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2013
YEAR IN REVIEW

SatMagazine

December 2013—Year In Review

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Eurockot Launch Services GmbH successfully launched the three satellite Swarm constellation for the European Space Agency on November 22nd at 12:02 hrs UTC (13:02 hrs CET), via a Rockot launcher from Plesetsk Cosmodrome in Northern Russia.

Rockot orbited the Swarm Earth Explorer mission into an orbit of 87.6 degrees at 490 km altitude. This launch was Eurockot's third successful launch for the European Space Agency.

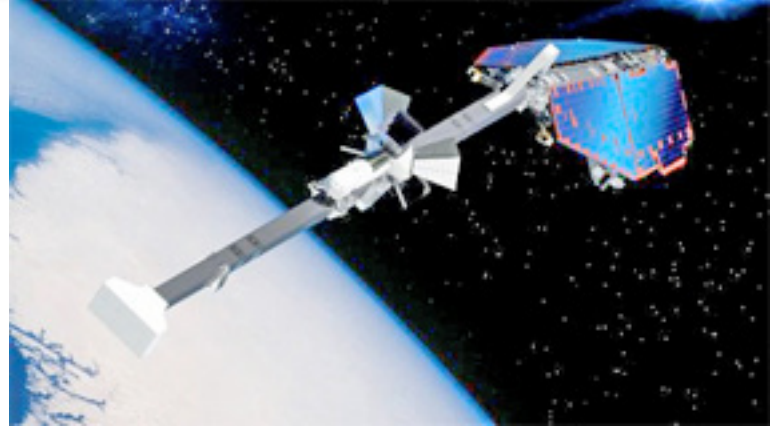
Swarm is a constellation of three satellites which will explore the Earth's magnetic field and its change with unique accuracy. As part of ESA's Living Planet Program, Swarm will provide a unique inside view of the Earth and will broaden our understanding of atmospheric processes and ocean circulation which effect climate and weather.

Each Swarm satellite has a mass of 500kg and, after their simultaneous release from the Rockot launcher, will move into different polar orbits using their own propulsion systems. All three Swarm satellites were built by Astrium GmbH at Friedrichshafen.

Eurockot's launch vehicle Rockot launched the Swarm constellation from its dedicated launch pad LC133 at Plesetsk Cosmodrome in Northern Russia, about 800km from Moscow.

Eurockot's next missions in late 2014 and early 2015 will be the launches of the Sentinel-2A and Sentinel-3A satellites.

Both spacecraft are part of the range of satellites belonging to the Copernicus program financed by the European Union. Eurockot was contracted to perform the launches by the European Space Agency in February 2012.



Artistic rendition of a Swarm satellite.

Eurockot Launch Services GmbH is the joint venture of EADS Astrium (51 percent) and Khronichev Space Center (49 percent) and performs launch services for operators of Low Earth Orbit (LEO) satellites using the flight-proven Rockot launch vehicle.

The Swarm satellite mission—developed and built by Astrium—saw the satellites placed on their orbits approximately 92 minutes after launching.

Over a period of at least four years, the European Space Agency's (ESA) Swarm mission will measure the Earth's magnetic field and its development with previously unattained accuracy.

The findings will improve our understanding of the Earth's interior and how it interacts with space. An improved understanding of the magnetic field also has significant practical uses.

In particular, it is anticipated that this research will ultimately contribute

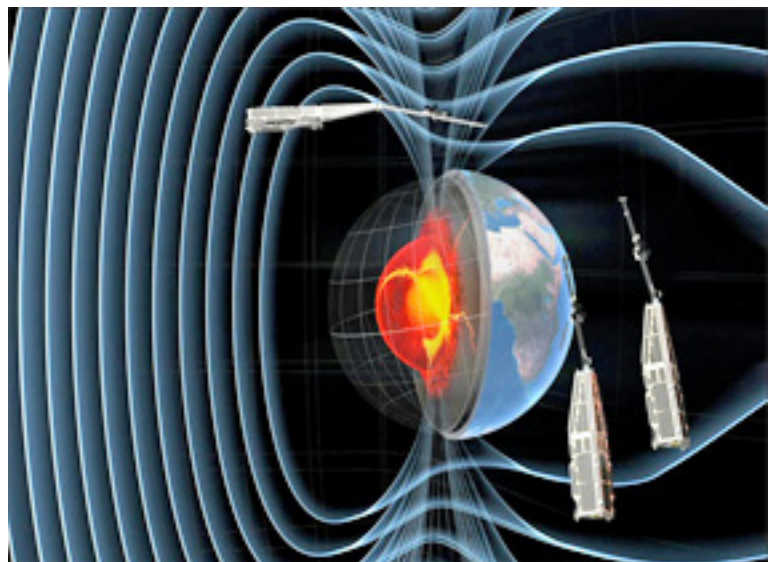
to more precise navigation with compasses or gyros, which can improve, for example, directional drilling in resource exploitation. In addition, it is expected to help improve space weather models.

Astrium is the prime contractor for ESA's Swarm satellite trio. Eurockot Launch Services, an Astrium subsidiary, is responsible for the launch.

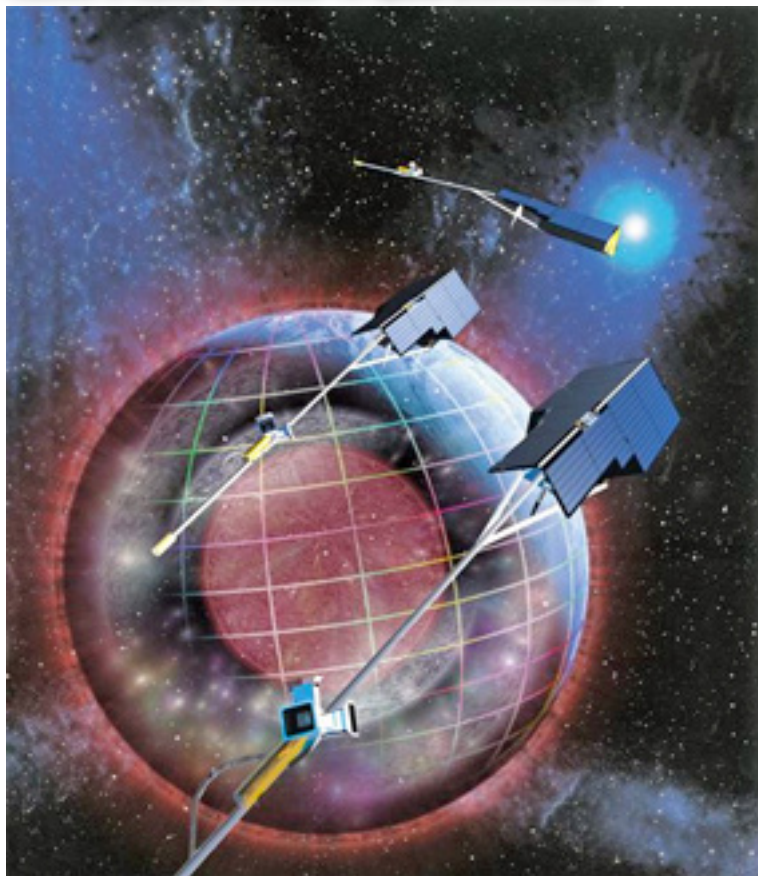
For more information regarding Swarm, access http://www.esa.int/Our_Activities/Observing_the_Earth/The_Living_Planet_Programme/Earth_Explorers/Swarm

For further information regarding Astrium, select <http://www.astrium.eads.net/>

Additional Eurockot info: <http://www.eurockot.com/>



Another artistic rendition of the SWARM constellation. Image courtesy of ESA.



From EADS Astrium comes this artistic rendition of the SWARM constellation.

COM DEV International Ltd. is also heavily involved in the Swarm mission. The company has three state-of-the-art scientific instruments aboard the Swarm mission.

The data collected by the Swarm satellites will provide new insights into a range of phenomena about the magnetic field which surrounds the Earth and shields it from the harmful effects of solar storms, cosmic rays and charged particles that bombard the planet. Strong solar storms have caused power and communication blackouts, and

damaged satellites on orbit. Without Earth's protective magnetic shield, the development of life would likely have been impossible. Evidence points to a weakening of the planet's magnetic shield and the Swarm mission will enable scientists to understand the causes.

COM DEV designed, developed, integrated and tested the Canadian Electrical Field Instrument (EFI), which is integrated into the instrument suites of all three satellites. Each Canadian EFI will collect information about the interaction of Earth's magnetic field



The three Swarm satellites in vertical positions ready to join the launch adapter. Photo is courtesy of ESA/M. Shafiq

with the solar wind and electric currents, and their effects on Earth.

