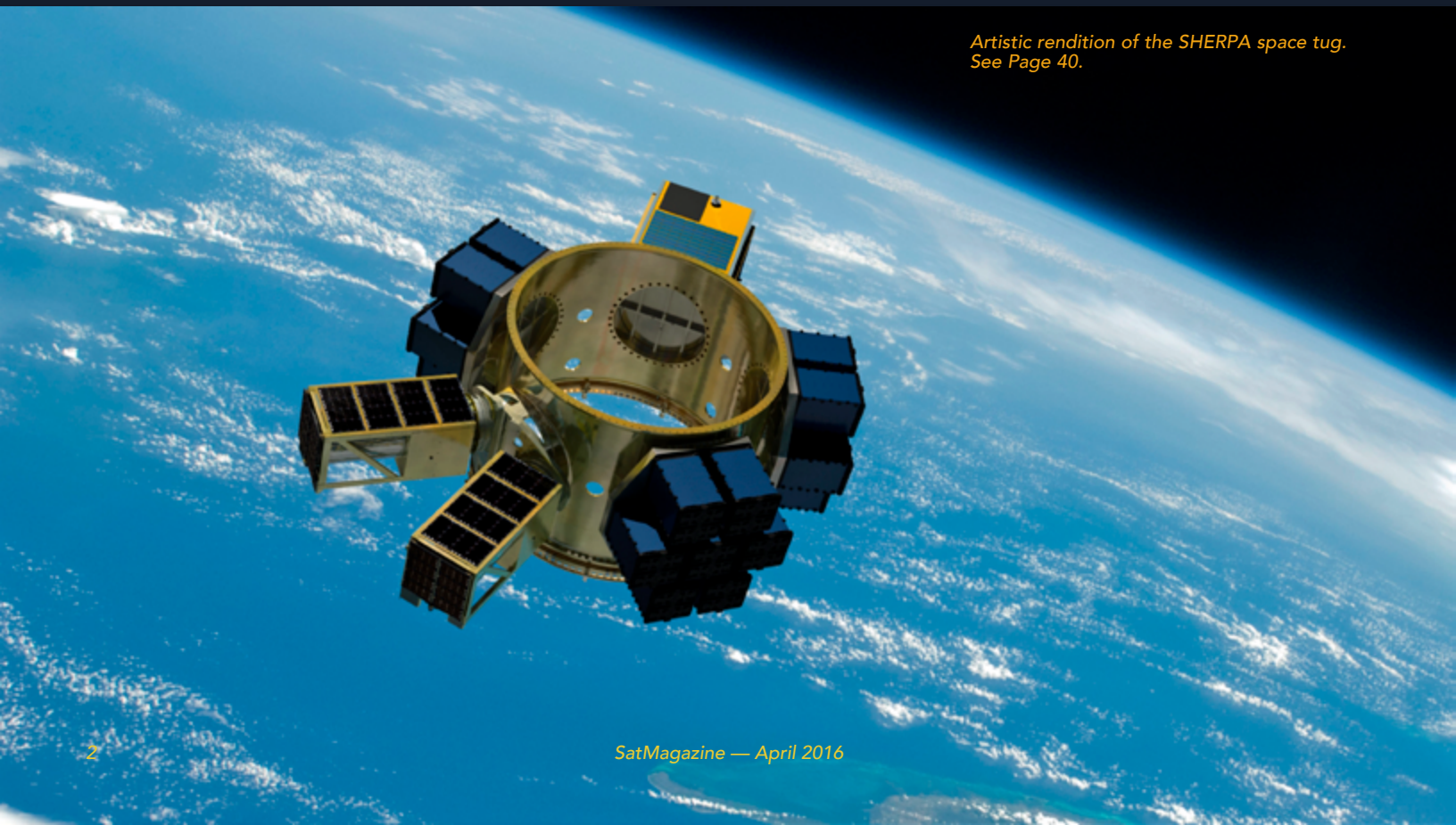

Artistic rendition of the SHERPA space tug.
See Page 40.

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InfoBeam Articles

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Panasonic Raises Their Anchor On New Maritime Comms Service

Panasonic Avionics Corporation (Panasonic) has disclosed their their broadband communications and digital entertainment services will now be available to passenger vessels across the maritime market.

Panasonic offers a new approach to connectivity at sea, serving passengers and crew, as well as communications for ship operations and corporate networking.

Panasonic already delivers business-critical communications to a wide range of mobility markets, leveraging a high availability Ku-band satellite network that covers more than 98 percent of maritime traffic routes.

Panasonic has made calculated investments in Ku-band for a number of reasons, including global coverage, ease of scalability, the maturity of the technology, and its high reliability. In February, the company announced multi-year contracts with satellite fleet operators, SES and Telesat, for high-powered HTS spot and wide beam Ku-band capacity to supplement its existing HTS capabilities. The agreement helps ensure a broadband experience for Panasonic customers across the US, Canada, Mexico and the Caribbean, as well as the Mediterranean, Europe and the Middle East.

Over the next several years, Panasonic's network will continue to evolve as the company rolls out extreme high-throughput (XTS) capacity in the densest of traffic areas—across North America, Europe and Asia—where these regions will be seeing multiple gigabits of capacity.

In an effort to bring an elegant, lightweight, easy to install solution to maritime customers, Panasonic has formed a cooperative with Kymeta Corporation to bring innovative, high-performance flat panel antenna technology to the maritime market.

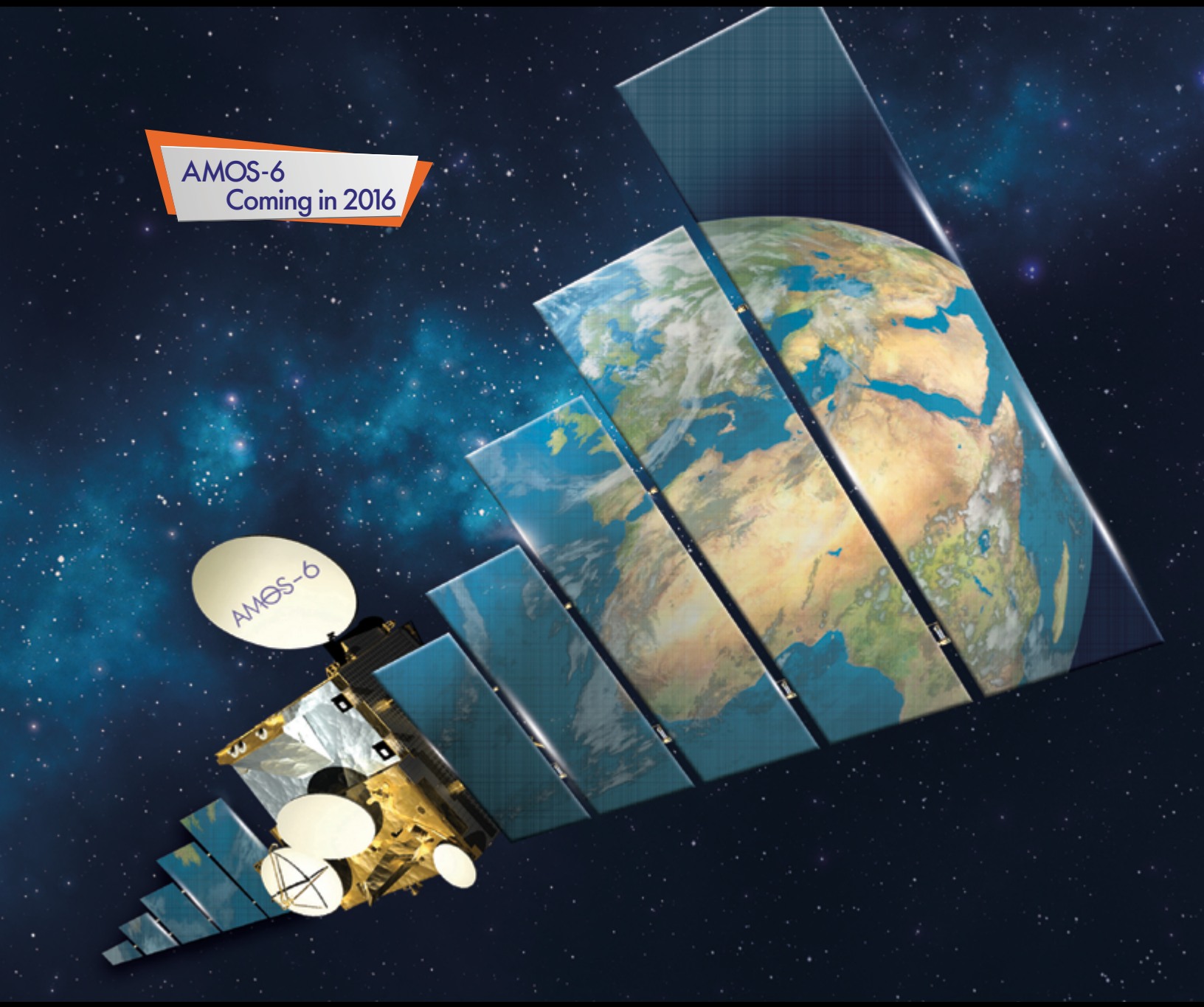
Panasonic will order a significant volume of Kymeta's flat panel antennas and use Kymeta's mTenna technology to manufacture and distribute maritime terminals for vessels around the world. Panasonic's high-throughput satellite network combined with Kymeta's lightweight antenna design will give maritime vessels the ability to provide cost-effective, ultra-reliable, high-speed connectivity to passengers and crew.

Panasonic's new maritime solutions leverage the company's best-in-class entertainment technology in order to address the ever-evolving connectivity requirements of today's passenger maritime operators. Panasonic was the first to bring live, global television service to the airline industry, and has delivered more than 8,000 inflight entertainment systems and 1,100 inflight connectivity solutions to the world's leading airlines. Now that same premier entertainment platform is available to the maritime market.

"*Panasonic, in close cooperation with ITC Global, is dedicated to delivering the best in digital entertainment and enterprise quality broadband communications to the maritime industry,*" said David Bruner, Vice President, Global Communications Services at Panasonic Avionics. "*We believe our network strategy sets a new standard in connectivity across a wide range of markets including yachts, river cruises and other passenger vessels.*"

maritime.panasonic.aero/

Expect More. AMOS Satellites.



More Coverage. More Throughput. More Services. Across the Middle East, Europe, Africa and Asia.

Spacecom's AMOS satellite constellation, consisting of **AMOS-2** and **AMOS-3** co-located at 4°W and **AMOS-4** at 65°E, provides high-quality broadcast and communications services across Europe, Africa, Asia and the Middle East.

With the upcoming launch of AMOS-6, Spacecom is expanding its coverage over Europe and Africa. The result: greater capacity, high-throughput Ka multibeam capabilities and affordable end-to-end satellite services. Spacecom. Expect More.

AMOS by Spacecom

EXPECT MORE

www.amos-spacecom.com

Features

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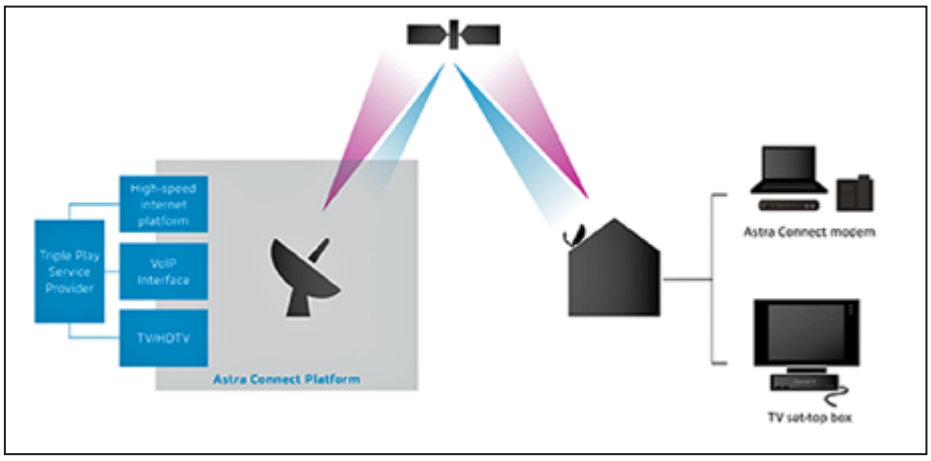
SES' First Maritime Service Is Unveiled



SES S.A. has unveiled their first maritime Ka-band services under the SES Maritime+ service offering.

This new service for the maritime and inland shipping mobility sector will use ASTRA 2E's and ASTRA 2G's Ka-band beams to drive efficiency and operational savings.

The new Ka-band service, to be launched in Q2 2016, combines SES Ka-band spot-beams, EPAK's DSi9 maritime antenna and Gilat Satellite Networks' broadband technology.

The offering is based on SES Techcom Services' Astra Connect solution and will provide coverage over Europe, including the North Sea, the Irish Sea and inland waterways.

The new service will target customers such as offshore wind farms, inland shipping companies, and supply ships for oil platforms.

"Our new offering for the mobility market is a highly cost-effective maritime Ka-band service, which is designed to deliver communications on the move and allows a wider range of customers to profit from maritime connectivity," said Norbert Willems, Commercial Vice President at SES Techcom Services.

"*Providing connectivity at sea has become increasingly crucial,*" he added. "*This new service not only meets this need, but also does so economically, thanks to the attractive price per megabit of our Ka-band offering.*"

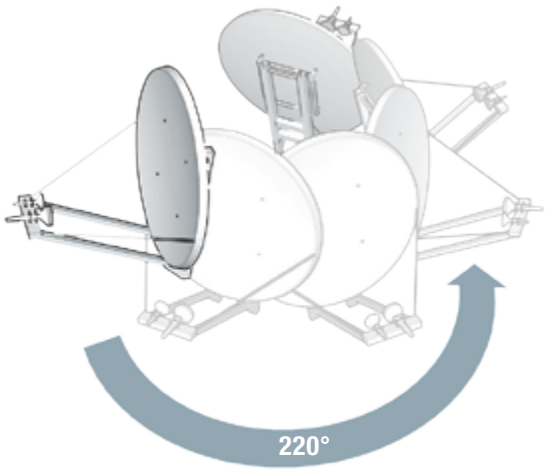
EPAK Managing Director Jochen Gruener said, "*Our DSi9 Ka-band terminal enables us to guarantee excellent network availability, even in the most challenging conditions.*"

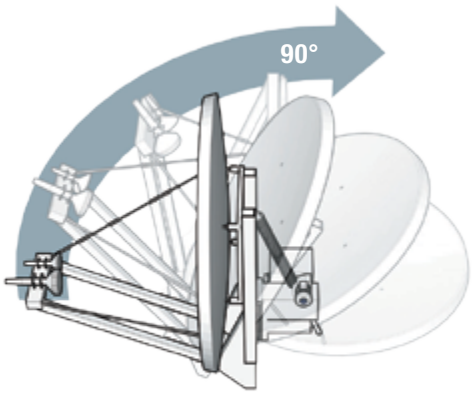
ses.com/21197409/astra-connect

epak.de/en

gilat.com/

Fast and precise positioning with tracking, amazing 220° azimuth range and 90° elevation range. Available for a wide range of antennas with up to 3.8 m reflector.





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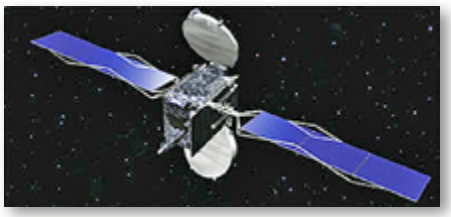
MEASAT Constructing An Asian UHD Neighborhood

MEASAT Satellite Systems Sdn. Bhd. ("MEASAT") now has an agreement with Television Entertainment Reality Network International ("TERN International") for the distribution of the INSIGHT UHD channel via the MEASAT-3a satellite—INSIGHT UHD is the second UHD channel distributed via the 91.5 degrees East video neighborhood.

Marketed in Asia by Thema, Insight UHD is Asia's first UHD factual entertainment channel. The channel, featuring original UHD material co-created with industry-leading production houses, brings a range of content from entertainment to extreme sports, and from game shows to beautiful, vivid cinematography.



Artistic rendition of the MEASAT-3a satellite.

Under the agreement, MEASAT will use MEASAT-3a's global beam to deliver the channel to payTV operators across Asia Pacific and Australia. The MEASAT-3a global beam also covers the Middle East and Eastern Africa.

Francois Thiellet, Chief Executive Officer, THEMA, said, "Working with MEASAT and TERN International, we are looking forward to the channel expanding its reach into another major world market with a large library of entertainment series in native UHD."

"*MEASAT is committed to bring the best of new content to the Asian region,*" said Paul Brown-Kenyon, Chief Executive Officer, MEASAT. "*As such, we are delighted to welcome Insight UHD to Asia's UHD video neighborhood on MEASAT-3 / 3a at 91.5 degrees East.*"

measat.com/

tern-international.tv/

To Ka band and beyond!

The future is Ka band. Now, there's a rugged, dependable handheld designed to deliver precise, lab-grade measurements up to 50 GHz. At only 7.1 lbs., it's an all-in-one cable and antenna tester (CAT) + vector network analyzer (VNA) + spectrum analyzer and more. Which means, now you get comprehensive system performance insight at higher frequencies. Plus with easy upgrades and multiple configurations, you'll be ready to go where no handheld has gone before – today and beyond.

Keysight FieldFox Handheld Analyzers

- 6 new models to 50 GHz
- MIL-PRF-28800F Class 2 rugged
- Agrees with benchtop measurements
- CAT + VNA + spectrum analyzer

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Agilent's Electronic Measurement Group is now **Keysight Technologies.**

MSUA Honors Cobham With Top Maritime Mobility SATCOM Award

Cobham has won the prestigious Mobile Satellite Users Association's (MSUA) 2016 Top Maritime Mobility Satcom Innovation award, recognizing the SAILOR 60 GX antenna system as one of the most innovative maritime VSAT systems ever developed.

The SAILOR 60 GX is a brand new 60 cm-class antenna system for Inmarsat's Ka-band Fleet Xpress—the maritime service offering of the new Global Xpress High Throughput Satellite network.

With SAILOR 60 GX, Cobham SATCOM has achieved the perfect balance between size and connectivity performance. Weighing just 82 lbs/37 kg, the SAILOR 60 GX user terminal features one of the lightest Ka-band maritime antennas and boasts class-leading radio performance to ensure a reliable link to the satellite and more availability of communication services across larger sea areas.

For maritime vessels with space and/or budget restrictions a new SAILOR 60 GX combined with a SAILOR FleetBroadband system is the perfect hardware platform for Inmarsat's new generation maritime SATCOM service.

