

Worldwide Satellite Magazine

October 2013

SatMagazine

LADEE's Lunar Leap
Executive Spotlights
Astrotech's White
Hughes' Slekeys
Broadband For Alaska
Clean Space One
Satellite Industry PR
Alaskan Broadband
Weather Satellites
Also: Heyman + Sadlter
Destroy Debris
IP-Modem Tech

LADEE's launch from
Wallops aboard a
Minotaur V. Photo
courtesy of NASA.



SatMagazine

October 2013

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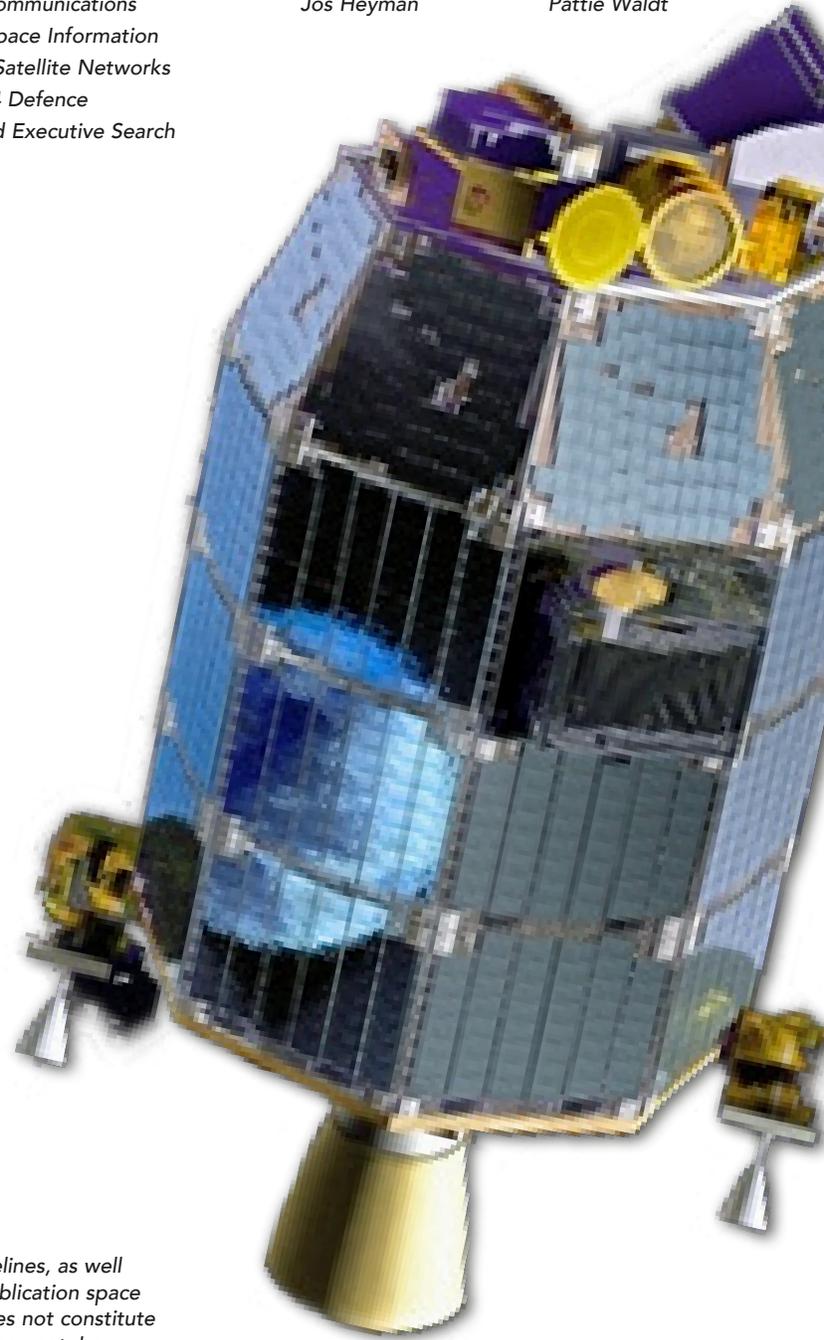
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Inmarsat—Happy Kiwis Will Be Recipients Of Broadband



Inmarsat has announced that Telecom has been awarded the contract to establish and manage one of Inmarsat's Pacific Ocean Region (POR) satellite access stations (SAS) for Global Xpress (GX).

The contract for this POR GX SAS marks an important milestone in the development and deployment of Inmarsat's market-changing GX network, which will deliver the world's first global Ka-band network, providing mobile users with true broadband speeds of up to 50Mbps.

Telecom will develop its Warkworth Satellite Earth Station, located near Auckland on New Zealand's North Island, to host Inmarsat and its GX satellite antenna. Warkworth will act as a co-primary GX SAS for the POR, alongside Inmarsat's own Land Earth Station and Teleport based in Auckland. Both will act as gateways between the broadband traffic routed via the POR satellite and terrestrial fixed networks.

Nick Clarke, Telecom's GM Wholesale and International, said, "The scale of this project reinforces that New Zealand can meet demand for security of international bandwidth supply at competitive prices. In choosing a location for a satellite Earth station it needs to be cost-effective and have reliable connectivity to the rest of the world. Given the scale, we had to prove our capability at our Satellite Earth Station as well as our National Transport Service, which will backhaul the satellite data when it hits Earth and carry it internationally on the Southern Cross Cable."

"The GX development program is on time and on budget," said Leo Mondale, Managing Director, Growth Management & Support (GMS), Inmarsat. "The sites for all six GX satellite access stations have now been selected and operational readiness is well advanced on the stations supporting our first Inmarsat-5 satellite serving the Indian Ocean Region, which we expect to launch around the turn of the year."

The full Inmarsat-5 constellation is on course to be deployed by the end of 2014, providing a single global broadband service which can be accessed by users on land, at sea and in the air. The satellites are currently under construction or testing at Boeing Space and Intelligence Systems' (S&IS) El Segundo facility in California.

Three Boeing 702HP satellites will provide new Ka-band high-data-rate mobile communications services.

Continuing a relationship spanning three decades, Inmarsat, the leading provider of global mobile satellite communications services, returned to Boeing in August 2010 to order three 702HP spacecraft to provide its new Ka-band global and high-capacity satellite services.

The new satellites will join Inmarsat's fleet of 10 geostationary satellites that provide a wide range of voice and data services through an established global network of distributors and service providers.

Each Inmarsat-5 satellite will carry 89 Ka-band beams that will operate in geosynchronous orbit with flexible global coverage. The satellites are designed to generate approximately 15 kilowatts of power at the start of service and approximately 13.8 kilowatts at the end of their 15-year design life. To generate such high power, each spacecraft's two solar wings employ five panels each of ultra triple-junction gallium arsenide solar cells. The Boeing 702HP carries the xenon ion propulsion system (XIPS) for all on-orbit maneuvering. When operational, the Inmarsat-5 satellites will provide Inmarsat with a comprehensive range of global mobile satellite services, including mobile broadband communications for deep-sea vessels, in-flight connectivity for airline passengers and streaming high-resolution video, voice and data.

Blue Sky Network—This Bird Flies + Tracks



Blue Sky Network, a principal supplier of satellite tracking and communication solutions for aviation, land and marine, has announced the launch of the HawkEye 7200 portable M2M tracking solution.

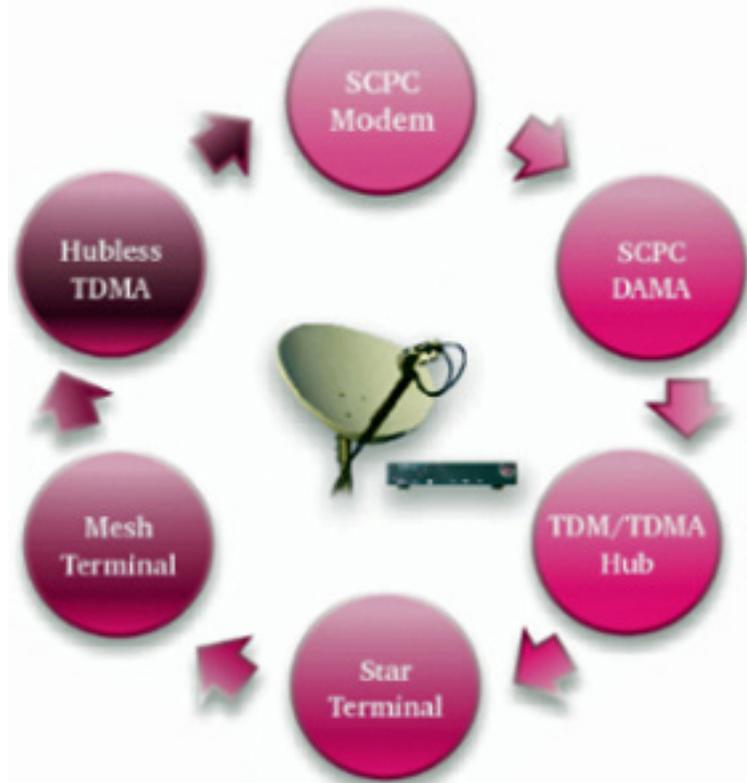
The HawkEye 7200 includes features such as multi-national global navigation satellite system (GNSS) receiver support and integrated Bluetooth for Iridium connectivity to smart devices. Designed in a small form factor, the HawkEye 7200 can be powered by battery or via an external power source and is a key addition to Blue Sky Network's solutions portfolio extending the reach of smart device communications globally anywhere in the world.

The HawkEye 7200 is Blue Sky Network's first product to incorporate a multi-national GNSS receiver. It combines the major GNSS providers into a single location-based chip that can be used in other parts of the world including GLONASS for Russia and the GALILEO

for the European Union. This multi-national GNSS receiver feature enables fleet operators with globally dispersed assets to obtain position reports with increased accuracy and performance. When used with New SkyRouter, Blue Sky Network's cloud-based web-portal, the HawkEye 7200 offers portable tracking and resource management of any asset type across the globe. The HawkEye 7200 hosts an RS232 interface and digital inputs/outputs for connectivity and control of external sensors or other telematics devices.

With the integrated Bluetooth connectivity, the HawkEye 7200 supports Blue Sky Network's new iPhone/iPad application. The application allows users to send emails, short-code messages and customizable electronic forms through the Iridium network. With the ability for operators to build and fully customize forms—such as flight plans, maintenance records, and logistic records of remote assets—HawkEye 7200 supports the industry's movement towards paperless fleet operations.

Romantis—Reflecting Clients' Confidence



Romantis, a global provider of satellite services and networking equipment, has recently received significant new orders for its UHP (Universal Hardware Platform) satellite products from the leading U.S. and Canadian satellite operators and system integrators.

The orders, valued at close to \$500,000, are scheduled for delivery in the coming months. Applications include enterprise networks as well as data and voice trunking and broadcast networks.

Romantis customers select UHP technology after extensive tests,

which confirmed its advantages over the competition. The advantages include a higher processing capability (60,000 packets per second or over 100 compressed VoIP calls); unique versatility (100 percent software defined; real-time switchover between modes of operation (such as SCPC and TDMA), superior efficiency (96 percent efficient TDMA protocols) and scalability.

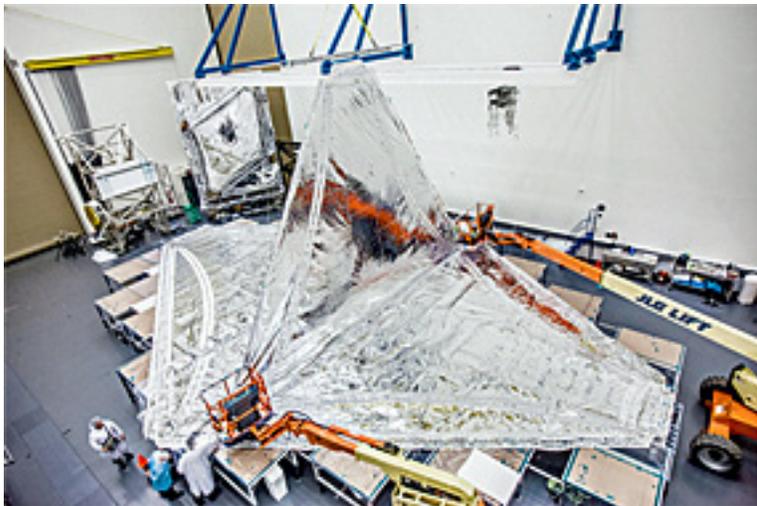
“We are pleased with the growing acceptance of the UHP technology by major companies in the U.S. and Canada, known for their innovation and entrepreneurship. These customers recognized the value of the technology which is both high-performance and cost-disruptive. They also recognized our ability to deliver the equipment with a very short lead time, and to provide training and to support installation and deployment of customer networks. This provides Romantis with a strategic opportunity to further expand its presence in the dynamic North American market,” stated Dr. Vagan Shakhgildian, President and CEO of Romantis Inc.

Romantis UHP is a high-throughput, ultra-compact VSAT platform. The platform features software-selectable, universal functionality supporting SCPC links, Hub-centric TDM/TDMA and Hubless TDMA networking.

There are more than 90 networks with 6000 terminals deployed worldwide.

- Romantis UHP - universal, compact, high-throughput VSAT platform, comprising all network elements: Hubs, terminals and management system
- Software-selectable, universal functionality supporting SCPC links, Hub-centric TDM/TDMA and Hubless TDMA networking
- Allows deploying satellite networks of any topology, including point-to-point, “star”, “mesh” or complex hierarchy
- True bandwidth-on-demand with intelligent Quality of Service management and hierarchical traffic shaper
- Based on the latest modulation and coding technologies, ensuring highly-efficient use of satellite bandwidth
- Inexpensive, scalable and flexible VSAT with industry-best cost of ownership

Northrop Grumman + NeXolve—Templates Completed



Technicians at Northrop Grumman's Space Park facilities in Redondo Beach, California, are conducting tests to ensure the Webb Telescope's sunshield membrane layers meet flight performance requirements.

NASA's James Webb Space Telescope is dominated visually by the tennis-court sized sunshield, which separates the observatory into a warm sun-facing side and a cold anti-sun side.

Each of the five sunshield layers helps to protect the telescope optics—or mirrors—from the sun's heat. Northrop Grumman Corporation and teammate NeXolve Corporation, a subsidiary of ManTech International Corporation, based in

Huntsville, Alabama, completed the manufacturing of all template layers for the Webb Telescope sunshield.

The James Webb Space Telescope will be pointed so that the Sun, Earth and Moon are always on one side, and the sunshield will act like a parasol, keeping the optics and science instruments cool by keeping them in the shade and protecting them from the heat of the sun and warm spacecraft electronics. The sunshield will allow the telescope to cool down to a temperature below 50 Kelvin (equal to -370 degree F, or -223 degree C) by passively radiating its heat into space.

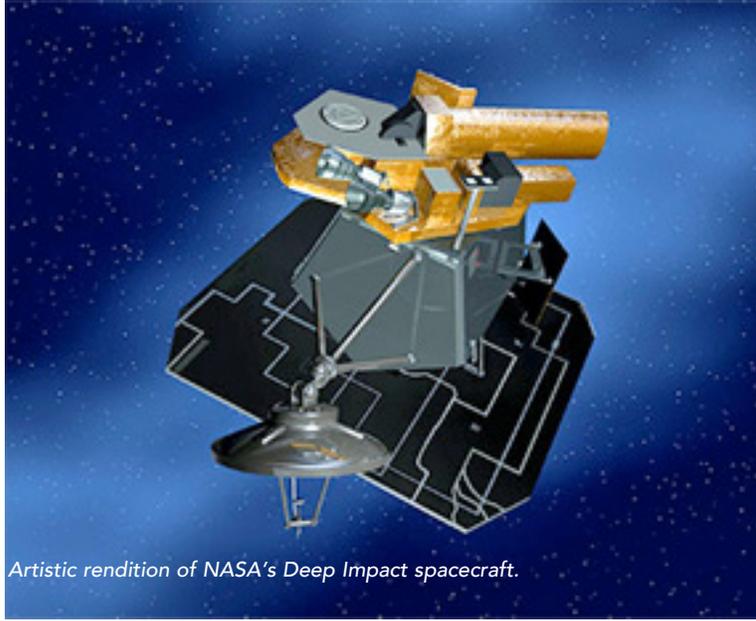
The template layers are the last step before manufacturing the final flight sunshield layers. After successful completion of a manufacturing readiness review, the team is now ready to produce the final flight layers. Northrop Grumman is under contract to NASA's Goddard Space Flight Center in Greenbelt, Maryland, for the design and development of the Webb Telescope's optics, sunshield and spacecraft. NeXolve is subcontractor to Northrop Grumman to manufacture the one-of-a-kind sunshield membranes.

The sunshield template layers have the same design and manufacturing processes as the final flight layers.

Each layer has been individually shape-tested to verify that they were built to requirements. As all five template layers are being subsequently tested at Northrop Grumman's Space Park facilities to ensure the membranes meet flight performance requirements, NeXolve is beginning manufacturing of the final flight layers. Technicians at Northrop Grumman are also practicing folding and unfolding the five layers by hand on a test bed.

The Webb Telescope will primarily observe infrared light from faint and very distant objects. In order to detect infrared light, the optics have to be cold; thus, the sunshield passively cools the telescope to a temperature of -375 degrees F, preventing the observatory's own heat from “blinding” its infrared sensing instruments. The sunshield membrane layers, each as thin as a human hair, are made of Kapton®, a tough, high-performance plastic coated with a reflective metal. On-orbit, the observatory will be pointed so that the Sun, Earth and Moon are always on one side, with the sunshield acting as an umbrella to shade the telescope mirrors and instruments from the warmer spacecraft electronics and the sun.

NASA-Deep Impact's Superb Service Comes To A Close



Artistic rendition of NASA's Deep Impact spacecraft.

After almost nine years in space that included an unprecedented July 4th impact and subsequent flyby of a comet, an additional comet flyby, and the return of approximately 500,000 images of celestial objects, NASA's Deep Impact mission has ended.

The project team at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, has reluctantly pronounced the mission at an end after being unable to communicate with the spacecraft for over a month. The last communication with the probe was August 8th. Deep Impact was history's most traveled comet research mission, going about 4.7 billion miles (7.58 billion kilometers).

"Deep Impact has been a fantastic, long-lasting spacecraft that has produced far more data than we had planned," said Mike A'Hearn, the Deep

Impact principal investigator at the University of Maryland in College Park. "It has revolutionized our understanding of comets and their activity."

Deep Impact successfully completed its original bold mission of six months in 2005 to investigate both the surface and interior composition of a comet, and a subsequent extended mission of another comet flyby and observations of planets around other stars that lasted from July 2007 to December 2010. Since then, the spacecraft has been continually used as a spaceborne planetary observatory to capture images and other scientific data on several targets of opportunity with its telescopes and instrumentation.

Launched in January 2005, the spacecraft first traveled about 268 million miles (431 million kilometers) to the vicinity of comet Tempel 1. On July 3, 2005, the spacecraft deployed

an impactor into the path of the comet to essentially be run over by its nucleus on July 4. This caused material from below the comet's surface to be blasted out into space where it could be examined by the telescopes and instrumentation of the flyby spacecraft. Sixteen days after that comet encounter, the Deep Impact team placed the spacecraft on a trajectory to fly back past Earth in late December 2007 to put it on course to encounter another comet, Hartley 2 in November 2010.

"Six months after launch, this spacecraft had already completed its planned mission to study comet Tempel 1," said Tim Larson, project manager of Deep Impact at JPL. "But the science team kept finding interesting things to do, and through the ingenuity of our mission team and navigators and support of NASA's Discovery Program, this spacecraft kept it up for more than eight years, producing amazing results all along the way."

The spacecraft's extended mission culminated in the successful flyby of comet Hartley 2 on November 4, 2010. Along the way, it also observed six different stars to confirm the motion of planets orbiting them, and took images and data of the Earth, the Moon and Mars. These data helped to confirm the existence of water on the Moon, and attempted to confirm the methane signature in the atmosphere of Mars. One sequence of images is a breathtaking view of the Moon transiting across the face of Earth.

In January 2012, Deep Impact performed imaging and accessed the composition of distant comet C/2009 P1 (Garradd). It took images of comet ISON this year and collected early images of comet ISON in June.

After losing contact with the spacecraft last month, mission controllers spent several weeks trying to uplink commands to reactivate its onboard systems. Although the exact cause of the loss is not known, analysis has uncovered a potential problem with computer time tagging that could have led to loss of control for Deep Impact's orientation. That would then affect the positioning of its radio antennas, making communication difficult, as well as its solar arrays, which would in turn prevent the spacecraft from getting power and allow cold temperatures to ruin onboard equipment, essentially freezing its battery and propulsion systems.

"Despite this unexpected final curtain call, Deep Impact already achieved much more than ever was envisioned," said Lindley Johnson, the Discovery Program Executive at NASA Headquarters, and the Program Executive for the mission since a year before it launched. "Deep Impact has completely overturned what we thought we knew about comets and also provided a treasure trove of additional planetary science that will be the source data of research for years to come."

The mission is part of the Discovery Program managed at NASA's Marshall Space Flight Center in Huntsville, Alabama. JPL manages the Deep Impact mission for NASA's Science Mission Directorate in Washington. Ball Aerospace & Technologies Corp. of Boulder, Colorado, built the spacecraft.

SES + Arqiva—Tying Into Transponders



SES has signed a new, long-term, multiple transponder contract with Arqiva to serve that firm's television and radio customers in the UK and Ireland.

With its fleet positioned at 28.2 degrees East, SES has served more than 12 million satellite households in the UK and Ireland at year-end 2012.

"Our investment in the complete renewal of our fleet at the 28.2 degrees neighbourhood and our access to additional frequencies at this neighbourhood, give Arqiva an ideal base to serve its wide range of broadcasting clients and to address large audiences in the UK and Ireland," said Ferdinand Kayser,

Chief Commercial Officer of SES. "This new contract underlines the attractiveness of our satellite offering for the UK and Irish market and is a strong component of our long-standing partnership with our valued customer Arqiva."

Barrie Woolston, Commercial Director, Satellite and Media for Arqiva said of the agreement, "Arqiva is dedicated to providing the very best service for our customers and this requires a global and flexible satellite solution. This new contract with SES will provide us the capacity to achieve this."

Thuraya—Moving On Up

Thuraya Telecommunications Company has announced that Randy C. Roberts has joined the Company as Vice President of Innovation.

In this newly created role, Roberts will oversee product development, product management and solutions engineering. Roberts will report to Samer Halawi, Chief Executive Officer of Thuraya and will serve as a member of the Company's Executive Team.

"I am pleased to welcome Randy Roberts as Vice President of Innovation," said Halawi. "His extensive experience in product development and management with leading handset OEMs will be a strong asset for Thuraya as we drive new product innovation and expand our offerings, including the Thuraya SatSleeve to new audiences and new sectors."

Roberts is a seasoned telecommunications executive with over 25 years of experience at

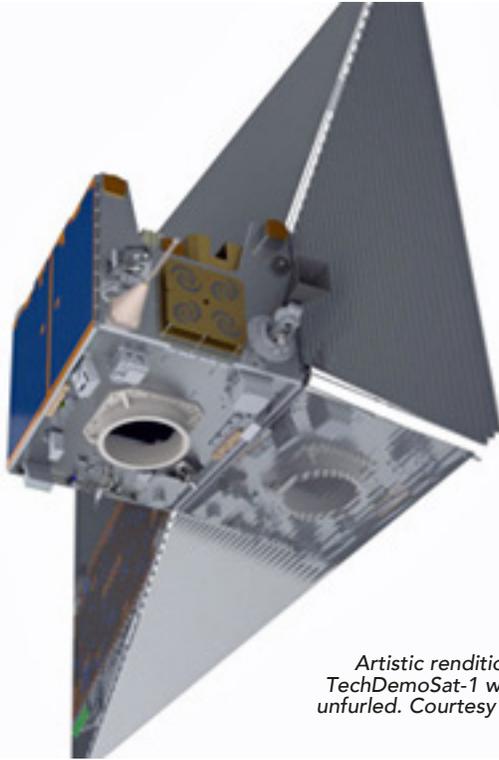
leading mobile device manufacturers. He brings to Thuraya a wealth of experience in application, hardware and software development, in addition to a strong background in product development and management.