Each Canadian EFI consists of two types of sensors and an electronics assembly. The two sensor types are the Thermal Ion Imagers and Langmuir Probes. The Thermal Ion Imagers, developed by the University of Calgary, will provide a high resolution 3D picture of the ion flow around the Earth. The Langmuir Probes, developed by the Swedish Institute of Space Physics, measure electron density, electron temperature and the electric potential of the satellite.

Under the Canada-ESA Cooperation Agreement, Canada is a participating state of ESA's Earth Observation Envelope Program (EOEP). This allows Canadian organizations to take part in the development and operation of EOEP missions by bidding on and obtaining related contracts, and enabling Canadian groups to access the data collected by these missions. ESA awarded the prime contract for the Canadian EFI to COM DEV in 2007.

The total value of the contract was \$16.6 million and the work was completed at the Company's facilities in Cambridge, Ontario. The CSA is funding work by Canadian universities to validate and perform scientific research with data from the Swarm mission and with data from Canadian ground- and space-based instruments. COM DEV's earlier work on the Cold Plasma Analyzer (CPA) instrument for Sweden's Freja satellite, and the Thermal Plasma Analyzer (TPA) instrument provided on Japan's Nozomi satellite, contributed to the success of the Canadian EFI project. Both the CPA and TPA projects were funded by the CSA.

"I appreciate the confidence that ESA expressed in COM DEV by selecting the company to be the prime contractor for three instruments that will make an important contribution toward the scientific goals of the Swarm mission," said Mike Pley, CEO of COM DEV International. "The CEFI project is a continuation of COM DEV's world-leading heritage in space science, space weather, and space situational awareness instruments."

The Swarm mission has a design life of four years. The satellites will travel in a polar low Earth orbit, two satellites side-by-side at an eventual altitude of 300 kilometers above the Earth, with the third maintaining an altitude of 530 kilometers. Data collected will be downloaded daily to the ESA's ground station at Kiruna, Sweden and processed at the Center for Earth Observation at Frascati, Italy.

For further information regarding COM DEV International, select this direct link: <http://www.comdev.ca/>

The UK Space Agency adds that the satellites carry a new generation of magnetometers that will identify and measure the magnetic signals that stem from the various sources with unprecedented accuracy. These advanced sensors are mounted on the satellite's 4m-long arm to minimize interference from the electric units on the craft.

Participants from the UK attended ESA's Second International Science Meeting on the Swarm mission back in June of 2009 in Potsdam, Germany. The purpose of meeting was to bring together scientists and students, working in all fields of geomagnetism and/or the near-Earth electromagnetic environment, who would benefit from the Swarm constellation.

Swarm is comprised of a constellation of three satellites; two of which will orbit the Earth, side-by-side, with the third satellite in another orbital plane at the higher altitude. The three satellites are identical in size and shape, each measuring about 9.25 meters in length and all carry the same instrument package. A deployable arm makes up more than half of the length of the satellite and about half way along carries one of the main instruments—the so-called Vector Field Magnetometer. Apart from the long arm, which is deployed once in orbit, the satellite has no other moving parts. The solar panels are rigidly fixed to the satellite body forming a 'roof'.

High-precision and high-resolution measurements of the strength, direction and variations of the Earth's magnetic field, will provide valuable data, which is essential for modelling the geomagnetic field. The results will offer new insights into the Earth system by improving the understanding of the dynamics of the Earth's core, the composition of the mantle and structure of the crust. Swarm will also enable analysis of the Sun's influence on the Earth.

There's additional information at: <http://www.bis.gov.uk/ukspaceagency/missions/Swarm#sthash.gDNQIXQk.dpuf>



Photo of the Swarm constellation packed for the launch. Photo is courtesy of ESA.

ESA's three-satellite Swarm constellation was lofted into a near-polar orbit by a Russian Rocket launcher where, for a period of four years, it will monitor Earth's magnetic field, from the depth of the planet's core to the heights of its upper atmosphere.

The Swarm satellites will provide unprecedented insights into the complex workings of the magnetic shield that protects Earth's biosphere from charged particles and cosmic radiation. They will perform precise measurements to evaluate its current weakening and understand how it contributes to global change.

The Rockot launcher lifted off from the Plesetsk spaceport in northern Russia at 12:02 GMT (13:02 CET) on November 22nd. Some 91 minutes later, its Breeze-KM upper stage released the three satellites into a near-polar circular orbit at an altitude of 490km. Contact was established with the trio minutes later through the Kiruna station in Sweden and the Svalbard station in Norway.

The three identical satellites were launched together on one rocket. Two satellites will orbit almost side-by-side at the same altitude—initially at about 460km, descending to around 300km over the lifetime of the mission.

The third satellite is in a higher orbit of 530km and at a slightly different inclination. The satellites' orbits drift, resulting in the upper satellite crossing the path of the lower two at an angle of 90 degrees in the third year of operations. The different orbits, along with the satellites' various instruments, optimize the sampling in space and time, distinguishing between the effects of different sources and strengths of magnetism.

The field protects our planet from cosmic radiation and charged particles that bombard Earth in 'solar winds'. Without this protective shield, the atmosphere, as we know it, would not exist, rendering life on Earth virtually impossible. By analyzing the different characteristics of the field, the mission will provide new insight into many natural processes, from those occurring deep inside the planet to weather in space caused by solar activity. In turn, this information will yield a better understanding of why the magnetic field is weakening.

All three satellites are controlled by ESA teams at the European Space Operation Centre in Darmstadt, Germany. Over the next three months of commissioning, their scientific payloads will be verified and they will move to their respective operational orbits.

"Swarm is about to fill a gap in our view of the Earth system and in our monitoring of global change issues," said Volker Liebig, ESA's director for Earth Observation. "It will help us to better understand the field that protects us from the particles and radiation coming from the Sun."



Artist's concept view of a Swarm satellite. Image courtesy of ESA.

Launch-O-Rama: SWARM

Swarm is ESA's fourth Earth Explorer mission, coming after the successful CryoSat, GOCE and SMOS satellites. These are all missions that expand the knowledge of Earth and its environment.

The combination of data collected by Swarm will deliver precious information on the sources of the magnetic field inside Earth. This includes understanding how the magnetic field is related to the motion of molten iron in the outer core, how the conductivity of the mantle is related to its composition and how the crust has been magnetized over geological timescales.

They will also investigate how the magnetic field relates to Earth's environment through the radiation belts and their near-Earth effects, including the solar wind energy input into the upper atmosphere.

Swarm will also be able to distinguish between the various sources of the planet's magnetic field and ensure continuity in its monitoring from space in conjunction with measurements from ground observatories.

Earth's magnetic field plays a major role in protecting the biosphere because it generates a bubble around the planet that deflects charged particles and traps them in the radiation belts. This shielding protects all life on Earth from the bombardment of heavy ions coming from the Sun and deep space.