SAILOR 60 GX is based on an advanced new lightweight carbon fiber composites/aluminum design. It retains the same performance and installation benefits that have established SAILOR VSAT antennas as clear technology leaders.

Specific innovations of the SAILOR 60 GX technology platform include: Precision reflector dishes, Direct Motor Drives using high torque stepper motors, single cable between antenna and below deck equipment, Automatic Azimuth Calibration, and Automatic Cable Calibration to eliminate cable attenuation.

Cobham SATCOM's unique SAILOR 60 GX innovations combine to deliver numerous benefits to maritime end-users.

By providing a reliable, high-throughput link to the Global Xpress network from a smaller antenna package, SAILOR 60 GX supports a wider range of vessel types that...

- ***Save money on bunker costs by optimizing fuel consumption***
- ***Improve environmental footprint by reducing harmful exhaust emissions***

- ***Streamline equipment maintenance tasks through remote monitoring***
- ***Collaborate with experts on shore with always available voice calling and videoconferencing***
- ***Contact loved ones more often and for less cost***

"SAILOR 60 GX delivers unmatched RF performance for its reflector size, meaning the high bandwidth of the Fleet Xpress service can be enjoyed fully, even on the edges of coverage, despite a smaller antenna. Both SAILOR 60 GX and its stablemate SAILOR 600 VSAT Ka for Telenor's European Thor 7 network enable more vessels and fleets operating on lower communication budgets to harness the power of reliable, flat rate, high bandwidth satellite connectivity on board," said Jan Kragh Michelsen, VP Maritime Business Development, Cobham SATCOM.

"We're delighted that the MSUA has highlighted the innovative design of the newest addition to the established SAILOR VSAT portfolio. With SAILOR 60 GX, our design engineers have leveraged the spot-beam architecture of Inmarsat Global Xpress, which encourages smaller reflector dish sizes and therefore the potential to reduce the size and weight of on board antennas.

"Our approach has the potential to considerably expand the maritime VSAT market," said Casper Jensen, Vice President for Business Development at Cobham SATCOM.

msua.org/

cobham.com/

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SMARTER SOLUTIONS, GLOBAL REACH.

Advantech Wireless delivers intelligent broadband communications solutions that achieve excellence, maximize performance and minimize operational costs, all with uncompromising quality. Ultimately, we help people stay connected and informed by designing and manufacturing the most advanced terrestrial and satellite communication technologies on the planet.

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Enterprise & Corporate

www.AdvantechWireless.com

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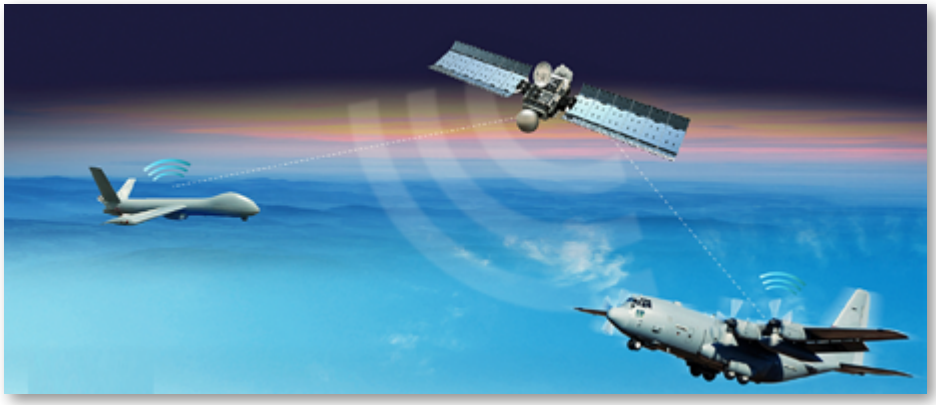
ORBIT Communications To Provide Comm Solutions To NATO Navy



ORBIT Communication Systems, Ltd. introduced an innovative airborne stabilized VSAT antenna system for various aircraft at Defexpo India 2016.

Providing high throughput and quality broadband communication via satellite, the company has already received an order for several AIRTRx™60 systems from an Asian customer.

Designed to accommodate the regional and global coverage needs of the airborne communication market, the low-weight AirTRx™ 60 is built to empower critical applications.

AirTRx™ 60 complies with the most stringent worldwide SatCom regulations and certifications, including RTCA/DO-160G.

Following the demand from the government and defense market, ORBIT released its MPT 60 Airborne VSAT Antenna systems suitable for mission aircraft and UAVs.

AirTRx™ 60 and MPT 60 support Ku- or Ka-bands and feature RF performance and dynamic response under virtually any operating environment.

Switching between RF bands requires a simple replacement of the feed. Additional features include among the rest: multiband support, minimal swept volume, short lead time, INS and RF tracking.

According to Erez Shabirow, ORBIT's CEO, "ORBIT continues to make significant investments in R&D—reflecting customer demand for comprehensive, reliable, compact and continually more complex broadband infrastructure for audio, video, data and Internet.

"Prestigious customers—including aircraft manufacturers, major integrators, communication service providers and government agencies—have selected ORBIT's robust and dependable solutions for the past 20 years, with more than 1,500 systems in operation globally."

ORBIT's portfolio includes mobile satellite communication systems, tracking & telemetry solutions, communication management systems and earth observation ground stations which are operating on thousands of platforms worldwide.

orbit-cs.com/

Major European XpressLink + Global Xpress Maritime Activation

Network Innovations and Intellian have announced the first major European Government XpressLink conversion and Global Xpress (GX) Maritime service activation.

Network Innovations is a leading Inmarsat VAR with extensive experience in field testing and transmitting on the GX network, and has spent months gaining insight into the organization's communication requirements, where speed of service combined with global coverage presented a unique challenge existing satellite services could not fulfill. Its earlier leadership conducting successful in-field testing of the GX service on land

and at sea for Government, Maritime and Enterprise clients proved to be pivotal as the teams created a customized solution.

Using an existing Intellian GX100 1m Ku-band and converting it to a GX terminal by using the Intellian upgrade kit, Network Innovations and Inmarsat were able to provide the organization with transmission speeds that far exceeded what was achieved on the previous service.

Roy Sielaff, Director, European Government Sales, Inmarsat, said, "*This first GX conversion and activation for a major European customer marks another milestone for Network Innovations and Inmarsat as part of the Inmarsat Global Xpress launch.*"

networkinv.com/

inmarsat.com/service/global-xpress/

Satellite Operator Benchmarks 2016 Report Released By World Teleport Association

The World Teleport Association (WTA) has released their *Satellite Operator Benchmarks 2016*, a new research report.

This is the sixth report in WTA's annual Satellite Operator Benchmarks series.

WTA conducted the report with Futuresource. Key findings from the report include:

- ***Teleport operators perceive the commercial performance of satellite operators improving***
- ***The operational performance of satellite operators continues to strengthen, according to teleport operators***
- ***Commercial flexibility and portability are improving***
- ***Direct competition between teleport and satellite operators is declining and becoming somewhat more fair, as perceived by teleport executives***

With the Satellite Operator Benchmarks series, WTA examines the crucial relationship between teleport operators and satellite operators.

WTA seeks to keep that relationship healthy and strong by informing teleport operators about how their peers view the principal satellite operators while at the same time providing objective feedback to those operators from an important customer group.

By objectively tracking, rating and comparing the operational and commercial performance of satellite operators, as experienced by teleport operators, WTA seeks to strengthen the industry by driving self-improvement across all companies.

"When we began the Benchmarks reports six years ago," said WTA executive director Robert Bell, "we wanted to influence how satellite operators sell, service and partner with their teleport customers for the better. The latest results suggest that the unified voice of the teleport sector has been clearly heard."

The full report is available at: ***worldteleport.us1.list-manage1.com/track/***

Flat Panel Antenna For Maritime Market Debuts From Harris CapRock + Phasor

Phasor, Inc. has partnered with satellite and remote communications services provider Harris CapRock Communications to develop an electronically-steerable antenna (ESA) terminal.

Phasor's ESAs are based on patented innovations in dynamic beam-forming technologies and system architecture.

The companies will co-develop a maritime terminal based on Phasor's ESA technology that will support high throughput (HTS) Ku-band satellite communications to be included as part of Harris CapRock's managed services offering.

This terminal will be ideal for high mobility and higher bandwidth applications, such as those found in the cruise market. Harris CapRock holds special distribution rights for the terminal in the cruise market.

The cruise-sector communications market is experiencing rapid growth and the ships of today have very unique connectivity requirements.

They combine multiple services such as passenger broadband-access, retail, banking and hospitality and this places big demands on their communications infrastructure

The ability to offer a very high standard of connectivity to passengers on board is differentiating factor. Therefore, reliable and expandable broadband connectivity on board a vessel is imperative.

Phasor's very low profile antenna provides high-bandwidth service in a more reliable, robust and failure-tolerant way.

The antenna is solid-state, with no moving parts, so satellite signals are tracked electronically. Its sleek look is ideal for cruise lines, eliminating the need for visually unappealing radomes spread around the vessel.

The terminal can match the performance of a 2.4m antenna dish, making it the ideal solution to meet the demanding communications requirements of cruise lines, while the antenna's modular architecture allows the system to be scaled to any environment.

Tracey Haslam, President, Harris CapRock, said, "*Phasor makes a smart partner for driving our momentum forward by developing and bringing the world's first flat panel, phased array antenna communications solution for the cruise market.*"

David Helfgott, CEO of Phasor, said, "*Phasor's game-changing, electronically steerable antenna (ESA) technology provides greater capability, flexibility and performance than existing systems today. Together we will leverage our strengths to provide a maritime terminal to ensure the delivery of reliable broadband communications to the cruise market.*"

phasorsolutions.com/

harriscaprock.com/

First Launch Scheduled For Russia's Vostochny Spaceport

Builders have started the final stage of work at the Vostochny spaceport in Russia's Far Eastern Amur region—the site improvement, the press service of Dalspetsstroy (a branch of the Russian Federal Agency for Special Construction) reported in a news story published by the Russian news agency, TASS.

The construction of the Vostochny space launch center in the Amur region began in 2012. The total area of the cosmodrome is 700 square km. It is destined to become the first national facility for civilian space launches, ensuring Russia's full-scale access to space and reducing the dependence of the Russian space industry on the Baikonur space center in Kazakhstan.

The first liftoff from Vostochny was initially scheduled for late December last year, but was rescheduled for 2016. Now it is tentatively planned for late April. The Mikhailo Lomonosov and Aist-2D satellites, as well as the nanosatellite SamSat-218, will be the first to be launched from the Vostochny cosmodrome with the help of Soyuz-2.1a carrier rocket to transmit scientific experimental data to the Earth.

Plans are afoot to create a heavy-class space and rocket center for the launches of unmanned space vehicles and as part of a manned flight program. The cosmodrome is expected to be fully commissioned in 2020.

According to previous reports, the first launch from the Vostochny spaceport may occur on April 28-29, but the final date will be determined at a meeting of the state commission on April 4. The new cosmodrome's launch facility successfully passed comprehensive tests on March 21-25.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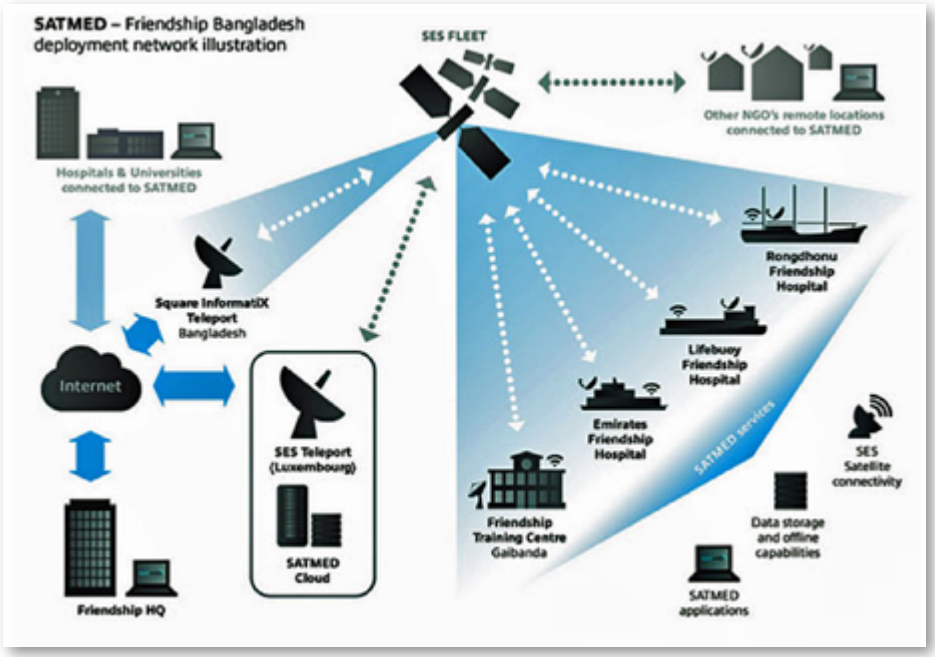
Transponders in Ku-band
Arabsat BADR-7 @ 26°E, with unparalleled market specific beams covering the Middle East and Africa
with unrivaled Ku and Ka-band payload and a special Ka-band mission tailored to deliver broadband and tripleplay services from satellite.
www.arabsat.com

SES Deploys Maritime VSATs On Friendship Floating Hospitals



SES S.A. and FRIENDSHIP, a non-governmental organization, along with the technical assistance of Square Informatix (Bangladesh) Ltd., have launched the first state-of-the-art Maritime VSATs on three of the FRIENDSHIP floating hospital ships—Lifebuoy Friendship Hospital, Emirates Friendship Hospital and Rongdhonu Friendship (formerly the Rainbow Warrior II) Hospital.

SATMED, the newly deployed satellite-based e-health platform, will enable FRIENDSHIP to establish communications with national and international doctors from remote areas, to provide medical counseling to marginalized communities through telemedicine and to exchange medical knowledge with local doctors.

SATMED is an IT enabled cloud infrastructure accessible around the globe that facilitates data exchanges between professionals and medical frameworks such as electronic medical records and teleradiology systems.

The platform is an open, flexible and affordable solution that perfectly fits SES's range of satellite based e-activities. The project is funded by the Luxembourg Government and implemented in cooperation with SES Techcom Services and e-Medical Communication (eMC).

"*The SATMED project is a great illustration of a true partnership between governments, the private sector and NGOs. Mutual trust and collaboration can enable innovative steps forward, and lead to deep benefits that impact directly on the beneficiaries,*" said Runa Khan, Founder and Executive Director of FRIENDSHIP in Bangladesh. "*SATMED gives us a tool by which we are able to bring in specialized services of e-learning, special doctors, specialized back office resources, decisions of problems and ethical decisions, all this can be centralized and the same message can be given organisation wide.*"

"*After implementing SATMED platform tools and services, the ship hospitals—via satellite connectivity—will be able to support and facilitate work in the areas of e-care, e-learning, esurveillance, e-health management, and digital imaging,*" said Gerhard Bethscheider, Managing Director of SES Techcom Services.

"*At the end of the inauguration ceremony, two European doctors consulted with patients from the remote island known as chars through teleconferencing directly from Europe,*" said Marc Elvinger, Chairman, FRIENDSHIP Luxembourg. "*Without FRIENDSHIP's innovative healthcare model and the SATMED connectivity, such a facility would have been simply inconceivable to the poor marginalized people of this country.*"

ses.com/satmed-friendship-bangladesh

ses.com/techcom

Geomatica 2016 Rolls Out From PCI Geomatics

PCI Geomatics has released their Geomatica 2016, the latest version of the company's complete and integrated desktop, geo-image processing software featuring tools for remote sensing, digital photogrammetry, geospatial analysis, mosaicking and more.

Geomatica 2016 improves accuracy and speed for key geo-image processing steps, including aerotriangulation and bundle adjustment, automatic contrast control and mosaic touch-up.

This new version also provides enhanced support for airborne scanners, SAR data handling and compact polarimetric tools.

Geomatica 2016 is immediately available for 64-bit versions of Microsoft Windows (7, 8.x, 10) and CentOS/RHEL Linux (7.x).

"We've designed this release around the concepts of sensor support and overall workflow with the goal of making Geomatica more accurate and more flexible for different customers," said David Piekny, Product Marketing Manager at PCI Geomatics

"We see a lot of diversity in how our customers use Geomatica. In Geomatica 2016 we're able to work with even more types of geospatial data through specific additions to the software, but at the same time have improved on widely-used tasks like tie-point collection, DEM extraction and automatic color balancing."

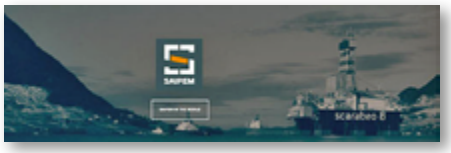
pcigeomatics.com/software/geomatica/professional?/geomatica

Ultra-Deepwater Project Awarded To ITC Global

ITC Global has been awarded a multi-million dollar contract to provide remote offshore communications to two floating production, storage and offloading (FPSO) vessels in Western Africa.

The seven-year, $6.5 million contract, awarded by Saipem, is part of the Kaombo Field Development Project in offshore Angola.

The ultra-deepwater contract is one of the most significant offshore projects in the world today, dedicated to developing oil deposits spread across six different fields with water depths of 1,400 to 1,900 meters (4,600-6,200 feet).



Saipem is a world leader in drilling services, as well as in the engineering, procurement, construction and installation of pipelines and complex projects in the oil and gas market.

Saipem was awarded contracts for the installation and commissioning, and operation and maintenance services for the FPSO vessels, which are owned by leading European-based oil and gas company, Total.

The FPSOs will both be outfitted with two C-band stabilized antenna systems, delivering between 5 and 10 Mbps high data rate service to each vessel.

In December, ITC Global announced that it had been awarded multiple offshore communications contracts for five separate FPSO vessels operating in the Congo, Angola, and Equatorial Guinea. This latest award solidifies ITC Global as one of the industry's most stable and trusted providers.

ITC Global was acquired by Panasonic Corporation in 2015. The organization has a long-term strategy for growth that includes an expanding network portfolio of traditional wide beam, high throughput and extreme high throughput capacity, delivering near 100 percent uptime with coverage spanning 98 percent of the world's most trafficked maritime routes.

As the world's largest buyer of commercial space segment, Panasonic is revolutionizing today's VSAT market with game-changing pricing and service delivery.

"*This award speaks to ITC Global's reputation for delivering reliable communications for highly complex projects in key geographic regions for our customers across the oil and gas sector,*" said Joe Spytek, Chief Executive Officer, ITC Global.