Roberts joins Thuraya from Siemens Enterprise Communications where he was the Vice President of their Global Mobile Product Portfolio.



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SSTL—Sailing For Re-Entry Success

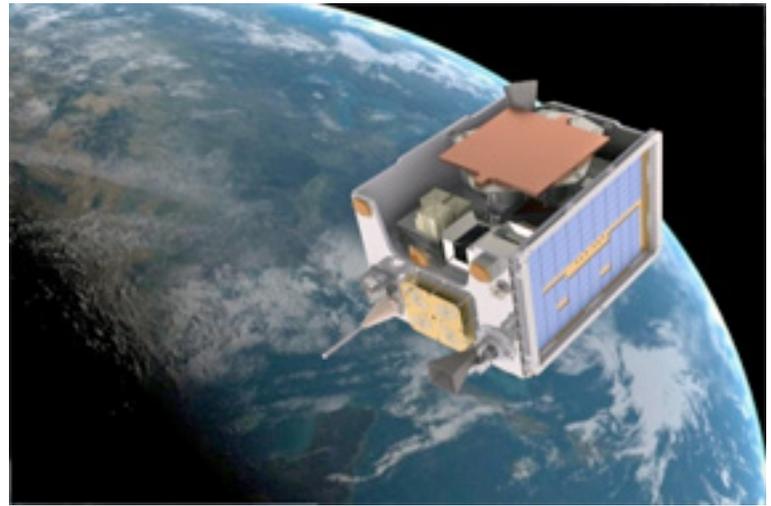


Artistic rendition of TechDemoSat-1 with sails unfurled. Courtesy of SSTL.

Space Debris is becoming an increasingly worrying problem for the space industry. Various methods for bringing inactive satellites back to burn up in the Earth's atmosphere are being considered by satellite operators.

TechDemoSat-1 will be escorted back in to the Earth's atmosphere by one of its eight payloads, a specialized de-orbit sail designed by Cranfield University's Space Group Team.

The de-orbit sail is the product of several years of Cranfield University's work on sustainable approaches to space exploration. SSTL's TechDemoSat-1 gave the Cranfield team the unique opportunity to take-on the challenge of evolving their ideas from designs on paper, to flight-ready hardware. Maintaining a low mass is always a challenge with space projects; the TechDemoSat-1 de-orbit sail is made from a material called Kapton, which is just one thousandth of an inch, or 25 micron, thick.



Stephen Hobbs, who led the project for Cranfield University, said: "The main challenges were the short timescale, and coordinating all the different elements which were new to us as we moved from just doing paper studies to producing real flight hardware. Individually, several of us had practical project experience including previous space missions, but it was the first flight hardware project for the Space Group as a team."

The sail will be deployed when TechDemoSat-1 issues a command at the end of its mission. This command will trigger cable cutters to be fired, which will release a restraining belt, and the sail will then be deployed by stored spring energy. Cranfield's payload will then take up to 25 years to safely guide the TechDemoSat-1 spacecraft into the Earth's atmosphere to disintegrate.

Exactly how long Cranfield's de-orbit sail will take to complete the satellite's course back into our atmosphere will be a subject of great importance to those interested in the management of space debris and the continued exploration and use of space. This process will be affected by a range of things including the amount of solar activity that it is being exposed to, and what altitude the satellite is at when the sail is deployed.

SSTL hopes that TechDemoSat-1, through offering organizations the rare opportunity to demonstrate their payload's abilities in space, will help the collaborating organizations win substantial international business. TechDemoSat-1 is due for launch later this year.

Gilat (Wavestream)—Adding A BUC To The Matchbox



Gilat Satellite Networks Ltd. has released to the market their Wavestream Ka-band Matchbox Mini Block Upconverter.

The Matchbox Mini incorporates Wavestream's Spatial advantEdge™ technology to provide higher output power in smaller, lighter weight packages that are more reliable and use less energy.

The Ka- Matchbox Mini is the next evolution in the Wavestream Matchbox series. The Mini product retains all the features and improves on the performance of its Ka-band predecessor while being one-third (1/3) the size, one-third (1/3) the weight and twice (2x) the linear output power.

The Matchbox features:

- Groundbreaking compact 8W Linear
- Low power draw, high MTBF (mean time between failures)
- Flexible, modular feed-mount design—small enough to fit any antenna

- Switchable bands cover both Ka- Commercial and Ka- Military bands in the same unit

Wavestream products are biased for Class AB operation, drawing less power when backed off to help save valuable energy resources. They generate less heat, ensuring a higher MTBF for greater reliability and lower lifecycle costs. The Ka- Matchbox Mini joins the Matchbox family and is available for order now.

"In creating the Ka- Matchbox Mini, we leveraged the experience gained in fielding over 4,500 50W Ka-band BUCs and over 8,000 Ku-band BUCs," said Fran Auricchio, President and CEO of Wavestream. "The smaller and lighter Mini retains all the features, high reliability and dependability our customers have come to expect, in a more compact and powerful BUC."

Astrium—SWARM Participants En Route To Plesetsk



The first of the three Astrium-built Swarm research satellites is on its way to the Plesetsk Cosmodrome.

An Ilyushin-76, headed for Russia, took off from Munich Airport with the first satellite, while the remaining two satellites, plus the test and installation equipment, will follow at two-day intervals. This amounts to a total of 63 tons of freight.

The trio of satellites will be launched simultaneously from Plesetsk (around 800 kilometers northeast of Moscow) on a single Rocket launch vehicle in November 2013.

Astrium is the European Space Agency's (ESA) prime contractor for the Swarm mission. The purpose of the Swarm mission is to analyze, in unprecedented detail, the geomagnetic field and its evolution. The findings will help improve our understanding of the Earth's inner workings and its interaction with the space environment.

The three identical Swarm satellites will be launched into a polar orbit at an altitude of 490 kilometers and will carry out the most accurate survey to date of the Earth's magnetic field and its changes. Swarm will, in a manner of speaking, follow in the footsteps of Jules Verne's novel "Journey to the Centre of the Earth."

Today, however, it is not always necessary to dig or drill to take a closer look at the composition and workings of the Earth's interior. Thanks to the development of 'satellite remote sensing', Swarm can achieve this goal from orbit.

The Earth's gravitational and magnetic fields offer direct insights into the workings of its interior: from the variations these fields display at different times and places, scientists can draw conclusions about the dynamic processes taking place deep beneath the planet's surface, in the outer core.

Extremely accurate, high-resolution readings of the geomagnetic field's strength, orientation and fluctuations, complemented by precise navigation and velocity data, along with measurements of the electric field intensity, will provide the observational data required to distinguish between the various sources of the geomagnetic field and to explain them through models.

Observation of these aspects from space offers a unique opportunity to take a closer look both at the composition of the interior of our planet and at the processes at work there.

The mission will also enable scientists to analyze the Sun's influence on the Earth. In addition, improvements in our knowledge of the geomagnetic field are expected to provide benefits of a practical nature, such as more accurate navigation for ships and aircraft, the discovery and access to natural resources below the Earth's surface, improved global weather forecasting, and timely warnings of dangerous solar radiation.

Astrium began developing its first satellite for magnetic field research in deep space—the ISEE-B—back in the late 1970s. This work has continued with the development of the four-satellite Cluster constellation which has been in orbit and operating since 2000. In the field of low Earth orbit satellites, the German Champ satellite, which collected data from 2000 to 2010, was built to an Astrium design.

The Swarm constellation is now the logical next step down this path. In terms of technology, Swarm has benefited from the legacy of both the Champ satellite and Cryosat, the polar ice research satellite—both projects led by Astrium.

Swarm is the 'Three-satellite-mission' in ESA's 'Living Planet' program. Its mission is to study the Earth's magnetic field. In its role as industrial prime contractor, Astrium (Friedrichshafen) is responsible for developing and building the Swarm satellites.



Polar mesospheric clouds—also known as noctilucent, or “night shining” clouds—are formed above the Earth’s surface near the mesosphere-thermosphere boundary of the atmosphere, a region known as the mesopause. (Photo: Image Science and Analysis Laboratory, NASA-Johnson Space Center. “The Gateway to Astronaut Photography of Earth.”)

Scientists at the U.S. Naval Research Laboratory (NRL) have determined that there has been an increase in bright polar mesospheric clouds (PMCs) in the last two years, an unexpected result since these clouds are generally thought to be less prevalent during conditions of high solar activity which acts to destroy the tiny ice particles.

Their research suggests that the man-made effect of water released by exhaust from space traffic during recent years has overwhelmed the effect of higher solar activity. This research was published in the June 6, 2013, issue of *Geophysical Research Letters*.

“This new understanding of weather at the edge of space serves to test high altitude weather and climate models of the upper atmosphere, including the co-located D&E-regions of the ionosphere which is critical for improving models of over-the-horizon-radar (OTHR) propagation,” explains NRL’s Dr. David Siskind, a scientist in NRL Space Science Division and principal investigator for the research.

Each summer, the Arctic and Antarctic atmospheres at very high altitudes (the upper mesosphere, 80 to 100 km) become extremely cold with temperatures well below -100°C, despite the presence of 24 hours of sunlight. These very low temperatures allow the atmosphere to become supersaturated, and enable thin, wispy ice clouds to condense on nuclei of meteoric dust and smoke particles.

Due to the possibility that this region of the atmosphere may be changing due to man-made effects, NASA launched a dedicated satellite, the Aeronomy of Ice in the Mesosphere (AIM) mission six years ago. Scientists used the AIM data to test atmospheric analyses provided by special high altitude prototype versions of the then-operational Navy Global Forecast System (NOGAPS).

Previous studies by NRL scientists had shown this high altitude version of NOGAPS could demonstrate how variations in lower atmospheric weather conditions thousands of miles away might “teleconnect” to the Arctic and cause PMCs to vary.

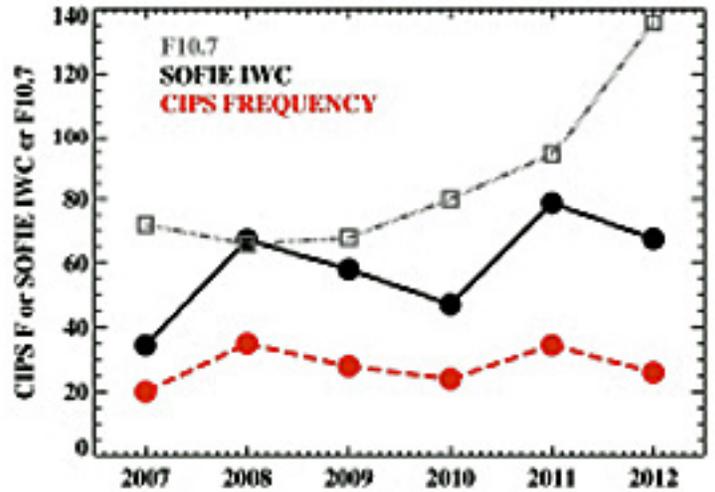
NRL scientists also believe that weather at the edge of space is sensitive to solar activity. An increase in the ultraviolet output of the sun can cause small temperature increases—NRL scientists expected these temperature increases to inhibit the formation of ice particles. In addition, increased ultraviolet light from the sun destroys water vapor molecules, making the already bone dry upper atmosphere even drier.

Solar activity was unusually low for the first four years of the AIM mission, from 2007 to 2010, but has increased in the last two years.

Before the AIM mission, researchers estimated that the clouds should have decreased by 20 to 30 percent because of the high solar activity. Researchers were quite surprised to see that the occurrence of PMCs remained high and even increased. By studying the frequency and ice water content (IWC, which is a measure of cloud brightness) of the ice with weather conditions in the lower stratosphere, scientists see irregularities between the 2011 and 2012 measurements compared with measurements from the previous four years.

Instead of 20 to 30 percent decreases, they saw up to 30 percent increases.

Researchers suggest that the explanation lies in a water vapor source from rocket exhaust. NRL scientists were the first to discover that individual PMCs could be formed by the exhaust from the space shuttle. Those earlier studies also suggested that these effects might appear in the long-term PMC record.



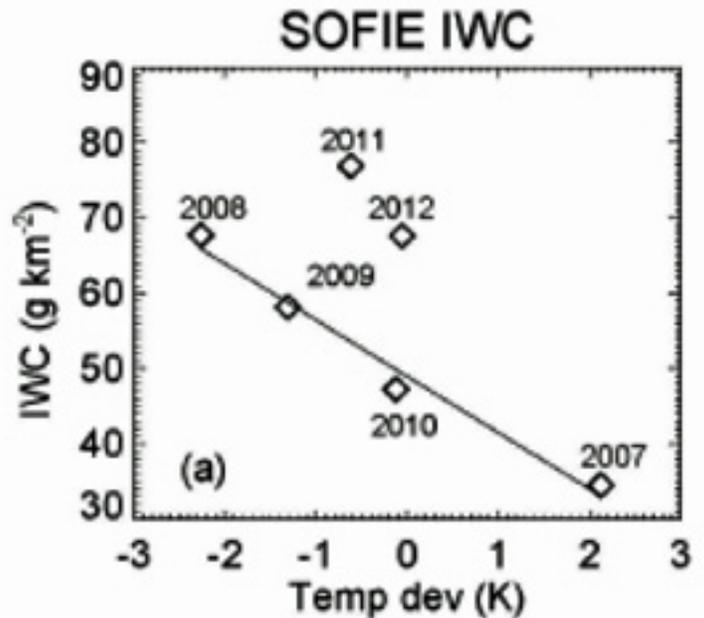
Variation of mid summer polar mesospheric clouds observed by two instruments on the NASA AIM satellite from 2007-2012. The Solar Occultation for Ice Experiment (SOFIE) measures ice water content (IWC) which is a proxy for cloud brightness; the Cloud Imaging and Particle Size Experiment (CIPS) records the frequency of occurrence. (Image courtesy of the Naval Research Lab)

The new results confirm that suggestion and also suggest that this effect can dwarf that from solar cycle variations. A record of H₂O injected into the upper atmosphere by space traffic over the six-year period from 2007 to 2012 shows low amounts from 2007 to 2010 and then large increases in 2011 to 2012, precisely what is needed to explain the inconsistent PMCs.

NRL scientists are particularly interested in the 2012 anomaly as it occurred after the termination of the shuttle program.

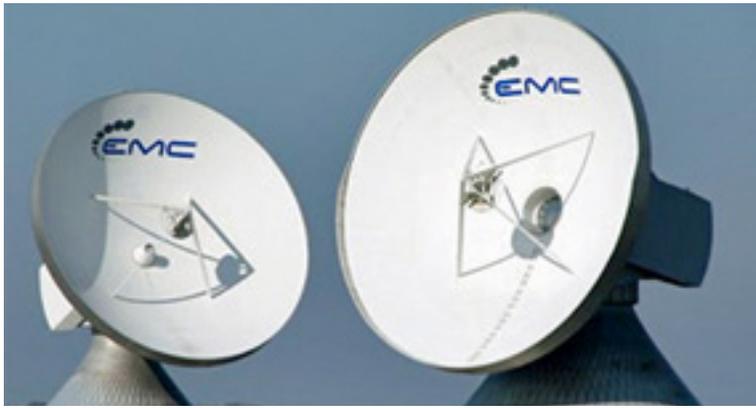
Thus the possibility that the space traffic contribution to PMCs may persist post-shuttle is one that will be of intense interest as new data is studied over the next several years.

Information for this story was provided by the Naval Research Lab.



The ice water content (IWC) from the SOFIE instrument on AIM shows that cloud brightness varied linearly with stratospheric temperatures (the x-axis is a measure of these temperatures) for the first 4 summers of the AIM mission. The excess cloud water content seen in 2011 and 2012 is clearly displayed. Based upon theories of solar cycle activity, IWC values of about 40 were expected for 2011 and 2012. (Photo: U.S. Naval Research Laboratory)

EMC + STM—An Acquisition Of Note



Emerging Markets Communications (EMC) has acquired STM and its affiliate entities Global IP and Vodanet Brazil.

Global IP is a global satellite connectivity services provider, specializing in the mobility, maritime and oil and gas markets. Vodanet serves as an operating company in Brazil and is fully licensed to provide VSAT services both onshore and offshore.

STM is a leading hardware manufacturing company for the satellite industry with proven experience developing high quality and bandwidth-efficient, VSAT products based on the DVB-RCS2 standard. The combined organization has over 20 years of industry experience in 150 countries with over 150,000 VSAT terminals deployed in to service.

EMC's unique satellite connectivity offering now includes a global C- and Ku-band footprint for high availability enterprise networks with the largest number of wholly-owned field support locations in the industry. EMC owns and manages 32, in-country, field support centers worldwide.

These support centers are staffed with EMC-certified engineers, spare parts, test equipment and manage all logistics in deploying, maintaining and repairing services for onshore and offshore customers.

Additional mobility customers include fishing boats, ferries, high-speed trains and helicopters. These customers leverage EMC's wholly-owned support centers and global Ku-band and C-band networks to maximize their business performance on land, in the air or at sea.

EMC's additional geographic locations broaden its reach in servicing customers worldwide. In addition to being the largest VSAT provider in Africa, EMC now has a solidified presence in Latin America, Europe, the Middle East and Indonesia, creating a complete global network with 32 wholly-owned support centers worldwide.

Brazil, a key market for oil and gas, EMC is now one of the only global providers with a direct, Anatel-approved, VSAT license for delivering services in the country, both onshore and offshore.

EMC also has in-country teleport infrastructure and field support offices in Rio, Sao Paulo, Brazilia and Belo Horizonte, equipped with engineers to quickly respond to customer demands. In Brazil, EMC has approximately 8,000 VSAT terminals in service for the oil and gas, telecom, and government industries.

Technology Leader EMC's research and development facilities in United States and India, and its 18 patented

technologies, combined with STM's research and development facilities in Norway and innovative design and manufacturing of high quality, bandwidth-efficient satellite systems, positions EMC as a leading provider of the DVB-RCS2 standard.

EMC's patented bandwidth technology will optimize the SatLink™ networking system in providing IP-based voice, data, interactive video, mobility and Coms-On-The-Move (COTM) solutions for mobility customers and SatLink™ users in general.

M.I.T.—Greater Reach For CubeSats



View of a CubeSat equipped with an inflated antenna, in a NASA radiation chamber. (Credit: Alessandra Babuscia)

The future of satellite technology is getting small—about the size of a shoebox, to be exact. These so-called “CubeSats,” and other small satellites, are making space exploration cheaper and more accessible: The minuscule probes can be launched into orbit at a fraction of the weight and cost of traditional satellites.

But with such small packages come big limitations—namely, a satellite’s communication range. Large, far-ranging radio dishes are impossible to store in a CubeSat’s tight quarters. Instead, the satellites are equipped with smaller, less powerful antennae, restricting them to orbits below those of most geosynchronous satellites.

Now researchers at MIT have come up with a design that may significantly increase the communication range of small satellites, enabling them to travel much farther in the solar system: The team has built and tested an inflatable antenna that can fold into a compact space and inflate when in orbit.

The antenna significantly amplifies a radio signal, allowing a CubeSat to transmit data back to Earth at a higher rate. The distance that can be covered by a satellite outfitted with an inflatable antenna is seven times farther than that of existing CubeSat communications.

“With this antenna you could transmit from the moon, and even farther than that,” says Alessandra Babuscia, who led the research as a postdoc at MIT. “This antenna is one of the cheapest and most economical solutions to the problem of communications.”

The team, led by Babuscia, is part of Professor Sara Seager’s research group and also includes graduate students Benjamin Corbin, Mary Knapp, and Mark Van de Loo from MIT, and Rebecca Jensen-Clem from the California Institute of Technology. The researchers, from MIT’s departments of Aeronautics and Astronautics and of Earth, Atmospheric and Planetary Sciences, have detailed their results in the journal *Acta Astronautica*.

An inflatable antenna is not a new idea. In fact, previous experiments in space have successfully tested such designs, though mostly for large satellites: To inflate these bulkier antennae, engineers install a system of pressure valves to fill them with air once in space—heavy, cumbersome equipment that would not fit within a CubeSat’s limited real estate.

Babuscia raises another concern: As small satellites are often launched as secondary payloads aboard rockets containing other scientific missions, a satellite loaded with pressure valves may backfire, with explosive consequences, jeopardizing everything on board. This is all the more reason, she says, to find a new inflation mechanism.

The team landed on a lighter, safer solution, based on sublimating powder, a chemical compound that transforms from a solid powder to a gas when exposed to low pressure.

“It’s almost like magic,” Babuscia explains. “Once you are in space, the difference in pressure triggers a chemical reaction that makes the powder sublimate from the solid state to the gas state, and that inflates the antenna.”

Babuscia and her colleagues built two prototype antennae, each a meter wide, out of Mylar; one resembled a cone and the other a cylinder when inflated. They determined an optimal folding configuration for each design, and packed each antenna into a 10-cubic-centimeter space within a CubeSat, along with a few grams of benzoic acid, a type of sublimating powder. The team tested each antenna’s inflation in a vacuum chamber at MIT, lowering the pressure to just above that experienced in space. In response, the powder converted to a gas, inflating both antennae to the desired shape.

The group also tested each antenna’s electromagnetic properties—an indication of how well an antenna can transmit data. In radiation simulations of both the conical and cylindrical designs, the researchers observed that the cylindrical antenna performed slightly better, transmitting data 10

times faster, and seven times farther, than existing CubeSat antennae.

An antenna made of thin Mylar, while potentially powerful, can be vulnerable to passing detritus in space. Micrometeoroids, for example, can puncture a balloon, causing leaks and affecting an antenna’s performance. But Babuscia says the use of sublimating powder can circumvent the problems caused by micrometeoroid impacts. She explains that a sublimating powder will only create as much gas as needed to fully inflate an antenna, leaving residual powder to sublimate later, to compensate for any later leaks or punctures.

The group tested this theory in a coarse simulation, modeling the inflatable antenna’s behavior with different frequency of impacts to assess how much of an antenna’s surface may be punctured and how much air may leak out without compromising its performance. The researchers found that with the right sublimating powder, the lifetime of a CubeSat’s inflatable antenna may be a few years, even if it is riddled with small holes.

Babuscia says future tests may involve creating tiny holes in a prototype and inflating it in a vacuum chamber to see how much powder would be required to keep the antenna inflated. She is now continuing to refine the antenna design at JPL.

“In the end, what’s going to make the success of CubeSat communications will be a lot of different ideas, and the ability of engineers to find the right solution for each mission,” Babuscia says. “So inflatable antennae could be for a spacecraft going by itself to an asteroid. For another problem, you’d need another solution. But all this research builds a set of options to allow these spacecraft, made directly by universities, to fly in deep space.”

Editor’s note: The above story is based on materials provided by Massachusetts Institute of Technology. The original article was written by Jennifer Chu.

Astrium—First Flight Proves Endurance



Astrium has successfully completed the first flight of its long endurance Zephyr, solar powered, High Altitude Pseudo-Satellite (HAPS), since it acquired the assets of the Zephyr program from QinetiQ in the UK in March of 2013.

The flight of the Zephyr took place at the Yuma Proving Ground in Arizona, USA, in August 2013. Astrium’s HAPS program has been running in conjunction with its EADS partners, Cassidian and Innovation Works, for several years.

The solar powered Zephyr holds the world record for flight endurance, having flown for more than two weeks at altitudes in excess of 70,000 feet.

This latest flight was to demonstrate a number of improvements in the design and operation of the vehicle, to enable future long-endurance operational trials.

“We are delighted that we have shown not only that the Astrium Zephyr is the most advanced High Altitude Pseudo-Satellite in the world but also that Astrium and the UK Ministry of Defence were able to put together this program to demonstrate persistent Intelligence, Surveillance & Reconnaissance (ISR) capability and to complete a full flight with the support of the U.S. Department of Defense within only four months,” said Jens Federhen, Astrium’s HAPS program manager.