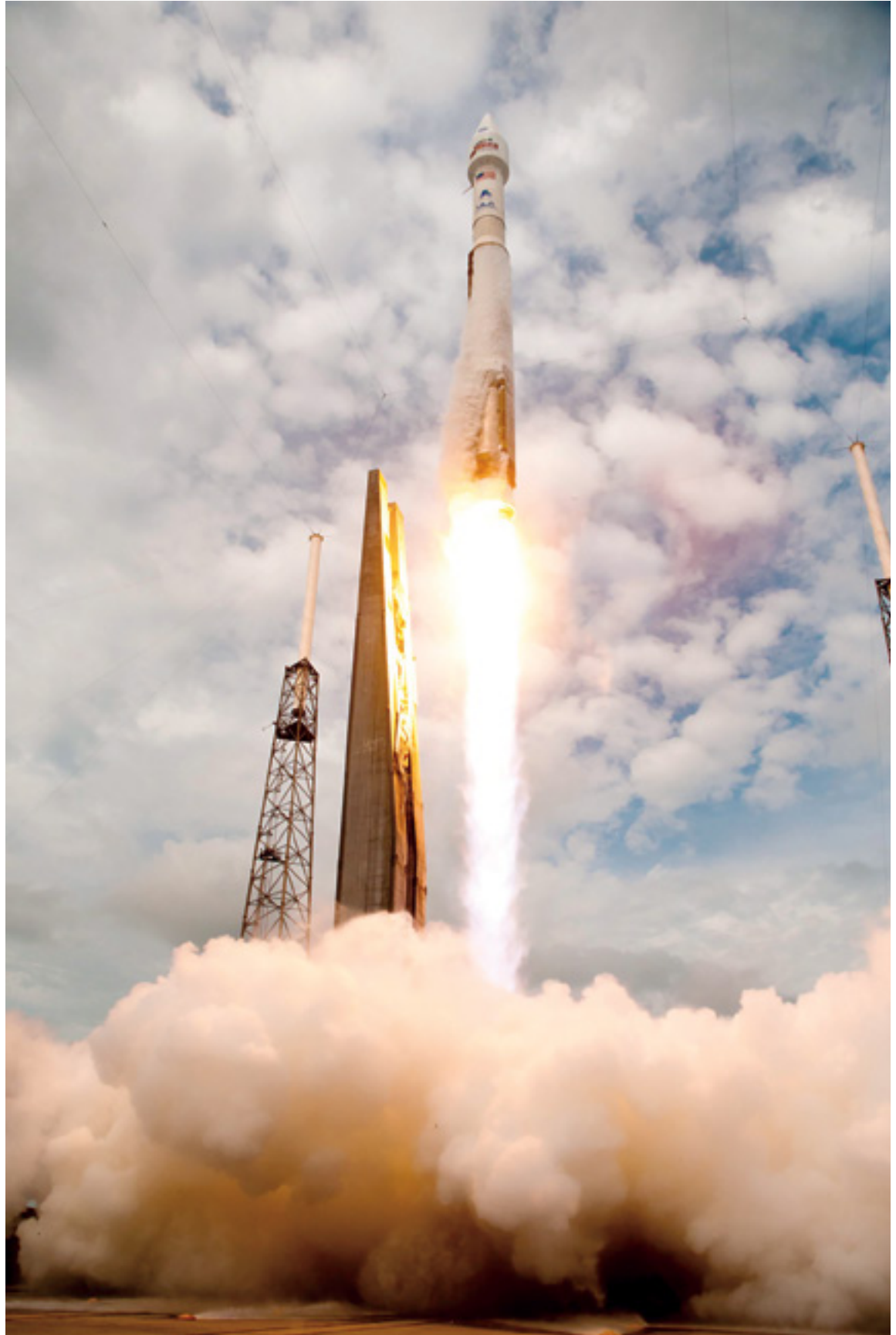
Since the 1980s, previous missions have showed this field to be weakening, which could be a sign that the north and south magnetic poles are beginning to reverse—known to have occurred on multiple occasions during geological times.

Although such inversions usually take thousands of years to complete, a further weakening of magnetic protection could lead to an increase in events that damage the orbiting satellites or disrupt power grids and other electrical systems on the ground.

For more information regarding the ESA's Swarm role:

http://www.esa.int/Our_Activities/Observing_the_Earth/The_Living_Planet_Programme/Earth_Explorers/Swarm

Launch-O-Rama: ULA, NASA, Tencate—Sending MAVEN To The Stars + Mars



A United Launch Alliance (ULA) Atlas V rocket carrying NASA's Mars Atmosphere and Volatile Evolution (MAVEN) spacecraft lifts off from Space Launch Complex-41 at 1:28 p.m. EST at Cape Canaveral AFS. Photo by Pat Corkery, United Launch Alliance.



MAVEN sits atop a ULA Atlas V awaiting its launch at Cape Canaveral AFS. Image capture from USTREAM's launch coverage.

United Launch Alliance has chalked up another successful launch for NASA. The November 18th event presented a perfect Atlas V launch at Space Launch Complex 41 at Cape Canaveral Air Force Station in Florida as MAVEN was sent on her journey to the Red Planet.

This was ULA's tenth launch of the year and marks the 41st Atlas V mission and the 76th launch for ULA.

This mission was launched aboard an Atlas V 401 configuration vehicle, which includes a four-meter diameter payload fairing. The Atlas booster for this mission will be powered by the RD AMROSS RD-180 engine and the Centaur upper stage will be powered by a single Aerojet Rocketdyne RL10A engine.

MAVEN will examine specific processes on Mars that led to the loss of much of its atmosphere. Data and analysis will help planetary scientists understand the history of climate change on the red planet and provide further information on the history of planetary habitability.

The MAVEN spacecraft will be the first probe to directly assess the mysteries of the atmosphere of Mars.

Previous missions clearly show the past presence of water, but how it and the other gas components were lost is uncertain.

Some may have been stripped away by the Sun, while others may still be on Mars, absorbed into its crust.

MAVEN will determine the present state of the upper atmosphere and today's rates of loss to space, which will enable determination of the net integrated loss to space through time.

Weighing more than 5,600 lbs at launch, the spacecraft will generate 1,135 watts of power when it arrives in orbit via its solar panels. The solar panels have been designed in a 'gull wing' configuration to help stabilize the spacecraft as it dives through the Martian atmosphere as well as to carry magnetic field instruments at each tip.

The fixed main antenna will return global data from the primary atmospheric mission as well as serve as a data relay for future missions.

Manufactured by Lockheed Martin Space Systems for NASA's Goddard Spaceflight Center (GSFC), the spacecraft carries instruments provided by GSFC, the Colorado



Launch control center all prepared to "Go..." — Image captured from the USTREAM Live streaming widecast of the MAVEN launch.

Launch-O-Rama: ULA, NASA, Tencate—Sending MAVEN To The Stars + Mars (Continued)

University Laboratory for Atmospheric and Space Physics, and the Space Sciences Laboratory at UC Berkeley.

The spacecraft includes an Articulated Payload Platform (APP), which is a deployable boom with a wide range of attitude capability. The APP will precisely point three instrument packages on its tip to sample the Mars atmosphere.

This suite of instruments includes the Neutral Gas and Ion Mass Spectrometer, the Imaging Ultraviolet Spectrometer, and the Suprathermal and Thermal Ion Composition instruments.

A separate deployed boom provides standoff from the spacecraft for the Solar Wind Electron Analyzer. Instruments mounted on the spacecraft body provide detailed measurements of the Sun's electrons, ions, particles, and radiation. Two additional booms measure electron temperature and density.

Together, these instruments will provide unprecedented insight into Mars as it exists today, and how the planet was in the past.

The MAVEN mission was flown on an easterly trajectory from Space Launch Complex 41 at Cape Canaveral Air Force Station (CCAFS), Florida.

The mission started with the ignition of the RD-180 engine approximately 3.8 seconds before liftoff. Shortly after the ignition, the vehicle cleared the pad, performing its pitch/yaw/roll maneuvers.

Following maximum dynamic pressure, the RD-180 was throttled down to 95 percent. Guidance steering was enabled approximately 140 seconds into flight. Booster engine cutoff (BECO) occurred 242.4 seconds into flight, followed by Centaur separation six seconds later.

Approximately four minutes into flight, the Centaur stage ignited its main engine (MES1). Eight seconds into the burn, the payload fairing is jettisoned.

Over the Atlantic Ocean, the burn lasted 9.5 minutes and used a special steering profile. This profile optimized the trajectory for the interplanetary target, placing the vehicle into a unique parking orbit tailored for the day and time of launch.

Following a 24-minute coast, the Centaur main engine is ignited for a second burn (MES2), lasting 5.5 minutes. Following Centaur engine shutdown (MECO2), the vehicle turned to the separation attitude and delayed separation for approximately three minutes to ensure that the down range Deep Space Network stations



This photo shows the large hydrazine propellant tank prior to integration with the core structure of the MAVEN spacecraft at a Lockheed Martin clean room near Denver. The tank will hold 450 gallons of hydrazine propellant and is 6 feet 2 inches tall. The tank was built by ATK Aerospace Group, Commerce, California. The primary structure in the background is cube shaped at 7.5 feet x 7.5 feet x 6.5 feet high. Built out of composite panels comprised of aluminum honeycomb sandwiched between graphite composite face sheets, the entire structure only weighs 275 pounds. Photo is courtesy of Lockheed Martin.

had contact with MAVEN during the separation event. Separation occurred over Australia at approximately 53 minutes after launch.

"United Launch Alliance is proud to be a part of this tremendous mission, working closely with the NASA Launch Services Program and MAVEN teams," said Jim Spennick, ULA vice president, Atlas and Delta Programs. "Missions to Mars are very exciting and over the last decade, ULA launch systems have been entrusted to launch all of NASA's missions to the red planet, including the Spirit and Opportunity rovers and most recently the Mars Science Lab mission with the Curiosity rover."

"In just a few days, the Centaur upper stage will celebrate its 50th anniversary since its first successful launch," said Jim Spennick, "Centaur has a rich heritage dating back to the beginning of human spaceflight and continues to reliably deliver critical science missions for NASA."