"*Our customers continue to count on us for their long-term requirements in Western Africa, where we are able to leverage our local presence and expertise. It's a great example of what ITC Global can do in the current market environment in terms of partnering with a customer to understand their long-term requirements and developing a solution that still delivers more bandwidth and better performance while providing significant cost efficiencies.*"

itcglobal.com/

saipem.com/sites/SAIPEM_en_IT/home/saipem-homepage.page

Keysight Technologies To Maximize Customer Technology + Migration Services

Keysight Technologies, Inc. has introduced their new portfolio of technology extension and migration services that focuses on maximizing customers' test asset value and consequent utilization—Keysight's Technology Refresh Services program is making it easier to get the latest technologies while accessing limited funding.

Technology advances across all industries are rapidly changing, while budgets are continuing to be constrained. Defense industry companies must adopt leading-edge test and measurement solutions while maintaining long-term program support to keep communications and security systems operating at peak performance over many years. The wireless industry needs to transition affordably to next-generation technologies, such as 5G. In addition, they need to speed up design, validation and test development to meet the tight time-to-market schedules and reduce the possibility of any design rework.

Trade in for eligible Keysight or non-Keysight test equipment offers attractive credits when trading in or trading up to new equipment. For example...

- *50 percent credit when purchasing a new X-Series signal analyzers B version models.*
- *$30,000 (U.S.) credit on a new N995xA, N996xA FieldFox Handheld analyzer when trading in an eligible analyzer.*
- *50 percent credit for Infiniium V-Series and Z-Series Oscilloscopes when customers trade-in eligible oscilloscopes from any manufacturer*

Additional information regarding Keysight's new customer services is available at:

www.keysight.com

InfoBeam

Opportunities For Wireless Backhaul Links Examined By ABI Research

The evolution toward 4.5G and 5G will be imminently accompanied by substantial network densification and massive deployments of small cells.

The trend will completely transform the backhaul market and create tremendous opportunities for wireless backhaul links. ABI Research forecasts that the market will deploy more than one million Sub-6 GHz licensed backhaul links by 2020. As the fastest growing market segment, Sub-6 GHz will challenge microwave and millimeter waves for the largest market share of 35 percent in 2020.

The combined wireless backhaul equipment revenues from Sub-6 GHz links and millimeter waves make up nearly 57 percent of the total backhaul revenue in 2020.

Over the course of 2016, outdoor small cell rollouts will gain momentum. As Wi-Fi and distributed antenna systems (DAS) continue to advance and compete with small cells for the enterprise and in-building connectivity, their impact on the outdoor deployments is imminent.

ABI Research suggests suppliers consider offering professional services, including high-resolution 3D mapping for backhaul link placement. They should also support multiple backhaul technologies and partner with Tangible Asset Monetization Companies (TAMCos), like advertising agencies, cable providers, and tower companies, to offer rights of way, and attach permits for small cell sites.

Service providers should look into leveraging network sharing schemes, unlicensed spectrum, and virtualization technologies in order to lower the cost of expanding backhaul and increase the overall ROI. These findings are part of ABI Research's *Fronthaul and Backhaul for Next Generation Networks Service*, which includes research reports, market data, insights, and competitive assessments.

abiresearch.com/market-research/service/fronthaul-backhaul-next-gen/

Product Focus: High Power BUC Technology... Keeping Up With The Latest Technology Demands

By Gerard Charpentier, Vice President, Business Development, CPI Satcom Products

Solid State Power Block Upconverters (SSPBs or High Power BUCs) have long been a mainstay technology for maritime ship-to-shore satellite communications systems.

The reason for the dominance of SSPBs was that these systems were only required to provide telephone service for many years; with L-band being the original frequency of choice for telephone service, output power requirements for amplifiers were not demanding.

Using L-band frequencies was also convenient because the antenna pointing accuracy did not have to be as precise as for higher bands—an advantage on a vessel which is often moving or swaying.

Eventually, the INMARSAT network expanded into C-band, due to the limited L-Band GHz frequency allocations available[1]. Once INMARSAT was privatized in the 1990s, competitors began to develop their own C-band and Ku-band communications systems.

Communications methods have evolved, and communications systems must evolve too. In the last decade, the maritime industry has again encountered limitations with the available frequency as demands for bandwidth have increased due to increased Internet usage, requirements for voice over IP (VOIP) communication and the proliferation of devices that can link into increasingly sophisticated networks.

Additionally, airlines have begun to require network access in order to remain attractive to customers seeking inflight entertainment options. No longer are cruise line passengers, or even ship crews, happy with having to make an appointment at a hard-wired terminal in order to use the Internet or with having a voice-only line when they would rather see the person to whom they are speaking.

The time may soon be upon us when a large percentage of passengers on a ship want to stream a major sporting event or some other live event simultaneously. If the passenger ship only has low power Ku-band connectivity with a geostationary satellite and is cruising in the upper or lower latitudes, traditional ship-to-shore systems may not be enough to meet this demand.

For SSPB manufacturers, providing products at C-band and Ku-band has been relatively easy in the maritime industry. While output power requirements have increased over the years, the technology needed to meet those requirements has rarely been an issue.

Power capabilities have generally increased as fast as needed by the maritime industry. Recently, Gallium Nitride (GaN)-based solid state high powered amplifiers (HPAs, also called solid state power amplifiers or SSPAs) have been introduced that are both more efficient and more powerful than previous generations of solid state products.

On rare occasions, the power and bandwidth required for maritime communications applications make even GaN SSPAs somewhat unwieldy due to their increasing inefficiency at high power levels. While a 400 W Ku-band traveling wave tube amplifier (TWTA) equipped with the latest life-extending technology can provide nearly the same reliability and lifetime as an SSPA in a package that is 30 percent to 50 percent lighter and requires about one-third the prime power, most integrators opt for SSPAs due to end-user familiarity with these products.

Additionally, because most integrators require access to quick replacements that must already be in stock in locations around the world, some of which may not have been turned on for several years prior to operation, SSPA technology is a convenient choice.

The installation of an SSPA replacement is literally a plug-and-play situation, making it very convenient for long term storage. The occasion may arrive, however, when the efficiency of TWTA products may spur more interest among maritime integrators and end users.

Ka-band has emerged as another solution to the latest requirements for more bandwidth, due to the availability of networks such as IRIDIUM and Globalstar, and the inherently wider spectrum that this frequency band has available.

CPI and at least one other manufacturer offer GaN-based SSPAs nearing 80 W of linear output power at Ka-band. Although this might not have been enough output for geostationary orbit (GEO) satellite connections, it is unlikely that more than 50 W will be needed in the higher frequency band for the near future because antennas have become sophisticated enough to track low earth orbit (LEO) satellites, even from a mobile earth station such as a ship or airplane.

Since LEO satellites are close to Earth, rain fade at Ka-band is not the issue it might have been were satellites aiming at GEO satellites thousands of miles from Earth. Even less power is likely needed for satellite communications systems on airplanes, as these vehicles typically travel above the cloud cover, allowing for an uninhibited signal path to the satellite.

As a result of the resolution of most of the technological issues in the maritime and in-flight services applications, the HPA industry is facing the commoditization of low power products intended for these applications. Nevertheless, the few integrators that dominate this market have tended to qualify just a few trusted suppliers each to fulfill their requirements for high power BUCs. Integrators must be certain of the quality of their technology provider by demanding high mean time between failures, reliable delivery times and failsafe service.

Cost competitiveness never hurts either. Despite the highly competitive nature of this business, CPI is proud to be a leading supplier of solid state BUCs to the maritime and inflight service industries and to use its technological expertise to be one of the first to market with a high power, GaN-based, Ka-band BUC.

cpii.com/SATCOM

References

[1] *http://web.archive.org/web/20090425091056/http://www.boeing.com:80/defense-space/space/bss/factsheets/376/marisat/marisat.html*

and

http://space.skyrocket.de/doc_sdat/marecs.htm

CPI 160 W Ka-band GaN BUC.

CPI 100 W C-band GaN BUC.

CPI 400 W Ku-band SuperLinear® TWTA.

NSR Analysis

The Great Polar Broadband Leap

By Alan Crisp, NSR, Hong Kong

Polar markets have traditionally been an afterthought of a region for broadband access.

With residents having to "make do" with dial-up Internet access, low-speed L-band network connectivity at speeds that don't meet most definitions of 'broadband', or high priced Ku-band connectivity, assuming that VSATs even have a view of GEO satellites.

For the not so insignificant populations that live above the Arctic Circle at 65 degrees north, capacity has been relatively constrained, such that despite the large ARPU supported by consumer and business broadband services alike, the relatively small number of people willing to pay for such services in the Arctic still translates to limited revenue opportunities.

NSR's recently released *Polar Satellite Markets* report found that Broadband Access in the Polar regions (primarily in the Arctic) is one of the key markets expected to be altered significantly after the introduction of LEO-HTS services in the 2020 time frame.

The current broadband picture in the Polar region is largely Ku-band VSAT and GEO-HTS, with a handful of platforms having been launched in countries that have some spillover into Polar, such as US./Canada with ViaSat, parts of Europe with Ka-Sat, and to some extent parts of Russia with Express-AM5/AM6.

These payloads have largely targeted the major markets listed in the chart, but with a relatively small population in the Polar region, part of these countries—and still under these beams—will ultimately end up benefiting from better quality of service at a better price.

City	Population
Murmansk (Russia)	~300,000
Noril'sk (Russia)	~200,000
Vorkuta (Russia)	~70,000
Tromsø (Norway)	~70,000
Apatity (Russia)	~60,000
Severomorsk (Russia)	~50,000
Bodø (Norway)	~50,000
Moncegorsk (Russia)	~50,000
Kanadalaksa (Russia)	~35,000
Kirovsk (Russia)	~30,000
TOTAL	~915,000

ARPUs in the US are somewhat higher due to ViaSat having thus far seeing more success in its business model, with WEU seeing slightly lower ARPUs, and CEEU seeing lower still, although still within the $20-30 per month range.

However, this all is likely to change markedly with the introduction of Non-GEO-HTS in the form of a LEO-HTS constellation, which is expected to target broadband access demand.

A LEO-HTS constellation targeting the broadband vertical is expected to more or less double the market in terms of subscribers, adding around 12,000 subs between 2020 and 2024 that are believed to be incremental demand (without significant cannibalization).

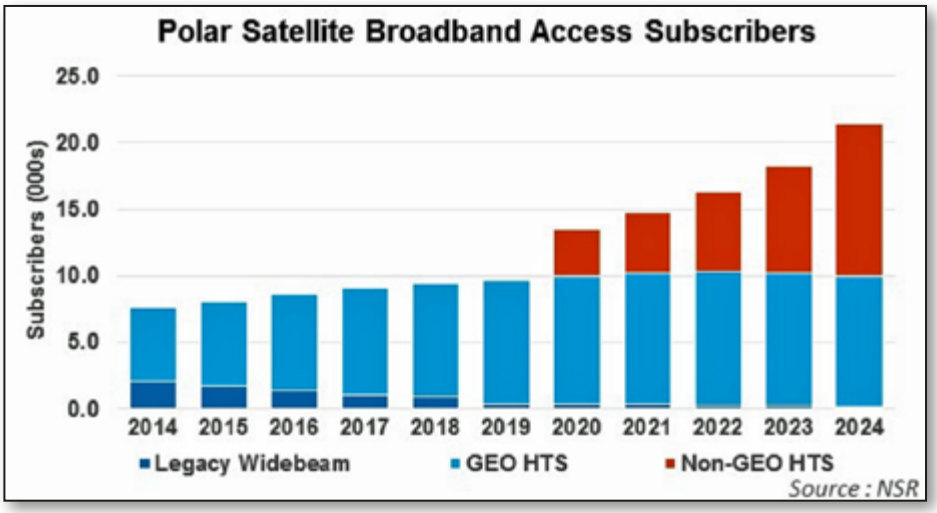
Not all subs are created equal, though, and NSR does believe that Non GEO-HTS subs will generate somewhat lower ARPU. Overall, broadband access services in the Polar region are expected to be relatively niche.

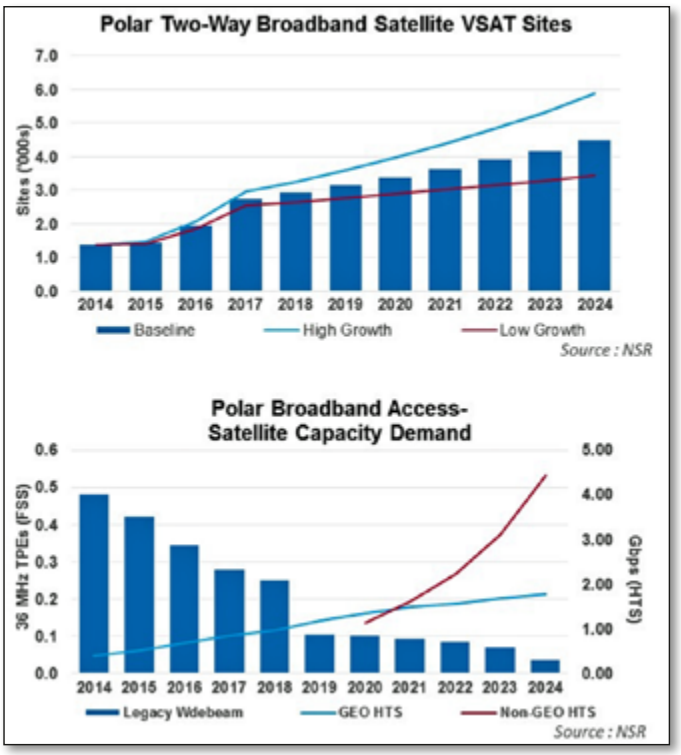
For instance, by 2024, approx. 22,000 subs translate to an annual market size of around $63 million—hardly a tiny market, but also hardly one worth launching dedicated capacity over.

Traditional FSS capacity that currently serves broadband access in the region—of which there is very, very little—is expected to no longer be cost competitive; however, this would represent a tiny sliver of a niche market currently (~1,500-2,000 subs).

Ultimately, the Polar broadband market will by definition continue to be a niche market simply due to small populations. The region has historically been characterized by highly ineffective or otherwise cost uncompetitive fiber and terrestrial broadband options.

However, moving forward, it is expected that GEO-HTS, and eventually Non GEO-HTS, will be able to bring down the cost of broadband to the end user, expanding the market to a slightly larger niche.





Although the population base is close to a million in targeted cities in Russia and Norway, which represents more than 250,000 households, the satellite broadband subscriber base is expected to be less than 25,000 or below 10 percent by 2024 as other challenges will be at play in servicing these cities. These challenges include equipment and setup costs, ongoing bandwidth costs and a lack of distribution to end consumers and focus by retail partners.

Mr. Crisp joined NSR in 2014, following a Hong Kong based engineering role at Aurecon. Mr. Crisp is the co-author of NSR's annual M2M and IoT via Satellite report and also Linear TV and other video broadcasting reports

As a member of NSR's Fixed Satellite Services (FSS) group, Mr Crisp's areas comprise of M2M and IoT communications—including both the satellite and terrestrial M2M landscape. Previous consulting experience includes forecast analysis and risk management of natural disasters in Manila, where he made recommendations to policymakers about backup and emergency telecommunication links for use in city and nationwide emergencies.

Mr. Crisp obtained a Bachelor's Degree with First Class Honours in Engineering (Civil & Structural) from the University of Adelaide, Australia.

nsr.com/research-reports/satellite-communications/polar-satellite-markets/

The Challenges Of Satellite Communication @ Sea

By Stav Gizunterman, Head of Product Marketing, and Guy Naym, Communication Solutions Expert, ORBIT Communication Systems Ltd.

Satellite communications have earned their rightful place in the arsenal of communication solutions for a truly connected world and are often the only viable solution for remote areas.

A wide range of satellite communications (SATCOM) technologies are in use today which support one or two way communications.

Maritime SATCOM involves a combination of two challenging tasks: SATCOM on the move and performance under extreme weather conditions. Customers expect to have broadband Internet connectivity at low cost wherever they are and in all conditions.

Designing a terminal that can withstand extreme weather conditions, one that is small, robust, lightweight, and attractively designed all the while providing constant broadband connectivity while following worldwide standards and regulations—now, that is definitely a true challenge.

Why Do We Need Regulation + Standards?

Geostationary satellites keep their fixed, relative positioning in space by moving along a very specific orbit and maintaining a zero-sum force vector at all times. Geostationary positioning becomes possible at a predefined height of 35,680 km (22,170 miles), a predefined speed of 3.07 km/s (1.91 miles per second), and in an orbit that is directly above (parallel to) the Earth's equator.

Communicating from Earth to a single satellite at that distance is not, in itself, a major challenge, but doing so in a crowded sky is a significant one.

As the demand for communication increases and more and more satellites are being placed in the geostationary orbit, space becomes quite crowded and the satellites are being positioned closer and closer to one another.

This physical proximity between adjacent satellites—currently standing at typical values of around 2 degrees—requires transmitting Earth stations to limit their EIRP per bandwidth toward the adjacent satellites.

Transmission from Earth must be focused exactly on the correct spot or there may be interference with another satellite. Strict regulations dictate that Earth stations limit their transmission towards adjacent satellites by pointing exactly toward the target satellite (an easy enough feat from a fixed system, but quite challenging when transmitting from a mobile platform). In addition, they must test the antenna emission patterns so as not to contain any "side-lobes" emitting energy off center.

Intensive development, simulation and testing efforts are required in order to design and produce antennas that comply with today's regulations. While this task is not easy to begin with, even more challenges come into play as the desired size of the antenna becomes smaller, leading the industry to agree on de-facto standards for the minimal antenna size that can still produce a "performing" antenna.

The technical design of smaller Ku- or Ka-band antenna systems combined with the need to comply with the regulation requirements of the satellite operators can result in higher operational costs and lower cost/performance ratio.

These days, it is clear to operators that not only immediate CAPEX investments count, but total cost of ownership (TOC) is important—regulation, reliability, life cycle maintainability, installation simplicity, and so on.

ORBIT strongly believes that for most markets, the 1.2 meter "Dual-offset Gregorian" antenna was found to have the best combination between excellent regulation compliance (side-lobes, x-pol) and very low dome-to-antenna size ratio.