Harris Corporation—GOES-R Receivers Testing Successful



Five simulators that will help the National Oceanic and Atmospheric Administration (NOAA) user community to prepare for the advent of a new generation of geostationary weather satellites have been delivered by Harris Corporation (NYSE:HR5).

The Geostationary Operational Environmental Satellite – R Series (GOES-R) will provide continuous imagery and atmospheric measurements of Earth's Western Hemisphere and space weather monitoring. The advanced spacecraft and instrument technology used on the GOES-R series will result in more timely and accurate weather forecasts by supplying meteorological data with much greater detail and clarity than the current GOES satellites provide. The GOES-R series will be a primary tool for the detection and tracking of hurricanes and severe weather.

To accommodate the anticipated 40-times increase in data to be ingested, processed and distributed, receiving systems operated by satellite weather data users must be replaced or modified to support this high-resolution data—similar to upgrading

a TV antenna to receive HD video broadcasts at home. The Harris GOES-R Rebroadcast (GRB) simulators produce a full-resolution stream of science data similar to what will be produced during actual operations of the satellites. This will enable GOES data users, such as the National Hurricane Center, to test receivers well in advance of the launch date to ensure a smooth transition.

"None of the existing receivers will work with this new generation of weather data," said Romy Olaisen, vice president, Civil Programs, Harris Government Communications Systems. "Harris worked very closely with the customer, and within a challenging schedule, to ensure that the simulators meet the unique needs of the weather community and aids vendors in manufacturing receivers."

Harris is the prime contractor and systems integrator for the contract to produce the GOES-R Ground Segment, which will process approximately 60 times more data than is possible today, and deliver weather products to the National Weather Service and more than 10,000 other direct users.

SatLink + i24 News—Distribution Delivery



i24 News has selected SatLink Communications Ltd. for the global distribution of three international news channels.

The new 24/7 broadcaster will use SatLink's comprehensive satellite and fiber distribution network to deliver its multi-lingual channels across Europe, the Middle East, Africa and Asia, as well as providing other services including: Production, Satellite News Gathering (SNG), Occasional Use coordination, fiber to the UN buildings in New York, to Gaza and Ramallah as well as content monitoring.

As a new player in the market, i24 needed a satellite communications partner that was able to support

them in delivering fast, reliable news from the Middle East to a global audience. i24 News will also be taking advantage of SatLink's Content Monitoring solution, a service, which monitors all of the news feeds in the Middle East in Arabic, Farsi and English and provides reports and analysis direct to i24 of all of the current news emerging from the region. In addition, SatLink's Occasional Use (OU) services will enable the swift and cost effective delivery of bundled, end-to-end solutions including production, SNG'S, OU satellite capacity, global fiber optic network, streaming and added value services.

LADEE Leaves For Lunar Landscapes + Dusty Determinations

On September 6, 2013, an Orbital Sciences' Minotaur V launch vehicle boosted the \$263 million Lunar Atmosphere and Dust Environment Explorer (LADEE) mission skywards to engage in a study of the Moon's thin exosphere (an atmosphere that is extremely thin and tenuous where molecules do not collide with one another) and lunar dust environment.

LADEE will orbit the Moon for 100 days and will host three scientific instruments. About two-and-a-half months will be required for the spacecraft to reach the Moon, with travel including a number of phasing orbits to ensure arrival at the Moon during the appropriate phase and time. Before starting the mission, LADEE must move into its scientific orbit and engage in a full systems' checkout before initiating its robotic work.

The Launch

Originating from Wallops Flight Facility in eastern Virginia, the LADEE mission marked the first launch of Orbital's Minotaur V rocket and the fifth Minotaur vehicle to be launched from that facility.

The first stage of Minotaur V ignited at 11:27 p.m. (EDT) on September 6th and separated the LADEE spacecraft 23 minutes later into its intended insertion point, successfully completing the rocket's five-stage sequence. With the placement of LADEE into its highly elliptical orbit, the spacecraft started its 30-day journey to the Moon. Upon reaching its nominal orbit approximately 31 miles above the lunar surface, LADEE will collect data on the Moon's exosphere and lunar dust environment.

The launch of NASA's LADEE spacecraft aboard the Orbital Sciences' new Minotaur V rocket was a tremendous success," said Mr. Lou Amorosi, Orbital's Senior Vice President of Orbital's Small Space Launch Vehicle business. "This mission further demonstrates the capabilities of our well-established Minotaur rocket family and our commitment to providing reliable access to space."

The Minotaur V is a five-stage space launch vehicle designed, built and operated by Orbital for the U.S. Air Force. The vehicle uses three decommissioned Peacekeeper government-supplied booster stages that Orbital combines with commercial motors for the upper two stages. Together they produce a low-cost rocket for launching smaller spacecraft into low-Earth orbit and higher-energy trajectories, such as the trans-lunar flight of the LADEE mission.





The Minotaur launch vehicle on the pad, photo courtesy of Orbital Sciences

Under the Orbital/Suborbital Program (OSP) contract, which is managed by the U.S. Air Force Space and Missile Systems Center (SMC), Space Development and Test Directorate (SMC/SD) Launch Systems Division (SMC/SDL) located at Kirtland Air Force Base, New Mexico, Orbital designs, integrates, tests and provides launch services to orbit with the Minotaur I, IV, V and VI rockets, as well as other suborbital capabilities with the Minotaur II and III configurations. The company has launched a total of 23 Minotaur rockets with a 100 percent success record that dates back to January of 2000.

The rockets are specifically designed to be capable of launching from all major U.S. spaceports, including government and commercial launch sites in Alaska, California, Virginia and Florida. Orbital's use of standardized avionics and subsystems, mature processes and experienced personnel make Minotaur rockets both reliable and cost-effective for U.S. government customers.

LADEE's launch marked several firsts—it was the first payload to launch on a U.S. Air Force Minotaur V rocket integrated by Orbital Sciences Corp. as well as the first deep space mission to launch from NASA's Goddard Space Flight Center's Wallops Flight Facility in Virginia.

Mission Overview

A number of new technologies will be tested that include a modular spacecraft bus that could assist in reducing the cost of future deep space missions—a most welcome possibility—as well as a two-way, high rate laser communications system from the Moon. Called the Lunar Laser Communication Demonstration, the transmissions will be via laser (622Mb/s) and not radio signals (around 100Mb/s).

The lunar examination is to investigate the Moon's exosphere for composition, density and temporal variability, as well as studies of the lunar dust that is expelled from the Moon into the atmosphere. Solar wind, the interior and the surface of the Moon, and meteoric infall will also be studied. The immediacy of this mission was required to obtain the projected data before any further human exploration and disturbance of the Moon's relatively natural state occurs.

LADEE's investigations will assist scientists in understanding other planets' exospheres which, in turn, aid in the understanding of our solar system. And, the last time humans were on the Moon's surface, the astronauts sighted diffuse emissions at 10s of km above the lunar surface. LADEE will be able to determine if these emissions were caused by sodium glow or dust.

The LADEE mission is divided into mission phases: Launch, Ascent, Activation and Checkout, Phasing Orbits, Lunar Orbit Insertion, Commissioning, Science, and Decommissioning. The spacecraft will approach the Moon from its leading edge, travel behind the Moon out of sight of the Earth. LADEE will then re-emerge and execute a three-minute Lunar Orbit Insertion maneuver. This will place LADEE in an elliptical retrograde equatorial orbit with an orbital period of approximately 24 hours.

A series of maneuvers will then be performed to reduce the orbit to one that is nearly circular, with a 156-mile (250-kilometer) altitude. The 100-day Science Phase is performed at an orbit that will vary between 20–60 kilometers due to the Moon's "lumpy" gravity field. During the Science Phase, the Moon will rotate more than three times underneath the LADEE orbit.

Following the Science Phase, a decommissioning period is planned, during which the altitude will be managed down to lower altitudes, followed by the spacecraft impacting the lunar surface.

The Crafting Of LADEE

NASA's Ames Research Center in Mountain View, California, designed, developed, built and tested the spacecraft and will also be responsible for mission management. There is an innovative build to this spacecraft as multi-use designs are built, enabling more of an "assembly-line"-like production model. Just as the Ford Model-T managed at the dawn of the automotive age, this multi-use manufacturing mode will drastically reduce the cost of spacecraft builds.

As an example, if a common bus was assigned to land on a planet, a "legs" module could be added, as well as other necessary components specific to mission's needs. Spacecraft could also be built that are lighter, or quicker to build, simply by removing extensions from the common bus... more of a "plug-and-play" design that is able to handle all sorts of missions, from lunar to NEOs (Near Earth Objects) examinations.

The Instruments

The three science instruments, as well as the technology onboard demo:

- Ultraviolet and Visible Light Spectrometer (UVS)—will determine the composition of the lunar atmosphere by analyzing light signatures of materials it finds. The Principal Investigator is Anthony Colaprete, NASA's Ames Research Center, Moffett Field, California.



UVS instrument



NMS instrument

- Neutral Mass Spectrometer (NMS)—Will measure variations in the lunar atmosphere over multiple lunar orbits with the Moon in different space environments. The Principal Investigator is Paul Mahaffy, NASA's Goddard Space Flight Center, Greenbelt, Maryland.
- Lunar Dust Experiment (LDEX)—Will collect and analyze samples of any lunar dust particles in the tenuous atmosphere. These measurements will help scientists address a longstanding mystery: Was lunar dust, electrically charged by solar ultraviolet light, responsible for the pre-sunrise horizon glow that the Apollo astronauts observed? The Principal Investigator is Mihaly Horanyi, Laboratory for Atmospheric and Space Physics, University of Colorado at Boulder.
- Technology Demonstration: Lunar Laser Communications Demonstration (LLCD)—Currently, communications with spacecraft beyond close Earth orbits require them to have small, low-mass, low-power radio transmitters and giant satellite dishes on Earth to receive their messages. However, the LADEE spacecraft will demonstrate the use of lasers instead of radio waves to achieve broadband speeds to communicate with Earth

The Checkout

Rachel Hoover of NASA Ames Research Center reported that LADEE was placed by the Minotaur V launch vehicle into an elliptic orbit around Earth, as the start of its journey to the Moon. After adjusting some fault protection settings to enable the reaction wheels, mission controllers at NASA's Ames Research Center in Moffett Field, California, successfully completed the initial systems' checkout phase, and everything looked good. This checkout included spacecraft acquisition, tracking, and ranging by all the ground stations.

The propulsion system also was activated to do a momentum dump, which means that the spacecraft spin and the reaction wheel spins were reduced together to a nominal state.

The LADEE spacecraft, as of this writing, is currently in an elliptical orbit around Earth, about 162,000 miles (260,000km) in altitude. Mission controllers performed an extended checkout phase that included guidance, navigation and control characterization, reaction control system tests, and on-board controller tuning.

The spacecraft was at the highest point in the current orbit (apogee) at 9:30 a.m. PDT, Tuesday, September 10th. LADEE dropped back down to its closest



Artistic rendition of the LADEE spacecraft.

approach to Earth (perigee) at 9:38 a.m. PDT on Friday, September 13th, when an engine burn to boost its orbit was performed. LADEE will continue with two more of these elliptical orbits until it is captured around the Moon to do its initial Lunar Orbit Insertion (LOI-1) burn on Sunday, October 6th. After that, the spacecraft is in lunar orbit. The LOI burn is one of the most critical phases of the mission, as without it working, there is no lunar orbit.

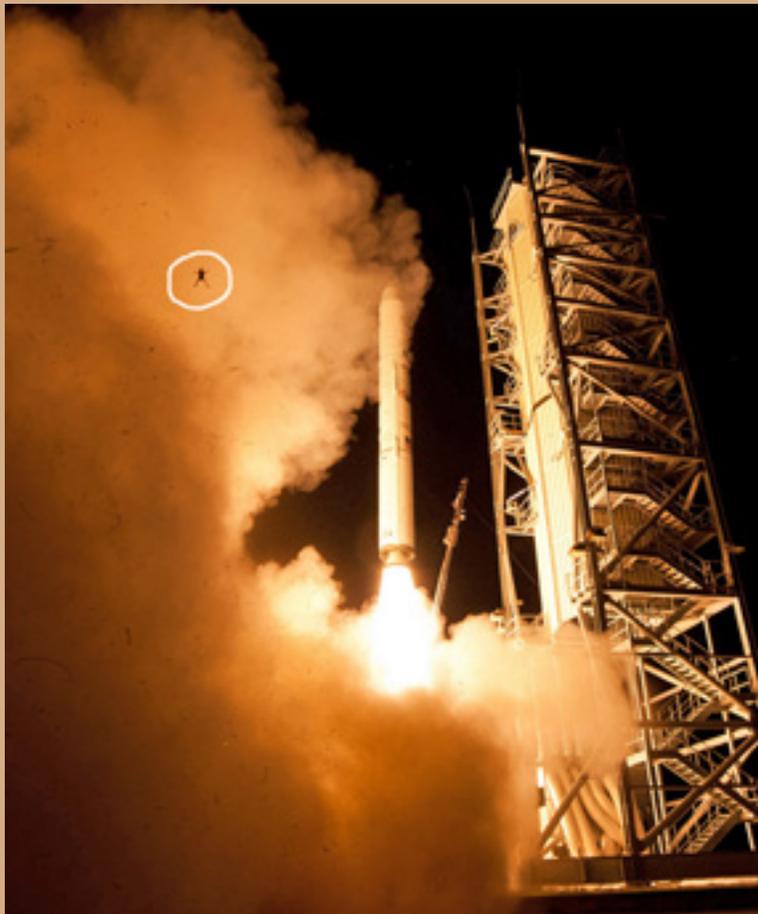
The Launch Family

The Minotaur V from Orbital Sciences is just one member of an entire launch vehicle family:

- » Minotaur I—The initial member of the Minotaur family, the Minotaur I is a four-stage space launch configuration that can place up to 1,300 lbs. into low-Earth orbit. It was originally launched in January 2000 and has conducted a total of 10 successful launches to date.
- » Minotaur II—A three-stage suborbital rocket, the Minotaur II is used as a target vehicle for testing U.S. missile defense systems and related missions. This configuration has performed eight successful launches to date.
- » Minotaur III—A three-stage suborbital rocket, Minotaur III can deliver suborbital technology demonstration payloads of up to 6,500 lbs. or serve as a target vehicle for testing U.S. missile defense systems and similar missions.
- » Minotaur IV—A heavier-lift four-stage space launch vehicle using retired Peacekeeper rocket motors, the Minotaur IV is capable of launching satellites weighing up to 3,800 lbs. into low-Earth orbit. Five successful launches have been conducted with this configuration.
- » Minotaur VI—The Minotaur VI provides a highly-capable and cost-effective launcher for U.S. Government-sponsored spacecraft of up to 7,000 lbs. into low-Earth orbit.

Even A Frog Gets Into The Act

This photo is legitimate and totally unaltered. One of NASA's remote cameras rolling on the Minotaur V rocket launch on September 6, 2013, captured, frame-by-frame, in great detail the launch... of a frog. NASA released the photo with this explanation: "A still camera on a sound trigger captured this intriguing photo of an airborne frog as NASA's LADEE spacecraft lifts off from Pad 0B at Wallops Flight Facility in Virginia. The photo team confirms the frog is real and was captured in a single frame by one of the remote cameras used to photograph the launch.



The LADEE Science Team

Sarah Noble, program scientist, NASA Headquarters, Washington

Richard Elphic, project scientist, NASA's Ames Research Center, Moffett Field, California

Greg Delory, deputy project scientist, NASA's Ames Research Center, Moffett Field, California

Ultra Violet and Visible Light Spectrometer Anthony Colaprete, principal investigator, NASA's Ames Research Center, Moffett Field, California

Neutral Mass Spectrometer, Paul Mahaffy, principal investigator, NASA's Goddard Space Flight Center, Greenbelt, Maryland.

Lunar Dust Experiment

Mihaly Horanyi, principal investigator, Laboratory for Atmospheric and Space Physics, University of Colorado at Boulder.

Guest Investigators

Jasper Halekas, University of California, Berkeley "Quantifying the links between the space plasma environment and the lunar dusty atmosphere: A virtual plasma instrument for LADEE"

Dana Hurley, The Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland, "Exospheric modeling for interpretation of LADEE data"

Sascha Kempf, University of Colorado, "Investigating Dust Exospheres by LADEE"

Menelaos Sarantos, University of Maryland, Baltimore County "A toolbox of exospheric models and visualization methods for LADEE data acquisition and interpretation"

Tim Stubbs, NASA's Goddard Space Flight Center, Greenbelt, Maryland, "Exploring the Lunar Exospheric Dust Environment with LADEE"

Program / Policy Management

NASA's Ames Research Center, Moffett Field, California, is responsible for managing the LADEE mission, building the spacecraft and performing mission operations for NASA's Science Mission Directorate, Washington. The LADEE mission is part of the Lunar Quest Program managed at NASA's Marshall Space Flight Center in Huntsville, Alabama. NASA's Goddard Space Flight Center, Greenbelt, Maryland, is responsible for managing the science instruments and technology demonstration payload, and the science operations center. NASA Wallops Flight Facility will be responsible for launch vehicle integration, launch services, and launch range operations.

At NASA Headquarters, John Grunsfeld is associate administrator for the Science Mission Directorate.

James Green is director of the Planetary Division.

Joan Salute is LADEE program executive, and Sarah Noble is the program scientist.

At Ames, Butler Hine is LADEE project manager. Dawn McIntosh is deputy project manager.

At Marshall, Danny Harris is the Lunar Quest program manager.

At Goddard, Robert Caffrey is the LADEE payloads manager.

At Wallops, Doug Voss is launch manager. Bruce Underwood is deputy launch manager.

Orbital Sciences Corp., is responsible for the Minotaur V rocket that carried LADEE into space.



Executive Spotlight **Don M. White** **Vice President + G.M.** **Astrotech Space Operations**

Don White has been instrumental in supporting and then leading Astrotech's satellite processing operations since 2005. As Vice President and General Manager of Astrotech Space Operations, Mr. White oversees the subsidiary's rigorous schedule of processing numerous spacecraft annually.

He is also responsible for expanding business services, improving profitability, as well as managing current contracts and assuring customers' needs are met or exceeded. Additionally, Mr. White maintains ongoing negotiations with all customers, pledging that every mission contract process is streamlined with the utmost efficacy and safety.

Prior to joining the Astrotech team, Mr. White was employed at Lockheed Martin where he began his tenure as their Payloads/Ordnance Chief Engineer, which later led to his promotion as their Mission Support Manager, leading various aspects of the Atlas V Development Program. Mr. White's extensive aerospace experience also includes providing leadership to the Titan and Shuttle External Tank programs while at Martin Marietta Corporation.

Mr. White earned a master's degree in business administration from the Florida Institute of Technology in Melbourne, Florida and a bachelor of science degree in industrial technology at the University of West Florida.

SatMagazine (SM)

What sets Astrotech Space Operations apart from the other payload processing facility companies?

Don White

Our business model: The vast majority of U.S. payload processing facilities are owned by the government (USAF, NASA, and NRO) and operated by government contractors. Astrotech is unique in that we own and operate our own facilities, giving us the ability to adjust our infrastructure and scheduling to suit the specific needs of our customers. Unlike most government processing facilities, our clients are free to use our infrastructure for an exact amount of time needed to process their spacecraft. Additionally, our facilities can be configured to accommodate the changing schedules of our customers. This model effectively spreads the fixed cost to own and operate the facilities across a broader customer base, with the goal of providing better value to the client.

Our capacity: Astrotech's facility capacity sets us apart from other payload processing facilities. Our Florida facilities are equipped to simultaneously process five spacecraft. Our Vandenberg Air Force Base (VAFB) facilities are able to house three spacecraft simultaneously, yet our facilities are rarely fully utilized. This excess capacity allows us to accommodate spacecraft schedule changes and delays often encountered by our customers. We have accommodated every client schedule delay, acceleration, and extended occupancy request encountered.

SM

As the GM, what strategies are you taking to ensure the success of Astrotech?

Don White

Our primary strategy is to serve our core customer base and ensure each experience is at least as good as their last one. Our industry primarily consists of a small number of companies / organizations (i.e., spacecraft manufacturers, launchers, and end users), which makes repeat customers our best opportunity for new business. It is imperative that we meet and exceed current customer requirements to obtain new business. We are also evaluating risk adjusted opportunities in the processing market to enhance our return on assets. This is an increasingly competitive market but we have done an outstanding job of maintaining our facilities without significant price increases. Our customers value this approach.

Astrotech is not immune to the pressures of our industry to maximize customer value. We continue to explore and implement more cost effective ways to meet customer requirements without sacrificing quality. One recent example of this is the conversion of our propane HVAC system at VAFB to natural gas. This capital investment paid for itself in less than one year and provided additional reliability and security benefits to our client base.

We are also expanding our payload processing services. Our non-standard services, such as propellant loading and GSE design / build, continue to provide valuable additional services and improve our company's profitability.

SM

You are an aerospace veteran; how does your previous aerospace experience help with the evolution of Astrotech?

Don White

My previous 21 years of aerospace experience included working on the Shuttle, Titan, and Atlas programs. This experience provided foundational knowledge of the flight hardware requirements currently levied on our facilities. As a Titan and Atlas payloads manager, we processed our spacecraft through the Astrotech facilities, so I was a customer of Astrotech before joining the firm.

Additionally, my customers on the Titan and Atlas programs are the same customers we support at Astrotech today. My experience was particularly helpful as Astrotech transitioned from, primarily, processing commercial satellites, to government spacecraft. Even though Astrotech provides commercial services to all of our customers, our government customers are more demanding in documentation requirements and require additional insight into our processes. My government program experience has benefited Astrotech's transition from one of supporting commercial spacecraft to that of government spacecraft.

SM

What are some of the challenges that Astrotech faces, both today and tomorrow?

Don White

We must continue to provide a quality service for a reasonable price. Our value proposition is entirely driven by our commitment to customer requirements and delivery of quality services. We are seeing increased pressure for our customers to use excess capacity at competing government facilities. Our customers have expressed a general frustration with this trend. The government is not permitted to profit from spacecraft processing through their facilities. So, if a spacecraft processes through a government facility, they do not pay any of the fixed costs associated with maintaining the facility, and the fixed costs account for the large majority of the overall costs to own and operate a facility.

Another concern is that of shrinking budgets, leading to fewer spacecraft. Interestingly, however, our two greatest concerns of competing with government owned facilities and shrinking budgets also creates an opportunity for Astrotech. As the government looks for more cost effective ways to process spacecraft, the commercial services Astrotech has been providing for 30 years can help meet many of those budget challenges. Our services can enable the government to divest themselves of owning their own facilities, reducing their overall cost to process spacecraft. This is not only a win for Astrotech, but for the taxpayer, as well.

SM

Where do you see Astrotech as the commercial space industry unfolds?

Don White

The recent focus on commercial launchers and services is not new to us. Our founders 30 years ago realized an opportunity to provide commercial services that were historically performed by the government, and that remains our core business today. Astrotech has historically adapted its business to meet market demand. We have modified our facilities and services to support nearly every vehicle launching from the U.S. We have supported Shuttle, commercial Titan, Atlas II/III/IV, Delta II/III/IV, Athena, Sea Launch, Pegasus, Minotaur, and Taurus. We will continue providing our facilities and services, with exciting opportunities to support processing the many new commercial vehicle entrants in our industry.



An encapsulation process underway at Astrotech. Photo courtesy of NASA.



Fully enclosed spacecraft being prepared for transportation. Photo courtesy of NASA.

Space Solar Power + The Electric Power Market Tapping The Source

By Darel Preble, Executive Director, Space Solar Power Institute



The general public and the electric power utility industry are unfamiliar with Space Solar Power and advanced aerospace capabilities. The aerospace industry is, likewise, unfamiliar with electric power's operational demands, regulatory restraints and critical issues.