ULA's next launch is the Atlas V NROL-39 mission for the National Reconnaissance Office scheduled for December 5 from Space Launch Complex-3 at Vandenberg Air Force Base, California.

ULA program management, engineering, test, and mission support functions are headquartered in Denver, Colorado. Manufacturing, assembly and integration operations are located at Decatur, Alabama, and Harlingen, Texas. Launch operations are located at Cape Canaveral AFS, Florida, and Vandenberg AFB, California.

TenCate advanced composites were launched, once again, for Mars on the MAVEN orbiter.

TenCate Advanced Composites, as a key supplier of advanced composite materials to Lockheed Martin, supports NASA on the Mars Atmosphere and Volatile Evolution (MAVEN) orbiter that was successfully launched earlier this week. The MAVEN orbiter will analyze the upper atmosphere of Mars, which will help scientists examine how the climate of Mars has changed over time due to the loss of atmospheric gases.

The core structure of the MAVEN spacecraft under construction at Lockheed Martin in Denver, Colorado.

TenCate has supported NASA and Lockheed Martin on prior Mars missions, including the Rover and Curiosity exploration vehicles. For the MAVEN orbiter, TenCate Advanced Composites provided a highly stable, engineered carbon fiber-reinforced composite material that was used to fabricate the primary bus structure of the orbiter.

This primary structure is cube shaped and was built by Lockheed Martin in Denver, Colorado, with high modulus composite face sheets sandwiched between aluminum honeycomb sheets. The entire primary structure is only 275 pounds, yet can withstand the launch forces of 6 g's, which imparts loads of up to 61,000 lbs on the launch vehicle's interface.

To learn more about TenCate Advanced Composites, access <http://www.tencate.com/emea/aerospace-composites/default.aspx>



MISSION OVERVIEW | SLC-41 CCAFS, FL



To download the MAVEN MOB PDF for further information, go to http://www.ulalaunch.com/site/docs/missionbooklets/AV/av_maven_mob.pdf



ILS Proton successfully placed the Sirius FM-6 satellite into geostationary transfer orbit for Sirius XM Radio on October 26, 2013. Photo is courtesy of ILS.

An International Launch Services Proton rocket sent the Sirius FM-6 into its orbital slot late on October 26th.

The ILS Proton Breeze M vehicle launched from Pad 39 at the Baikonur Cosmodrome at 00:09 local time (18:09 GMT and 14:09 EDT on

October 25). The first three stages of the Proton used a standard ascent profile to place the orbital unit (Breeze M upper stage and the Sirius FM-6 satellite) into a sub-orbital trajectory. From this point in the mission, the Breeze M performed planned mission maneuvers to advance the orbital unit first to a circular parking orbit, then to an intermediate orbit, followed by a transfer orbit, and finally to a geostationary transfer orbit. Separation of the Sirius FM-6 satellite occurred approximately 9 hours and 11 minutes after liftoff.

The satellite, weighing more than 6 metric tons, was built on the flight-proven SSL 1300 platform. This was the sixth satellite launched by ILS Proton for SiriusXM and the 27th SSL 1300 satellite launched. Sirius FM-6 has an X-band uplink transponder and an S-band downlink transponder to deliver digital audio radio service. With approximately 20Kw end-of-life power and an anticipated service life of 15 years, the final orbital location for the satellite will be 116.15 degrees west longitude.

This was the 390th launch for Proton since its maiden flight in 1965 and the 83rd ILS Proton Launch, overall. The Proton Breeze M vehicle is developed and built by Khrunichev Research and Production Space Center of Moscow, Russia's premier space industry manufacturer and majority shareholder in ILS.

ILS has exclusive rights to market the Proton vehicle to commercial satellite operators worldwide and is a U.S. company headquartered in Reston, Virginia, near Washington, D.C.

For further insights into the company's operations:
<http://www.ilslaunch.com>

Sirius FM-6 is a high-power geostationary satellite for SiriusXM, America's largest radio broadcaster measured by revenue and one of the world's largest pure-play audio entertainment companies. The satellite will help with the delivery of commercial-free music, and premier sports, news, talk, entertainment and Latin programming, traffic and weather to more than 25 million subscribers. Sirius FM-6 will also assist in the delivery of traffic and other data service information to markets across North America for vehicles with navigational systems.

Sirius FM-6 will ensure SiriusXM's array of audio and data services are received by vehicles, mobile devices and home receivers and will play an important role in bolstering the continuity of service for years to come.

The SiriusXM infosite is located at:
<http://www.siriusxm.com/>





Liftoff of India's Mars Orbiter Mission (MOM) on November 5, 2013, from the Indian Space Research Organization's (ISRO) Satish Dhawan Space Centre SHAR, Sriharikota, India. Photo credit: ISRO

Mars is, once again, in the news. During November of 2013 the world witnessed two successful mission launches towards planet Mars. The first was by India on November 5th and the second by United States on November 18th.

It will take approximately nine more months for these missions to reach Mars. Both of these are obiter missions and the satellites launched by these two nations will be engaged in various observations of the Martian surface and surrounding areas.

India's first mission to Mars, named Mars Obiter Mission (MOM), successfully started its travel toward the red planet on November 5, 2013. However, within a week after the launch, the India Space Research Organization (ISRO) had to suffer through a few anxious moments due to a glitch while performing the orbit raising maneuver. Eventually ISRO scientists were able to take remedial action and the mission was back on track.

Reaching Mars is an extremely complex task. Human attempts at sending satellites to study Mars began

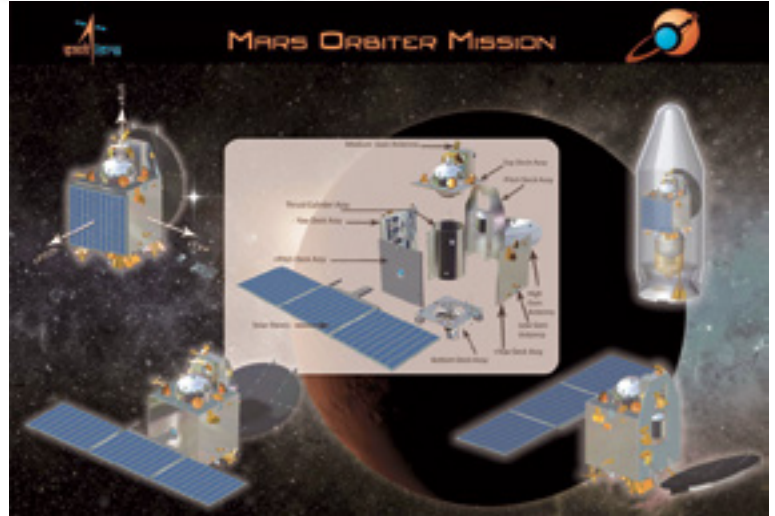
during the 1960s. Mars missions pose a great challenge to the scientific community and there have been more disappointments than successes.

Roughly two-thirds of all spacecraft destined for Mars have failed without completing their missions. One of the biggest challenges for all of these missions has been to cover the significant amount of distance from Earth to Mars. In fact, the distance between Earth to Moon is approximately 400,000 kilometers and, in the case of Mars, it's 200 times (approximately) more than this distance.

At its closest approach, Mars is about 50 million kilometers from Earth; at its furthest, almost 402 million kilometers (when Earth and Mars are on opposing sides of the Sun).

The best opportunity to engage in a Mars mission arises every 26 months when the planet is relatively close to Earth. The next opportunity to undertake Mars mission would be during 2016 and 2018.

MOM is India's first interplanetary mission—operating in deep space is not a new project for India. During



2008, India successfully completed its first mission to the Moon called Chandrayaan-1. India understands that missions such as these could end up contributing to immeasurable technological breakthroughs in a number of areas. Missions to the Moon and Mars could add to the knowledge in spacecraft, propulsion and robotics systems, as well as communication and guidance technologies, and so on.

ISRO has two basic objectives for its Mars mission: The primary technology objective is to realize and bring to the launch pad a spacecraft that possessed the capability to reach Mars (Martian Transfer Trajectory) and to then orbit around the planet (Mars Orbit Insertion). The secondary scientific objective is to engage in various scientific studies during the spacecraft's orbit of Mars—five sensors have been included as a payload to accomplish this task.

Specific challenges in reaching Mars orbit relate to power, communication and propulsion systems. As the travel toward Mars requires approximately 300 days, the spacecraft will have augmented the radiation shielding to protect from prolonged exposure to radiation.