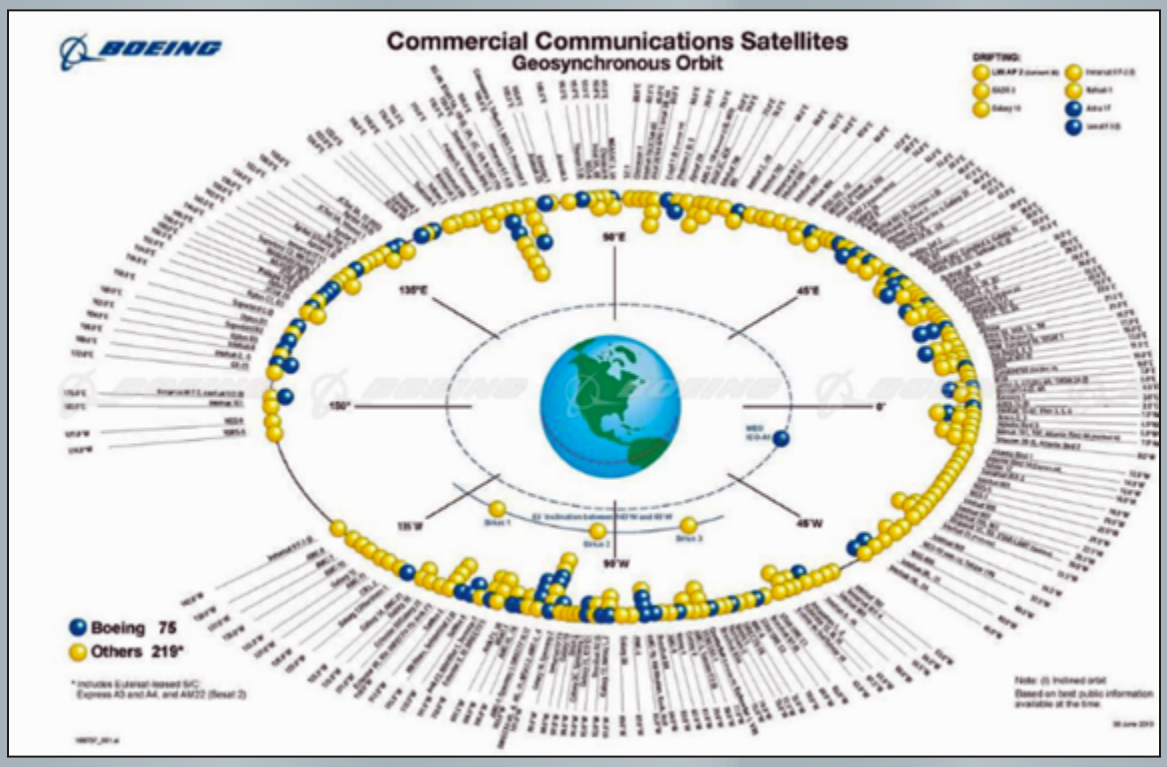


Figure 1. A Crowded Sky—Commercial Geosynchronous Satellites in Orbit. Image is courtesy of Boeing.

Implementing the complicated tracking and stabilization algorithms, (keeping in mind that the GEO Satellites are located 1.5 - 3 degrees apart) is a challenging task.

Better Performance Resulting In Lower Service Costs

System performance affects service cost. The better designed a system is, with maximum capability to transmit and having pointing capabilities without interference, the less service costs are incurred

System performance and pointing accuracy, in the end translate to availability; customers would like to be connected and get service. That is what they are paying for—it's as simple as that.

Pointing accuracy is all about service and availability. For example, ORBIT's test of OceanTRx4-500 Ka-band with the following profile:

Sea-State-6 for 40 M Ship Dynamic Profile

- Pitch: +/- 5 degrees in 1.75 seconds (5 deg amplitude over 3.5 sec period sine-wave)
- Roll: +/- 19 degrees in 4.4 seconds (19 deg amplitude over 8.8 sec period sine-wave)
- Yaw: +/- 8 degrees in 7.5 seconds (15 deg amplitude over 15 sec period sine-wave)

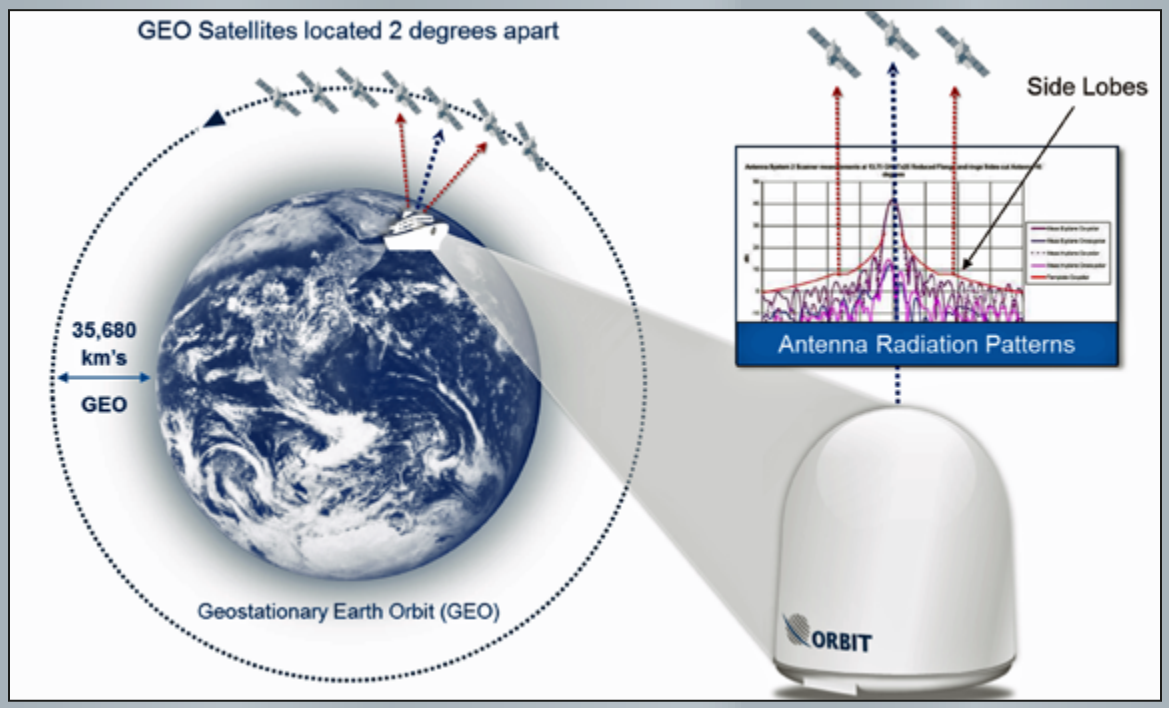
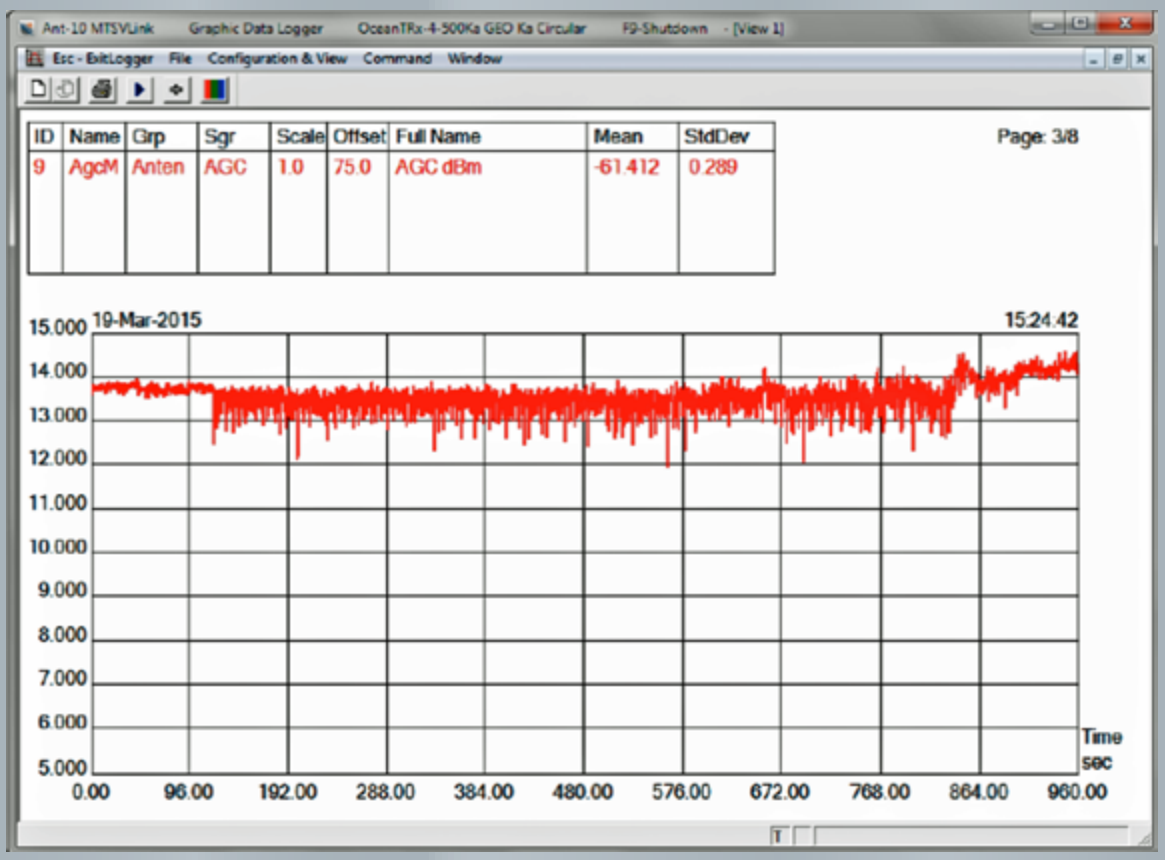


Figure 2. Radiation Patterns + Risk of Interference

Shows the following signal fluctuation:



That can be easily translated to the pointing accuracy.

Pointing Loss Calculator		
Pointing Loss Calculator	**Unit**	**Parameters**
Equivalent antenna diameter	cm	115
Rx frequency	GHz	19.2
Antenna point error	Deg	0.15
Antenna point error loss	**dB**	**0.30**

With fluctuation of 0.289 dB, the pointing accuracy is less than 0.15 degrees. This is translated to availability and system performance:

SATCOM Regulations

Satellite communication regulations for fixed and mobile Earth stations are governed by a three level management structure:

- ***International Telecommunication Union (ITU)****: defines and recommends the envelope limitations under which transmissions of ships, aircraft and trains could be operated with GEO satellites worldwide. Basic level regulations to create order on international level and prevent chaos by standardization.*

- ***Regional regulatory organizations****: ETSI for Europe (www.etsi.org), FCC (www.fcc.gov) for North America, Anatel for Brazil and others, derive their own standards and regulations based on the ITU recommendations. Those regional organizations would like to prevent chaos and manage their own local spectrum.*

- ***Satellite operators:*** *Primarily concerned about the EIRP/Bandwidth as a function of the offset angle from beam center (EIRP/BW) and about Cross Polarization Discrimination (XPD) at beam center, which is of practical importance for preventing interference to adjacent satellites and to their own satellites by XPD. Satellite operators would like to sell their bandwidth to as many people as possible with as much profit as possible. They truly do not want the vendors to interfere with them there.*

When we talk about regulations, two main mask types are considered (for ITU and Regional Regulations)

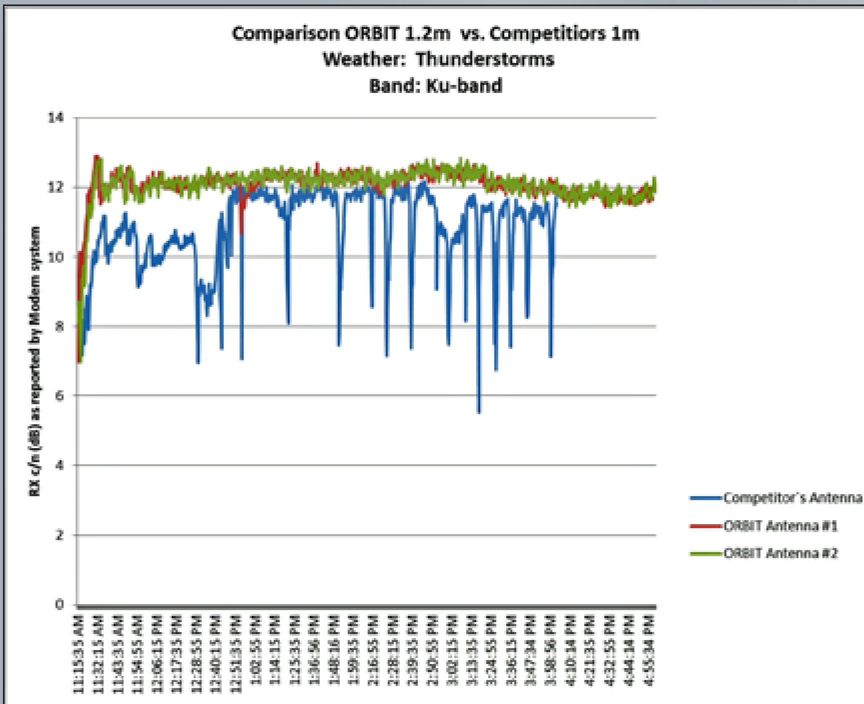
1-Gain, Side- Lobes, X-Pol "mask" and EIRP Spectral Density Limitation "mask".

2-Gain, Side – Lobes, X-Pol "mask" is dictated by standards and such as: FCC-25.209, ITU-580-6, EESS-502, ANATEL #572, MIL-STD-188-164B.

At ORBIT, we believe that the most important masks to consider are ITU and FCC:

ITU-R S.580-6 & 465-6 Co-pol Sidelobes in Az ° for D/λ ≥ 50			
29 – 25•Log(Θ)	dBi	for	$\theta_{min} \le \Theta \le 20.0°$
-3.5	dBi	for	$20.0° < \Theta \le 26.3°$
32 – 25•Log(Θ)	dBi	for	$26.3° < \Theta \le 48°$
−10	dBi	for	$48° < \Theta \le 180°$

FCC 25.209 C-band Antenna Co-pol Sidelobes in Az °			
29 – 25•Log(Θ)	dBi	for	$1.5° \le \Theta \le 7.0°$
8	dBi	for	$7.0° < \Theta \le 9.2°$
32 – 25•Log(Θ)	dBi	for	$9.2° < \Theta \le 48°$
−10	dBi	for	$48° < \Theta \le 180°$



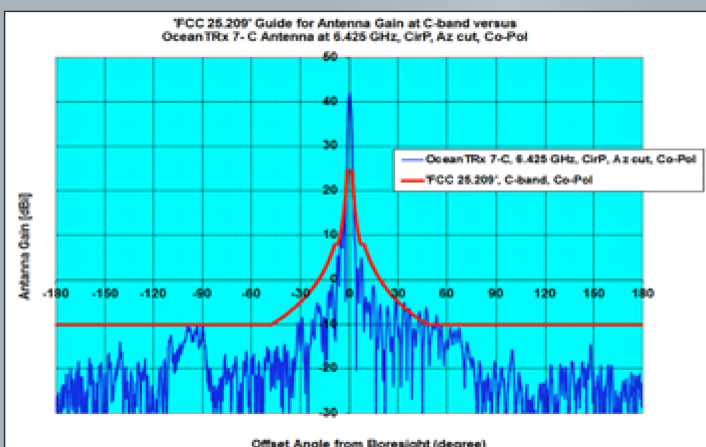
Example of ORBIT OceanTRx7 patterns meeting FCC 25.209 mask:

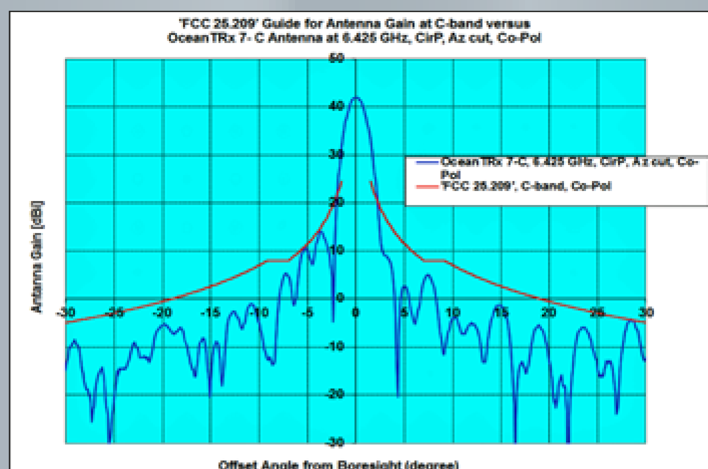
EIRP Spectral Density Limitation "mask", such as: FCC 25.221 (C-band), FCC 25.222 (Ku-band), FCC 25.138 (Ka-band), ITU-728-1, EESS-502, MIL-STD-188-164B.

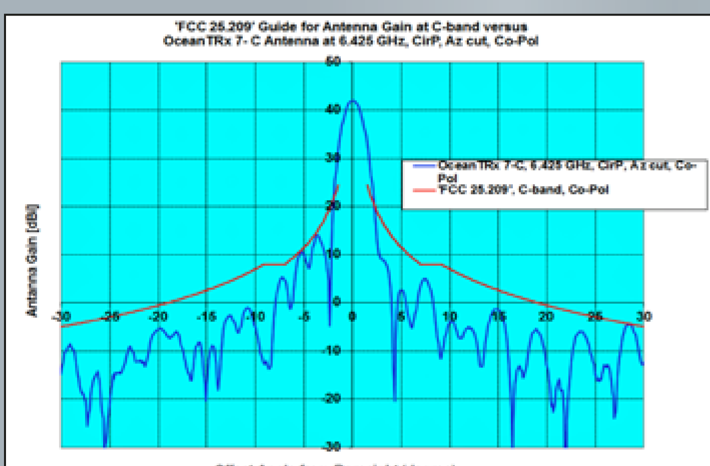
This "mask" is the most important to the operators as money is saved, as it limits the maximum allowed EIRP

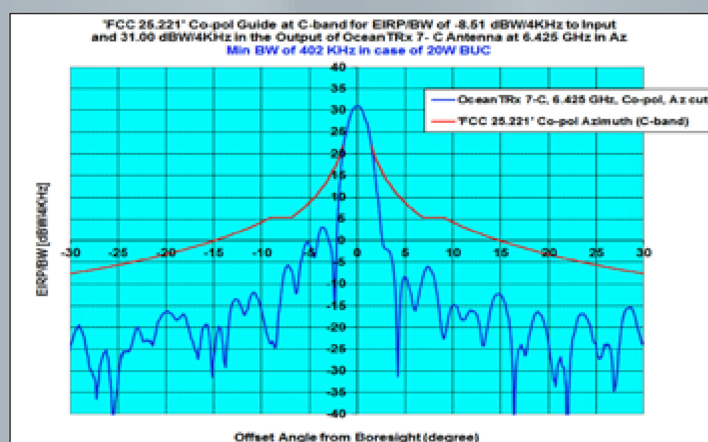
FCC 25.221 C-band Antenna Co-pol EIRP/BW in Az °			
26.3 – 25•Log(Θ)	dBW/4kHz	for	1.5 ° ≤ Θ ≤ 7.0 °
5.3	dBW/4kHz	for	7.0 ° < Θ ≤ 9.2 °
29.3 – 25•Log(Θ)	dBW/4kHz	for	9.2 ° < Θ ≤ 48 °
−12.7	dBW/4kHz	for	48 ° < Θ ≤ 180 °

spectral density, transmitted to the adjacent satellites. The output of the analysis is the maximum allowed EIRP/SD (dBW/40 KHz)—higher is better and results in lower service costs.