Our global and U.S. economy is dependent on stable and reasonable energy prices, especially oil, which directly affect commodities costs. James Hamilton has shown that 10 out of 11 post-World War II recessions were associated with oil price spikes. He has also shown that oil price changes in the 2005-2008 period were sufficient to lead to the Great Recession (Brookings Paper). (Ref 1, 2)

A key measure of the economic value of energy is Energy Return On Investment (EROI), meaning how many BTU's of energy are brought to market per BTU invested. Some fields in the Mid-East have had EROIs of 100. But different oil fields have markedly different EROI, which can and is dramatically impacting the market outlook for those countries and fields and the market's response to consumer's ability to meet market price points. As this "hurdle" is slowly being raised, countries and consumer markets are and will be excluded.

The fact that SSP has essentially zero fuel cost for power generation, is a prime advantage for SSP. Like nuclear and other massive electric power plants, SSP is not quick, cheap or easy to build. However, SSP, by tapping the sun directly, is expected to be lower in cost (EROI) than anything else on the energy horizon, as well many other advantages. As we see the cost of oil edge up, *Figure 1* on the next page illustrates EROI for various power generation plants.

As *Figure 1* shows, coal, gas (Combined Cycle Gas Turbine) and nuclear can be dispatched, or turned on, when desired. This means there is no need for energy storage or buffering, such as may be needed for roof-top solar or wind mills. This is why these units compose the bulk of the generation plants in the U.S. and globally.

Hydro is excellent power, when available, but it has many higher priority goals; drought and flood control, recreation, environmental and reservoir demands, to name a few. The developed countries have few unused hydro sites. Nuclear has a capacity factor of about 90 percent. Wind, for example, may be economic only if it does not need buffering or storage. This is a major issue with these energy alternatives—ground solar and wind—especially as the amount on the grid approaches the spinning reserve level, which can adversely affect reliability, as they are pseudo-random intermittent, and cost, since they have lower (poorer) EROI than competing energy sources.

Space Solar Power is estimated to have an EROI of about 300, using thin-film photovoltaics and assuming reusable commercial launch vehicles. Achieving that EROI—and SSP's economic viability—depends on cutting launch to orbit prices down to about \$150 per lb. to orbit. Accomplishing that requires much higher launch volume than currently exists. SSP alone has such a massive launch demand to require these. Elon Musk's company SpaceX, is among those on track to develop RLVs. (Ref. 4):

"The payload penalty for full and fast reusability versus an expendable version is roughly 40 percent," Musk says. "[But] propellant cost is less than 0.4 percent of the total flight cost. Even taking into account the payload reduction for reusability, the improvement is therefore theoretically over a hundred times."

A hundred times is an incredible gain. It would drop the cost for Musk's Falcon Heavy rocket—a scaled-up version of the Falcon 9 that's currently rated at \$1000 per pound to orbit—to just \$10. "That, however, requires a very high flight rate, just like aircraft," Musk says. (Ref. 5)

Another common question is, "Why should we tap the sun's energy in space rather than with roof-top solar units or solar farms?" A photovoltaic panel at GEO provides about 9.6 times more energy per day than the same efficiency and size panel would on your roof in the continental U.S. (Ref. 6).

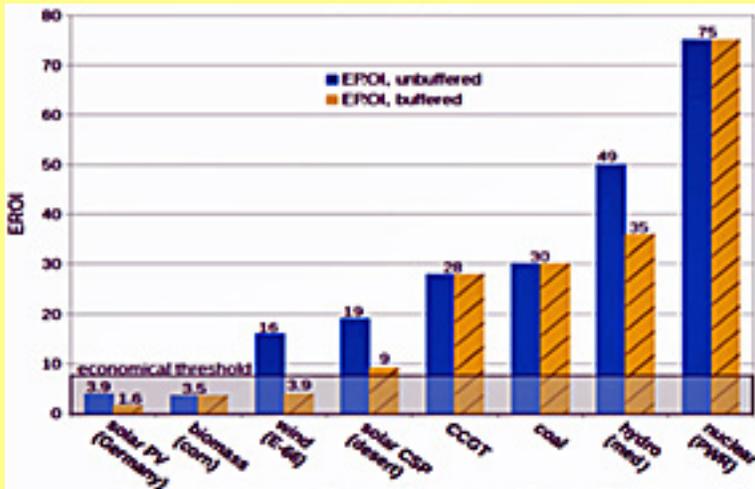


Figure 1. EROI of Power Plants with Economic Threshold (Ref. 3)
Cost of transportation not included.

Even better than that, the SSP panel is in constant sunlight 24/7—actually a potential capacity factor of 99.3 percent—short outages would occur at local midnight during the fall and spring equinoxes, but even these are optimal times for outage, when even your refrigerator wouldn't notice if SSP were your only power, which is unlikely.

By comparison, a typical roof-top panel has a pseudo-random intermittent capacity factor of about 29 percent. If you buffer, or use the lowest cost available energy storage—Compressed Air Energy Storage (CAES)—to improve the roof-top panel's dispatchability, or availability on demand, SSP's advantage increases to 71 times more energy per day—and that assumes only storing the energy for 24 hours, which is typically inadequate (Ref. 7), as cloudy days can often extend for a week or more.

Other advantages for SSP include very low water use:

Water Use

Approximately 85 percent of the current U.S. electric generation is produced by thermal generation facilities, such as coal, nuclear and natural gas, requiring massive amounts of freshwater supplies for cooling and steam production. Water supply has been the second highest-ranked environmental concern for the electric industry for the past seven years second only to carbon legislation. For the water industry, water supply is the top sustainability concern. (Ref. 8) Southern California has started building huge desalination plants:

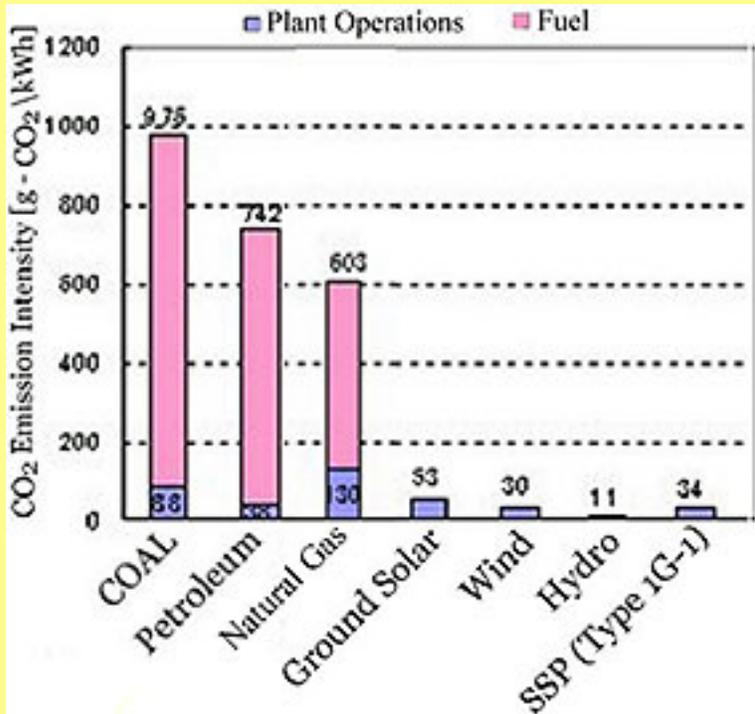


Figure 2. CO2 Emission Intensity
Source: JAXA

"Water in California historically has been cheap and plentiful," he said. "Neither of those facts is true anymore." said Peter McLaggan, who heads development of Poseidon's Carlsbad, California, plant. When it comes online in 2016, the plant will join 8,200 reverse osmosis desalination plants worldwide, producing 9.8 billion gallons of water a day, McLaggan said. A twin plant will be built at Huntington Beach, California, in 2018. Desalinated water is expected to cost about \$2,000 per acre-foot, about twice what the authority pays for imported water from the Los Angeles-based Metropolitan Water District. (Rev. 9)

For the first time in history, the Bureau of Reclamation will reduce Colorado River water deliveries from Lake Powell downstream to Lake Mead, the largest water reservoir in the U.S. "This is the worst 14-year drought period in the last hundred years," said Upper Colorado Regional Director Larry Walkoviak. Matt Niemerski, director of Western water policy for nonprofit American Rivers, said, "Nobody really thought we'd have to deal with this as quickly as we are. It's the first definitive domino to fall that could lead to a host of other troubles if we don't begin to act. That, in turn, could affect food prices." (Rev. 10)

And CO2 Intensity

As our atmospheric CO2 level continues to increase, plant photorespiration decreases and nitrate assimilation in most plant species is severely inhibited. Declines in forest health and food quality that are associated with climate change derive in part from CO2 inhibition of nitrate assimilation that diminishes plant organic N levels. (Nitrogen, and therefore, protein concentration.) This exacerbates damage from insects and other pests as they consume more plant material to meet their nutritional needs. (Ref. 11)

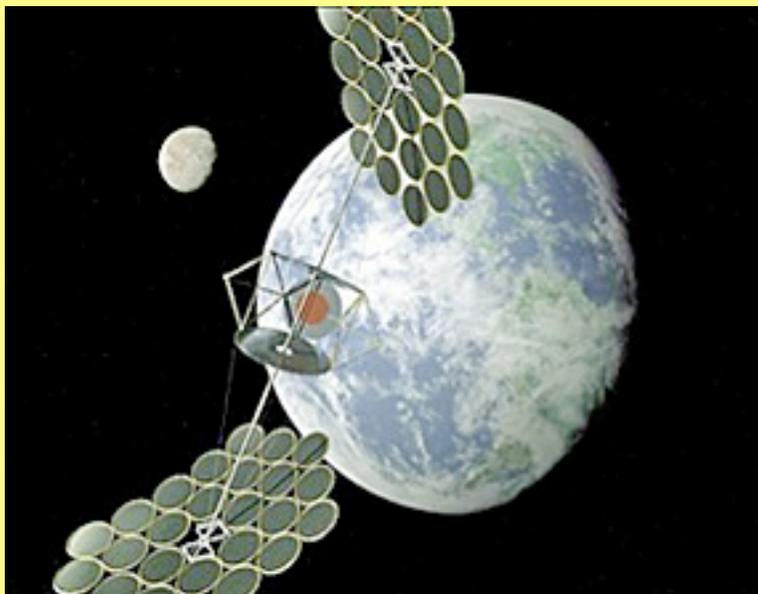
Nutrition from wheat and rice decline. Wheat grown at doubled CO2 declines in protein content by 9-13 percent. It produces poorer dough of lower extensibility and decreased loaf volume. The quality of flour for bread making degrades. The protein content of rice declines under doubled CO2 corresponding temperature increase. Iron and zinc concentrations in rice, important for human nutrition, would be lower. (Ref. 12)

Summary

The electric power system generation and grid is the most equity intensive business on the planet. It requires more dollars of concrete and steel in the ground to make a dollar of revenue than any other business. That is why power generation has been a regulated monopoly for most of the industry's existence. Lenders are not eager to loan to build a massive project which has a poor likelihood of generating revenue.

Many energy alternatives have been explored and subsidized, yet our dependency has grown; while prices escalate, our per capita incomes, our energy, economic and environmental security continues to decline. To sustain a reasonable standard of living, while protecting our environment, we must rebuild our energy supply.

Existing U.S. energy policies continue to ignore SSP. SSP is commercially feasible using key legislation we call the Sunsat Act. The fact that we are technically able to build a Space Solar Power System must be tempered by the fact that there are no existing U.S. corporations, including electric power companies, with the patient financial resources, technology and charter to initiate SSP today.



An Integrated Symmetric Concentrator, a NASA design, circa 2001

Just as the Comsat Act of 1962 created our robust commercial satellite communications industry, a Sunsat Act would create a commercial power satellite industry. Japan has already embarked on this SSP development path and are expected to bring it to the global electric power market 10 to 20 years from now, China is expected to soon embark on this path also.

Space Solar Power holds out the promise of directly tapping the sun's bountiful energy supply and plugging it directly into our global electric power grids. A careful examination of the pros and cons of primary energy sources now available, shows Space Solar Power (SSP), to be a clean, dispatchable, and virtually unlimited energy source with many crucial advantages.

References

"Oil Prices Lead to Hard Financial Limits", *Our Finite World*, Gail Tverberg, <http://ourfiniteworld.com/2013/08/28/oil-prices-lead-to-hard-financial-limits/#more-38393>

"Historical Oil Shocks", James D. Hamilton, Department of Economics, University of California, San Diego, Revised: February 1, 2011 http://dss.ucsd.edu/~jhamilto/oil_history.pdf and http://www.brookings.edu/~media/Files/Programs/ES/BPEA/2009_spring_bpea_papers/2009a_bpea_hamilton.pdf

"Energy intensities, EROIs, and energy payback times of generating power plants", *Energy*, Volume 52, 1 April 2013, Pages 210-221, D. Weißbach, G. Ruprecht, A. Huke, K. Czernski, S. Gottlieb, A. Hussein

Elon Musk interview Aug. 2, 2011 at the AIAA/AMSE/SAE/ASEE Joint Propulsion Conference, <http://satellite.tmcnet.com/topics/satellite/articles/203450-spacex-ceo-elon-musk-drops-more-hints-rockets.htm>

"Elon Musk on SpaceX's Reusable Rocket", Feb. 7, 2012, <http://www.popularmechanics.com/science/space/rockets/elon-musk-on-spacexs-reusable-rocket-plans-6653023>

"Photovoltaics", *Space Solar Power Workshop*, <http://www.sspi.gatech.edu/photovoltaics2006.pdf>

"Space Solar Power A Strategic Overview", Darel Preble, slides 33-36, presented at AIAA Atlanta May 2012, <http://www.aiaa-atlanta.org/downloads> and others.

"Black and Veatch's annual electric and water industry report for 2013", <http://bv.com/reports/2013-electric-utility-report/power-generation> and <http://bv.com/reports/2013-water-utility-report/sustainability>

"Desalination comes of age with Poseidon Plant", <http://www.utsandiego.com/news/2013/Mar/31/Poseidon-carlsbad-desalination-water/>

"Drought forces first-ever cutbacks in Lake Mead water deliveries", by Annie Snider, E&E reporter, August 16, 2013, <http://www.eenews.net/stories/1059986117>

"Elevated Carbon Dioxide", Arnold J. Bloom, Ph. D, Professor and chair, Dept. of Plant Sciences, Univ. of California, Davis <http://www.plantsciences.ucdavis.edu/Faculty/bloom/bloom.htm>

"Chapter One Climate Change - Nutritional Impacts", page 5, <http://www.sspi.gatech.edu/chapter1.pdf>

About the author

Darel Preble is Executive Director, Space Solar Power Institute, Atlanta, Georgia. Among his previous positions are advanced systems development and strategic planning for a major electric power company. The Space Solar Power Institute is a non-profit educational corporation chartered in 1997, working to bridge the educational gap between the aerospace industry and critical energy issues impinging upon our economy and environment.

Editor's note:

In mid-September of 2012, Mr. John C. Mankins, Principal Investigator, filed the SPS-ALPHA: The First Practical Solar Power Satellite via Arbitrarily Phased Array final report to NASA. Mr. Mankins is the President of Artemis Innovation Management Solutions, based in Santa Maria, California. To obtain a PDF of this NIAC / NASA report, access http://www.nss.org/settlement/ssp/library/SPS_Alpha_2012_Mankins.pdf.

A Case In Point:

Vast Alaskan Distances Require High Performance Broadband

By Sam Baumel, Vice President, SME Sales & Marketing, North American Division, Hughes Network Systems, LLC

Alaska's wide-open spaces and spectacular landscapes are high on the list of qualities that make this state a singular place to live. These same vast distances and rugged terrain also make Alaska a difficult place to operate businesses, especially when basics such as high-performance Internet and data connections are critical to success.

Will Johnson found that out firsthand when operating the Yuut Yaqungviat Flight School in the Western Alaskan town of Bethel. Flying small planes goes hand-in-hand with Internet connectivity for weather reports, flight plans, radar images—almost all of the information needed for safely flying between Alaska's widely separated communities.

"We're so desperate for connectivity in this part of the world. We just couldn't get any connection that was worth a darn, and you cannot run a flight school without Internet connectivity. It's the only way you can do business today in aviation," Johnson said.

Johnson's experience with inadequate and spotty Internet connectivity led him to start Alaska Satellite Internet to bring Internet connectivity to companies such as the flight school. Founded in 1992, Alaska Satellite Internet resells Hughes broadband satellite services and provides customer support for the hunting and fishing lodges, work camps, oil rigs, gold mines, government agencies, schools, police stations, and tribal offices that make Alaska's economy and public sector work.

"We got involved with Hughes because their services work and the word spread. Word-of-mouth is very powerful in Alaska because it's hard to advertise; we have very few radio stations in the bush that accept advertising and only a few newspapers. But if you provide a good product, that word will spread, and that's what happened with the Hughes service," Johnson said.

Johnson started reselling the widely popular Hughes satellite broadband services based on the HN System in 2005. Since then, he has since installed more than 3,500 systems—a large number in this sparsely populated state.

Within the last few years, however, Alaska Satellite found that even the HN System couldn't keep up with demand for more bandwidth from Alaska's businesses and tribal organizations.

"A lot of businesses wanted to do Voice over IP (VoIP) but there just wasn't enough bandwidth. At that point, we would have had to refer our customers to competitors. However, Hughes came out with its HX product and High QoS service and gave us a way to keep our customers," Johnson said.

Meeting Growing Needs

Hughes High QoS Service is based on Hughes' advanced HX System platform—this is a turnkey, bundled package of hardware, software, and network hub capacity that enables virtual network operators (VNOs) and service providers to offer high-bandwidth Internet and private network access to customers without requiring a large upfront investment.



High QoS offers businesses download speeds of up to 10Mbps to support high-bandwidth applications such as VoIP that need prioritized traffic. High QoS enables customers to prioritize traffic by class, which ensures high quality for mission-critical business applications and latency-sensitive applications such as voice calls and full-motion video.

When Hughes rolled out its High QoS Service, Johnson immediately found a market for it among Alaskan businesses, tribal organizations and tribal for-profit corporations.

"Hughes QoS has been a very successful service for us. It has really opened up our ability to serve businesses and tribal organizations," Johnson said. "It's very popular with customers who consume a lot of bandwidth, mostly in the business market and for some residences. They like the unlimited download plans and the service's consistency. Even though we have fewer installations because the product is new, the customers are buying so much bandwidth, it makes High QoS profitable. Our customers like the consistency and low latency it provides, which is especially important when they're running multiple business applications or running a private network over multiple sites."

High QoS' CBR (committed bitrate) feature has been an especially attractive feature for customers, Johnson said. CBR enables customers to temporarily partition their bandwidth to give specific packet traffic—usually voice—its own dedicated channel. When the special packet traffic is finished, the channel reverts back to general bandwidth.

"It's been a major selling point," he said. "If a business is spending millions on a big project, they don't want their on-site professionals affected by slow Internet access. CBR gives them an extra measure of performance."

Hughes High QoS Service is well suited for providers serving specialized industries such as oil/gas exploration, maritime, and mining in remote locations. In Alaska, High QoS is particularly popular at mining company work camps where crews are isolated from their families for extended periods. One of Alaska Satellite Internet's first High QoS installations was for a mining camp outside Juneau that wanted its employees to have telephone access to friends and family. The company has also installed High QoS at a hydroelectric plant in Sitka and will be installing it on an oil rig on the Cook Inlet.

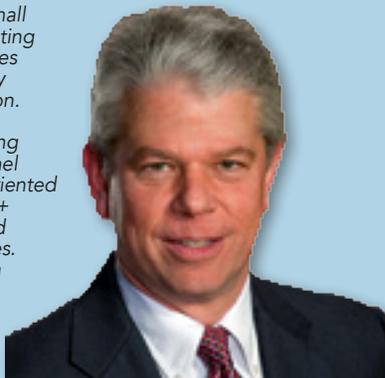
"There are no roads or phone lines into these areas, so the workers are desperate to call home and stay in touch with their families. They turned to Hughes High-QoS service for quality Internet telephony," Johnson said. "If a company is going to put men in a remote camp for months away from their families, they want to take good care of them. They're going to feed them well, give them good connectivity for phone calls, emailing, Skyping and surfing the Internet, and provide entertainment like satellite television."

Hughes' dependability is also a key selling point for High QoS in Alaska. Distance and extreme weather make maintenance and repairs difficult and expensive, Johnson said. Reliability makes HughesNet popular with business customers who can't afford extended outages.

"It's rock-solid dependable. I don't know of anything in the Bush that's more dependable," he said. "The High QoS service was new to us last year, and we're expecting it to take off during 2013."

About the author

Sam Baumel is vice president of SME (small and medium enterprise) sales and marketing for the North American Division at Hughes Network Systems, LLC (Hughes), a wholly owned subsidiary of EchoStar Corporation. In this capacity, he is responsible for the sales and marketing organization including resellers and channel partners. Mr. Baumel has more than 25 years of technology-oriented sales and marketing experience, with 18+ years at Hughes focusing on wireless and satellite broadband products and services. Prior to Hughes, Mr. Baumel worked in a variety of sales and marketing positions, including Merchandising Manager and International Sales Manager for Fujitsu America's cellular telephone products.



About the Hughes HX System

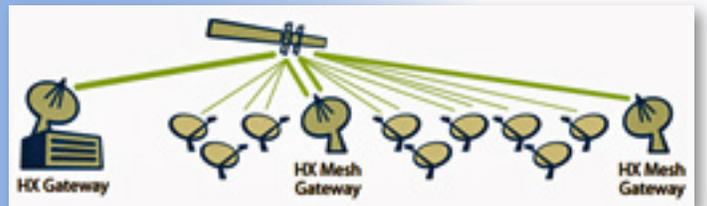
Designed and optimized for carrier-grade IP broadband networking and specialized applications such as mobility and mesh networking, Hughes brings to the market the HX System—a broadband satellite system with an economical gateway Earth station and high-performance remote terminals.

HX System Architecture

The core component of the HX System is the HX Gateway, which acts as the system master and includes the network management and dynamic bandwidth assignment manager. The HX Gateway uses a DVB-S2 carrier with Adaptive Coding and Modulation (ACM) for the outbound channel received by all HX System remote terminals. HX remote terminals use FDMA/TDMA channels to communicate back to the HX Gateway (star mode) or to each other (mesh mode).

The FDMA/TDMA channels of the HX System are highly efficient and are based on the industry-leading standard, Internet Protocol over Satellite (IPoS), which has been endorsed by ETSI, ITU, and TIA. The HX System FDMA/TDMA channels of the HX System support data rates up to 9.8 Mbps.

Efficiency and flexibility in utilizing satellite bandwidth are core to the design of the HX System. Each link, in star or mesh mode, can be configured to provide a QoS tailored for an individual remote terminal. And each remote link can be independently configured with unique Committed Information Rates (CIRs), thereby allowing a service provider to develop a service tailored to their customers' specific requirements. In addition, the HX System bandwidth allocation scheme is designed so that idle terminals can be configured to release all bandwidth assignments, thereby ensuring optimal bandwidth utilization.



Features include:

- » Compact hub configuration
- » Intelligent, protocol-sensitive bandwidth assignment for optimum performance and efficiency for each application
- » Dynamically assigned CIRs per remote or group of remote terminals
- » High-performance IP feature set
- » End-to-end network security
- » Advanced network management capabilities including detailed remote diagnostics
- » Active redundancy for all critical components
- » Optional mesh controller for supporting single hop remote-to-remote connectivity

The HX System from Hughes is designed and optimized for smaller and mobile networks, including maritime and airborne applications, where the provision of high-quality and high-bandwidth links is paramount. Capable of simultaneous mesh, star, and multi-star configurations, the HX System builds upon the capabilities and global success of the high-performance HN System, incorporating many advanced features pioneered by Hughes, including integrated TCP acceleration and advanced IP networking. Its broadband satellite products are based on global standards approved by TIA, ETSI, and ITU, including IPoS/DVB-S2, RSM-A, and GMR-1.