The real test for the mission would be to insert the spacecraft into a correct Martian orbit (Mars Orbit Capture maneuver) and then restart the propulsion system. Also important is to cater for a number of additional challenges, such as long shadows due to eclipses. This required the orbital plane to be targeted to avoid long shadows and to ensure good illumination conditions prevailed near periapsis (the low point in an orbit, when an orbiting object is closest to the target of its orbit).

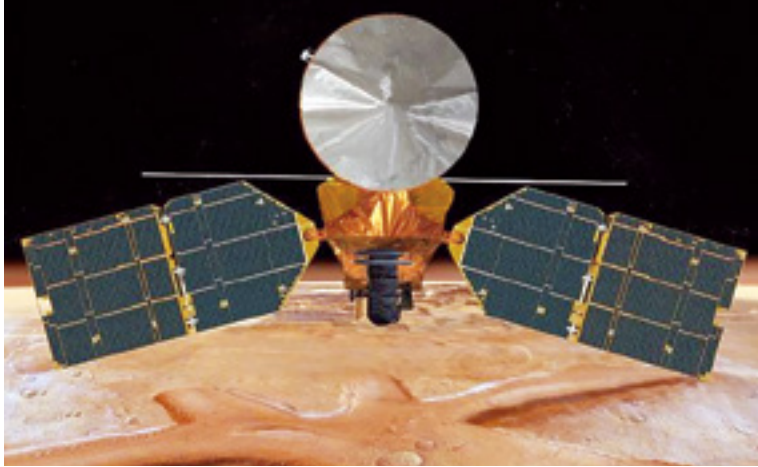
India's first mission to Mars could be viewed as a technological mission as it travels toward Mars and then, upon arrival, converts into more of a scientific mission. As a science mission, the five sensors on-board MOM will study Martian atmospheric studies, engage in Mars, its moons and, possibly,

asteroids imaging activities, and to also carry out radio experiments.

One sensor will carry out high accuracy measurements of methane content in the Martian atmosphere in order to glean data about the planet's origin, whether it such is biogenic or volcanic. The next important objective is the investigation of the Martian upper atmosphere escape processes, especially as such relates to the process of water loss. Understanding this escape process for non-magnetic planets such as Mars is important to make inferences regarding the evolutionary history of the planetary atmosphere. Additionally, the mapping of the surface composition and mineralogy of Mars will be carried out, with photographs of the topographical features taken and additional measurements completed.

Over the years, ISRO has developed a significant infrastructure and has almost 16,000 people working on various projects. Private industry has also greatly contributed to help make ISRO projects successful. The organization has always encouraged the participation of public and private Indian industry to help achieve shorter turnaround times for ISRO missions. As per the chairman of the ISRO, "around 500 Indian industries are participating in realizing a variety of hardware, components, sub systems and systems, stage propellant tanks, fabrication activities etc. More than 160 types of electronic components and 115 types of space grade materials have been developed and qualified for use in spacecraft, launch vehicles and ground systems. Industry consortium partners have continued supplying VIKAS engines for their launch vehicles. Industry participation is on the rise in area of spacecraft power system, spacecraft building and related activities."

For the Mars Mission, the primary mechanical structure and the equipment panels were fabricated and delivered by Hindustan Aeronautics Ltd (HAL) as per ISRO's design. HAL is India's premier aerospace company and has been associated with the ISRO's various programs for many



An artistic rendition of the Mars Reconnaissance Orbiter shows the spacecraft's main bus facing down toward the planet. Image is courtesy of NASA.

years. High Gain Antenna Reflector mold fabrication, power electronics systems fabrication and few of the spacecraft communication systems have also been realized through different industries.

India's Mars mission is not just a science and technology mission—there is national pride and the prospect of gaining international prestige, both obvious offshoots of a successful mission. There are also certain commonalities with the ISRO's Mars mission MOM and NASA's mission, MAVEN. It is expected that both agencies will share the data resultant of these missions and undertake joint analysis. Apart from the scientific benefits, this could increase interaction between these agencies, hopefully leading to additional cooperation in future.

The success with this Mars mission will allow ISRO to announce to the rest of the world that they run an extremely professional and cost-effective space program. India is keen to improve its stakes in the international satellite launch market and have already launched 35 satellites for non-Indian customers. A major accomplishment as MOM will likely attract more states

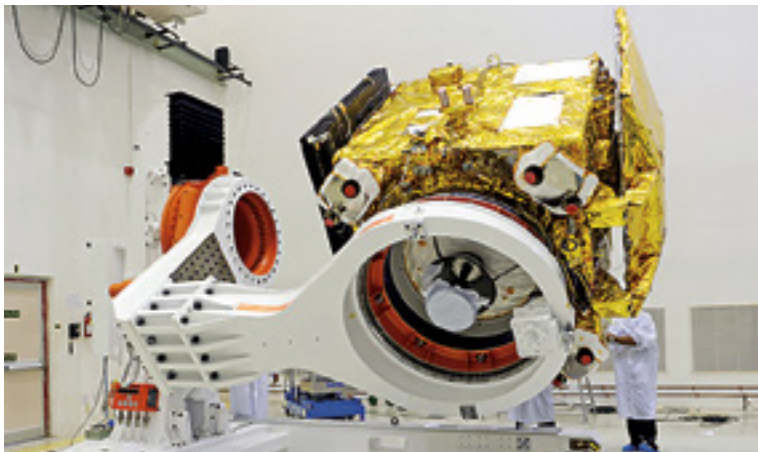
and private agencies into seeking launch services from ISRO.

ISRO also offers consultancy services for the development of ground infrastructure, assists in satellite building as well as data collected from its constellation of remote sensing and Earth Observation (EO) satellite systems. However, it is important for ISRO, which is essentially a research organization, to diversify and involve more private industry involvement.

There is a definite need to transfer relevant technologies to private industry and to also establish a public-private partnership (PPP) model, to allow ISRO concentrate on its basic role of research and development. The euphoria generated around the Mars mission also needs to be translated into a business model for future operations.

About the author

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India's Mars Orbiter Mission (MOM) spacecraft being prepared for a prelaunch test at the Satish Dhawan Space Centre SHAR at Sriharikota.



The Long March-3B carrier rocket carrying China's Chang'e-3 lunar probe blasted off from the launch pad at Xichang Satellite Launch Center, southwest China's Sichuan Province, on December 2, 2013.

This will be the first time China has sent a spacecraft to soft land on the surface of an extraterrestrial body, where it will conduct surveys on the moon.

The Xinhua News Agency is reporting that this launch of China's lunar probe Chang'e-3 was "successful." The announcement of the launch success

was made by the Xichang Satellite Launch Center.

Zhang Zhenzhong, director of the center, made the announcement after the lunar probe entered the Earth-Moon transfer orbit and unfolded its solar panels. The Chang'e-3 lunar probe, aboard a Long March-3B carrier rocket, is expected to soft-land on the moon in mid-December.

The 3.78 ton Chang'e-3 arrived at the orbit with a perigee of 200 kilometers and an apogee of 380,000 kilometers, as scheduled.



Launch-O-Rama: exactEarth—Constellation Beefed Up By One



Artistic rendition of an exactEARTH AIS satellite.

exactEarth Ltd. has launched an advanced AIS satellite that will extend its exactAIS® constellation and increase the capacity of its global vessel monitoring service.

The spacecraft was built by SpaceQuest, Ltd., of Fairfax, Virginia, and was launched from the Yasny launch base in Russia on November 21st, 2013, at 07:10:10 UTC aboard a Dnepr rocket.

The addition of this spacecraft will increase the exactEarth constellation to five satellites and further improve exactEarth's world-leading AIS message detection performance from space.

"We are pleased to announce the successful launch of EV5, another important step in our growing constellation of dedicated AIS satellites," said Philip Miller, VP of Operations and Engineering at exactEarth. "The satellite is performing to expectations and we are confident of quickly bringing the asset into operational use. The addition of this satellite to our fleet is an important milestone as we continue to provide the world's leading space-based global maritime vessel monitoring service.