Example of ORBIT OceanTRx7 patterns meeting FCC 25.209 mask:

Note: Presently, with usage of smaller antennas (30 to 60 centimeters, for example), satellite operators, such as Eutelsat, Intelsat, FCC, ETSI, do not have to comply with "Gain, Side-Lobes mask" (*e.g.*, FCC 25.209), but are enforced to comply with these EIRP/SD "masks."

ORBIT OceanTRx7 example of compliance with FCC 25.221.

Availability + Reliability

Customers expect maritime SATCOM terminals to be reliable and maintain communication 365 days a year. Those terminals are usually located in places where accessing them and maintaining them during the voyage is almost impossible—yet, high reliability is still required. On top of that, it is quite difficult to assume that on those vessels, one can find communication experts as a standard.

To summarize, availability has a large influence on total cost of ownership. As an example, an MTBF of ORBIT OceanTRx4 basic system is 27,900 hours.

An effective maritime solution must consist of the following parameters:

- *Pointing accuracy to maintain high availability and not to interfere with adjacent satellites while in harsh marine conditions*
- *Ability to meet satellite regulations while reducing the dimension of the systems*
- *Reliability of the system and high MTBF with low MTTR. No periodic balancing*
- *Performance in an RF noisy environment – to meet EMC standards such as IEC 60945*
- *Easy and fast installation of pre-tested systems with only several hours on the dry dock*
- *Wide configurations of band support and ability to support demanding applications to satisfy customer needs in a compact package*
- *Keep total cost of ownership as low as possible*

ORBIT Communications OceanTRx-7.

BULLETIN

ORBIT Communication Systems, Ltd. introduced an innovative airborne stabilized VSAT antenna system for various aircraft at the recent Defexpo India 2016 trade show.

Providing high throughput and quality broadband communication via satellite, the company has already received an order for several AIRTRx™60 systems from an Asian customer.

Designed to accommodate the regional and global coverage needs of the airborne communication market, the low-weight AirTRx™ 60 is built to empower critical applications.

AirTRx™ 60 complies with the most stringent worldwide SATCOM regulations and certifications, including RTCA/DO-160G.

Following the demand from the government and defense market, ORBIT released their MPT 60 Airborne VSAT Antenna systems suitable for mission aircraft and UAVs.

AirTRx™ 60 and MPT 60 support Ku- or Ka-bands and feature outstanding RF performance and dynamic response under virtually any operating environment. Switching between RF bands requires a simple replacement of the feed. Additional features include among the rest: multiband support, minimal swept volume, short lead time, INS and RF tracking.

According to Erez Shabirow, ORBIT's CEO, "ORBIT continues to make significant investments in R&D—reflecting customer demand for comprehensive, reliable, compact and continually more complex broadband infrastructure for audio, video, data and Internet. Prestigious customers—including aircraft manufacturers, major integrators, communication service providers and government agencies—have selected ORBIT's robust and dependable solutions for the past 20 years, with over 1500 systems in operation globally."

ORBIT is a global provider of advanced business and mission critical communication solutions for land, sea, air and space applications. The company's solutions address the maritime, aerospace, defense and homeland security markets.

ORBIT's portfolio includes mobile satellite communication systems, tracking & telemetry solutions, communication management systems and earth observation ground stations which are operating on thousands of platforms worldwide.

ORBIT's customers include leading navies, government and defense organizations, major integrators, space agencies, earth observation and communication service providers.

ORBIT is a public company traded on the Tel-Aviv Stock Exchange (TASE: ORBI). The company has global presence of sales and customer support with footprints in the United States, Europe and the Far East.

Thuraya + WiCis Sports Combining Their Expertise For Expeditions

Thuraya Telecommunications Company and WiCis Sports have joined forces in a bid to support climbing expeditions to the Himalayas.

The expedition, which started on March 19, is part of a six-month project which will take climbers from Jomsom in Nepal, to Lo Manthang, on to a high-altitude trek, followed by a trip to K2 in June.

Thuraya Telecommunications has donated its IP+ terminal, SatSleeve+ and SatSleeve Hotspot, to help Madison Mountaineering climbers stay in touch during their expedition. Madison Mountaineering is a boutique mountain guide service based in Seattle, Washington.

The company specializes in mountaineering expeditions to the "7 Summits" and other renowned international and domestic peaks, as well as unclimbed peaks in extremely remote regions.

The WiCis Adventure Sports Solution includes small, wearable devices that compile and save data such as heart rate, body temperature, oxygen saturation, location, altitude and speed of each climber.

This data is then uploaded to the cloud via the Thuraya IP+, SatSleeve+ or SatSleeve Hotspot and is accessible and downloadable in 'real time' by health professionals and the climbers themselves.

Thuraya's SatSleeve+.

The climbers also have access to weather updates and can upload their data to social media platforms using the Thuraya products.

Weighing only 1.4 kg, the Thuraya IP+ has speeds of up to 444 kbps on standard IP and 384kbps on streaming IP with an integrated antenna. Light and compact, the portable IP+ broadband terminal delivers the fastest IP speeds from a terminal of its size. It can be easily deployed from backpack to broadband in a matter of seconds, however remote the location. A simple, sleek accessory that looks like a phone cover, SatSleeve+ clips easily on to smartphones, turning them into satellite phones. With Thuraya's SatSleeve+, users can make calls, send emails and messages, and use their apps directly on their smartphone. SatSleeve+ also has an SOS function which enables users to set up a predefined emergency contact person to call on in times of trouble.

For those on-the-move, the SatSleeve Hotspot is a portable satellite WiFi hotspot which comes complete with a stand in the package. Created for users preferring to use their smartphone separated from the satellite unit, simply place the Hotspot outside your tent or campervan and make a call, send an email and message, or use social media or info apps in satellite mode, indoors.

Customers can start using the WiCis solution in just three easy steps: Ensure all equipment is fully charged, attach the wearable monitors, connect to the Internet via the Thuraya IP+, SatSleeve+ or SatSleeve Hotspot and then start monitoring your health details.

The modern, WiCis Sports Adventure Solution can help save lives. Those monitoring the progress of adventurers now have access to vital health information, which can help doctors and emergency response teams react faster in critical situations, particularly in remote locations.

Randy Roberts, Chief Innovation Officer, Thuraya, said, "*When these wearables are connected to our IP+ terminal or the SatSleeve+, the WiCis monitoring solution will keep climbers and adventurers in touch with family, friends and healthcare professionals.*"

Carlota Fenes, President, WiCis, said, "*Our latest solution is perfect for explorers and outdoor adventure enthusiasts. It can be used on smartphones and smart watches. It checks, tracks, and reveals vital health details and gives weather updates while on-the-move, even in remote locations.*"

thuraya.com/

Executive Spotlight: Jaime Dickinson, President NewCom International, A SpeedCast Group Company

SatMagazine (SM)

Over the years, you and your company, NewCom International, have been recognized within and outside of the SATCOM industry for your work in leveraging satellite connectivity to improve lives in developing regions throughout Latin America. Can you share your personal and business philosophy behind this core company focus?

Jaime Dickinson

It's personal to me because I was born in Peru and have seen the country's needs firsthand. I want to help people living in remote regions throughout Latin America and other remote corners of the world to have access to a quality education, health care and the same opportunities that we enjoy in the United States. From a business perspective, we know that connectivity—and the voice, data, video, content and security solutions that come with it—has a direct impact on economic growth and development and connectivity is the key for all.

SM

Education seems to be at the forefront of NewCom's efforts in Latin America. Why is NewCom putting so much emphasis on bringing Internet connectivity and educational content to schools?

Jaime Dickinson

At NewCom, we believe that education is the key to advancing a country—both in terms of improving quality of life and driving innovation and economic growth. Education transforms lives and ensures that children have the chance to pursue their dreams and compete in today's global economy, and Internet connectivity opens the door to it all.

Education is also a top priority for many government agencies and NGOs throughout Latin America. The issue has been figuring out how to deliver quality, affordable education to remote, hard-to-access schools. This is where satellite communications technology and our turnkey educational platform come into play.

SM

Can you tell us about your education platform and how you are using it?

Jaime Dickinson

Our Education Anywhere™ Platform is an affordable, turnkey solution that enables governments and NGOs to deliver seamless connectivity, interactive videoconferencing services and much needed educational content to remote classrooms throughout the world.

We developed this solution because many of the NGOs and government agencies we partner with are starting from scratch and need a complete education solution that goes far beyond Internet connectivity. Our education platform includes affordable satellite-based Wi-Fi connectivity; firewall and web filtering functionality to block inappropriate content, government-approved bilingual English/Spanish educational content for grades k-12, and cloud-based pre-caching of the most-used educational content.

Education Anywhere™ also includes automatic off-hours content updates, online measurement tools and video conferencing capabilities. Our platform has been implemented in more than 100 remote schools throughout Colombia and has been a huge success. We are currently piloting this service at a primary school in Mexico's Puebla region and hope to duplicate the program in schools throughout the region over the next year.

In some situations, we just focus on providing high-quality Internet as we are currently doing with a school servicing the indigenous Q'eros Nation tribe living high in the Andres of Peru. As is the case with many of the schools we service, getting our equipment to the village was quite a feat.

The installation involved trekking a satellite dish up steep mountain trails to an elevation of more than 16,000 feet and installing a solar panel to generate the necessary electricity, both of which were facilitated by our project partner, Kidnected World.

SM

Tell us about some of other social advancement initiatives NewCom is spearheading throughout Latin America.

Jaime Dickinson

We are currently teaming with local organizations, NGOs and government agencies throughout Latin America to improve the lives of the residents there. In Panama, for example, we have partnered with Digicel to deliver high-quality, low-cost satellite communications services to 57 community centers throughout the country—providing free public Internet access.

In Guatemala, we've been partnering with COMNET, the largest VSAT provider in the country, to provide satellite-based connectivity and high-speed Internet services to 117 schools, medical clinics and community centers. Another example is our work with the Red Cross.

We are currently providing a private satellite network for Internet access to facilitate the ongoing Red Cross humanitarian mission at Guantanamo—including communication between field workers and headquarters in Switzerland and Washington D.C.

SM

Driving economic growth in these developing regions is also a key mandate for NewCom. Can you tell us how you are working to achieve this?

Jaime Dickinson

At NewCom, we are more than a global satellite and terrestrial communications provider. We are also an engineering firm that specializes in the design, implementation, operation and management of critical integrated voice, video, data, content and security solutions for government agencies, financial institutions, oil & mining companies, the maritime industry, ISPs, airports, broadcasters and other business sectors.

Promoting economic growth starts with providing the critical communications and security solutions companies need to operate in remote corners of Latin America. To address this, we developed our Office Without Borders™ platform, a compact turnkey unit that provides instant voice, video, data and content services anytime, anywhere.

This turnkey remote office system, along with our monitoring and Autonomous Cellular solutions, are used by many oil, gas and mining companies. Contingency solutions are also important to fostering economic growth and we work with numerous financial institutions to ensure they have a cost-effective, seamlessly contingency service in case of fiber cuts or other disruptions.

Additionally, we have strategic teleports located in Miami and Lima, Peru, and they give us an advantage in terms of the satellite footprint and teleport services we can provide.

SM

By the way, congratulations on NewCom's recent acquisition by SpeedCast Limited International. How will this move impact NewCom's ability to drive social change and advance economic growth throughout Lain America?

Jaime Dickinson

SpeedCast is the perfect company to join forces with as the firm shares our customer-centric values (agility, flexibility, cost-consciousness, quality) and our commitment to leveraging satellite connectivity to make the world a better place.

As a global satellite communications provider with 27 international sales and support offices and 30 teleport operations worldwide, SpeedCast offers NewCom access to the vast global infrastructure, technology and support that will enable us to further leverage satellite communications technology for the benefit of our customers and expand our service offerings throughout the Americas and Africa.

newcominternational.com/

Product Focus: Advanced GaN Based SSPA Technology For Airborne Applications

By Cristi Damian, M.E.E. Engineering Vice President, Business Development, Advantech Wireless

One of the most interesting SATCOM applications today appears to be in the field of providing Internet access onboard commercial airplanes.

Either in the form of pure entertainment (movies, games, Skype types of phone calls, web browsing), or as a business enabling tool (emails, large data processing, accessing cloud services), Internet access on long haul flights certainly possesses strong appeal.

Today there are several companies providing these services. For the vast majority of these firms, access is provided via cellular networks while flying above areas covered by these services. In case of over-the-sea travel, cellular networks are not available—satellite access is the only method available for airborne communications.

The purpose of this article is to provide information regarding the complex nature of airborne SATCOM applications, with a view on the current challenges and solutions that are envisioned and offered by Advantech Wireless.

Open Standard

With the expected number of aircrafts that will be equipped with airborne SATCOM terminals exceeding tens of thousands of units, the need for the implementation of an Open Standard becomes quite obvious.

Today, two major standards cover such terminals.

ARINC791

The first standard is ARINC, in particular, ARINC791. This standard is working on defining the implementation architecture, the interconnecting software as well as the electrical interfaces. The Standard Committee includes Airlines Representatives, Aircrafts Manufacturers, Service Providers, Hardware Solutions Providers.

Advantech Wireless, as a Corporate Member, participates actively in the SATCOM Committee of ARINC standard. Our goal, together with all of the other members, is to identify and specify coherent technological solutions, based on the latest technological advancements, and on our own expertise.

ARINC791 is currently under review and will be replaced in the near future by ARINC792: Second Generation Aviation Ku-Band and Ka-Band Satellite Communication System.

RTCA/DO-160G

The second important set of standards is RTCA/DO-160G. This standard defines the critical environmental challenges that the SATCOM equipment on board of aircraft must overcome.

These range from extreme operating temperature, high shock and vibration, extremely low EMI profile, lightning immunity, and so on. Considering the very high level of safety and security required by airlines, it is easy to understand the implications of any new equipment that has to be added on an aircraft.

Maintenance cost and time has to be kept at a minimum, therefore, a very high reliability is expected.

Previous work in the Standard Committee, as well as feedback from industry, has clearly identified several challenges:

- A wide range of aircraft frames impose challenges on having a unified placement location. Larger aircrafts can accommodate the entire SATCOM system in the Outdoor Antenna Enclosure (OAE), which is, in a sense, a Radome. Smaller aircrafts cannot accommodate the entire load of equipment and the SSPA should be located elsewhere within the aircraft structure.

- The SATCOM terminal is expected to operate Gate-to-Gate. That will expose the equipment to potentially high temperature while on the ground, as well as very low temperatures after a short climb to high altitude.

- The repair time has to be minimal, and all maintenance operations need to be done only when the aircraft has landed for reloading and take off. Access to the external Radome (OAE) is most likely not possible during that time. The requirement is that the equipment should be replaced a maximum of one to two times during the aircraft's life time, which is expected to be 25-30 years. That translates into an MTBF of 250,000 hours.

The Design Target

Considering all of the above challenges, Advantech Wireless approach was as follows:

- The extreme operating environment, clearly identifies GaN based design as a strong candidate. GaN based SSPAs can handle high temperature, thermal and vibration shock, have a low form factor, and weight, while being very linear and energy efficient.

- The possibility of having the SSPA installed in the Outdoor Antenna Enclosure on large frame aircrafts, or inside the aircraft (cabin) on smaller aircrafts, will impose as much as possible available linear transmit power. The SSPA should provide at least double

the amount of TX power that ARINC standard is suggesting, in order to allow for high insertion losses when installed far away from antenna.

- A commercial off the shelf (COTS) design will clearly not be able to accommodate the required reliability, therefore, a different approach has to be taken. We need higher linearity without any impact on equipment reliability.

- Thermal shock during takeoff will require the selection of special materials, a new electrical design approach, and a special cooling system that has been adapted to all these requirements.

The Suggested Solution

In early 2010, Advantech Wireless pioneered the new GaN based SSPA line. As part of that offering, the 100W Ku-band SSPA/BUC was a key product.

That unit was designed to replace 200W Ku-Band TWTs and targeting was focused on Military Grade SATCOM-On-The-Move (SOTM), or Commercial Satellite News Gathering (SNG) trucks operating for the broadcasting industry.

The final product, once released, outperformed all other technology that was available on the market, either SSPAs or TWTs, by offering higher reliability, higher linearity, and higher efficiency.

Since the initial product launch, more than 800 units have been shipped. Below is a list of key parameters as well as a review of MTBF, both as Belcore calculated and as field MTBF:

Figure 1. 100W Extended Ku-band GaN COTS SSPA/SSPB.

Performance	100W Ku-Band GaN, COTS
Mechanical footprint	12" x 8" x 5.4"
Linear RF Power	+46 dBm
Maximum Junction Temperature	+155° Celsius
Maximum ambient operating T	+ 60° Celsius
Calculated MTBF	160,000 hours
Field MTBF	230,000 hours

While the existing design would be a good starting point for an Airborne Grade RTCA/DO-160G compliant unit, design changes will be required to accommodate the following:

- Operation at +70 deg C without a decline in MTBF
- Higher Linear Power New thermal design
- Lower height profile in order to fit in the OAE Radome

Figure 2. 100W Extended Ku-band GaN Airborne SSPA/SSPB.

These additional design targets were incorporated into a new generation of Airborne Grade SSPAs

Below is a summary of the main parameters:

Performance	100W Ku-Band GaN, Airborne Grade
Mechanical footprint	16'.2 x 13.7" x 2.9"
Linear RF Power	+48 dBm
Maximum Junction Temperature	+145° Celsius
Maximum ambient operating T	+ 70° Celsius
Calculated MTBF	160,000 hours
Expected Field MTBF	230,000 hours

At first glance, it is clear that in order to keep the same maximum junction temperature (channel temperature inside the GaN FET), we need to increase the cooling capabilities. This has to be done in parallel with reducing the unit height from previous 5.4 to 2.9-inches.

An innovative thermal design was used in order to achieve that form factor, which relied on:

- New material selection for cooling system
- New RF design and assembly techniques
- Intelligent Distributed cooling system, with gradual heat control to mitigate thermal shock, and built in soft fail mechanism for cooling elements
- At the same time, a new generation of GaN based RF design was used, that has 60 percent provided additional linear power

This key element implies that the proposed unit can now be either installed in the OAE, or at least 10 meters away from the OAE (in the cabin), without any impact on link performance.