To date, Hughes has shipped more than 2.2 million satellite terminals to customers in over 100 countries.

Additional information

<http://www.hughes.com/technologies/satellite-systems/hx-system>

The Time Has Come To Destroy Debris... The Clean Space One Mission

By Lionel Pousaz

The CleanSpace One satellite has a new ally in its mission to clean up space debris. École polytechnique fédérale de Lausanne (EPFL) has entered into a partnership with Swiss Space Systems (S3) and the company will invest 15 million Swiss Francs (CHF) in the project and will launch the satellite into orbit.

In 2012, EPFL announced its intention to design and launch CleanSpace One, a satellite whose mission is to start to clean up the thousands of bits of jettisoned rocket and satellite components orbiting Earth at speeds of more than 28,000 km/h. The mission is crucial for the future of the space industry. Now Swiss Space Systems—S3 has now joined the project. The Swiss company is developing a new method to launch satellites weighing up to 250kg and will take charge of CleanSpace One's launch, which is scheduled for 2018.

A Satellite For Cleaning Up

The debris orbiting Earth continues to accumulate. Although collisions with functioning satellites are rare, each collision can generate several thousand new bits of debris. The problem is becoming increasingly serious and making space missions far more complicated.

CleanSpace One's mission is to grab hold of a piece of space junk—in this case, an out-of-commission Swiss nanosatellite that measures 10cm on each side—and thrust it into the atmosphere, where it will burn up. Navigating to and seizing the ex-satellite is a formidable feat of engineering.

A Three-Phase Launch

S3 is now the Prime partner in this project. The company, headquartered in Payerne, Switzerland, is developing a new launch method for small satellites that weigh up to hundreds of kilograms. A small shuttle rides piggyback atop an A300 jetliner. When the plane reaches cruising altitude, this Suborbital Reusable Shuttle (SOAR) ignites its engines and takes off, upwards. When it reaches an altitude of 80km, it ejects a vessel, which after reaching an altitude of 700km, releases the satellite into Earth's orbit. The Airbus and the shuttle are reusable and use standard fuels, making the system quite cost-effective.

The goal of this three-phase process is to make space more accessible—it cuts launch costs by a factor of four. To make sure that this doesn't end up placing even more space debris in Earth orbit, S3 will ensure that all the elements in the chain, including the satellites, include their own re-entry systems. In this context, their partnership with CleanSpace One makes perfect sense.

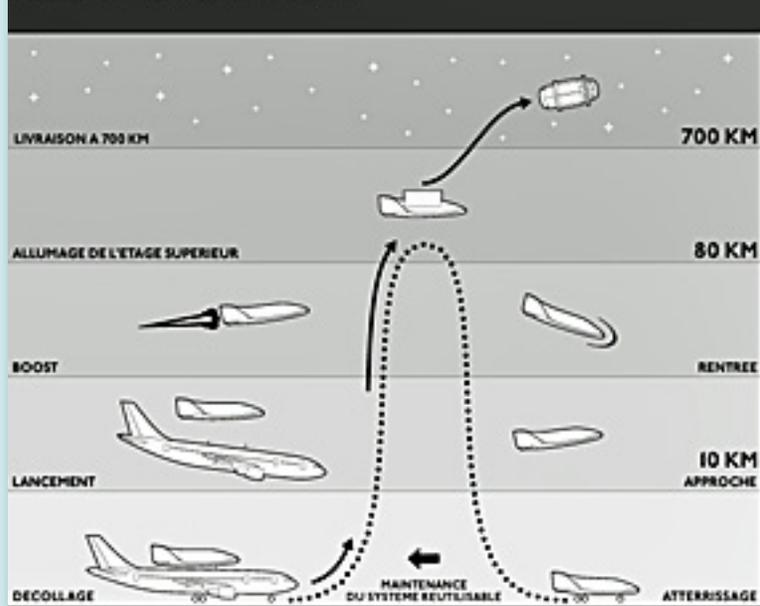
"You can't democratize space access without having a responsible attitude," says Pascal Jaussi, CEO of Swiss Space Systems. "If we don't deal with the problem of orbiting space debris and its accumulation, future generations' access to space will be compromised."

The company will take care of launching CleanSpace One, which in 2018 will be the first satellite launched into orbit using the new method. All told, Swiss Space Systems will invest at least CHF 15 million in the project—CHF 10 million for the launch itself and CHF 5 million for assembling and testing satellite components and ground-based command operations.



The Zero-G certified Airbus A300 and the SOAR Spaceplane. Image courtesy of Swedish Space Systems.

FLIGHT OPERATION



On The Correct Track

At EPFL, the project has made considerable progress since the public announcement in 2012 regarding the project. The design is slightly different—it's a bit bigger than originally planned—and will weigh approximately 30kg. Scientists have tested many technologies that could potentially be integrated into the satellite, some that are already on the market, and others still in the development stages.

Finally, as part of a partnership with the European Space Agency, researchers are developing many key technologies targeting space debris—propulsion, navigation and reconnaissance systems and, above all, a device that can anchor itself to pieces of debris. ETH Zurich, CSEM and the Swiss Universities of Applied Science are participating in this crucial project, as well. They are counting on the integration of their developments into the CleanSpace One project.

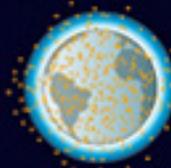
More information at Swedish Space Systems

<http://www.s-3.ch/en/mission-goals>



CleanSpace One Will De-Orbit Space Junk in 2018

CleanSpace One is to be the first satellite to clean earth's orbit of dangerous debris. Developed at EPFL in Lausanne, Switzerland, the satellite will be launched into orbit by the Swiss Space Systems, aka S3, based on new launch technology that produces no spatial debris.



Over 16000 pieces of space junk, larger than 10 cm, have been counted in orbit around the Earth.



Executive Spotlight: Dr. Arunas Slekys, Vice President of Corporate Marketing + G.M. Russia & CIS Business, Hughes

Dr. Arunas Slekys is vice president of Corporate Marketing, as well as vice president and general manager of the Russia & CIS Business for Hughes, a wholly owned subsidiary of EchoStar Company. In these dual positions, he is responsible for managing all of Hughes marketing and advocacy initiatives worldwide, along with overall P&L responsibility for the company's broadband satellite business in Russia, Ukraine, and the CIS countries.

Previously, Dr. Slekys served as vice president of the Wireless Networks Division at Hughes, responsible for the product line business comprising the AIReach® family of digital cellular mobile, wireless loop, and wireless data (CDPD) systems. During this period he was elected and served for several years on the CTIA board. His long affiliation with the wireless industry began at NovAtel Communications, Ltd. in Calgary Alberta, where he served from the company's inception as senior vice president for product research and development, spearheading its success worldwide in the cellular mobile and systems marketplace. In 1991 he was awarded the Alberta Centennial Engineering Award for attaining the highest distinction in his profession.

Slekys began his telecommunications career over 30 years ago at Caltech's Jet Propulsion Laboratory, where he worked as a digital communications research engineer, developing deep space network and pulsar tracking systems. He later joined Bell Canada Systems and, subsequently, Bell Northern Software Research, managing switched-network related systems development and advanced technology programs.

He holds a bachelor of applied science degree in electrical engineering from the University of Toronto, an M.Sc. degree from the University of Illinois, and a PhD in computer and communications engineering from UCLA. Sleky is co-author of a founding patent for CDPD (Cellular Digital Packet Data) systems and is a frequently published author on satellite and wireless communications. He is the elected Chairman of the Board of the Global VSAT Forum.

SatMagazine (SM)

Dr. Slekys, would you provide our readers with your background and how you came to decide to further your career with Hughes Network Systems?

Dr. Arunas Slekys

Half of my 40-year career has been with Hughes, a company which is all about challenging conventional wisdom, whether it concerns technology or business. You could say that innovation is what drives me, from my first job at NASA/JPL in the 70s developing Deep Space network systems (while completing my PhD in engineering at UCLA), to heading up R&D at cellular start-up NovAtel Communications in the 80s, where we led the rural systems marketplace and were first to develop a wireless data modem in an IBM laptop. During that program, I co-authored a patent on cellular packet data that became the basis for CDPD systems.

Not surprisingly, joining Hughes was a natural fit for me, and presented the new challenge of moving into a business leadership role after 15 years in R&D; I'm proud to have helped plant our technology flag in many countries, as well as promoting our world-known brand and advocating for the satellite industry through groups like the Global VSAT Forum (GVF), of which I'm Chairman.

SM

With such a number of responsibilities, the challenge must be in focusing on projects by their priority—what do you consider to be Hughes' most important initiatives as of this interview, and any adjustments due to sequestration?

Dr. Arunas Slekys

As noted earlier, bringing JUPITER technology to the global market is clearly our focus internationally, while we continue to expand our highly successful HughesNet Gen4 consumer Internet business in North America, now with over 700,000 subscribers, the world's largest satellite network of any kind.

We placed a big bet on this business over 10 years ago when there were plenty of naysayers, and stayed with it to where it's now the fastest growing part of Hughes, and indeed the industry. On the enterprise side, we're making great inroads into managed network services across a wide range of verticals, including banks, retailers, oil/gas, lotteries, cinemas and government agencies/ministries to name a few.

We've recently combined our expanding range of managed services under the HughesON™ brand—providing comprehensive turnkey solutions, from design to implementation and ongoing service/support at any number of sites across a state, country or worldwide—freeing customers to focus on running their organizations.

Sequestration will certainly curtail the large military-only programs of the past, in which Hughes was not a big player. But it will bring us more COTS opportunities as the defense sector learns to adopt relevant cost-effective offerings already available in areas such as SATCOM-On-The-Move for land, sea and air, and to employ commercial satellite capacity.



SM

Current VSAT systems have evolved over the past 20 years to incorporate many advanced features. Can you describe the VSAT evolution and the system requirements for VSATs with the emergence of HTS satellites?





The Hughes HX100 remote terminal.

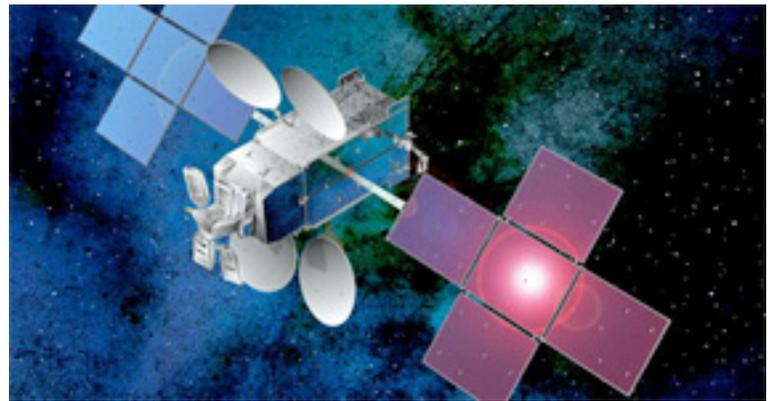
Dr. Arunas Slekys

Since Hughes invented the VSAT and sold the first commercial Ku-band satellite network to Wal-Mart in the mid-80s, VSATs have evolved dramatically in performance and cost: From a briefcase-size box weighing several kilos connected to an external 1.8m antenna, with a maximum user data rate of 9.6kbps and costing approximately \$10,000, to today's JUPITER compact set-top box modem with single cable connection to a 74cm antenna, with maximum throughputs of over 1Gbps and selling for under \$500.

At the systems level, we've advanced from single CONUS-coverage Ku-band satellites with a few Gigabits of capacity, to multi-spot beam Ka-band architectures with from tens to 100+ Gigabits of capacity, necessitating new designs for HTS gateways and high-speed user terminals. For example, with JUPITER we've pushed the technology envelope ever closer to theoretical limits—including advancements such as wideband channels with DVB-S2/ACM modulation, high-density gateways with lights-out operation, web acceleration/caching, advanced compression and hardware security—which all taken together result in efficient management of satellite bandwidth and, hence, low OPEX/CAPEX for operators, greater flexibility in creating competitive service plans, and a media-rich customer experience.

SM

Internet access is a key driver for HTS systems—what other applications will drive the usage of HTS Systems?



Artistic rendition of the EchoStar® XVII satellite with JUPITER High-Throughput Technology, built by Space Systems/Loral for Hughes Network Systems

Dr. Arunas Slekys

Video-rich applications are proliferating, demanding ever-more bandwidth, and HTS systems will serve an increasingly larger role in meeting that need globally. Enterprises and governments are harnessing the power of high-definition video in applications from distance-learning, to digital signage and surveillance/reconnaissance. An emerging area is the defense sector which is under severe budget constraints, and will turn to more affordable commercial capacity as military-only satellite capacities are exhausted, especially for video reconnaissance.

SM

Would you tell our readership about Hughes' JUPITER™ high-throughput technology? How do you see JUPITER impacting the company's business models as well as improving global communications?

Dr. Arunas Slekys

Key elements of JUPITER technology were noted earlier, and clearly the higher performance and lower cost per bit has accelerated growth of our HughesNet Gen4 service. Additionally, we've expanded our distribution network through wholesale agreements with Dish, Frontier and DirecTV, who are bundling satellite broadband with DTH service for the large addressable market without terrestrial broadband connectivity—which in the U.S. alone is estimated at 10 to 15 million households.

Our plan is to add more than 1.5 million new HughesNet subscribers on EchoStar XVII. We expect to continue the healthy double-digit consumer growth rate with JUPITER 2/EchoStar XIX in 2016 and beyond. In the developing world, ability to pay at an individual residence level remains the biggest hurdle, so instead we're seeing novel solutions such as pay-as-you-go Internet kiosks in India, and shared VSAT usage via a WiFi cloud among dacha communities in Russia, where customers can turn their connectivity on and off seasonally during vacations.

The bottom line is that broadband should be an economic imperative of all nations: IMF studies have concluded that a 10 percent increase in broadband connections per capita yields an average 1.2 percent increase in GDP per capita. And satellite is the ideal technology to reach populations cost-effectively in all ex-urban areas, which is where Hughes is focused.



SM

What regions of the world would benefit from JUPITER technology? Do you see other areas (other than U.S.) adopting HTS technology?

Dr. Arunas Sleky

JUPITER™ high-throughput technology is beneficial to all operators planning larger-scale satellite broadband service, and in particular has been optimized for broadband Internet access typical of consumer/small business target markets. The first JUPITER System outside of North America was recently announced by Media Networks Latin America (MNLA) in South America (a Telefonica subsidiary) to expand their successful DTH and broadband services with satellite Internet for households, using Ka-band capacity on Amazonas 3.

In Russia, RSCC is planning launches of several HTS satellites with Ka-band capacity starting later this year and through 2015 (AM5, AM6 and AMU1), also targeting consumers/small business through selected VNOs. The favorable economics of HTS multi-spot beam systems have brought the price/performance of high-speed satellite Internet service down to levels that are competitive with DSL, and though initially available in Ka-band, the same technology could operate in Ku-band. Growth across the globe is inevitable, fueled by the insatiable demand for high-speed connectivity by the huge populations either unserved or underserved by terrestrial broadband.

SM

How is the Russian/CIS market seen by Hughes and what are the challenges for you and Hughes in making inroads into that market?

Dr. Arunas Sleky

Russia and the CIS countries (Ukraine, Azerbaijan, Kazakhstan and Uzbekistan) has always been a strategic market for Hughes since the early 90s. We've now shipped over 50,000 terminals cumulatively to 24 operator customers, representing more than 50 percent market share. The main challenges have been the predictability of the market itself—which is heavily dependent on government-subsidized programs, such as Internet for schools/rural communities and post offices—and during the past several years, limited satellite capacity due to failed rocket launches.

Successful launches by RSCC of AM5 later this year and AM6 in 2014, plus AMU1 in 2015 (jointly owned with Eutelsat), should break the capacity constraint and lead to possibly several hundreds of thousands of new customers, mostly residential and small business. That's still a small percentage of the population of 150 million, though overcoming the ability-to-pay barrier will likely take some novel solutions and government subsidized initiatives, such as were played out in the U.S. broadband voucher program under the Recovery Act.

SM

An area of great concern to many companies in our industry is that of locating and hiring professionals for the technical areas of program development. Does Hughes support STEM education in our middle and high schools and colleges to help assure a talent pool of viable candidates for future hiring? What course of studies would you recommend for students who are interested in careers within our varied industries?

Dr. Arunas Sleky

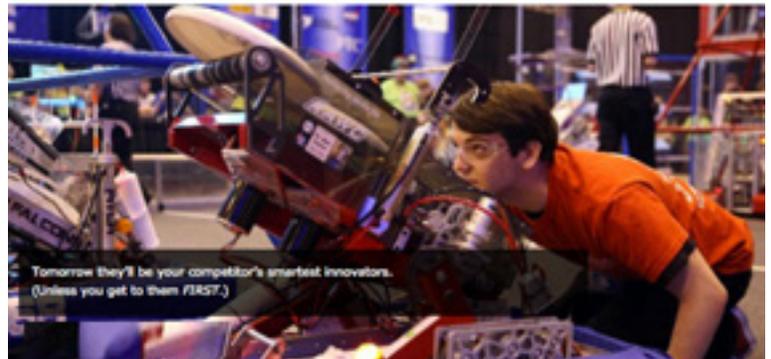
Headquartered in Germantown, Maryland, just outside our nation's Capital, Hughes is one of the region's largest employers of engineers and technical talent, with more than 1,500 employees in Maryland, of which more than two-thirds combined have Bachelor's, MS or PhD degrees. Globally we are around 2,000, including our Hughes service companies in Europe, India and Brazil, and sales/support offices in Russia, Mexico and UAE.

Clearly finding and retaining technical talent is an ongoing challenge and we actively hire the brightest graduates available, as well as funding joint programs in engineering and business with selected universities, such as the University of Maryland. We also support STEM education in high schools through initiatives such as FIRST (www.usfirst.org), where I'm on the advisory board and have had the pleasure of judging the amazing robots built by these future technology leaders.

Any course of study in engineering, science or mathematics would be appropriate for an aspiring student interested in the technology side of the satellite industry. But we also need those interested in marketing, communications, sales and business development, particularly with international language and cultural skills, since our industry's scope is truly global—and interesting as it is reflected in the diversity of the Hughes employee base, with more than 50 percent non-white and almost 30 percent female.



FOR INSPIRATION AND RECOGNITION OF SCIENCE AND TECHNOLOGY



U.S. First's mission is to inspire young people to be science and technology leaders, by engaging them in exciting mentor-based programs that build science, engineering and technology skills, that inspire innovation, and that foster well-rounded life capabilities including self-confidence, communication, and leadership.

SM

What challenges do you see ahead for the industry in the next five to 10 years? How is Hughes best equipped to face these challenges?

Dr. Arunas Sleky

Our primary industry challenge is to keep improving the capacity/performance/cost of satellite networking technology, while also expanding solutions and service offerings, making them more affordable and available to people globally; call it 'The Mainstreaming of Broadband Satellite'. This is a universal objective without a time limit, and requires taking calculated risks and continuing investments in all areas, from core components, to platforms and systems, to applications and market development.

For example, JUPITER technology includes a unique SoC (System on a Chip) that Hughes developed over several years and is now a key component in delivering the latest HughesNet® Gen4 high-speed Internet offerings—from 10 Mbps up to 25 Mbps—the fastest in the industry. At the systems level, Hughes earlier this year announced a major investment in building the next-generation JUPITER 2/EchoStar XIX satellite, which will exceed 150 Gigabits capacity and is planned for launch in the first half of 2016.

It remains for Hughes to do what we do best—keep pushing the envelope on broadband technologies, products, and services, delivering ever more value and competitive-edge benefits to our customers—a strategy that has helped us to successfully navigate through the economic storms of prior years and positions us for strong growth well into the future.

SM

Given your wealth of experience in this industry, when you look back upon your career, what projects truly bring a sense of satisfaction to you?

Dr. Arunas Sleky

Nothing beats the satisfaction of bringing people high quality, affordable technology that can better their lives at work, home or play through better communications—one connection at a time. It's been my privilege over a 40-year career to have played some part in all aspects of that delivery.

The Truths, Half Truth's + Myths Of PR For The Satellite Industry

By Joshua Kail, Co-Founder, Glass Lantern Public Relations



The unofficial start to the satellite industry's business year within the U.S. is fast approaching with SatCon 2013 (IBC globally). With that in mind, now is the time to start thinking about engaging a focused public relations campaign. Such a decision can come with questions, false beliefs, and possible misunderstandings. What I am attempting with this article is to provide an honest and blunt assessment to what PR is, is not, and how it specifically benefits the satellite market.

I have had the good fortune of working with several satellite technology companies on their public relations initiatives, including the launch of a few companies within the North American market. I say fortunate because, on average, the press who cover satellite issues are genuinely interested and committed to the topics they publish. This passion for the satellite industry opens many doors of opportunity for public relations (PR) and marketing (marcom) firms with editorial teams—it also means when you approach the satellite media for coverage, you truly need to have a story idea with substance beyond a simple product announcement.

The big question is... **why put resources into public relations and is such worth the effort?**

Statistically speaking, chances are you don't really know what PR is. Don't worry, few do. My parents, my wife, and when they are old enough, my children, really will not know what it is. No matter how often I explain the basics of PR, retention of that knowledge is surprisingly short. This is a PR industry-wide issue and leads to potential client doubt as to the value of investing resources into a PR person at all. I should emphasize that my parents, wife, and children are all intelligent people. Now that I have ensured I am not sleeping on the couch and have a place to eat Thanksgiving dinner, let's continue.

The problem is that, as an industry, PR professionals are so busy working on client reputation management that we do a terrible job on our own image. The result is many different explanations and interpretations of what we do.

The definition that is of the most value to anyone considering PR is: Public Relations works to increase a client's visibility within their target markets, most often through unpaid media placements, analyst briefings, and, where applicable, social media interaction. The goal of PR is to increase brand recognition, which, in turn, builds familiarity and trust. This work results in more engaged potential clients during sales interactions.

The Myth Of Instant ROI

The number one question I get asked by potential clients when I speak with them regarding PR is; "What is the return on investment (ROI) for a press hit?" This is a reasonable question. You budget a good amount of money each month specifically to ensure your company's name is included in important satellite industry articles. You want to make certain that you are doing this for a reason. After all, when you invest in a six month advertising campaign, you expect specific returns in new or renewed business. Consistent (read: repetitive) placement of your logo, your tagline, and an attractive image of your service helps to drive clients to your company. This is a generally proven method of obtaining attention, albeit an expensive one. What, you then ask, is the dollar value of such a hit?

This is where a lot of PR agencies wander into the land of science fiction. I say this because they apply the same calculations to a press hit as an advertising firm applies to an advertisement. There is just one problem with this approach—PR is *not* advertising.

The truth is, it is almost impossible to assign a short term monetary value to a press hit, especially for the satellite industry. While I have never worked in satellite sales, I am confident to say that, never in the history of the industry, has anyone bought a new dish or an antennae on a whim. Customers have never decided to upgrade from DVB-S to DVB-S2 just for the hell of it. No one woke up one morning and said, "Let's go hybrid because I had a dream about how cool it is."

Satellite technologies are not at all similar to the candy bars that populate the checkout lane at the supermarket. If a potential customer reads about you in an article, even if the article is important and presents a high profile, chances are such will not drive the reader to suddenly call your company to make a purchase. Any of those issues I listed above require time and consideration from the client. The decision to transition into the DVB-S technology transition decision can actually take several months.

There is definitely ROI in PR, but such is not calculable in instantaneous monetary conversions. If you are ever given numbers along these lines, even if based on logical sounding arguments, know that the figures are about as real as the possibility of a unicorn's horn increasing bandwidth.

What is the value of PR, if not in direct dollar signs? The value of PR is in the long run, in the careful and calculated increase of a company's awareness within the industry and, most importantly, the brand's impression on the minds of your potential clients. Articles, regardless of length or importance, provide an understanding of your company as more than the technology or services you offer—editorial features establish you as a committed and trusted player in the industry and further your business success. This is what is called "thought leadership building."