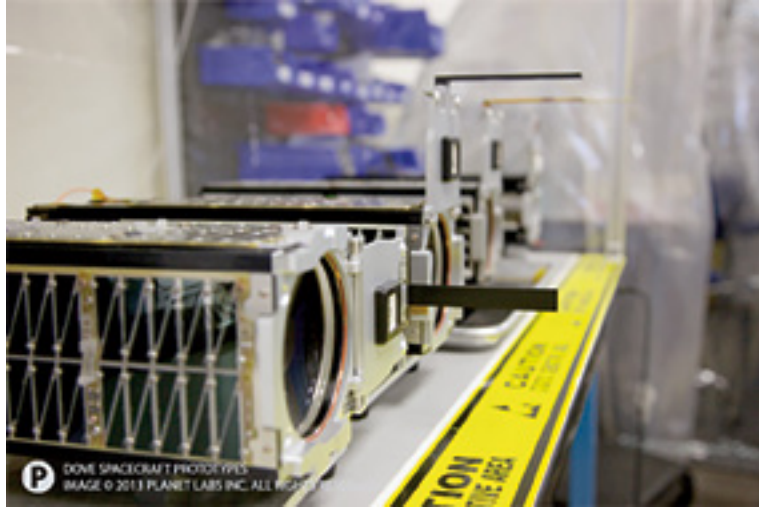
exactAIS® provides a global capability for monitoring all AIS-equipped vessels using our own satellite constellation and global network of ground stations. As we receive AIS messages at our data processing center in Canada, we forward these messages instantly to our customers via a secure Internet link. The messages are provided in one of several industry standard formats that are compatible with most existing AIS display systems. exactAIS streams the data securely, quickly and continuously, enabling you to monitor any area of the planet for vessel traffic like never before. We process and distribute all received AIS messages in your Area of Interest (AOI) providing you with Maritime Mobile Service Identity Number (MMSI), ship location, ship course and ship speed. All data is also time-stamped and provided with each message.

system, capturing thousands of distinct vessels in a single pass. Utilizing our patented processing technology, we are able to provide our customers with better information allowing you to make better decisions for security, traffic management, environmental and safety applications."

exactAIS is available on an annual or multi-year subscription with pricing based on factors unique to your needs—primarily the square nautical miles in your Area of Interest (AOI).

exactAIS provides global coverage today with additional satellites and ground stations being deployed in the coming months and years to continuously improve the refresh rate for the global maritime picture.

Learn more at the company's infosite:
<http://www.exactearth.com/>



Dove satellite prototypes. Photo courtesy of Planet Labs.

Planet Labs has successfully launched its most recent satellites, Dove 3 and Dove 4, into orbit via a Russian Dnepr vehicle.

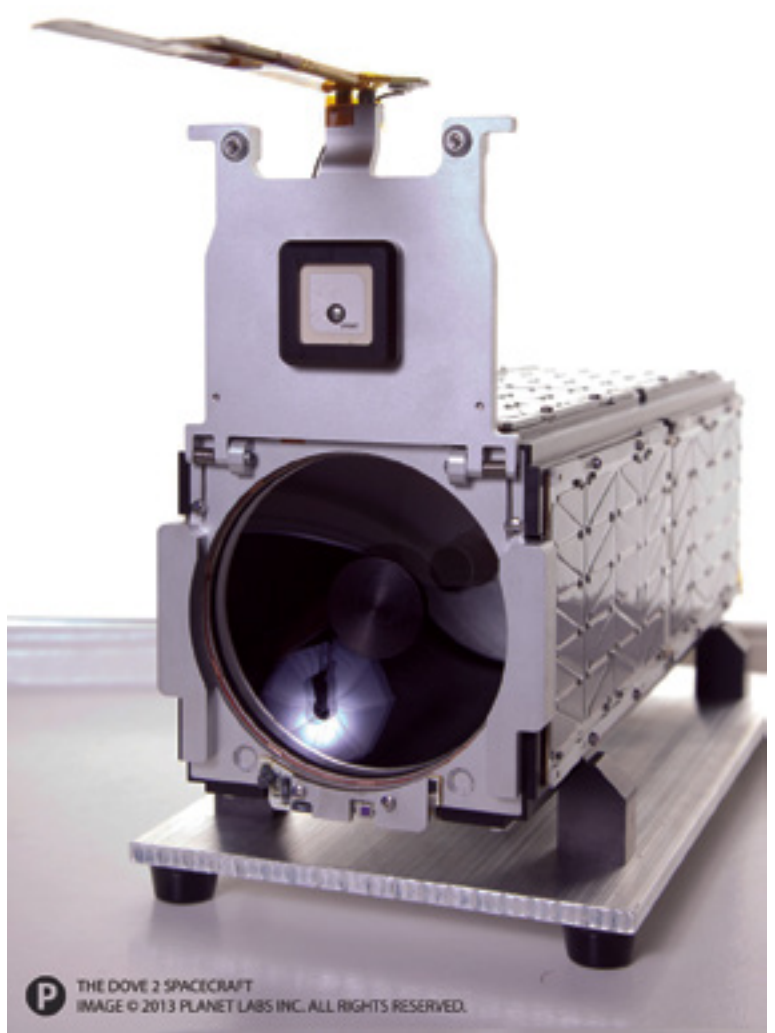
This launch will be closely followed by the launch of Planet Labs' "Flock 1" fleet of 28 satellites in December, which will be the largest constellation of Earth-imaging satellites ever launched.

"This is the third rocket launch for Planet Labs this year, and the Dove 3 and 4 satellites are the most advanced and agile satellites we have built to date" said Chris Boshuizen, co-founder and CTO of Planet Labs.

Planet Labs' Flock 1 satellites were delivered this month to NASA Wallops Flight Facility in Virginia for launch on board an Antares rocket in December. These satellites were built in production at the Planet Labs headquarter offices in San Francisco. Planet Labs is on track to launch 32 satellites on four different launches in 2013.

"The delivery of Flock 1 is an important milestone for both our team and the industry," said Will Marshall, co-founder and CEO of Planet Labs. "The latest generation of satellites will enable us to image the whole globe at high frequency, producing an unprecedented data set that will unlock huge commercial, environmental and humanitarian value."

Planet Labs Inc. is a purpose-driven space and data analytics company based in San Francisco, California, Earth. The company operates large fleets of Earth imaging satellites, to image the entire planet at an unprecedented frequency. Planet Labs aims to provide universal access to information about the changing planet to enable both commercial and humanitarian applications. Founded in

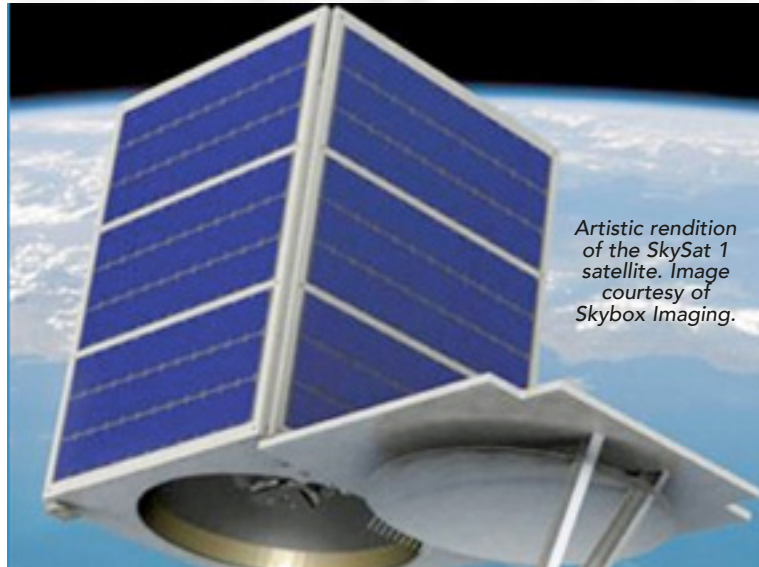


The Dove 2 satellite. Photo courtesy of Planet Labs.

2010 by former NASA scientists, the team includes engineers, developers, and leading venture capital investors.

There's more information about Planet Labs at their infosite: <http://www.planet-labs.com>

Launch-O-Rama: Skybox Imaging—Off + Away To Improve Their Imagery

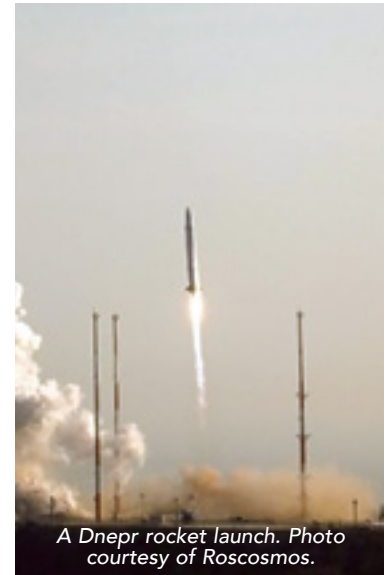


Skybox Imaging has launched SkySat-1, the company's first Earth Observation (EO) satellite.

The company is only the fifth organization that is licensed to provide high-resolution, space-based, panchromatic and multispectral imagery of Earth. The success of this launch on a Russian Dnepr vehicle led NSG Analysts to improve Skybox's ranking from #12 to #7 on the NSG 100 index.