This gives a major advantage to the system integrator, allowing installation on multiple size aircrafts.

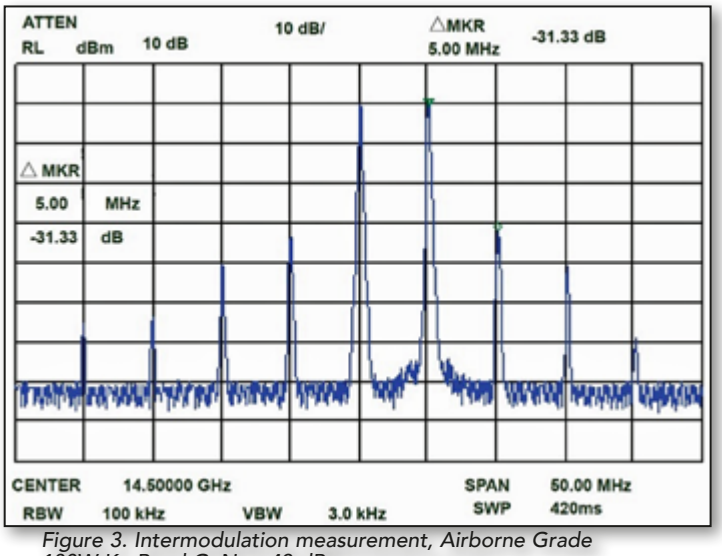


Figure 3. Intermodulation measurement, Airborne Grade 100W Ku-Band GaN at 48 dBm output power.

Being able to maintain the same MTBF numbers relates in the following way:

1. *As a rule of thumb, we expect that a 10 degree Celsius ambient temperature increase will reduce the MTBF numbers by 30 percent (going from +60 degrees C to + 70 degrees C ambient temperature).*

2. *However, we notice that by increasing the cooling capabilities, we can reduce the junction temperature by 10 degrees C on the Airborne Grade Design.*

3. *That implies that at MTBF level, the results will not change and we can still expect a very strong 230,000 hours performance.*

An MTBF of 230,000 hours does not signify that the unit will operate that entire time without failure—this is a common misinterpretation.

What MTBF really suggests, as a statistical distribution over an entire population, is that at the end of the MTBF time, 33 percent of the total population remains functional.

This suggests that during the life time of 230,000 hours (26+ years), we can expect a 66 percent failure, or roughly a maximum of two replacements per aircraft lifetime, which is well within the ARINC expectations.

Challenges + Solutions

In order to address the demands and the challenges imposed by the new In Flight Internet Access and Entertainment application on commercial aircrafts, Advantech Wireless has designed and manufactured a 100w Ku-Band Airborne Grade SSPA/SSPB.
Initially identified challenges included:

- The height of the unit had to be reduced by 47 percent versus the COTS equivalent in order to fit within the aircraft radome and mechanical structure

- Operating ambient Temperature required was as high as +70° Celsius, as per RTCA/DO-160G

- A very high reliability rate had to be maintained, due to the impossibility of accessing the aircraft radome, during operation

Despite these challenges, the new Advantech Wireless Airborne Grade Ku-Band SSPA offers an impressive MTBF of 230,000 hours while providing 62 percent higher linear power than the COTS equivalent.

This power increase will allow the SSPA installation either in aircraft radome, for large body airplanes, or up to 10 meters away from antenna (in the cabin) for smaller body aircrafts.

This installation flexibility offers a wide range of installation choices for the system integrator, while reducing the options and the inventory.

In order to maintain a very high reliability, an advanced cooling system was designed which allowed the overall temperature of the electronic components to drop by 10 degrees Celsius.

These 100W Ku-band Airborne SSPAs are now part of Advantech Wireless' Second Generation GaN offering, including C-Band, X-Band and Ku-Band units with power levels from 16W to 1.2 KW.

advantechwireless.com

Mr. Damian joined Advantech Wireless in 1995 where he held various leading positions in Operations, Manufacturing, Sales, Engineering and Customer Support. Prior to Advantech Wireless, he acquired experience as a hardware engineer in various high-tech companies. Mr. Damian holds a Master's degree in Electrical Engineering from Concordia University.

Performance	100W Ku-band GaN COTS	100W Ku-band Airborne Grade	Variance
Mechanical footprint	12' x 8" x 5.4 "	16'.2 x 13.7" x 2.9"	↗ 24%
Linear RF Power	+46 dBm	+48 dBm	↗62%
Maximum Junction Temperature	+155° Celsius	+145° Celsius	↘10°C
Maximum ambient operating T	+ 60° Celsius	+ 70° Celsius	↗10°C
Calculated MTBF	160,000 hours	160,000 hours	↔Same
Field MTBF	230,000 hours	230,000 hours	↔Same

Figure 4. Technology Comparison.

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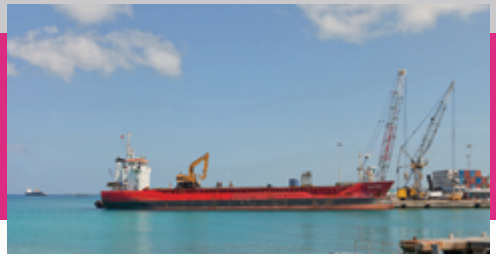

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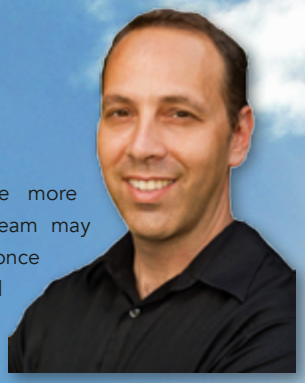
Cloud VNOs: The Rising Stars Of Your Satellite Network



By Ezra Olman, Content Marketing Manager, Gilat Satellite Networks

We all know that the introduction of networks based on multi-spot beam satellites has reduced bandwidth costs.

The happy result is that satellite capacity, previously priced out of reach for many service providers, is now economically viable. What may be less apparent at first glance is how this new reality creates opportunities for Virtual Network Operators (VNOs).

VNOs are essentially resellers of network services, service providers with their own end users. They typically offer broadband, enterprise and cellular services to their subscriber base.

Generally speaking, VNOs are less concerned with the technicalities of a satellite network and more concerned with providing quality service. In this article, we'll dive a bit deeper into how VNO models work and we'll also peek around the corner to see some of the features that HTS-enabled "Cloud VNOs" are likely to provide.

The HNO/VNO Partnership

Typically, a Host Network Operator (HNO) is a satellite operator or teleport owner with satellite capacity. An HNO sells hosted network services or complete managed service to VNOs.

With the introduction of High Throughput Satellites (HTS), however, we're seeing changes to the traditional satellite service value chain. In the past, an HNO would sell satellite services on a wide beam to a VNO.

However, as multi-spot beams become more common, VNO presence on a single beam may not be sufficient; a geographic region once covered by a single wide beam may instead be covered by several smaller beams. In this case, the model of a per-beam VNO loses its appeal. The question then becomes—what becomes of the VNO who wants to expand or even just keep pace—during this wide-beam-to-HTS conversion?

This is where opportunity awaits. VNOs are poised to emerge from this transition stronger than ever. The rollout of HTS clears a path for HNOs to offer dynamic wholesale services, expanding possibilities for network sharing. Looking ahead, by combining a software-defined network and cloud-based architecture, HNOs can offer a new breed of services—rich, cloud-based packages that VNOs can use to attract subscribers.

Change Is In The Air…

To appreciate where the VNO world is heading, we need to understand where it is now. Currently, satellite networks can be shared in any number of ways. In some models, the HNO controls the hub infrastructure and controls network operations. In others, the HNO controls only the hub infrastructure while the VNO controls network operations. The permutations of this shared model are endless. But what are the benefits?

WHICH VNO MODEL BEST SUITS YOUR NEEDS?

Hardware VNO

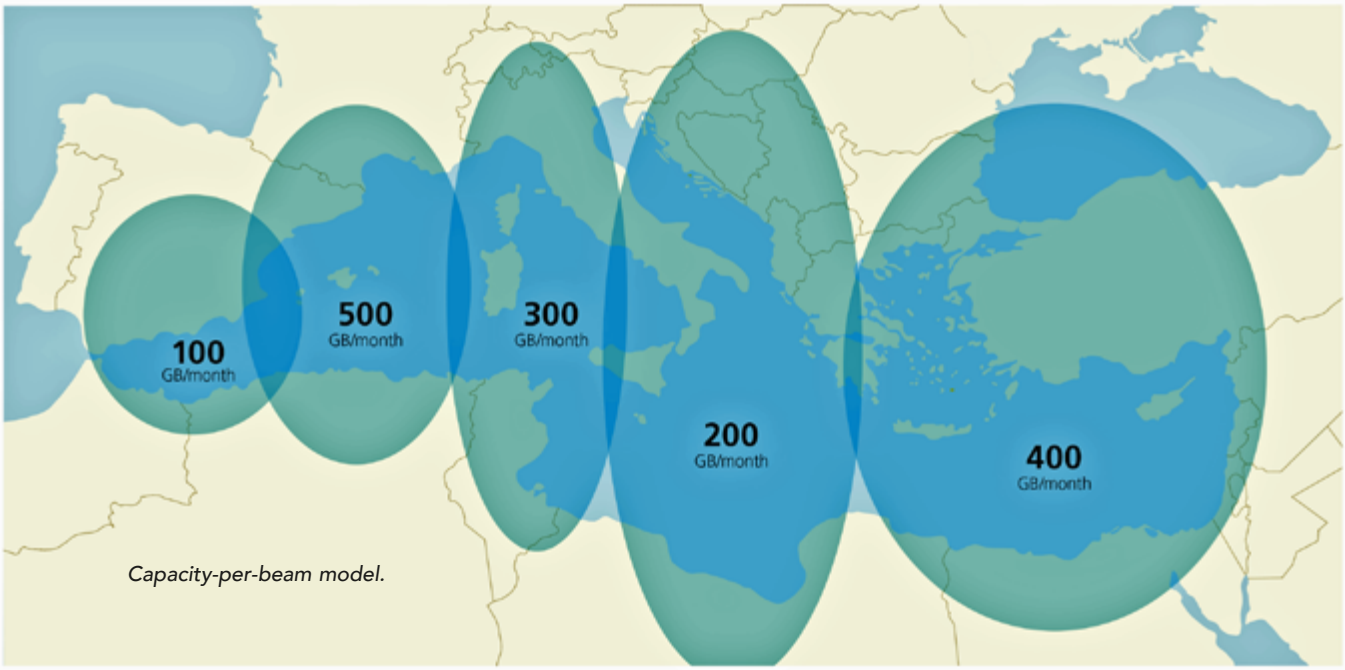
A VNO service utilizing dedicated Tx/Rx hardware components with inbound and outbound MHz capacity.

Software VNO

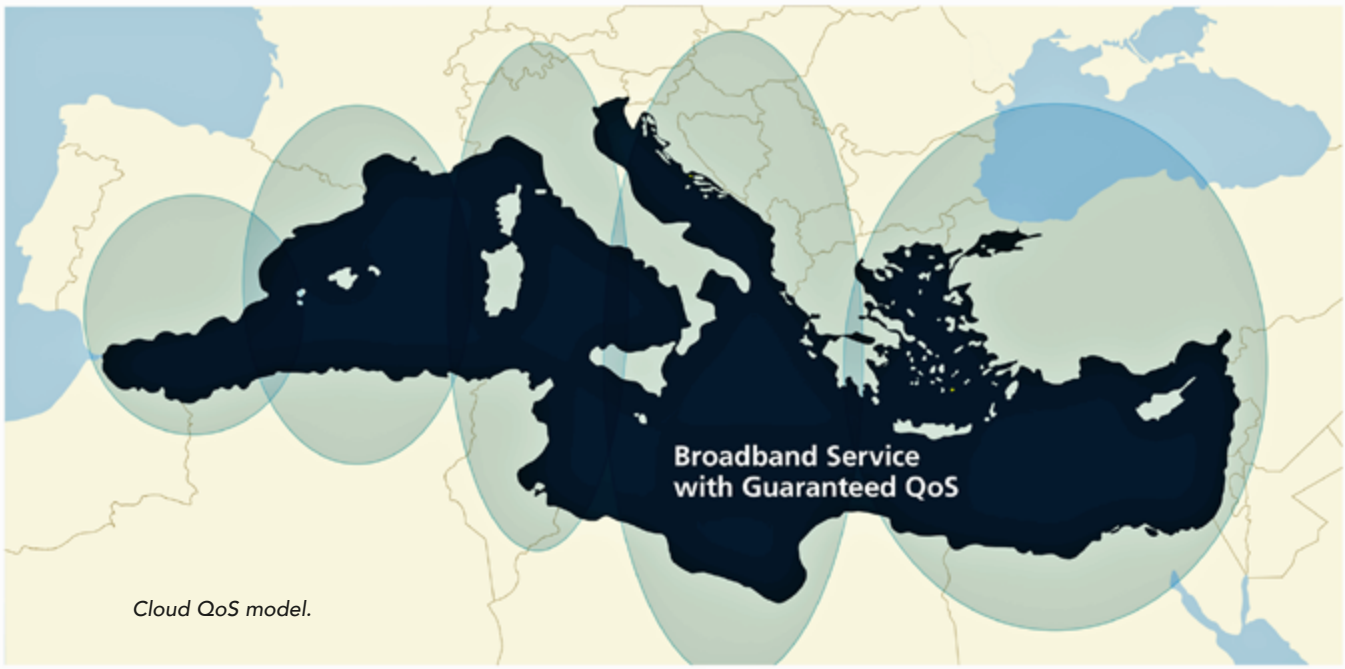
A VNO service utilizing shared hub resources with inbound and outbound Mbps capacity.

Cloud VNO

A VNO service over multiple spot beams and satellites, leveraging a shared pool of network functions, data processing, and space segment spectrum.



Capacity-per-beam model.



Cloud QoS model.

Let's take a closer look at three types of VNO models that enable HNOs to deliver B2B VNO wholesale services. "Hardware" and "Software" are long-standing VNO models suited for wide-beam, while an emerging third model, "Cloud", includes HTS-specific features as well.

Hardware VNOs

For satellite service providers requiring full control over their network operations, Hardware VNO is an ideal solution. Hardware VNO uses dedicated transmit/receive hardware components with inbound and outbound MHz capacity.

The VNO controls satellite resources, software update scheduling, and configuration of all hardware elements. By supplying VNOs with a separate network and independent management capabilities, HNOs can offer VNOs the opportunity to run their own services without requiring upfront investment in teleport infrastructure.

Software VNOs

To achieve a lower price point for satellite capacity and reduce CAPEX, a software VNO solution fits well. Software VNO is a

managed network, supporting applications from broadband to mobility and uses shared hub resources with inbound and outbound Mbps capacity. In this model, the HNO can generate detailed data usage records per VSAT, enabling pay-per-use business models.

The VNO does not invest in hardware; rather, the VNO uses the HNO's infrastructure and selects a range of service options covering quality of service (QoS), rate and quota. The VNO can also offer redirect services, as the shared resources are transparent to the end user.

Cloud VNOs

For VNOs seeking to enter HTS-driven networks with minimal overhead, Cloud VNO is an optimal point of entry. Cloud VNO offers service over multiple spot beams and satellites, leveraging a shared pool of network functions, data processing, and space segment spectrum. Enabling rapid introduction of new services and business models, this model scales as the business grows.

The Cloud VNO model, coupled with recent developments in Software Defined Networking (SDN), allow HNOs to offer some of the most powerful features of modern networks, such as capacity on demand and guaranteed QoS across beams and satellites.

In this Cloud QoS construct, QoS is a cloud function and is no longer managed at a carrier or beam level. Rather than determining how much bandwidth is needed in a given beam's footprint and having that amount of GB/month statically allocated, the VNO receives a service-level agreement for a multi-beam service area.

This model is uniquely enabled by HTS. The flexibility to reallocate bandwidth across beams opens the door to offering services on demand rather than an allotment of satellite capacity per region. One obvious use case for this is mobility services across multiple spot beams. Services are managed at the network level as the VSATs move between beams or satellites.

Anticipating trends in the satellite industry, the Cloud VNO model supports features that are quickly becoming standard. Network-on-demand enables VNOs to boost bandwidth for a limited time in a given location, *e.g.*, an outdoor amphitheater that requires a bandwidth increase when hosting a weekend festival.

Another feature is backup-on-demand, in which a satellite network is activated in place of a terrestrial network with damaged infrastructure. Satellite networks are often a preferred backup for terrestrial networks because they are quick to deploy and do not rely on the same infrastructure.

Looking even further ahead, a Cloud VNO model will enable on-the-fly bandwidth adjustment based on analysis of traffic patterns or due to a sudden spike in demand. An example of this would be a decision to reallocate bandwidth to and from an island frequented by vacationers in the summer but sparsely populated most of the year. Functionality of this type will become widespread with the next generation of satellites, scheduled for launch in the near future.

Features such as these are rapidly becoming integral to network operations; they are also features that VNOs will be expected to provide.

…And Change Is On The Ground

While powerful and exciting in its potential, a cloud-based VNO can only be offered when backed by ground segment architecture designed to support HTS, multiple services and multiple beams. Most ground segment architectures in use today are not able to offer these features, so selecting a platform that includes these features is vital. In addition, a service-oriented network management system is needed to enable HNOs to rapidly introduce VNO entities and guarantee the VNO service level.

From the VNO perspective, by accessing a network management system they can simply operate their network and concern themselves with business decisions rather than the technicalities of running a satellite-based system.

How do you determine which VNO model your network needs? The answer usually is—it depends. Considering business imperatives and how your network is structured, it may well be that several models are needed.

At Gilat, we believe that the global trend toward network virtualization will lead to predominately Cloud VNO models. We also understand that what works for your network today may change tomorrow. Business opportunities can often carry you in unexpected directions. Gilat's SkyEdge II-c with X-Architecture, a single platform supporting all VNO models, provides you with the flexibility to prepare for any eventuality.

gilat.com/x-architecture

*Ezra Olman (**ezrao@gilat.com**) is Content Marketing Manager for Gilat Satellite Networks. In this role, Olman is responsible for content creation, from articles and white papers to case studies and social media posts. He also designs and manages marketing automation campaigns.*

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Executive Spotlight: Curt Blake, President, Spaceflight Inc., On Ridesharing

Curt Blake is currently the President of Spaceflight and previously served as Senior Vice President and General Counsel.

Mr. Blake has led efforts to expand Spaceflight Services global network of launch service providers while building relationships with key commercial-, civilian- and defense-related customers. Mr. Blake has more than 25 years of executive experience in high-growth and tech industries, with past experience including a range of senior executive and general counsel roles at Microsoft, Starwave, Corbis and Aldus.