What Is Thought Leadership?

Studies have found that it is not until an individual comes across a company's reference at least three times, within a relatively short period of time, that they start to recognize the name of that company. For example, Dexy's Midnight Runners, the band behind the popular 80's hit "Come On Eileen," have found that it takes more than one popular song to be remembered beyond that moment of success. Not recalling the exact name of the group that I wanted to use in this article, I engaged in a search engine probe of the name "Dexter's," which I thought was the true name, and immediately learned of my error. As I hadn't been exposed to the group's name recently, nor had successive encounters with the name, the true name had been forgotten. Not good for Dexy.

If you combine these two concepts (reference and encounters), the result is why thought leadership and PR are so important. In order to be remembered, you need to be in front of your potential clients' eyes regularly and consistently. Just because you had a lot of coverage last year, does not mean you will be remembered next year.

This is really where the value of PR comes into play. A successful PR campaign is one that builds that presence as an ongoing constant. The campaign initially builds that important visibility, through the media, through analysts, through social media, and then ensures you are always part of the conversation, in a media channel that is being accessed by your firm's potential clients.

Being part of the conversation is more than simply putting out a press release on a new product or upgrade and hoping for a hit or two in industry publications or social media. The exposure must go beyond what is being sold. Readers/viewers must start to recognize who you are and why you should be considered for the product being presented. A company's executives must be brought into play to weigh in on the issues facing the industry—in this manner they become recognized as subject-matter experts and start to become "spokespersons" for a particular technology or market segment.

Is it better to invest in compression or modulation? What is the best way to accommodate for 4K... 8K? Will space run out of space for video satellites? By involving your executives, and by extension your company into these conversations, it shows a knowledgeable investment into the future of satellite beyond the product line. These are the same issues your clients are contemplating. Having a company on board that shares the concerns and options of such issues builds trust in that company and the people who run the firm.

PR Case In Point

Here is a classic example—I had the opportunity to launch a satellite modulation technology within the North American market. When introducing any new company into a market, there are always the challenges of convincing the media, and by proxy, potential clients, into feeling comfortable enough to embrace that company as reliable.

This gets even more complicated when the company is a foreign entity, and even more difficult when no one believes the technology is real.



Had this company entered the market with no PR outreach at all, the client company would have had to counter these challenges. They were actually at the point where potential clients were laughing at them during prospect meetings, once they heard the claims of this DVB-S2 competitor. When the concept alone induces laughter, how can success be gained when no one believes a company's claims? This was my first challenge with this company's launch into the U.S.

With any outreach, be it PR, sales, or marketing, claims straight from the horse's mouth are hard to swallow. The "believe me because I say so" approach is seldom a good one... unless you are a cult leader or have the impact of the late Steve Jobs. Imagine the response the company claims were a 72 percent bandwidth increase over DVB-S2, before such was possible to attain. Luckily for our PR efforts, those claims were true. However, without a third party backing the claim, the laughter would have continued.

Our PR team ID'd and obtained third party endorsements, starting with industry analysts. By arranging briefings with them, we were able to accomplish several necessary elements for the campaign.

We obtained direct and unedited feedback of what the analysts thought of the claims and concepts of the presented technology. We also received insight into how the greater industry would best receive such claims. Most importantly, we received support from the analysts that these claims were more than hyperbole.

With these facts in hand, we went to the media and formally presented the technology. It was no longer a PR company saying, "This is some amazing technology." We now had the support of reputable analysts. This, in a nut shell, squashed any media doubt of the company's claims and allowed a market to be built. This presence included the usual new product, upgrade and corporate growth announcements, but primarily focused on the "bigger picture" industry stories.

Most U.S. broadcasters operate using DVB-S. The markets were originally slow to convert to this proven technology and the conversation became... why is it now time to upgrade when DVB-S works for our company? This is where we really thrived—in obtaining coverage for the technology change.

The Turn Around Begins

Within a few months, if there was an article about modulation upgrades, we were included in the conversation. If there was a conversation about the Ka-band, we were part of the conversation. If there was a conversation about compression, we were part of the conversation. We were able to build market awareness and belief in the technology to the point where the press was reaching out to us for comment and insight on these issues. Remember the subject-matter expertise mentioned previously? It works.

On the business front, the first noticeable effect was that the laughter at new business meetings stopped completely. At trade shows, there was greater booth attendance, and, most noticeably, those who stopped by already knew who the company was and what they were able to accomplish. It was no longer a question of "What do you guys do?" It was "I need to see this in action!" For those of you who have guessed the company I am highlighting in this story, you may also be aware that despite all of the PR progress, they have now fallen on tough times.

This really underlines my earlier point that satellites and satellite technologies are not a Snickers bar. PR works in tandem with marketing and sales. We help with visibility, with industry-wide concept understanding, and with overall brand building. However, that alone is not going to finalize the sale.

How a company implements the benefits of PR campaigns is up to them. We were able to convert mistrust and doubt into industry acceptance. We turned zero industry and vertical market coverage into a constant and meaningful press presence, which directly resulted in turning new business meetings full of doubt and laughter into earnest opportunities. This is the real ROI of PR.

How Does This Apply To Me?

Now, you may be thinking, I am not a foreign company looking to break into the U.S. I am not involved in a technology that no one believes is real. I have successfully existed for decades without PR, why do I need it now?

While some, or all, of this may be true, the underlying principles of that story are just as impactful for a 50-year-old company with no PR history and who makes

Communication

Media

Sender → Reciever

industry standard satellite dishes. I would argue that if you have not engaged in PR of any sort at this point in your company's history, the days of equal success without it are rapidly dwindling—more on that later.

If your current approach and analysis of PR success is based on that immediate monetary ROI, then chances are you have already gone through at least two PR firms. The change of PR agencies also probably coincided with the fiscal success of the company for the quarter. You may have even found that after engaging the second or third firm, profits grew, and that change of guard was part of the reason for success.

However, if you take into consideration that claims of immediate fiscal ROI are completely false, it is just as easy to say that the "success" you are seeing from the new firm is actually the result of the previous firm's campaign working its magic. Or, that the success has nothing to do at all with any of the hired PR firms—you just happen to have had a great sales quarter that was independent of any PR outreach. There really is no way to tell. I wish there was. It would be great to say (as many firms do) "I guarantee that my work will breed one million in sales over the next quarter." There are just too many variables in play to make such absurd promises.

The Long Play

The real value in PR is the long play, the gradual and consistent build of industry awareness, recognition, and trust. It is most often slow, gradual, and makes the work of the sales and marketing teams easier when interacting with clients. This is why basing PR success solely on profits, and changing firms as a result, is so incredibly detrimental to the long term PR impact of the company, regardless of the firm hired.

A key to PR success is consistency; consistency in messaging and approach. Each time one PR firm is replaced by another, it is like hitting the reset button. Your boilerplate and one liner may be the same, but how your company is presented to the press, the angles of outreach, even the tone of the pitches themselves, all change. That change can be felt by your target customers. Every time a PR change is made, such requires a few steps back to rebuild the brand, company image, and to reposition the executives as experts.

This is not to say that there are never reasons why you should fire a PR firm—there are many conditions that could find a PR firm being released. If an agency's efforts fail to ensure the client firm is involved with those industry conversations played out in the media, if they fail to understand the company messaging, and produce subpar work, then they should be removed. In cases where industry recognition is not being achieved, removal is worth the time required for a reset in such cases. Retaining an ineffective firm can do more harm than good for your company. Just be certain the PR team is being judged on the correct criteria.

Ignoring PR Means Ignoring Yourself

Why is engaging PR for established companies more crucial now than ever before? The simple answer is technology. At this point, talking about the speed of communication is almost cliché, but non-the-less true. Fifteen- to 20-years ago, it was completely plausible to forgo any sort of PR outreach as it was faster to direct mail new product information than write up a press release for a print publication and then wait for the story to run.

This is no longer true. All it takes to get widespread coverage is an email, a phone call, and a story uploaded to the web that can go viral. Most print publications have a digital version—journalists are posting stories by the minute, not weekly, and reader feedback is instantaneous.

Let's say, for instance, you have developed a mobile uplink unit that is 15 percent lighter and allows camera operators to access more remote areas. At the same time, a competitor has simultaneously released a unit which is only 8 percent lighter. Where the competitor has conducted a PR campaign reaching out to industry and vertical publications, social media, blogs, and online forums, your firm decides to stick with a direct mail campaign and an aggressive sales pitch.

By the time your salespeople get through to the local news station, the potential buyer has already read about your competitor several times in the variety of media. This makes converting your sale that much more difficult. The goal should always be to drive the customer to reach out to you. By neglecting PR, what you are really doing is removing yourself from any digital relevance and also suffering from no presence in any of the traditional industry media. How will anyone know who you are?

I had spoken once to a satellite dish developer who consciously avoided PR outreach because they had experiences in the past where competitors stole their technology, re-branded it, and then sold it at a lower price. Their solution to this was halting all PR outreach. Chances are this move did not accomplish two things.

- » It probably did not stop continued sales by the competition
- » It probably did not negate any beliefs that this competitor was an industry leader for the target technology segment

What avoidance of PR accomplished was to instantly move the dish developer completely out of the conversation regarding future dish technologies. It also greatly limited the number of customers who were aware of anything the dish firm was doing... aside from past customers and whomsoever was on their new outreach database. The question any company with this lack of outreach plan can expect in a sales call is, "If you guys are so great, why am I reading about everyone else?"

The fear of having material stolen is certainly understandable—but such is not the result of a PR campaign. There is a simple rule to avoid this—the Rule of Duh. If there is something you don't want people to know about, don't promote it. Assume every word you release to the public is... well, public. If you keep this in mind for all PR outreach, then it is difficult for a PR campaign to undermine a company in the ways this particular dish developer was concerned about.

The Jist

There is a huge potential for finding long term success for any company within the satellite industry through a focused PR campaign. With PR, you can create a lasting and positive impression of your company and those who run it, not only with your peers, but your important target customers and the greater business community.

Public relations is a long play tactic that realizes positive results through consistent outreach. For the most part, there is no instant monetary ROI for PR within a sector as complex as the satellite industry. With this in mind, you need to take PR firms' claims of ROI around a specific cash amount with a huge grain of salt. As the technology behind communication becomes faster and more concise, having a presence in this world becomes all the more crucial—engaging a person, or firm who understands today's media environment is a critical component of a company's success.

Whatever your plan for visibility is for this coming year—be it the acquisition of an outside PR firm, hiring an internal PR person, or even employing a freelancer to work with you on some of your more important announcements, I hope you do engage in Public Relations. In one form or another, PR will help you build and grow your image within the minds of all of your potential customers or clients. I wish you all a very successful SatCon (and IBC).

About the author

Josh has been working in PR for nearly a decade and has represented everything from politicians to satellite technologies. For the past 5 years, his focus has been primarily on high tech B2B markets, working directly with the many facets of the broadcasting industry and beyond. Josh is committed to lifting the veil over the PR industry to help companies make well informed decisions with realistic expectations as they seek market visibility.

About Glass Lantern

Glass Lantern PR illuminates and communicates your messages using the hallmarks of creativity, ingenuity, determination and dedication. While communication methods have changed, trust and transparency are still the bedrock of lasting relationships and serve as the cornerstone of our partnership with you.

Glass Lantern PR is operated by Joshua Kail and William Madaras. With more than 40 years of public relations experience between them and the application of their Results Assurance approach, they have built client successes across a number of industries. The firm's specific focus includes high tech B2B and B2C companies in the sectors of SATCOM and satellites, consumer electronics, software, cable, cyber-security, medical, gaming, social media, photography and more.



For further information, please view:

Website: <http://www.GlassLanternPR.com>

The Intersection Of Recruiting + Marketing

By Bert Sadtler, Senior Contributor

During challenging times in business, shouldn't all of the oars in the boat be used to propel a company's forward momentum? To safely navigate through the bumpy water, let's discuss the relationship between two important oars: Best Practice Recruiting and Marketing.

Best Practice Recruiting is a process-oriented event. Marketing offers the ability to echo the employer's differentiators and positive attributes, which leads to attracting the "right talent." In many recruitment campaigns, marketing the employer's brand is underutilized. Here are several ways marketing in recruitment can be leveraged:

- An announcement of a critical need states to the marketplace, "We are growing and we need to add talent."

- A detailed position description can be used to highlight accomplishments and differentiators to the marketplace.
- The position description should authentically incorporate the company's values, culture and overall brand message to not only attract the right person, but deter potential applicants that may be the "wrong fit."

For a deeper dive, we have asked a marketing expert to offer perspective and focus on how marketing and recruiting can work in tandem. Wendy Baird is president of **Insight180**, a brand consulting and design firm for B2B advisory firms, located in the Greater Washington, DC region. Her clients include nonprofits, IT Consultants, Government Contractors and other advisory companies.



The following are Wendy's comments from our recent discussion. It's interesting how many of her comments naturally align with our views of best practices in recruitment, and they offer a valuable dimension.

Baird defines a brand as: "The essence of a company. Not just a logo and a name, although that is part of it. A brand is what the audience, whether that be the customer or a potential employee, feels when they think of your company. It is part reputation, part vibe, part aesthetic. A brand is also a promise from a company which is made through marketing/advertising/products or services and kept through actions and the test of time."

From the perspective of a seasoned marketer, here are Wendy's thoughts on integrating marketing into a recruitment campaign are as follows:

- When you're seeking the best talent in a competitive space, your brand needs to resonate with the potential recruit. It's important to think about how the brand has been presented to the talent and whether that representation is consistent on your website, LinkedIn and other marketing activities.
- It's important to research and find out if the talent's impression of your company is a good one, and if not, what you can do to change that.
- Another question to ask is what your company is known for. For example, having a reputation for being one of the best places to work goes a long way in attracting the best talent.
- Does your company have reputation for treating employees well and offering stimulating and secure employment with avenues for career advancement?

All of these questions must be addressed throughout the recruitment campaign in order to maintain the message you want to send to potential recruits.

One of the main goals of marketing is to put a brand in front of a target audience (in this case, the talent) in order to engage that audience and ultimately generate interested and qualified candidates. With recruitment branding, marketing's role includes building a relationship between the company and the talent, making the audience feel a certain way about your brand and creating a customer experience. Marketing also includes developing a dialogue for receiving feedback and evaluating insights.

Baird emphasizes the importance of the integration of the leadership's values into the culture of the company—such as a huge part of developing your "recruitment brand." Once identified, these values need to be constantly reinforced, from word of mouth in employee training classes to visual reinforcement on the walls or in a handbook. All employees should be on the same page regarding company values, as this will reflect internally and externally and employees will feel they are part of something that truly matters.

This extends beyond the workday. Whether you are aware of it or not, your brand is being expressed by word of mouth. Employees talk to their friends and families about their employer. Whether it's in a positive or negative

light is a direct result of the current culture of the company. When the values and culture jibe, then your brand will be accurately and positively reflected. Employees with a well-spoken message make great ambassadors—they are essentially your recruiters—particularly when it comes naturally.

In today's marketplace, candidates visit an employer's website as part of basic research. Websites have become more important than ever. As an employer, one factor to think about is designing your website with future employees in mind. Also, engaging a target market on Social Media and on a company blog is a critical part

of marketing. Having an online presence that clearly communicates the atmosphere and values is vital. The social nature of the Internet has become a big factor.

Many want to share what they're doing from location based "check-ins," through images, videos and other rich media. Just as employees enjoy posting Instagram pictures of what they're eating for dinner, they also enjoy posting reviews of their job experiences. Many recruiting and job search sites now have review sections. Websites such as *glassdoor.com* and *indeed.com* make it easy for any site visitors to know exactly what your current and former employees think of working for your company. Your unique brand message in your marketing is key in helping your audience connect with you as a potential client or employer. If you aren't managing the message, it leaves room for less desirable outcomes.

Baird also stresses authenticity. Create an accurate company representation. Lay out the facts. Let the talent know exactly what they're getting into. Your audience is savvy. With social networks so prevalent today, potential candidates (and customers) can sense a disconnect from a mile away.

We would add to Baird's comments the importance of constant internal communication interwoven into the overall marketing effort. While this may appear obvious, lots of employers could gain more "marketing benefit" with a minimal amount of additional effort. As every employee serves as an ambassador of their company, recruitment could be indirectly occurring when there is no formal open position and a seed is being planted for a future opening.

Through good internal communication, employees are always informed about the direction and focus of their employer, making the employee appear confident and knowledgeable, thus making the employee more attractive to potential future candidates.

In summary, remember that recruiting is a process. Integrating marketing into a recruitment campaign offers numerous advantages. Remaining competitive though every available means leads to a strong result. By leveraging brand messaging and marketing efforts as a part of a recruitment campaign, companies have the ability to attract the "right talent" while also improving the perception and awareness of the employer.

Good hunting and good marketing.

About the author + Boxwood Search



Bert Sadtler is the President of Boxwood Search and a Senior Contributor for SatMagazine—There is an ongoing battle for senior level talent. A great hire can make a long term positive impact and a failed hire can prove to be very expensive. How does a company recruit and hire the right talent? It is more than just networking within the community of friends and business associates. It requires focusing on results through a process oriented approach. We are committed to reaching a successful outcome. Our recruitment method has repeatedly proven to deliver qualified senior talent. Contact Bert at BertSadtler@BoxwoodSearch.com for more information.

The Importance Of Proper Alignment

By Sam Fasullo, Satellite Product Manager, Norsat International Inc.

Although a satellite's footprint covers a large area, it is imperative that your satellite terminal be aligned in the exact direction of the satellite to ensure a precise transmit path and to maximize signal strength for the receiver. If the terminal is slightly out of position, signal strength could be reduced, causing the received signal to be unusable. In addition, an improperly aligned terminal could affect adjacent satellites, as the transmitted signal could interfere with their operation. This interference could potentially cause issues with your satellite service provider and you may be prevented from operating your terminal.

To guarantee precise alignment while maintaining good terms with your service provider, it is imperative that a technician possess the proper satellite alignment tools in their toolkit. Although this is not an extensive kit list, here are some of the more frequently used tools:

- GPS
- Satellite Angle Calculator
- Current Satellite Almanac
- Level
- Compass
- Inclinometer
- Signal/Power Meter
- Spectrum Analyzer
- DVB Receiver
- Modem

Aligning and pointing a satellite terminal is a relatively straightforward procedure. However, if a technician doesn't have the basic tools available for use, this simple task could become difficult and quite time consuming. A technician must have the appropriate physical tools as well as the ability to follow accepted, standardized methodology for satellite acquisition

Methodology

1. Determine your location
2. Determine the location of the desired satellite
3. Calculate the azimuth and look angle and polarization
4. Level your terminal
5. Point your terminal at the satellite
6. Fine tune adjustments of your terminal

The first step in terminal alignment is determining where to point the dish. To calculate the azimuth and inclination angles, you will need to know the terminal's location relative to the satellite's location. Although you could use a map and calculate the latitude and longitude of the terminal's current position, a GPS is far more accurate and relatively inexpensive to purchase. There are many free, online, mapping tools on the Internet that you can use as an alternative to using a GPS. For example, Google Maps gives you an accurate location by drilling down and clicking on your location through their interactive GUI.

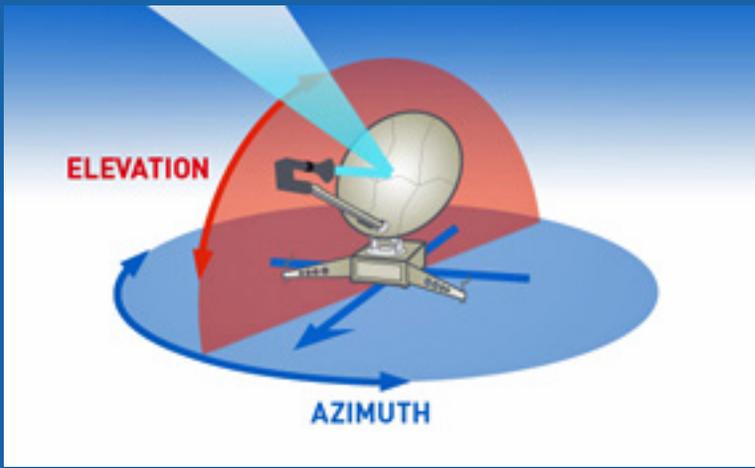


The next step will be to calculate the pointing angles. A satellite angle calculator is basically a reference source that will provide the proper compass heading, azimuth, elevation and look angle for the terminal, relative to the terminal's ground position and the particular satellite. This tool is quite easy to use (and usually free)—one only needs to input the terminal's latitude and longitude along with the satellite that you are trying to lock onto. Websites such as www.dishpointer.com, or an iPhone app such as Norsat's Satellite Locator, are some examples of available tools. If you do not have access to these types of on-line tools, a satellite almanac is required—this is a reference source that gives you the location of each satellite.

Now you are ready to point your terminal.

The first physical tool you should use is a level to ensure that your terminal base is as level as possible. This is extremely critical for assisted acquire terminals as many auto acquire terminals have a leveling feature. Leveling will safeguard you from missing the satellite as the dish is rotated.

As previously stated, the look angle is the angle between the ground plane of the terminal and the satellite itself. This measurement can be done using a simple compass ruler and plumb line, or a mechanical inclinometer such as is displayed in the figure below. These tools would be attached to your terminal and you would directly read off the angle. Additionally, depending on your system, your terminal could have an integrated electronic inclinometer that works with the system's GUI. One caveat of measuring the elevation is that you must account for any offsets of the feed horn from the center axis and either add or subtract the difference, accordingly.



Measuring the azimuth is another relatively straightforward calculation that is accomplished by using a compass. There are many types of compasses and it doesn't really matter if you use a traditional floating needle compass or a digital compass. However, you must account for the magnetic declination when taking a compass bearing. The magnetic declination is the difference between true north and magnetic north.

The satellite calculator, compass and inclinometer are standard tools to use to get your terminal aligned and pointed in the general direction of the satellite. Once pointed, you then need to fine-tune these measurements to actually acquire the satellite. The following will help you accomplish this task.

Signal Meters or Power detectors are quite inexpensive. These tools will measure the relative power of a satellite signal and give you an indication of whether your terminal is pointing to a satellite. Unfortunately, a disadvantage of a signal meter is that they cannot tell you which satellite you are targeting. However, if you know the location of a reference satellite, you should be able to rotate the dish along the orbit, counting the satellites that you have detected until you reach the desired satellite.

Spectrum analyzers are a step up from signal detectors. Similar to signal meters, spectrum analyzers will indicate that you are on a satellite and you can adjust your terminal to that signal. However, just like a signal meter, a spectrum analyzer will not tell you which satellite you are on. However, each satellite does have a particular signature and, unlike a signal detector, you can view these signatures with a spectrum analyzer.

Over time, a technician can build up their library of spectrum views and have full confidence that they are on a specific satellite. Another advantage of a spectrum analyzer over a signal detector is that a spectrum analyzer is more sensitive. That is, if there are two satellites close together, you would be able to see the difference. Also, for a narrow band carrier, the spectrum analyzer will see the satellite, where a signal detector will not be able to do so.

Finally, a modem and/or DVB receiver will allow a technician to validate that they have locked on to their desired satellite. A modem will only lock onto a specific satellite signal when the technician has aligned and peaked the terminal. The same is true with the DVB receiver—it will decode and allow a technician to view the transmission from the satellite, but again, only if the terminal has been properly aligned. If the technician knows what is being transmitted and can view it or lock onto the signal, they have just confirmed they are on the correct satellite; however, a spectrum analyzer or a signal meter should be used as well to guarantee they are receiving the best max signal possible.

In the end, a satellite signal is only as good as the properly tuned terminal—technicians need the correct tools to accomplish this job effectively.

About the author

Sam Fasullo is a Product Manager at Norsat International Inc. for the Company's Satellite division. He has more than 12 years of communications experience.