The satellite will operate in a polar inclined, circular orbit at approximately 450km above the Earth. For future launches, Skybox reportedly has an agreement with Virgin Galactic to use the LauncherOne rocket.

The company's infosite is located at: <http://www.skyboximaging.com/>



Signalhorn + ESA—Functional Funding



Signalhorn has been awarded funding from the European Space Agency (ESA) to develop a gateway that will allow its customers to monitor all aspects of their services with the company.

The funding is part of ESA's Advanced Research in Telecommunications Systems (ARTES) program.

ARTES is designed to support research and development activities that result in leading-edge satellite communications products and services. The Signalhorn Gateway will bring together all aspects of the functional relationships the company has with its customers in an easy-to-use, web-based interface accessible from any PC based browser or smart phone.

These functions include network visibility, site performance and trouble tickets to accounts, contracts and billing. Development of Signalhorn's Customer Gateway began in early 2013 and version 1.0 will be released in the first quarter of 2014.

Signalhorn has developed its Customer Gateway in-house with its own software engineering team.

"The requirements of this broad project have given Signalhorn the opportunity to deliver a single consistent and comprehensive interface to the networks we operate

for our customers," said Robert Kubbernus, President and CEO of Signalhorn. "The award will enable us to deliver much-needed functionality to our customers while making us more competitive by improving our internal efficiencies."

Signalhorn delivers fully managed services for its customers and in the past has provided a level of systems access to its customers on a case-by-case basis.

Many of Signalhorn's competitors offer customer portals but most address only one or two requirements, specific to either a single technology platform or a function such as fault escalations.

The depth of functionality built into Signalhorn's Customer Gateway will place Signalhorn ahead of the competition in the provision of information that spans multiple systems and multiple functions.

Signalhorn's infosite is located at: <http://www.signalhorn.com/index.php/en/company/>

ESA's ARTES overview infopage is located at: http://www.esa.int/Our_Activities/Telecommunications_Integrated_Applications/ARTES/ARTES_programme_overview

VSAT Latin America—Help To Develop This Event

Informa Telecoms & Media is proud to host the second annual VSAT Latin America event, taking place on April 29th and 30th, 2014, in São Paulo, Brazil—development of the conference agenda is underway, and now is your chance to help shape the discussions for 2014!

Phenomenally successful in its first year, VSAT Latin America 2014 will bring together leading satellite operators, systems integrators and ground segment providers, VSAT service providers, analysts, regulators and key enterprise & end user players from across the Latin America region, covering the VSAT market in detail with a mix of presentations and panel debates.

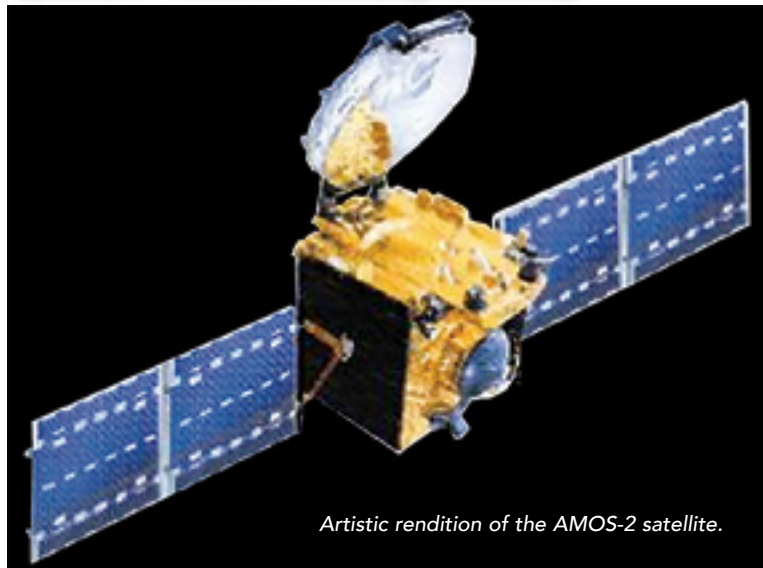
VSAT Latin America 2014 will feature 40+ speakers from across the entire VSAT ecosystem.

Do you have valuable experience within VSAT technology or services that you would like to share? If you represent a VSAT service provider, VSAT end user, association or regulator and would like to play a key role in defining the direction of the industry's premier event, please submit your proposal to Caroline Hicks today—caroline.hicks@informa.com.

Please feel free to take this opportunity to submit your ideas for inclusion in the conference and help shape the agenda.

Learn more at: <http://latinamerica.vsatevent.com/#>

Spacecom + Neterra—Promising Partnership



Artistic rendition of the AMOS-2 satellite.

Bulgarian telecommunication company Neterra Communications and Spacecom, operators of the AMOS brand communication satellites, have initiated a strategic partnership.

The two companies will work together on satellite Direct-to-home (DTH) TV services as well as video distribution to cable head-ends, VSAT communications, broadband Internet services via AMOS-2 satellite (and, after that satellite's end of activity, via AMOS-6).

The white-label DTH platform for TV services is called "W4" and enables operators to offer DTH services to end-users. More than 60 TV channels will be offered via "W4" and soon Neterra Communications will expand the list with HD channels. The service will be distributed on AMOS-2 satellite, located at 4 degrees West.

"White-label" is a model that enables a DTH service, provided and supported by one company to be distributed by other TV operators under their own brand.

Launched in 2003 to Spacecom's 4 degrees West orbital "hot spot," the AMOS-2 satellite operates in Ku-band and offers customers a wide range of communications and broadcasting services to Europe and the Middle East.

Plus, the AMOS-2 satellite is co-located with the AMOS-3 satellite for complete in-orbit redundancy to ensure backup capabilities and total service reliability.

More info at:

<http://www.amos-spacecom.com>

Bulgaria + EUMETSAT—Signing On



Signature of accession agreement by EUMETSAT Director-General Alain Ratier and Prof. Dr. Aneliya Klisarova, Minister of Education and Science of Bulgaria, during 79th Council meeting.

Bulgaria is on its way to becoming a EUMETSAT Member State in 2014 following the signature of the accession agreement by EUMETSAT Director-General Alain Ratier and Prof. Dr. Aneliya Klisarova, Minister of Education and Science of Bulgaria.

After the completion of the ratification process, expected in the course of 2014, Bulgaria will be fully involved in the strategic decisions of EUMETSAT's ruling Council, in addition to having access to all EUMETSAT data and products.

During the signature ceremony, Mrs. Klisarova said, "Accession to EUMETSAT as a full Member State will ensure that the Republic of Bulgaria has full access to high quality satellite information. The accession will also integrate the Bulgarian National Institute of Meteorology and Hydrology into European meteorological research and operational activities. This will help

protect life and property and offer benefits for the economy".

Ratier said, "I am delighted that Bulgaria is en route to full EUMETSAT membership and recognizes the benefits provided by our satellites. This is particularly significant at a time when EUMETSAT needs to invest in the renewal of its polar-orbiting satellite system."

For additional details, access the EUMETSAT infosite:
<http://www.eumetsat.int/>

Indra + ESA—Taking Charge Of Sentinel-2



Indra is one of the world's largest consultancy and technology multinationals, a leader in Europe and Latin America and is expanding in other emerging economies. Innovation is the cornerstone of its business, which is highly focused on the customer and on sustainability.

The multinational is one of the leaders in its sector in Europe in terms of investment in R&D and innovation, having invested more than €550M in the last three years. With sales approaching €3,000 million, it employs 42,000 professionals and has customers in 128 countries.

Additional information regarding Indra is available at their infosite:

<http://www.indracompany.com/en>

Indra has closed an agreement with the European Space Agency to host the main processing and archiving center for the images of the Sentinel-2 mission at its facilities, and take charge of its operation.

This contract will strengthen the consultancy and technology multinational's position as an operator of Earth observation image processing centers, consolidating its portfolio of solutions and services in the space sector. The company is the leader in the development of ground segments in Spain and has vast experience in Earth observation systems and applications.

The Sentinel satellites form part of the Copernicus Earth Observation Program, previously known as GMES (Global Monitoring for Environment and Security), which will equip Europe with its own Earth observation capacity to serve the needs of its users.

ESA Sentinel-2 information is available at: http://www.esa.int/Our_Activities/ii/Copernicus/Sentinel-2



United Launch Alliance (ULA) celebrated the 50th anniversary of the first successful launch of the Centaur upper stage during the Ohio Aerospace Institute event on November 22nd.

Centaur was recognized as the hallmark of innovative design and engineering excellence.