In the last three years, Mr. Blake oversaw Spaceflight Services' first four commercial rideshare launches, on the Antares, Soyuz and Dnepr vehicles, from sales to mission management to launch. Mr. Blake is a current member of the Commercial Spaceflight Federation Board and contributor to numerous small-satellite conferences.

Mr. Blake, how would you define a dedicated rideshare launch?

Curt Blake

Dedicated rideshare is a new launch alternative that lowers launch prices for organizations seeking access to space by maximizing utilization of the launch vehicle and apportioning cost based on schedule control and other service features.

What should people know about dedicated rideshare vs a normal launch?

Curt Blake

Dedicated rideshare is focused on seamlessly coordinating all aspects of the launch for our customers. Much like an airline or a cruise line, we're creating the first commercial spaceline. Airlines don't build airplanes, cruise lines don't build cruise ships and we don't build rockets.

Spaceflight purchased a SpaceX Falcon 9 rocket to expand its launch services and to meet the smallsat industry's growing demand for routine access to space.

What we do, and do very well, is fill empty space on scheduled launch missions or create new dedicated launch schedules, coordinate payload and launch logistics, manage operations and provide a great customer experience.

When did Spaceflight identify the need for a dedicated rideshare launch?

Curt Blake

About two years ago, we saw an increase in demand from prospective large satellite rideshare customers, unwilling to risk losing their launch payments if their satellite was not ready on launch day. While these customers were willing to pay a premium for a level of customer service and control, they didn't want the overhead or responsibility of buying their own rocket and they wanted the savings that came from including rideshare customers on their launch. It seemed like a perfect opportunity to offer rideshare as an alternative.

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What were customers' initial reactions to the first dedicated rideshare?

Curt Blake
Really, really excited! The notion of having a reliable, annual ride to a sun-synch orbit is really compelling. Anytime we can offer customers more options around schedule control, pricing, and increased frequency in access to space, it's a win for the industry as a whole.

Did you see an increase in interest from clients and potential clients after announcing the first dedicated rideshare?

Curt Blake
Absolutely. We continue to see high interest in this offering, customers have embraced the concept and are very interested in SSO-A, our first dedicated rideshare launch. It offers a very tangible value proposition for customers. We were even approached by GEO operators asking us about dedicated rideshare missions to geostationary transfer orbits (GTO).

For example, upon announcement of our first purchase of a SpaceX Falcon 9 for a 2017 launch (SSO-A), we had pre-sold 20 satellite payload spots—nearly 70 percent of the total space available—to organizations from six different countries.

Who benefits the most from dedicated rideshare?

Curt Blake
Everyone on the launch—commercial and non-commercial smallsat operators benefit from the certainty of set launch schedules, not previously available to rideshare customers.

Until now, rideshare customers had no option but to wait until excess capacity became available on a launch scheduled by a primary payload. With dedicated rideshare, we incent primary, or lead, customers to synch to our launch schedule by offering them significant savings. Dedicated rideshare missions enable customers with spacecraft that range in mass from five to 2500 kg to create long-range mission plans to sun-synch and GTO with more dependable launch dates.

In addition, U.S. government customers benefit from predictable, available U.S. launches, and launch vehicle manufacturers benefit as well. We will be buying more vehicles in the near future as customer awareness and demand for space access builds.

Who is the ideal customer?

Curt Blake
Any commercial or government entity that needs more control over their launch schedule and wants to save a significant amount on the cost of their launch. Thankfully for us, there are many organizations that fit that description.

One co-lead on our Falcon 9 mission (SSO-A) is SpaceIL, the Israeli Google X Prize contestant. As a non-profit customer, they were very cost conscious. They needed to reserve as much money as possible to plan and execute a moon-landing mission and we were able to provide them an affordable launch that met their financial and schedule control needs.

Why might a "lead customer" choose rideshare over traditional sole payload missions?

Curt Blake
Lead customers pay for schedule control and other accoutrements of a traditional "primary" customer, but see their price reduced by including rideshare customers on the launch. Likewise, the traditional rideshare customers pay less because our lead customers pay a disproportionate amount of the entire launch vehicle cost because they retain schedule control.

Are there specific payloads that don't work well in rideshare situations?

Curt Blake
There is a very small increase in mission risk when more than one spacecraft is launched and deployed on a single mission. For instance, although lead spacecraft are deployed first, if the price reduction for the lead is not enough to make dedicated rideshare attractive, they should purchase their own launch vehicle. An example might be an expensive USG Mars lander or a critical Defense Department satellite. If there are lives or billions of dollars at risk, and the customer has the resources to buy their own launch vehicle, they may want to go that route. However, that's not a common situation.

Are there any limitations to dedicated rideshare?

Curt Blake
Yes, there are. We think of dedicated rideshare missions as buses and sole payload missions as taxis. Dedicated rideshares, like buses, are best used to reach popular destinations. If a spacecraft needs to reach an uncommon destination or it absolutely must be at a popular destination at a specific time, it is best served by a taxi. In addition, there is a very small increase in mission risk when more than one spacecraft is launched and deployed in a single mission.

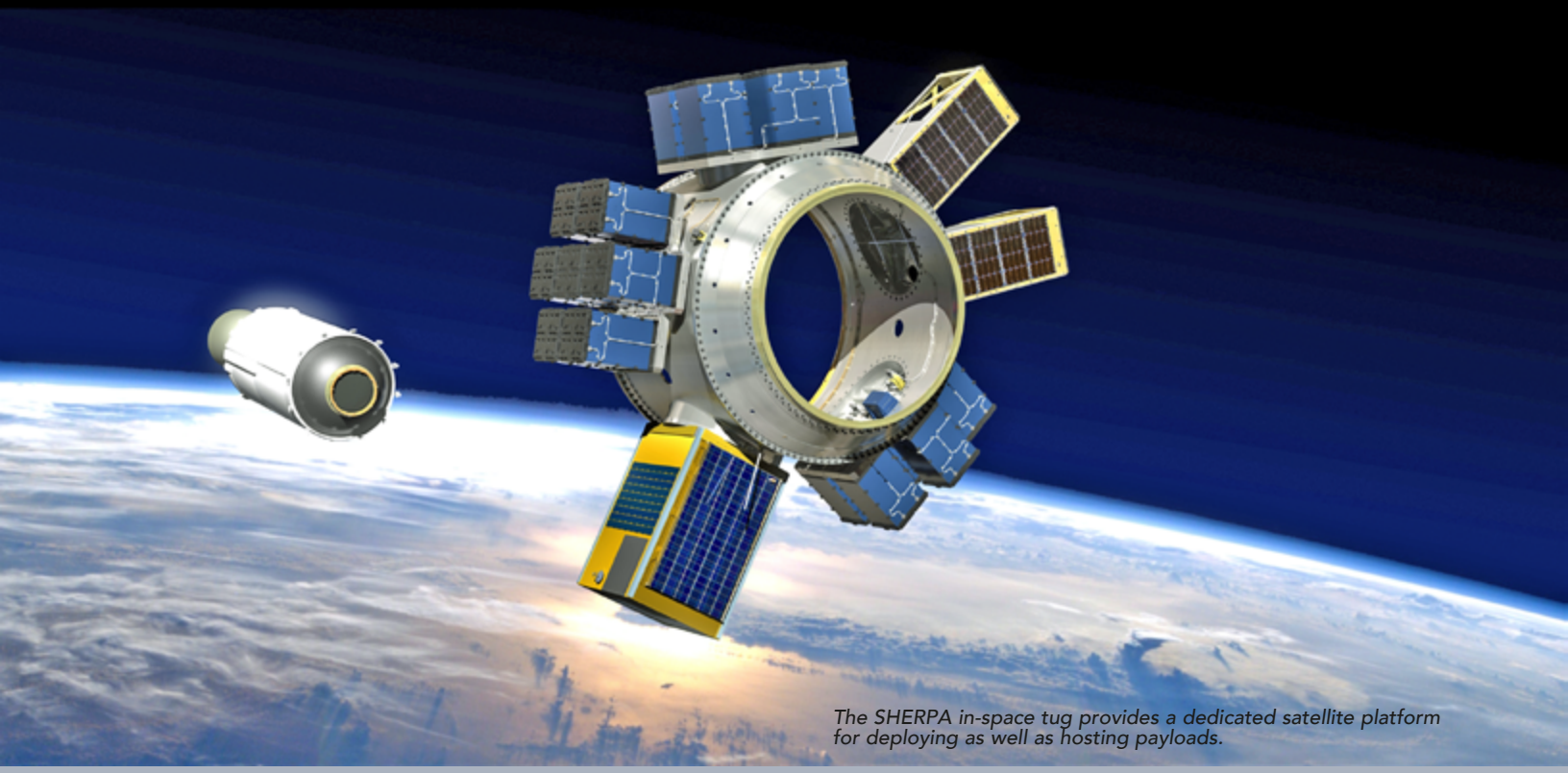
Do you imagine that other companies will begin to offer this as a service?

Curt Blake
Others may want to offer dedicated rideshare, but it is not an easy service to provide. The contracting and logistics involved in purchasing a launch vehicle and coordinating 15-20 customers onto one launch is not for the faint of heart.

How do you feel dedicated rideshare will evolve over the next 10 to 20 years? Please be as specific as possible.

Curt Blake
Dedicated rideshare will become routine because of the increasing need for small satellites to have affordable, dependable launch service options that provide consistent and frequent access to space. By extending this model to mid-size and large satellites, giving them more schedule control and service absent the enormous cost of buying a private launch vehicle, we provide a compelling service.

While dedicated rideshare missions currently only serve the sun-synchronous low Earth orbit and GTO launch markets, we will offer different orbits as new vehicles come online and customer demand increases. Launch providers want to concentrate on the launch vehicle itself; coordinating



The SHERPA in-space tug provides a dedicated satellite platform for deploying as well as hosting payloads.

multiple customers on a launch is something they don't want to focus on.

Do you think it has the potential to become the norm in the next 30 years? Will launches dedicated to one payload disappear?

Curt Blake

For 99 percent of the organizations seeking access to space, price is an issue. But as spacecraft size, and consequently, cost of launch goes up, having some say on launch timing becomes more important. Being able to offer both routine access and an affordable price point is critical in making space accessible for more organizations.

What is the most challenging aspect of dedicated rideshare launches?

Curt Blake

Like any launch, it's getting the payloads delivered and integrated on schedule. In the event there are co-leads, the allocation of rights between the parties can also be challenging.

We've launched 81 satellites to date and have more than 135 satellites to deploy through 2018. The frequency of satellite launches, combined with Spaceflight's cross-section of customers and variety of mission-applications, is a strong indicator of the growing capabilities of small satellites and the need for more timely and cost-effective access to space.

What are the biggest risks and benefits?

Curt Blake

The main risk is ensuring that everything comes together at the same time; as they say, space is hard and ensuring licensing, testing, integration, deployment, and communications all come together for numerous customers is a logistical challenge.

Everyone focuses on the launch, which is of course critical, but there's so much more involved, from the coordination of the spacecraft to be deployed, to the engineering of the payload stack.

The big benefits for customers and the industry alike are more frequent, routine access to space at a cost-effective rate.

Would you please walk us through the process of scheduling a rideshare, preferably from the client and the launch scheduling/coordinating side?

Curt Blake

The process starts with a client request for a certain schedule for a particular payload size. From there, it's really a matchmaking exercise. If the client is a lead or co-lead candidate, we review our database for other clients that have expressed a desire to reach a similar orbit within the same time frame.

For non-lead rideshare customers, we review our available missions, dedicated rideshare or not, in addition to other missions we know are out there. We then screen for what launch vehicles are available to an individual customer and evaluate their options. For example, some U.S. customers can only launch on U.S. vehicles.

From the customers' viewpoint we strive to make the process relatively seamless. We always keep in mind that customers just want to get their satellite on orbit at an affordable price and at a set time.

We try to respond to client queries within one business day to let them know we are working on their request. If they use our website there is a form to fill out giving us the information we need to start this process, if

they call we collect the data and usually provide them with launch options within a week.

How and when do the initial conversations with clients start? When do they need to deliver their payload and how long does it take Spaceflight to integrate it into the launch?

Curt Blake

Customers typically contact us via website, email or a call, providing information about their spacecraft, launch vehicle preferences, restrictions they might face, orbital requirements and preferred launch window. The timing of the launch integration process depends a lot on the launch service provider. Some require longer lead times than others, if the launch is from a foreign country we need to build in time for shipping, customs clearance, etc.

How long does Spaceflight need to schedule the launch? Do you drive the satellites to the launch site and what is your job once on site, and so on.

Curt Blake

That varies by situation. We like to have approximately two years from signing to a launch for dedicated missions, depending on the spacecraft involved and its status. For non-dedicated missions we have coordinated rideshare for customers in as little as three months, but that's a tight deadline.

We deliver the integrated payload stack, with the spacecraft attached, to the launch site. In some cases we have to integrate a spacecraft at the launch site, but we get charged for that, so it increases the cost.

Once at the launch site we perform a series of tests on the integrated payload stack to be sure it will operate correctly. We also conduct tests to be sure the spacecraft are operating normally. Then the launch service provider integrates the stack to the launch vehicle.

Beyond the integration services and tactical aspects of integrating a launch, one of our biggest differentiators is our attention to full-service mission management.

We oversee the entire launch process, taking the guesswork out of the experience for our customers. We work hard to be sure that when the customer signs, they know what the launch process will be like; what deliverables will need be provided and when, the important milestones, when their licenses are expected to be complete, when the spacecraft is to be delivered, etc.

We aim to eliminate any surprises. This level of service allows us to maintain long-standing relationships with our customers.

Spaceflight is the only one-stop spaceliner in the industry. As a client-service company we take care of everything from systems integration to spacecraft deployment, including guidance on trickier aspects, such as International Traffic in Arms Regulations (ITAR), Interface Control Document development and government licensing.

Customer don't have to be a launch expert; that's our job, we let them focus on their satellites and business.

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A Thuraya Insight: 25 Years Of Solar Success For The University of Michigan

The University of Michigan (UoM) solar car team began racing in 1990, winning the inaugural American Solar Challenge with its first car, Sunrunner.

To date, the team has won eight national championships and one international championship and has enjoyed five, top-three world finishes. Aurum is UoM's 13th solar vehicle to date.

The sun can either be your enemy or your friend. In Australia's outback—a vast desert the size of India—it is a constant threat. Travelers who set off in the intense heat without sufficient water, food and back-up communications are taking a huge risk.

However, for teams participating in the 2015 Bridgestone World Solar Challenge (WSC), the sun was a welcome companion. Competitors needed all the sunlight they could absorb as they crossed the outback between Darwin in the north and Adelaide in the south, covering 3,000 km of hostile terrain in vehicles powered by solar energy.

Thuraya partnered with the UoM solar car team for the WSC 2015. The company provided six Thuraya XT satellite phones, five IP Voyager data terminals, free airtime and unlimited Internet data. Six vehicle docking stations with built-in loudspeakers and microphones, also supplied by Thuraya, enabled easy, hands-free Communications On-The-Move (COTM).

Team Manager, Pavan Naik, said, "*Thuraya kindly supplied us with everything we needed for our fleet of seven support vehicles. You can't rely on terrestrial networks or radio in the outback, so satellite services were crucial. We were very impressed by the quality of the voice channels and the reliability of the data links, even in extreme weather conditions.*

"*Thuraya's equipment proved invaluable to us even before the race began. During a pre-race test, the car was driven off-road and it crashed into some bushes. Luckily, the driver was unhurt and the car was undamaged, but testing that day was cut short. It was already late in the day and half the team were on their way back to camp. With no cell phone coverage, team members with Aurum were relieved to have their Thuraya satellite*

25 Years of Solar Success

The University of Michigan solar car team began racing in 1990, winning the inaugural American Solar Challenge with its first car, Sunrunner. To date, the team has won eight national championships and one international championship and enjoyed five top-three world finishes. Aurum is UoM's 13th solar vehicle to date.

phones—they made a call and a truck was swiftly dispatched to trailer the car back to the camp."

Leda Daehler, UoM Head Strategist, said, "*It was already getting dark when our semi-trailer arrived, so if they had arrived much later we would have been waiting and moving the car in complete darkness. Thuraya really came through for us.*"

Marginal Gains

UoM has amassed vast expertise in their 25 years of racing. Team members have learned the value of new ideas and technologies that enable marginal gains across a five-day race—providing extra seconds that make the difference between a podium finish and a place further down the field.

Aurum benefited from improved aerodynamics, reduced weight and a host of other enhancements compared with earlier vehicles. However, the race strategy was equally important—which is where Thuraya satellite communications gave the team an edge, helping them squeeze every last bit of speed and power from the vehicle by ensuring a constant flow of information between team members and external partners.

The core objective was to keep Aurum running as fast and as far as the rules permitted each day while exploiting every opportunity to recharge the batteries via the onboard solar panels. However, in a solar car, the fastest speed is not always the optimum speed. The team has to keep multiple factors in mind—the most important of which is the weather.

Following The Sun

Even an Australian spring does not guarantee wall-to-wall sunshine, which means accurate weather forecasting is key to the WSC race strategy. UoM team meteorologist, Jeff Cwagenberg, monitored the weather every second of the 2015 race from a vehicle traveling about 30 minutes ahead of Aurum. He explained how this is crucial to conserving battery power.

"*We used the Thuraya IP Voyager data terminals to collect weather data continuously from weather stations and the IBM Watson weather modeling service to help us predict what the weather was going to do. We also used Thuraya phones to keep in constant touch with the strategy team traveling with*

the solar car. If I saw a cloud bank up ahead I let our head strategist Leda know immediately, so she could decide what action to take."

In this way, Thuraya helped the team gain vital seconds over their rivals. "Cloud chasing"—adapting the speed of your vehicle to gain maximum sunlight—is an established element of race strategy for all teams. To do it well, one needs up-to-the minute information. In some circumstances, it can pay to allow the car to lose speed and allow the clouds move ahead, as the car will charge its batteries more quickly in the sunshine and can make up time later in the race.

Alternatively, it could be best to speed up. This will use more power but will move the car ahead into full sunshine. Occasionally, maintaining a constant speed under the cloud is best if you are confident the cloud will pass overhead quickly.

Cwagenberg said, "*However, the bottom line is that any decision needs to be made quickly and based on good information. With Thuraya on board, the UoM team could communicate changes of strategy in an instant at any point during the race. We received the data needed to run real-time simulations enabling us to communicate easily with IBM Watson.*"

Knowing When To Stop

Head Strategist Leda Daehler traveled in a support vehicle close to Aurum at all times, using a Thuraya satellite phone to stay in touch with the weather car and other support vehicles.