About Norsat International

Norsat International is a market leader in communications solutions. Norsat's technologies enable the transmission of data, audio and video for remote and challenging applications. Included in Norsat's product offering is the SAA (Satellite Acquisition Assistant) toolkit that provides an all-in-one convenient, cost effective solution for quick, simple and accurate satellite acquisition. For more information about Norsat's satellite solutions or SAA toolkit, please contact a Norsat Representative. To learn more about Norsat's products and applications please visit <http://www.norsat.com/solutions/>

Norsat's Helping Hands

Norsat's satellite accessories options streamline the process of terminal set up and operation, enhancing the performance of any Norsat satellite terminal.



SAA

Norsat's Satellite Acquisition Assistant (SAA) is a complete satellite acquisition toolkit with everything required to quickly and accurately acquire a satellite lock. The SAA includes:

- » Spectrum analyzer
- » Integrated GPS, inclinometer, and compass
- » Narrow band receiver
- » DVB receiver
- » Intuitive LinkControl Software Interface



CIDU

Norsat's Compact Indoor Unit (CIDU) offers an integrated, modular IDU solution, portable enough to travel wherever you need to go—the CIDU includes:

- » Power Supply
- » SAA module
- » System Control
- » A variety of modem options

Weather Satellites: Critical Technology In An Uncertain Environment

By Dr. Mariel John Borowitz, Research Analyst, Space Foundation

In 2011, the United States experienced 14 weather disasters costing \$1 billion or greater, more than occurred in any other year on record. The second-greatest number occurred in 2012, with 11 billion-dollar disasters.¹

Weather has a significant impact on the nation through severe storms such as these, affecting businesses and individuals alike on a daily basis. More than 90% of the data in U.S. three- to seven-day weather forecasting models comes from satellites.² U.S. weather satellites provide billions of dollars in benefits through improved early warnings and by informing the decisions of companies in many industries, including aviation, energy, and agriculture.

The United States is currently developing its next generation of weather satellites, which will include major technological advancements that will significantly improve capabilities for weather forecasting. These programs are making good progress toward their current launch dates, however, they are operating in a very challenging environment. In 2013, the Government Accountability Office added "mitigating gaps in weather satellite data" to its list of 30 high-risk government operations.³

Originally expected to launch in 2009 as part of the National Polar-orbiting Operational Environmental Satellite System (NPOESS) program, the next operational polar-orbiting weather satellite system is now expected to launch in 2017 under the Joint Polar Satellite System (JPSS) program. The eight years added to the original launch date for the next-generation system has created a substantial risk of a gap in satellite data, which NOAA officials estimate will most likely last at least a year and a half, and result in degradation in the accuracy of three- to seven-day weather forecasts.⁴ If any additional delays or unexpected failures occur, the gap could last even longer.⁵

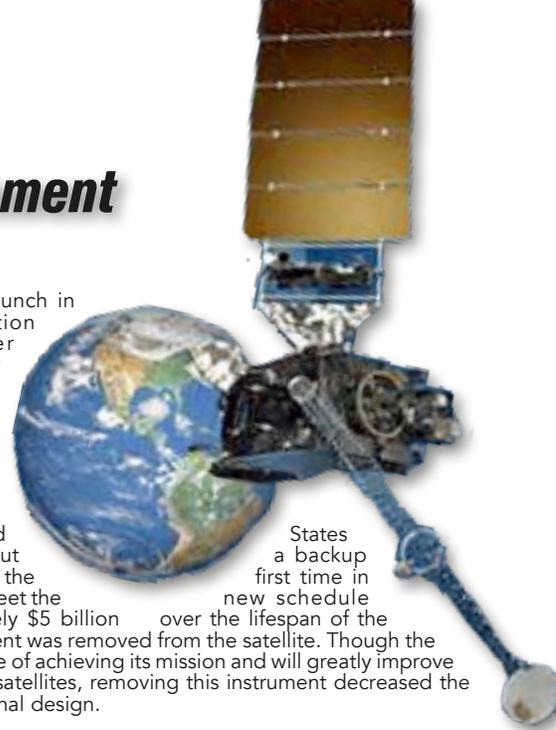
The U.S. polar-orbiting weather system originally included satellites in two different orbits, but it was later reduced to only cover one orbit. A partnership with Europe has helped to ensure continued coverage in the other orbit, but for its own portion of the constellation, the United States will soon have to rely on a satellite originally designed for research, not for operations.

The second component of the U.S. weather satellite system, which consists of geostationary weather satellites, has also experienced delays and other challenges. These satellites continuously monitor weather developments over the United States and are essential for tracking the development of severe weather events, such as tornadoes and hurricanes.

Originally planned for launch in 2012, the next-generation geostationary weather satellite, Geostationary Operational Environmental Satellite R-Series (GOES-R), is now scheduled for launch in 2015.⁶ The three-year postponement is not expected to cause a gap in coverage, but the United States may temporarily be without a GOES satellite in orbit for the more than a decade. To meet the new schedule and to save approximately \$5 billion over the lifespan of the program, a major instrument was removed from the satellite. Though the satellite will still be capable of achieving its mission and will greatly improve on current geostationary satellites, removing this instrument decreased the capabilities from the original design.

Action must be taken to ensure the long-term success of the U.S. weather satellite system. As a government service with one of the most well-demonstrated and straightforward benefits to the nation, future weather satellite programs should be properly selected, managed, and funded to help prevent the type of delays that have left current satellite programs in this precarious situation. The United States should invest in advanced technology development to provide improved weather forecasting capabilities in the future. Weather satellites help to save lives and save money, and we must ensure that this crucial technology is not neglected.

Recommendation 1: Program offices should provide accurate and stable life-cycle cost estimates for weather satellite programs, and Congress should respond with full and stable funding for these programs, including JPSS, GOES-R, and the Constellation Observing System for Meteorology, Ionosphere, and Climate 2 (COSMIC-2).

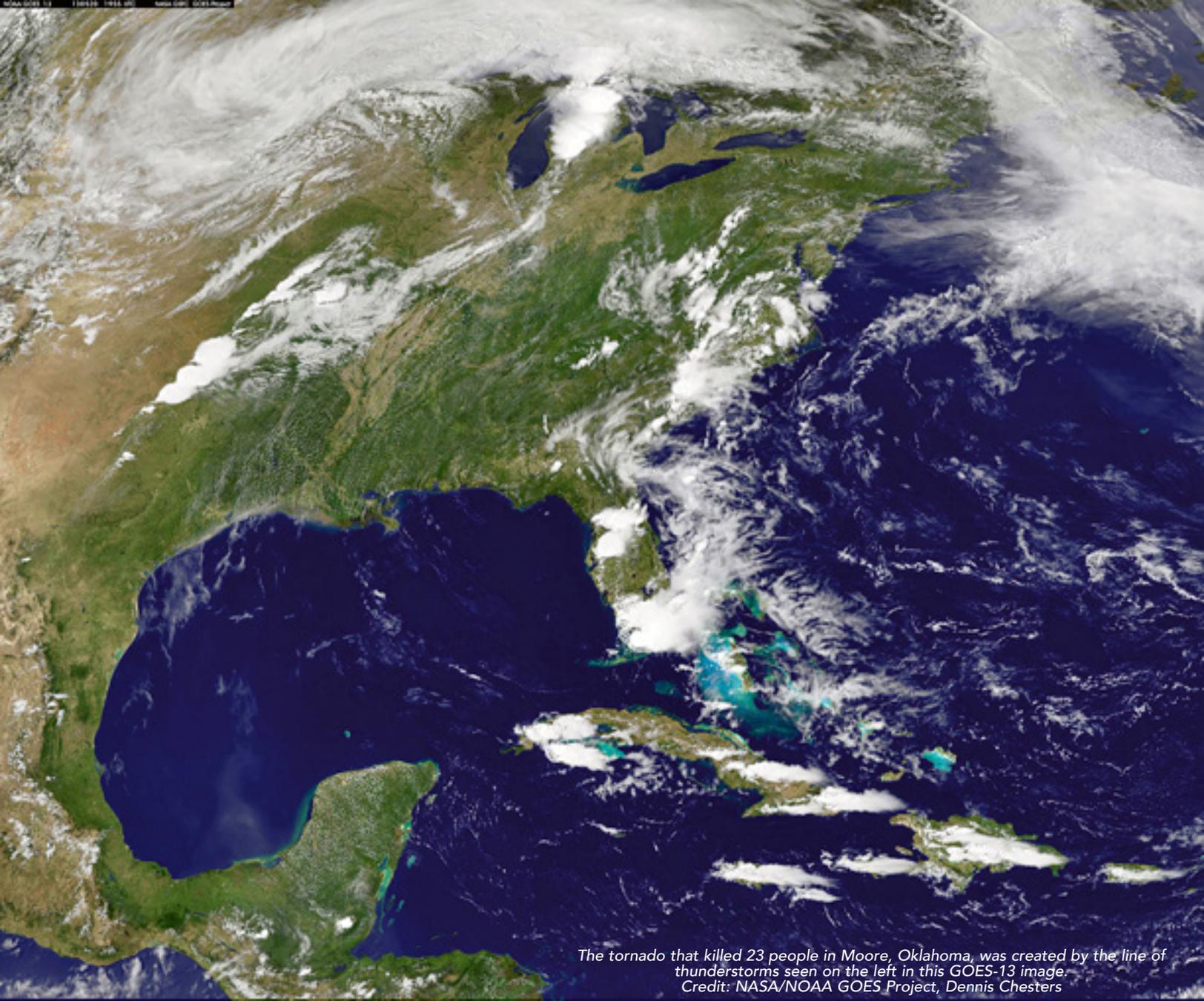


States
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first time in

new schedule
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Many satellites are only able to view the Earth during the day, when it is illuminated by the Sun. The VIIRS sensor aboard the Suomi NPP satellite allows scientists to view the Earth's atmosphere and surface both day and night. Credit: NOAA/NASA



*The tornado that killed 23 people in Moore, Oklahoma, was created by the line of thunderstorms seen on the left in this GOES-13 image.
Credit: NASA/NOAA GOES Project, Dennis Chesters*

While recent progress in both next-generation weather satellite programs has been positive, stability in program requirements, high-confidence cost estimates, and full funding are required to ensure they remain on track. Ever-growing life-cycle cost estimates, as seen in the NPOESS program, cause policymakers and the public to lose confidence in these estimates and make well-informed policymaking nearly impossible.

At the same time, unstable budgets and lower-than-requested funding for these programs exacerbate the problem, leading to delays in development and increasing life-cycle costs. These issues have resulted in a near-certain satellite data collection gap that will reduce the U.S. capability to forecast weather. In addition, focusing on the top-line budget numbers, rather than the budget needed for the mission to succeed or the return on investment, has led to short-sighted decisions that will cost taxpayers more in the long run. These budget and funding issues must be addressed.

Recommendation 2: The United States should seek opportunities to increase international cooperation on weather satellite programs to help decrease costs and increase capabilities.

The United States is already involved in a number of international agreements related to weather satellites that increase its capabilities while saving taxpayer money. The nation operates a joint polar-orbiting weather satellite constellation with Europe, in which each partner provides weather data critical for both regions. The United States engages in international exchanges of weather satellite and research satellite instruments, getting free rides for its instruments and receiving other countries' instruments for inclusion aboard its satellites.⁷ The United States also has an opportunity to collect valuable radio occultation data in partnership with Taiwan, a program that would provide the United States with the full value of

the satellite constellation for a fraction of the cost of the overall system. The United States should take advantage of these opportunities and actively pursue others.

Recommendation 3: The United States should explore the potential for working with commercial weather satellite data providers to augment current weather satellite capabilities and improve weather forecasting.

A number of companies have been established to build weather satellites or sensors to collect important weather data, using advanced techniques such as hyperspectral sounding or radio occultation. In some cases, these companies' proposed systems would have capabilities not present in the current or planned U.S. weather satellite system, and adding these capabilities could improve the nation's forecasting ability.

Data buys have the potential to be less expensive than full satellite procurement, but their business models may be difficult to reconcile with the U.S. policy of free and open data sharing on an international basis, which is essential to global weather forecasting as well as the value-added sector. The United States should explore the potential of these options while maintaining its commitment to free and open exchange of meteorological data, looking for partnerships that can reduce costs or increase capabilities.

Recommendation 4: The United States should conduct a comprehensive review of its weather satellite program portfolio to determine the correct level and distribution of funding to achieve the desired capabilities.



The Suomi NPP satellite orbits the Earth from pole to pole about 14 times a day, flying over almost every area of the globe twice. This "blue marble" image was created from multiple images taken by the VIIRS instrument on January 4, 2012. Credit: NASA

In order to keep system development costs down and minimize delays in launch, the United States has removed several advanced instruments from its next-generation weather satellite systems and has reduced the complexity and capabilities of some remaining instruments. Given the billions of dollars and thousands of lives affected by weather in the United States each year, leaders should carefully evaluate whether scaling back the planned capability of the United States to accurately forecast weather is truly in the best interest of the nation and should also consider providing additional funding to improve capabilities. The weather satellite system in the United States is an area that requires careful consideration regarding levels and types of investment, and a thorough review of future plans would help to ensure that the United States has a weather satellite system appropriate for the needs of the country.

The findings and recommendations in this report are based upon publicly available information. The views expressed are solely those of the author and may not reflect those of the Space Foundation's Corporate Members. The support of these



Artistic rendition of the Suomi NPP satellite, courtesy of NOAA.

organizations for the Space Foundation's broad spectrum of activities should not be construed as endorsement of, or agreement with, the findings and recommendations of this report, and should not be taken as reflecting the positions or stance of any of the supporting organizations.

The full report can be downloaded at <http://www.spacefoundation.org/programs/research-and-analysis/whitepapers-and-analysis/weather-satellites-critical-technology>

If you have questions about this paper, please contact research@spacefoundation.org.

Endnotes

- 1 "Billion Dollar Events." Billion-Dollar Weather/Climate Disasters. NOAA, n.d. Web. 28 June 2013. <http://www.ncdc.noaa.gov/billions/events>.
- 2 United States. NOAA. Continuing Oversight of the Nation's Weather Satellite Programs – An Update on JPSS and GOES-R. By Kathryn D. Sullivan. NOAA, 27 June 2012. Web. 28 June 2013. <http://www.legislative.noaa.gov/Testimony/Sullivan062712.pdf>.
- 3 High-Risk Series: An Update. Rep. no. GAO-13-283. United States Government Accountability Office, Feb. 2013. Web. 28 June 2013. <http://www.gao.gov/assets/660/652133.pdf>.
- 4 Polar-orbiting Environmental Satellites: Changing Requirements, Technical Issues, and Looming Data Gaps Require Focused Attention. Rep. no. GAO-12-604. GAO, 15 June 2012. Web. 28 June 2013. <http://www.gao.gov/assets/600/591643.pdf>.
- 5 "Joint Polar Satellite System (JPSS)." JPSS Launch Schedule. NOAA, n.d. Web. 28 June 2013. http://www.jpss.noaa.gov/launch_schedule.html.
- 6 United States. NOAA. Continuing Oversight of the Nation's Weather Satellite Programs – An Update on JPSS and GOES-R. By Kathryn D. Sullivan. NOAA, 27 June 2012. Web. 28 June 2013. <http://www.legislative.noaa.gov/Testimony/Sullivan062712.pdf>.
- 7 United States. NOAA. Agreement Between the United States National Oceanic and Atmospheric Administration and the European Organisation for the Exploitation of Meteorological Satellites on an Initial Joint Polar-orbiting Operational Satellite System. Washington: n.p., 1998. Print

About the author

Weather Satellites: Critical Technology in an Uncertain Environment was written by Mariel Borowitz in her capacity as a research analyst at the Space Foundation. She recently completed her Ph.D. at the University of Maryland School of Public Policy. Her research dealt with international cooperation in climate monitoring via satellite, focusing on the barriers to data-sharing. Dr. Borowitz earned her master's degree in International Science and Technology Policy from the George Washington University, and her Bachelor of Science degree in Aerospace Engineering from the Massachusetts Institute of Technology, with a minor in Applied International Studies. As of August 2013, Dr. Borowitz has joined the faculty at the Sam Nunn School of International Affairs at the Georgia Institute of Technology, where she will continue her research on space policy issues.



Editor's notes

SatNews Publishers wishes to thank Space Foundation (<http://www.spacefoundation.org>) for allowing SatMagazine to republish this report.

Artistic rendition of the GOES-R satellite on the first page of this article is courtesy of Lockheed Martin.

Event: The SATCON Connection

SATCON 2013: Industry CEOs and future leaders set the course at SATCON where compelling content, industry-leading exhibitors, partners and satcom end-users connect

For the twelfth consecutive year, the satellite industry will be converging on New York City for the SATCON exhibition and conference that will occur on November 13th and 14th at the Jacob Javits Convention Center. (www.satconexpo.com)

SATCON continues to offer an important gathering place each fall for satellite industry executives, their partners and many high powered end-user customers—this makes the event a “must attend” industry exhibition, conference and networking opportunity.

This year SATCON, combined with Content & Communications World (CCW), will feature a world-class program with 175 speakers, 50 sessions (25 of which are satellite focused) and more than 300 exhibitors in the combined two shows—some 6,000 people are expected to attend the trade show.

The SATCON conference program will cover a wide range of important topics related to satellite-enabled communications used by government and military, broadcast, media and entertainment, telecommunications, mobile satellite and enterprise firms. Thought leaders from DISA, DoD, the MSUA, SSPI, the WTA, Global VSAT Forum (GvF), the Hosted Payload Alliance, Intelsat, SES, Hughes, Inmarsat, ABC, CBS, CNN, Fox and others have contributed to this year’s session topics and speaker selection for panel sessions and keynotes related to commercial and government SATCOM users.

Expert speakers, including end-users, industry experts and satellite industry executives, will provide SATCON attendees with strategies for managing their communications infrastructure including video, data, voice and Internet using satellite, fiber, mobile and wireless technologies.

New + Notable Events @ SATCON

According to SATCON Event Director, David Reynolds, some of the many notable features of this year’s SATCON event include:

- The Industry Keynote session, entitled “Leadership Dialogue: Present Priorities, Future Visions, will feature Steve Collar, CEO, 03B Networks Ltd. and Pradman Kaul, President, Hughes Network Systems. These luminaries will be joined by the winners of SSPI’s 2013 Promise Awards for a discussion concerning the most profound trends that are shaping technology, the global markets and business models over the coming decades, from HTS to launch vehicles, ubiquitous communications to in-orbit industries. The SATCON Industry keynote will be held at 9:00 a.m. on November 14th, the second day of the show.



David Reynolds,
Event Director,
SATCON



- The winners of the 2013 Promise Awards will be recognized at the SSPI Future Leaders dinner, which will be held during the evening on November 12th. Since 2006, the Promise and Mentor Awards have honored men and women under 35 with the talent and motivation to advance into leadership positions in the satellite industry, as well as one executive recognized for mentorship of the next generation.

At the end of the first day of SATCON on November 13th Satellite Markets and Research will be hosting the second annual Vision Awards presentation and reception from 6:00 to 7:00 p.m. The Vision Awards will be presented to deserving individuals, companies and products in three categories: The Visionary Executive of the Year, Most Promising Company of the Year, and Most Innovative Product or Service of the Year. A key difference between the Vision Awards and other awards in the industry is that the Vision Award recognizes future promise and potential as well as visionary thinking and execution. All SATCON attendees are invited to attend the Vision Awards.

Separate registration is required to attend the Vision Awards reception and the SSPI Promise and Mentor Awards dinner.

Top Notch Conferences Sessions

"We have a full range of topics related to the industry, government and military markets, emerging markets, maritime, aeronautical, broadcasting, emergency response, hosted payloads, high throughout satellites and more. We offer very competitively-priced conference passes for vendors and complimentary conference passes for qualified end-users. The exhibit hall passes, which are free if you pre-register, include access to the keynote sessions and the vendor forums and workshops. Our informative sessions, industry-leading exhibitors and attractive attendee pricing make SATCON and CCW a great value for the attendees." said Reynolds.

The 2013 SATCON topics include:

Fundamentals of Satellite Communications Systems, Part 1

Fundamentals of Satellite Communications Systems Part 2

Government Keynote

Hosted Payloads Spawn New Paradigms on Affordability

Pushing the Envelope: How are Satellite Communications Systems Keeping up with and Leveraging Moore's Law?

Fighting Interference with Technology

Disaster Response: The Evolving Role of Satellite Communications in Survivor-Centric Responses

Platform Contractors' Perspectives on Future SATCOM Needs

The Role of Satellite in Aeronautical Communications

Next-Generation Content Distribution: Getting 4K to the Home (CCW Session)

Will High Throughput Satellites (HTS) Re-invent Satellite Communications?

Shifting Distribution Platforms

Keynote: Leadership Dialogue: Present Priorities, Future Visions

Industry Innovations to Compliment MilSatCom

The Over-The-Top Viewing Environment: Where Do Satellites Fit In?

Commercial SATCOM: The Importance of a Defined Role in the Future DoD Architecture

Maritime Communications: Opportunities and Threats

Emerging Markets: Satellites Fill the Gaps

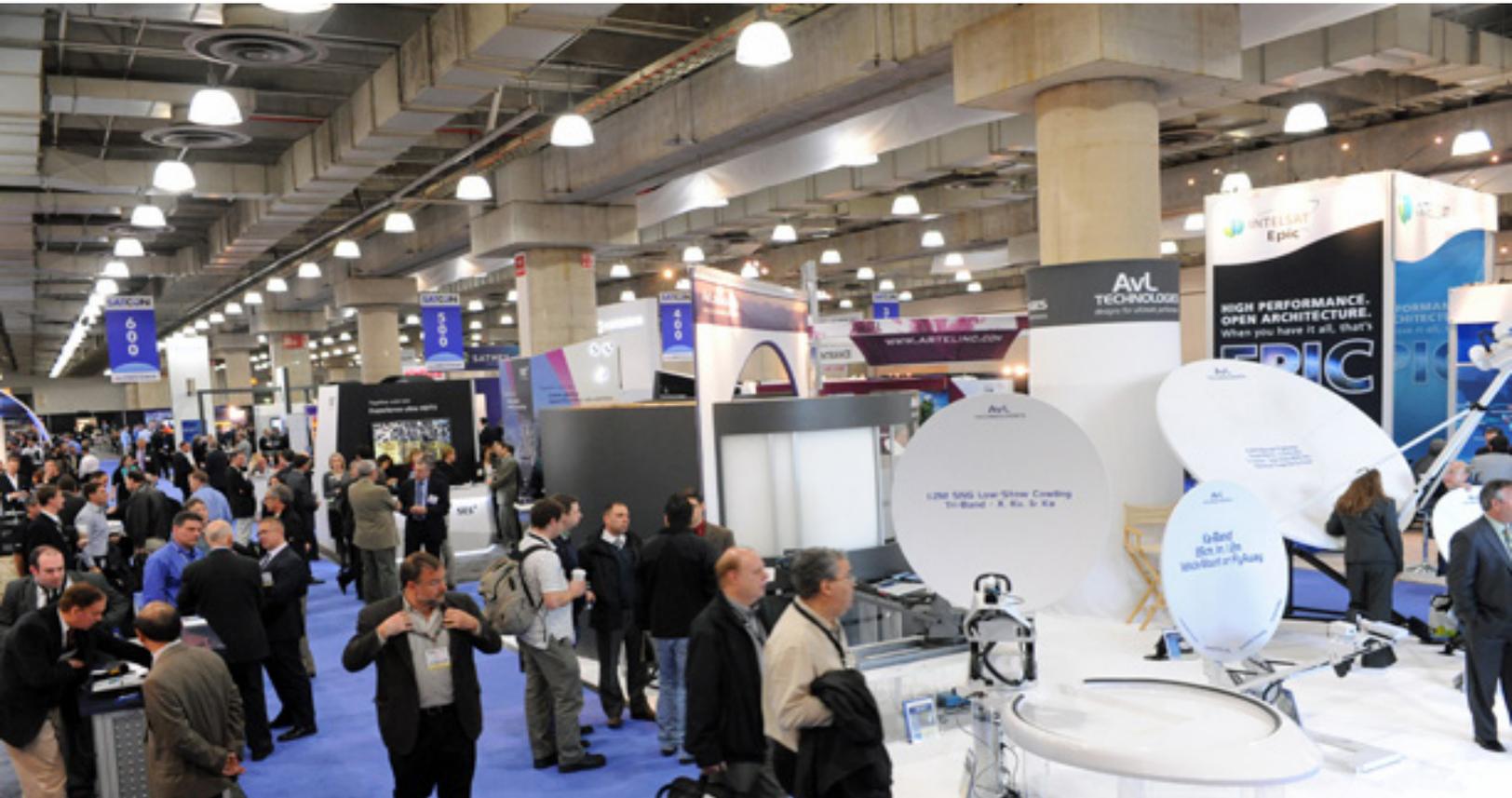
The Continuing Revolution in Next-Generation Newsgathering

"This year our conference team has created an interesting and compelling mixture of commercial and government sessions that will provide valuable insights into many of the most important satcom markets and technologies. On the exhibit floor attendees will see both the long-time, industry-leading, SATCON exhibitors as well as several new ones, so we encourage attendees to make plans to visit as many exhibitors as possible. SATCON and the co-located CCW event provide a comprehensive showcase of the latest satellite, terrestrial wireless, mobile and hybrid technologies for global communications, content delivery and distribution." Reynolds said in summary.