"*The ideal situation for any team in the WSC is to cross the finish line with zero battery charge*," she said, "*because that means you have used all your power where it matters—on the road. My job is to decide when and how we deploy our battery power.*"

Solar cars use most power when accelerating up to cruising speed (about 100 km/h), so an important part of Leda's job was to ensure Aurum only stopped when absolutely necessary.

Other than mandatory control stops at designated checkpoints, the most challenging task was to select a place to pull over each day at the official end of racing at 5:00 p.m. This was a complex task that required fine judgment, great teamwork and constant communication via the Thuraya phones, as stopping in the wrong place could seriously undermine the overall race strategy.

At camp, line-of-sight to the horizon was essential to catch the sun's rays for as long as possible and to obtain maximum battery charge. Pulling over close to trees or in thick bush severely restricted this process.

Also essential was to select an area where the car and support vehicles could easily pull off the road and to avoid stretches where the road was elevated up to a meter above the surrounding bush.

The hour or so leading up to 5:00 p.m. every day was a tense time for the team. Jeff in the weather car talked constantly to Leda on Thuraya phones, suggesting good places to camp for the night. Once the decision was made, the team used their satellite phones to guide the whole fleet for the last few kilometres in order for everyone to stop at the same place and at the correct time.

Work Continues

The end of the racing day was by no means the end of the working day for Thuraya. The team used the satellite phones for calls to race organizers, and to supporters in Michigan who were staying up late to hear the news of the day's race events.

Later, the Thuraya data service came into play as Leda hosted question and answer sessions with UoM alumni via email. These were important because many of the people emailing were former UoM team members who could offer valuable strategy advice for the race the following day. UoM's media team ensured everyone following the race was kept up-to-date, using Thuraya to post on websites, Facebook, Twitter and Flickr.

Night time was best for essential housekeeping tasks. During the 2013 race, the UoM team lost a hard drive containing a whole day's race data—the team was determined this would reoccur. Thuraya's IP data service was used to upload all vital data over night for safe back-up on the UoM home server and to also download updates for the team's race software.

Climbing The Ranks

Aurum came a highly creditable fourth out of 29 in the 2015 WSC Challenger Class (up five places from 2013) and completed the route in 38 hours, 54 minutes and nine seconds. The vehicle finished only four minutes behind third-placed Tokai University, with an average speed just 0.13 km/h slower.

Over a 3,000km course, such fine margins are remarkable and demonstrate the effectiveness of the UoM race strategy. Pavan said, "*We would have loved a podium finish but we were still very pleased with our performance. Throughout the race, Thuraya's voice and data services gave us a genuine edge, so we are really grateful to Thuraya for its generous support.*"

thuraya.com/ip-voyager

To learn more about the University of Michigan Solar Car Team, visit:
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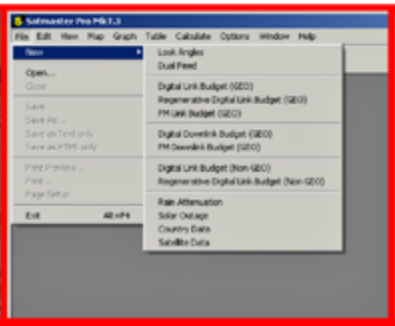

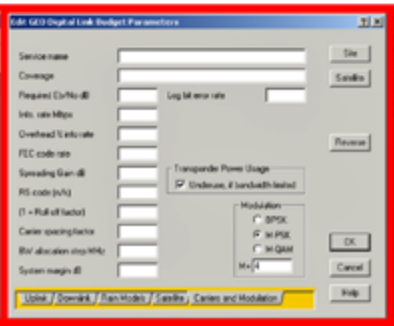

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Alix Partners Analysis: Space—A Buyer's Market

The space industry is—without question—one of the hottest sectors of the overall aerospace and defense (A&D) industry. This sector's current transformation is being marked by dramatic and potentially disruptive shifts, as suppliers aim for industrialized production levels while dealing with a heady mix of innovative new customers and competitors.

The industry may soon see a price range of $30 million to $50 million[1] for launches and as many as a thousand satellites in Low Earth Orbit (LEO) constellations. Those facts represent a dramatic shift from today's national-security-space launches that can cost as much as $420 million.[2]

Industry participants, especially long-term incumbents, are being painfully challenged to meet the needs of diverse customer groups and to stay ahead of constantly changing market requirements. Competition, as well as government support for various national space programs, is forcing established commercial players and traditional government suppliers to cut prices sharply, but in many cases, things are happening faster than they can reduce their own costs.

Although launcher and commercial satellite manufacturers have made many moves as individual companies, fundamental issues of overcapacity and a major lack of pricing differentiation remain unaddressed. Until that changes, space is likely to continue to be a buyer's market. Even recent consolidation and strategic alliances seem based more on the presumption of vertical integration benefits than on removal of excess capacity.

Spacecraft orders have been down sharply in the past 12 months. However, global satellite services revenue continues to increase—though at lower rates than in past years (*please see Figure 1*).

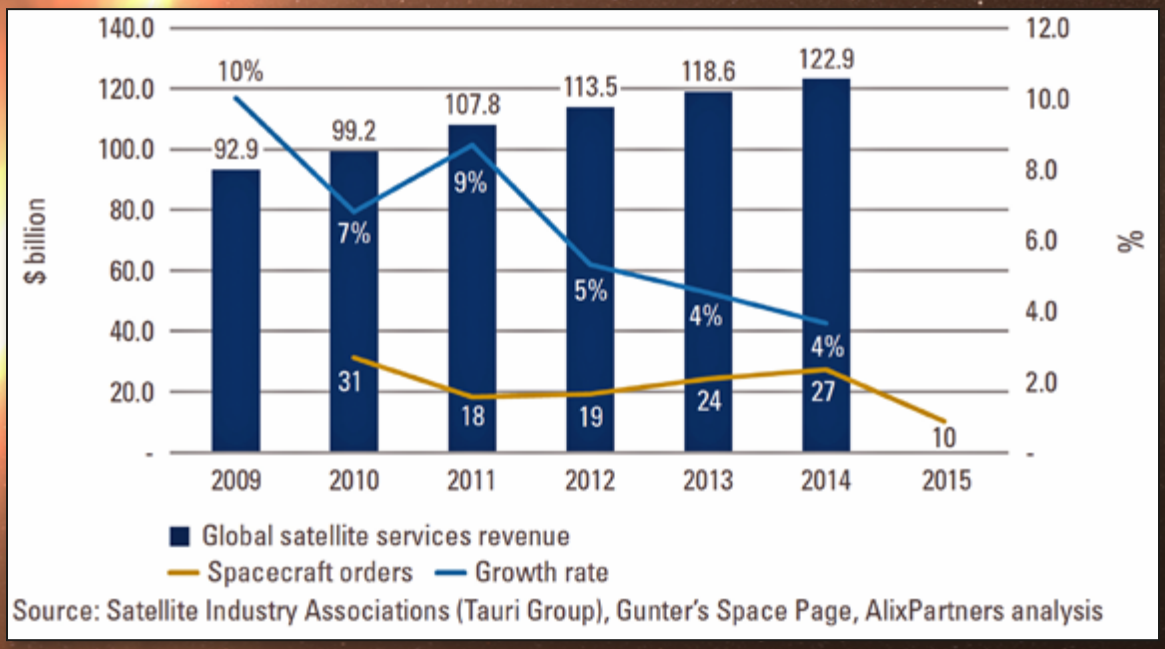

Figure 1. Global geocommunication satellite orders versus global satellite services revenue, 2009–15

The current lineup of competitors, ahead of any industry consolidation, features at least 17 vendors from nine different countries. As the industry reshapes itself, 2016 marks the time they must make changes to improve their ability to compete in the current buyer's market.

Seeing The Forest For The "Disruption" Trees

The past few years have seen an unusually large number of disruptive technology developments. Reusable launchers, digital on-orbit satellite reconfiguration and servicing, 3-D printing manufacturing techniques, nanosatellites, microsatellites (smallsats), and bolt-on payloads all represent significant technological change. Overall, technology changes have been dominating recent discussions and debates within the space industry.

When those discussions turn to business issues, though, they've typically focused on either the economic viability of new technologies or the many recent structural changes in the industry, such as the SSL-MDA merger, the Orbital-ATK merger, the Ariane 6 joint venture between Airbus and Safran, and Lockheed Martin's recent establishment of its satellite R&D lab.

The discussions are failing to address a critical element: Regardless of technological innovations or industry consolidations, technology is evolving so quickly—and user needs and demands are changing so dramatically—that survival requires unprecedented reductions in manufacturing costs and cycle times (*Please see Figure 2 on the next page.*)

Only manufacturers that quickly transition from producing laboratory-built "masterpieces" to producing aerospace-quality industrial output are likely to survive in the hypercompetitive new space market.

Some of the commercial satellite manufacturers have reduced their manufacturing costs by more than 40% versus their most aggressive initial estimates. That dynamic is becoming more pronounced—and more important—in the civil and national security segments as well. Even the national security segment, which requires highly capable and survivable spacecraft, will likely eventually adopt innovations from the commercial segment—specifically, around lead-time reduction. And companies that can incorporate relevant aspects of commercial trends are likely to have a distinct advantage.

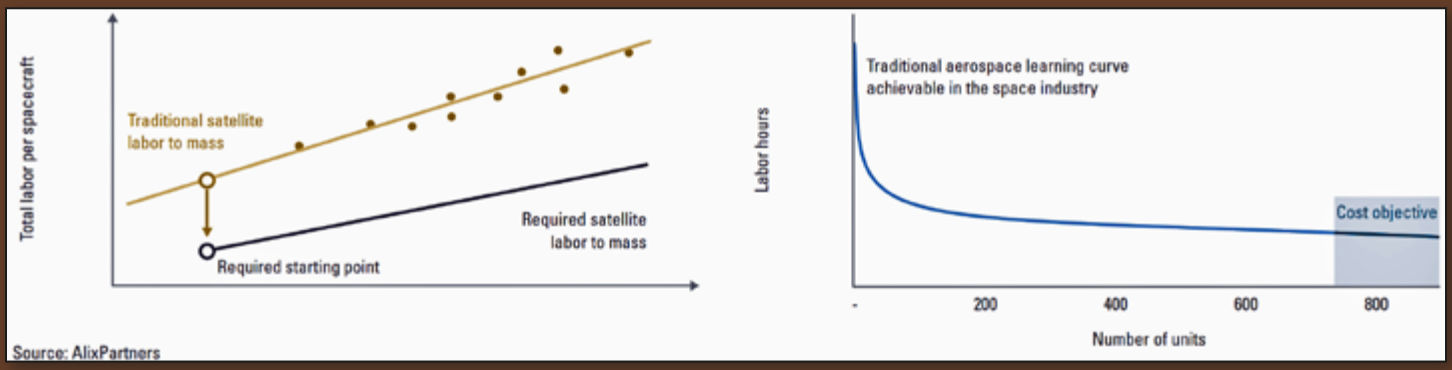

Figure 2. Size matters—from large masterpieces to smaller, industrialized production.

Industrializing Space Manufacturing

Launchers and satellites have typically been "craft built" in very low volumes and at very high prices. High custom-design content drives high engineering costs. The inability to service or otherwise modify products in orbit drives the need for impeccable launch reliability and extremely lengthy in-orbit life spans. That in turn further protracts design times, all of it leading to a vicious cycle of spiraling costs and ballooning requirements.

Current production cycle times of two to three years—an increase over the past decade—are dictated by the necessarily arduous and intricate construction of heavier, more complex satellites (*please see Figure 3*). That dynamic is becoming increasingly unsustainable, yet there's little evidence that the learning curve for that type of production is getting less steep or less expensive. To shorten those manufacturing cycle times and reduce those costs and still maintain the necessary levels of reliability, launcher and satellite manufacturers must adopt industrial techniques that are already commonplace in other sectors of the A&D industry.

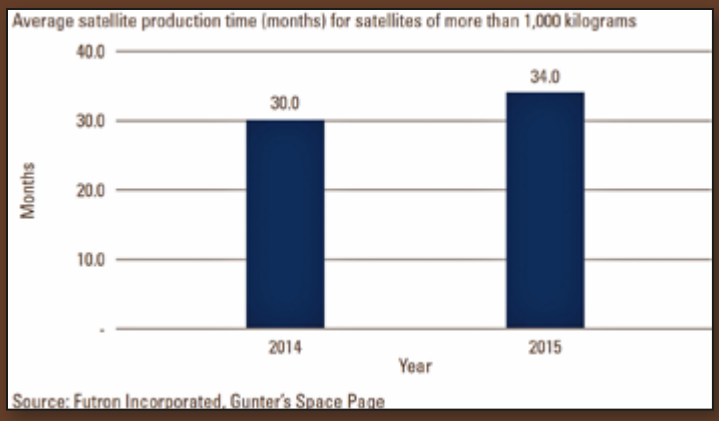

Figure 3. Growth in production times, 2004, 2015.

The space industry can embrace large-volume, high-rate production practices, but their wholesale adoption requires repeatable, producible designs and purpose-built production systems. Some space segment manufacturers have already adopted such practices as parallel pulsed lines, they've eliminated redundant testing, and they've built strategic inventory to reduce cycle times.

Most space manufacturers, however, have treated satellites as custom-built one-off products. It means that costly practices are typically still at work, including redundant testing at the subsystem, system, and final-assembly levels, as well as the imposition of full-range performance requirements for equipment whose expected operation is in a subrange. Space manufacturers impose those costly, time-consuming requirements on their suppliers. But traditional industry thinking has to change if it's to meet the challenges posed by designs, product specifications, manufacturing, and supply chain management practices.

Launching The Industrialized Space Business

Bringing the space industry into alignment with typical aerospace industry learning curves means reconsidering almost everything manufacturers do today. Companies trying to achieve the scale of cost reductions required for genuine transformation must deal with every aspect of satellite and launcher technology, including taking the following steps.

Product specifications and designs

- *Break through organizational impediments and heritage thinking to establish a culture that embraces cost and schedule performance to the same high degree as it does technical excellence*
- *Work with customers to set forth requirements that make the most of cost/performance/schedule trade-offs*
- *Adopt standard, modular designs to reduce (1) costs, (2) schedule time, and (3) lead time*
- *Increase the use of digital technology to minimize design customization*
- *Eliminate or minimize redundant testing as well as component, subassembly, and assembly levels*
- *Eliminate legacy testing protocols based on past singular events*
- *Increase the use of commercial-grade specifications and hardware*

Manufacturing

» *Design production systems that fully incorporate lean manufacturing principles*

» *Use automated, repetitive test methods and protocols*

» *Deploy automation and robotics to improve quality and reduce costs*

» *Dramatically increase use of additive manufacturing and 3-D printing techniques*

» *Design fixtures and tooling that eliminate the need for costly and risky processes, such as the use of cranes }} Design flexible and reconfigurable test equipment*

Supply Chain Management

» *Manage strategic spending with well-established categories*

» *Use make-or-buy decisions to manage supplier price growth*

» *Avoid sole-source-supplier relationships*

» *Shift to build-to-print methods from build-to-spec methods*

» *Hold technical cost reduction exercises and integrate supplier inputs throughout design activities*

» *Work with suppliers to reduce their documentation, testing, and administration costs*

» *Incorporate strong incentives for quality—from production to on-orbit performance*

Remaining to be seen is whether $30 million to $50 million launches or thousand-satellite, LEO constellations will become realities in the near future. Regardless of whether those ventures' business models will be worth the investment or how the profit pool will ultimately get split across the value chain, the space industry is changing irrevocably.

Satellite and launcher manufacturers unable to adapt operations to compete in markets that are beginning to demand dramatic reductions in cost and production lead times are unlikely to survive in the long run.

SpaceX: The Disruptor

Space Exploration Technologies Corporation, commonly known as SpaceX, takes a decidedly private-sector, Silicon Valley—influenced approach to reusable launcher technology.[3] Using a lean organizational model, its reusable vehicle product line may serve as a model for how to change planning, design, and production throughout the sector (*please see Figure 4*).

The company's tight loop between design, manufacturing, and prototype testing supports learning from experience, instead of the more costly approach of trying to anticipate all system interactions in advance. Its products are built with many shared features, mainly in-house, with few subcontractors, using standardization and manufacturing techniques used in other industries. Development costs are about 25 percent of competitors' numbers and operating costs are about 50 percent of other traditional launcher manufacturers.[4]

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[3]*Tim Fernholz, "What it took for Elon Musk's SpaceX to disrupt Boeing, leapfrog NASA, and become a serious space company," Quartz.com, October 21, 2014; http://qz.com/281619/ what-it-took-for-elon-musks-spacex-to-disrupt-boeing-leapfrog-nasa-and-become-a-serious-space-company/.*

[4]*AlixPartners, "Disruptive Innovation in Aerospace and Defense," March 2015; http://www.alixpartners.com/en/LinkClick.aspx?fileticket=uonkB2ORYOE%3d&tabid=635.*

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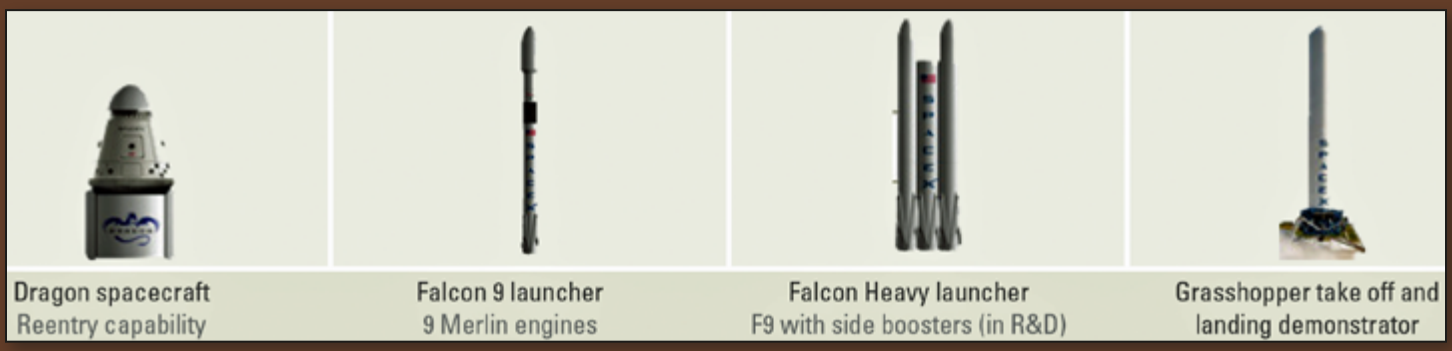

Figure 4. SpaceX: At the frontier of disruption.