Attendee registration at SATCON is online at www.satconexpo.com.

SatNews readers, apply for your complimentary pass using VIP Code **CCG52**.

If you have any questions regarding this event, please contact the organizers of SATCON at info@jdevts.com.



Foundations: Kistler Aerospace

By Jos Heyman, Senior Contributor

In 1993, Walter Kistler and Bob Citron founded Kistler Aerospace for the purpose of developing a fully reusable launch vehicle capable of achieving an Earth orbit at a minimal price point.

Walter P. Kistler, born 1918 in Switzerland, had studied the sciences at the University of Geneva and earned a Master's degree in physics from the Swiss Federal Institute of Technology in Zurich. He migrated to the United States in 1951 and started working at Bell Aerosystems, where his first encounter with the space industry occurred through his work designing and building instruments for the Agena upper stage.

Soon thereafter, Kistler established the first of a number of companies that bore his name and he also became involved in SPACEHAB Inc., the company that built four re-usable modules that flew aboard the 18 missions of the Space Shuttle between 1993 and 2007.

It was during this time period when Kistler met Bob Citron, who was born in 1932 and educated at the University of California and Northrop University. Citron had been involved in a number of companies before he turned his attention to SPACEHAB Inc.

Located in Kirkland, Washington, USA, Kistler and Citron designed a two stage launch vehicle that, provided funding could be obtained, would have been capable of placing a 900kg payload in low orbit. They intended to provide regular and inexpensive services by ensuring the launch vehicle would be fully re-usable, resulting in dramatically economical rocket.

The proposed K-1 launch vehicle was to have two stages. The first stage, called the Launch Assist Platform (LAP), was to be 18.30m long and have a diameter of 6.70m, driven by two Aerojet AJ26-58 and one Aerojet AJ26-59 liquid fueled engines. These were, in fact, refurbished and upgraded Russian NK-33 engines, which had been developed for the N-1 launch vehicle—Kistler had purchased 58 of them through Aerojet.

At 130 seconds after launch, the LAP stage would separate and then follow a ballistic trajectory. Two drogue parachutes and two clusters of three main parachutes would decelerate the LAP for a landing close to the launch site, using four low pressure airbags.

The second stage, called Orbital Vehicle (OV), was driven by a single Aerojet AJ26-60, which would place the payload into orbit. The AJ26-60 was based on the Russian NK-43 engine and Kistler had purchased 18 of them, again through Aerojet. The OV was to be 18.60m long and had a diameter of 4.30m.

After payload separation, the second stage engine was to perform a de-orbit burn, moving the OV for atmospheric re-entry. At a speed of Mach 2.5, a high altitude stabilization chute would be deployed, followed by a single drogue parachute. Using three main parachutes, the OV would eventually land, using four, low pressure airbags. Recovery was expected to take place between 11 and 24 hours after the launch.

The OV was offered with two payload module configurations: The Standard Payload Module (SPM) and the Extended Payload Module (EPM). Kistler intended to provide a quick turn around time, providing a further economic advantage.

A period of nine days between launch vehicle re-use was planned. With a fleet of three such vehicles, Kistler hoped to be able to launch a satellite every three days.

Launch sites at Pahute Mesa in Nevada and Woomera in Australia were considered. From a logistics point of view, the Nevada site might have had the initial advantage. However, it was the flat, downrange area of Woomera that worked to that site's advantage.

Preliminary design was completed by the end of 1995 with the hiring of key staff members, raising capital from private investors, and discussions with potential sub-contractors and customers, as well as an assessment of the global satellite launch market. From this analysis, a strategic plan for the K-1's entry into the global satellite launch business was created. The company specifically targeted the launch of Iridium class communications satellites into a medium altitude orbit.

Between 1996 and 1999, the company completed the K-1 design and established ground facilities. It purchased, through Aerojet, a quantity of Russian engines and negotiated and obtained a launch site within the state of Nevada and 'ground had been broken' for a launch site in Woomera. Also, Space Systems/Loral awarded a contract for 10 launches with a value in excess of \$100 million.

Routine K-1 fleet orbital operations, delivering customer payloads to low Earth orbit, was originally planned to start in 1999 with full operational status by 2002. The company also envisaged future developments, including a K-2 vehicle that would be capable of placing 2,700kg into low-orbit and a K-3 vehicle with a capability of 9,000kg.

The company managed to acquire \$440 million from investors and development was soon underway. However, the expected boom that was to have fueled the development of these satellites did not come to fruition. Kistler had to file for bankruptcy in 2005.

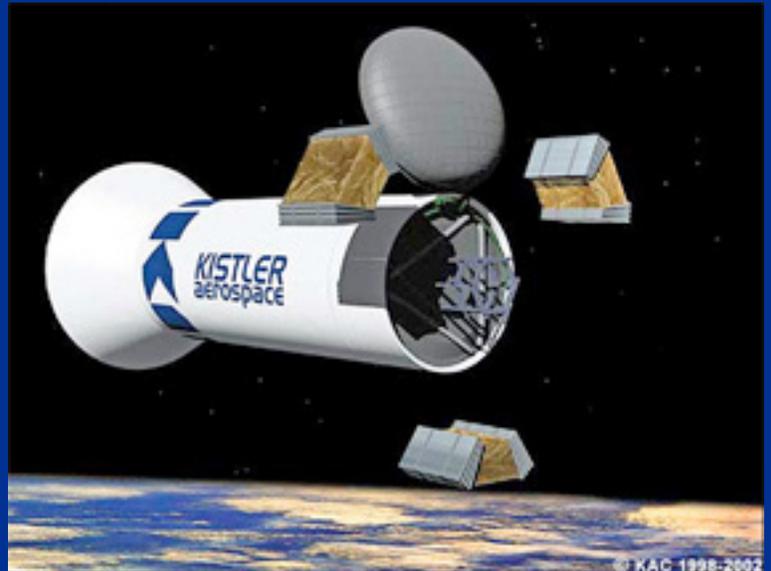
In February 2006, Rocketplane Limited Inc., a competing company, purchased Kistler Aerospace and continued to operate it as Rocketplane Kistler along with its additional subsidiary, Rocketplane Global. At this point, Walter Kistler and Bob Citron ceased their involvement and operations were moved to Oklahoma City where Rocketplane Limited headquarters and operations centers were located.

Rocketplane was formed in 2001 to develop, build and operate vehicles for the sub-orbital space tourism market. The company's Rocketplane XP was a proposed, four-seat, modified Lear executive jet fitted with a rocket engine that would allow it to be propelled to an altitude of 100km, where it would provide four minutes of weightlessness. The two jet engines were retained in the design to accommodate conventional flight. This vehicle was expected to make its first passenger flight in 2007, using the Oklahoma Spaceport in Burns Flat, Oklahoma.

In August 2006, Rocketplane Kistler was selected as one of the companies in NASA's Commercial Orbital Transportation Services (COTS) to develop a crew and cargo spacecraft to supply the International Space Station. For this project, the Kistler OV stage would be fitted with an ISS Cargo Module that would incorporate a docking collar and a pressurized cargo cabin. It would have a capacity of 3,200kg of cargo for the ISS and would have been able to reboost the ISS as much as 40km using the Orbital Maneuvering System of the OV. Launch on demand in as few as three days was offered.

Long term, it was envisioned that the cargo module could be modified to accommodate a crew. Rocketplane Kistler planned to have the first of three demonstration flights in 2008, all conducted from Woomera.

By September of 2006, Rocketplane Kistler missed the first of the financial milestones associated with the COTS agreement. NASA offered an extension—Rocketplane Kistler re-negotiated in February of 2007 and agreed to find \$500 million in private finance before the end of May of



Artistic depiction of satellite deployments.

2007. Earlier, in November 2006, Rocketplane Kistler had teamed up with Alliant Techsystems, with the latter company becoming the lead contractor for the K-1.

By August of 2007, the company had not obtained the necessary financing—it was forced to cut its workforce. On September 7, 2007, NASA informed the company that its COTS contract would be terminated in the following month, due to the continued inability of Rocketplane Kistler to meet its financial milestones. More employees were laid off in February 2009 and later that year, the company closed its Oklahoma City headquarters.

On June 15, 2010, Rocketplane Inc., the parent company, as well as the subsidiaries, filed for chapter 7 bankruptcy. Rocketplane Kistler listed \$108,250 in assets, including hardware and tooling for the K-1 rocket, as well as many unvalued patents and trademarks pertaining to the rocket. The company had liabilities of \$7.2 million.

On November 11, 2011, the assets of the company were auctioned off—these included all capital equipment and patents related to the company, and included physical assets that were located in seven facilities across the country.

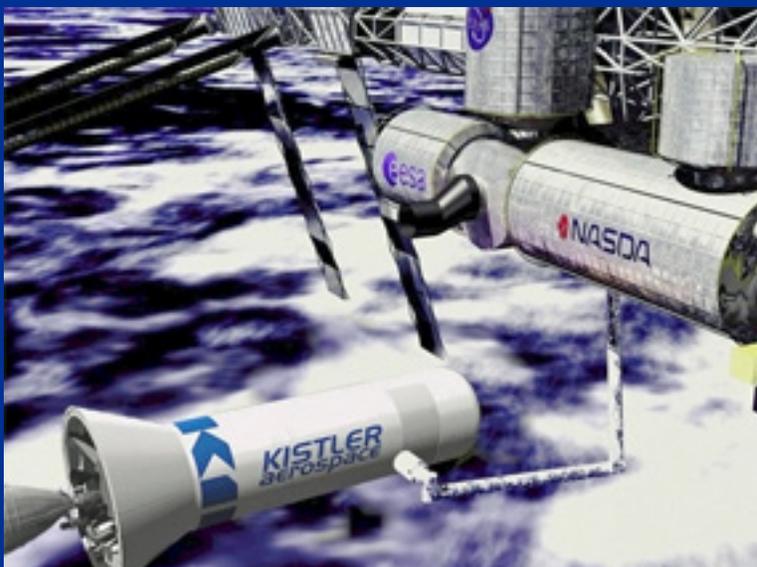
As far as Walter Kistler and Bob Citron are concerned, they established their Lunar Transportation Systems (LTS) company on January, 28, 2005, after NASA announced plans to return humans to the Moon and to build a lunar base. LTS proposed a new Earth-Moon transportation system using modularity and flexibility, leading to reduced development cost, a faster development schedule, and better evolvability.

LTS was a privately financed company that required cooperation from NASA in order to raise the private capital required to design, build, ground test, flight test, and operate its Earth-Moon transportation system. The concept was still 'alive' in 2011 but, currently, the LTS website is closed.

Walter is now 95 and remains a leading philanthropist. Bob passed away in January of 2012.

About the author

Jos Heyman is the Managing Director of Tيروس Space Information, a Western Australian consultancy specializing in the dissemination of information on the scientific exploration and commercial application of space for use by educational as well as commercial organizations. An accountant by profession, Jos is the editor of the TSI News Bulletin and is also a regular contributor to the British Interplanetary Society's Spaceflight journal. Jos is also a Senior Contributor for SatMagazine.



Rocketplane Kistler approaches the ISS in this artistic depiction of the COTS application.

The Latest Advances In IP-Modem Technology

By Jörg Rockstroh, Product Manager—Modem Technologies, WORK Microwave GmbH

Leveraging recent developments in DVB-S2 and similar SCPC type modem technology, today's operators can dramatically improve bandwidth use, video quality, and more. This article explores the various technology stages of a DVB-S2 IP modem, highlighting current and next-generation methods designed to optimize satellite communications.

Today's IP Modem Technology

There are multiple technological steps involved with establishing a network connection over satellite, starting with the IP stack, including IP-based optimizations. This is followed by encapsulation, forward error correction, and modulation and signal shaping.

IP-based optimizations comprise a wide range of methods, including IP header compression, TCP acceleration, prioritization of different traffic types, and reorganization and repackaging of the packets to optimize packet rate or size. Since they're not satellite-specific, these techniques are not always included in the IP modem itself. However, adaptive coding and modulation (ACM) can change the available bandwidth rapidly, making it critical that operators deploy an IP modem with some type of IP optimization technique in order to account for changing environmental conditions.

During the encapsulation process, IP packets are organized into a stream for transmission over satellite. For many years multi-protocol-encapsulation (MPE) was the common method for encapsulation. MPE packages IP data into an MPEG transport stream, which is transmitted over DVB-S or DVB-S2. Given the significant overhead that MPE requires, the industry recently developed a more efficient method of encapsulation called generic stream encapsulation (GSE). GSE improves the overhead situation by adding a 4-byte header and an optional MAC address to the IP packet.

Forward error correction, modulation, and signal spectrum shaping are then the elements that make up the DVB-S2 standard. Implementation of these parts is usually done in silicon, so any contact with this specification requires hardware changes. Thus, this is a rather complex subject matter, as operators want to protect the ROI of their equipment and remain interoperable with existing platforms. Therefore changes in this field are made with respect to backwards compatibility and/or as optional extension, which are commonly being referred to as DVB-Sx and currently in the processing of being written into a standard.

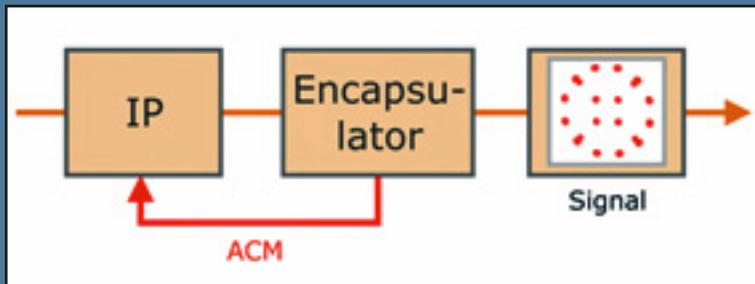


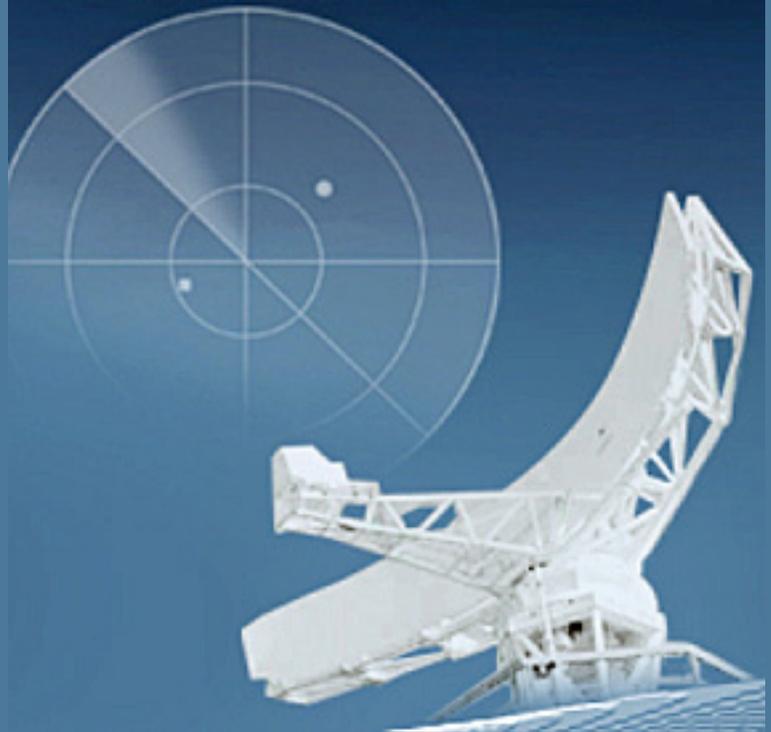
Figure 1. This diagram illustrates the highlighted approaches for optimization.

Next-Generation Technology Developments

The DVB recently published an extension (Annex M) to DVB-S2, introducing a new physical layer header and a time slicing method for wide Ka-band transponders. Focusing on the 200 to 500 MHz bandwidth spectrum, a carrier can now be shared between multiple receivers without each of them having to decode all frames before content selection. The benefit is that the LDPC decoder does not have to run at full carrier speed, which saves expensive silicon area, given that the full carrier could now be beyond the Gigabit frontier. Thus, the multiple input stream feature of DVB-S2 has been expanded down to the physical layer.

Advanced ModCods

With DVB-Sx a wider set of ModCods will provide a better granularity in highly optimized ACM links over the long term. Although proprietary solutions have been demonstrated, a common standardized solution is not yet defined. Should it be fully backwards compatible with the existing DVB-S2 standard? Or does the improvement and extension of use cases justify more daring extensions? The answer to that question, both from a technological perspective and commercial acceptance, will determine the future.



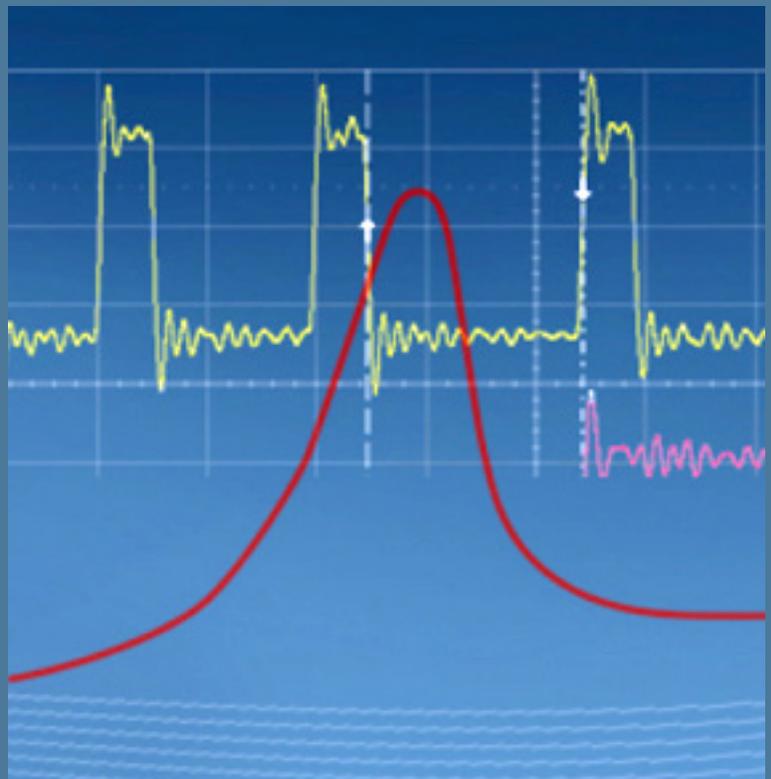
New Roll-Off Factors

New roll-off factors, down to 5 percent, were the first enhancement to DVB-S2 that has been widely deployed. This was made possible due to the fact that receivers could accept the lower roll-off and compensate for the difference in filter adaptation during the equalization phase. With high Es/N0 there is an influence of a few tenths of dB; however, in most cases, this does not even change the ModCod.

In the beginning there was a lot of excitement about the savings in bandwidth simply due to less occupied bandwidth. The reality showed that lower roll-off factors come with a trade-off: The peak-to-average power ratio (PAPR) increases, making the signal more susceptible for distortion. While 5 percent has been proven a bit too low for many environments, roll-offs between 7 to 15 percent are an advantageous alternative to DVB-S2 defined values.

Predistortion

Using higher modulation types causes nonlinearities, significantly reducing the Es/N0, especially on the transponder edges. Implementing a 5 percent roll-off within a full transponder operation increases the power transmitted to these critical parts, also increasing the influence of group delay. Anticipating these effects in the signal is the only reliable way to eliminate degradation. However, it's challenging



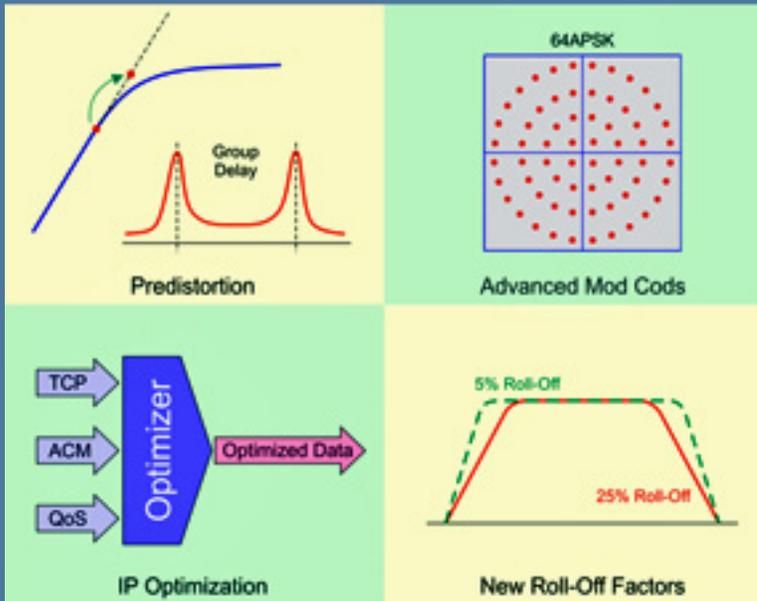


Figure 2. This diagram illustrates the most up-to-date-technology developments.

to implement predistortion while ensuring it can be easily modified by users, who may or may not be RF experts. Choosing a device with a predistortion feature that automatically performs measurements for linear and nonlinear distortions is an effective way to address this issue.

IP Optimization

While signal-specific technologies are trending, there is at least one IP-centric issue that's receiving attention. As ACM has become a common feature on IP links, network operators are presented with the challenge to identify and manage bandwidth issues when facing a capacity that is frequently changing. For example, during adverse weather conditions such as a hurricane, tornado, or sandstorm, Es/N0 could fluctuate by a factor of several dB within seconds, up and down. Typically bandwidth managers are not equipped to handle these rapid changes, causing remote monitoring to stop functioning.

An identified solution configuring ACM functionality and bandwidth management together in the same system is one approach that resolves this issue. The encapsulator shares the ACM ModCod information with the traffic shaper, enabling it to respond to changing the bandwidth.

Conclusion

Having been around for nearly a decade, the digital satellite transmission standard is ready for its next step. While the professional market is already using many of the technologies discussed throughout this article, the consumer market is concerned about the confusion that might arise with the introduction of a third-generation standard. Thus, the goal for the industry should be to develop a stable and understandable situation for both the technology and standardization. Now is the time, as another big change in the industry might take place another 10 years from now.

About the author

Jörg Rockstroh is the Product Manager—Modem Technologies with WORK Microwave GmbH. He is responsible for the products and the features roadmap for the digital SATCOM portfolio as well as the reference point ("Champion") for that portfolio with key internal stakeholders (sales, engineering, production, logistics) and is an active participant with industry bodies such as the DVB Project for future standards setting.



Image Credit: NASA

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