"By harnessing the power of liquid hydrogen to launch payloads to space, both near and far, the Centaur is the benchmark by which all other are measured," said Matt Smith, ULA's vice president of Engineering and Information Technology.

General Dynamics and NASA partnered to develop Centaur in the height of the space race.

The first Centaur launched in the early 1960s demonstrated extremely high performance that can be achieved with a liquid hydrogen/liquid oxygen rocket stage and provided the energy needed to propel larger missions to the moon and beyond.

Using an innovative approach, the team designed a tank with propellant compartments separated by a double walled bulkhead which also serves as a heat barrier to reduce the boil off of the much colder liquid hydrogen. Although Centaur has always flown on Atlas rockets, Centaur variants were subsequently used for the Saturn I, Saturn V, Space Shuttle, Titan, and Delta programs.

"Centaur celebrated its 200th flight in 2012 and has sent spacecraft to nearly every planet in our solar system, as well as delivering vital commercial and national security payloads," said Smith. "Fifty years today after its first successful launch, Centaur continues to deliver the highest mass fraction of any cryogenic upper stage, as well as meet customer requirements for reduced cost and enhanced capabilities."

In 2012, ULA, in partnership with the National Reconnaissance Office, developed the aft bulkhead carrier to launch auxiliary payloads mounted to the Centaur. These rideshare missions provide lower cost launch opportunities for customers with smaller payloads.

ULA is currently developing the next generation of Centaur, the Advanced Common Evolved Stage (ACES) to support multiple objectives, including 50 percent payload growth.

"ACES will enable unparalleled mission flexibility and incorporate the Integrated Vehicle Fluids, or IVF system, stretching mission capability from hours to weeks," said Dr. George Sowers, ULA's vice president of Strategic Architecture. "This replaces the existing hydrazine, helium and battery systems."

ULA program management, engineering, test, and mission support functions are headquartered in Denver, Colorado. Manufacturing, assembly and integration operations are located at Decatur, Alabama, and Harlingen, Texas. Launch operations are located at Cape Canaveral AFS, Florida, and Vandenberg AFB, California.

Learn more about ULA at:
<http://www.ulalaunch.com/site/>

BCC Research—Sat Tech To \$214 Billion By 2018

Telecommunication components, modules, and devices are integral to the crucial “eye in the sky” and data-relay functions that satellites perform for businesses and governments worldwide.

At the ground monitoring-and-control level, telecommunication technologies help to control the satellite, transfer payload data, and allow end-users to communicate with these satellites.

Continuing developments in satellite functionality and demand as well as advances in end-user side applications will drive growth in this market over the next five years.

BCC Research provides an in-depth analysis of the global markets for telecommunication components, modules, and devices used in satellite technologies through its report Global Markets for Satellite Technologies.

According to the report, this market was estimated at \$18.5 billion in 2012 and is expected to reach \$19.5 billion in 2013. BCC Research projects the market to grow to \$21.4 billion by 2018, and register a five-year compound annual growth rate (CAGR) of 1.9 percent from 2013 to 2018.

Use this report to:

- Gain an overview of the global market for satellite technologies, which is a complex interplay of defense, regulatory, and market forces as the technology is considered a critical resource in most countries
- Analyze global market trends, with data from 2011 and 2012, estimates for 2013, and projections of

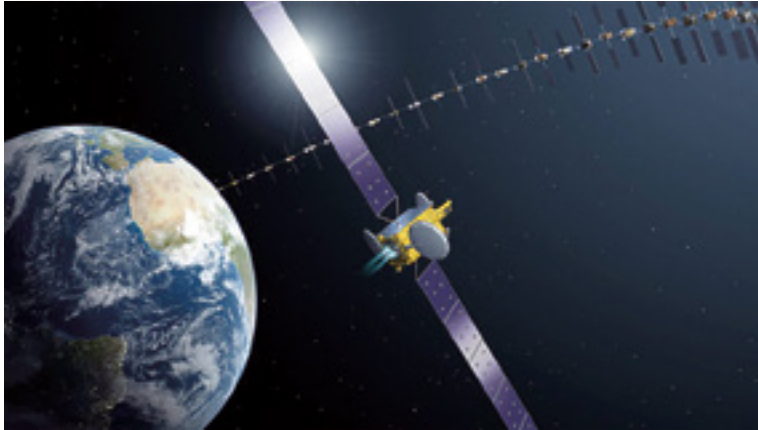
compound annual growth rates (CAGRs) through 2018

- Understand how commercial applications of satellites have developed almost hand-in-hand with defense, communications, and environmental applications
- Evaluate coverage of broadcast and network management equipment and devices, including transponders, antennas, gateways, and terrestrial management infrastructure; and coverage of user premise-based and user-operated equipment and devices, including satellite phones, satellite radios, VSATs, navigation devices, reception antennas, and set-top boxes

- Review a breakdown of satellite applications, such as defense, weather, communications, and navigation, as well as end-use applications, such as gaming, media, and entertainment; telecommunications; education and research; defense and government; maritime; logistics; and automotive

The BCC Research website is at:
<http://www.bccresearch.com/market-research>

OHB System AG—Propellant Mass Reduction



Artistic rendition of the Electra satellite. Image courtesy of ESA.

OHB System AG has been awarded a contract for the development of a telecommunications satellite known as Electra, which will be powered solely by electricity—the contract was entered into in Betzdorf with satellite operator SES.

Signed in the presence of Luxembourg communications minister Luc Frieden, research minister Martine Hansen, director general of the European Space Agency ESA Jean-Jacques Dordain, board member for space management at the German Space Agency Gerd Gruppe, president and CEO of SES Romain Bausch, member of OHB System's management board Frank Negretti, and other high-ranking representatives from politics and industry, the contract ushered in the next one-year B1 development phase in the project.

Electra is a public-private partnership under the ESA ARTES 33 program serving the purpose of providing the satellite communications industry with innovative products and systems. It is an advanced electrically powered telecommunications satellite in the sub-three-ton weight class. Such

a system has previously not been available commercially in Europe.

To date, electric power systems have only been used in research satellites or for orbit maintenance for telecommunications satellites. Artemis, a communications satellite operated by ESA, successfully tested the concept of using solely electric power to achieve a geostationary orbit for the first time.

The results showed that electric power systems reduce propellant mass requirements by up to 90 percent when compared to chemical power systems. Consequently, it is possible to reduce the launch mass of the satellite by almost half. Electra is now to be used to systematically broaden the scope for implementing this technology in a specially designed satellite system.

With this contract, OHB System is tapping a substantially larger area of business in commercial telecommunications and adding an innovative new power system design to its SmallGEO range.

For further information
<http://www.ohb.de/>

Inmarsat + MOL—Ship-Shape Management



Inmarsat (LSE:ISAT.L) has announced that global shipping company MOL SHIP MANAGEMENT CO. LTD. has commenced migrating over 100 vessels to the FleetBroadband 6 gigabyte (GB) plan for the primary purpose of enhancing both crew welfare and business operations—the decision to upgrade was made following a trial period on several selected vessels.

MOL SHIP MANAGEMENT CO. LTD. has deployed Inmarsat services on its vessel fleet for more than 10 years and has been using FleetBroadband since April 2010, gradually increasing its usage since the initial installation.

“Any FleetBroadband user can quickly and easily upgrade their plans without additional capital investment and data usage can be shared across vessels,” said Frank Coles, President of Inmarsat Maritime. “MOL’s decision to upgrade its Inmarsat usage yet again is a great testament to the quality, capability and value of FleetBroadband and its ability to enhance both on-board quality of life and operations.”

Since rolling out FleetBroadband, MOL SHIP MANAGEMENT CO. LTD. has progressively increased its usage from 30 MB initially, to the 200 MB plan in 2011 before now moving to the 6 GB plan.

The company intends to offer its crew free email, chatting and Internet browsing through AmosConnect Crew, an all-in-one communications solution for crew members at sea.

MOL SHIP MANAGEMENT CO. LTD., which specializes in shipping dry cargo fleet including container carriers, car carriers and other types of bulk containers, has also expressed interest in becoming an early Global Xpress adopter once the Ka-band service comes online in 2015.

For further information regarding Inmarsat’s Maritime services:
<http://www.inmarsat.com/maritime/>



CEA-Leti's next-generation magnetometer technology was launched into space on board the European Space Agency's three Swarm satellites to collect unprecedented detail about the Earth's magnetic field.

The four-year mission will gather data that for the first time will make it possible to distinguish between the various sources of the magnetic field: the Earth's core, mantle, crust and oceans, as well as the ionosphere and magnetosphere.

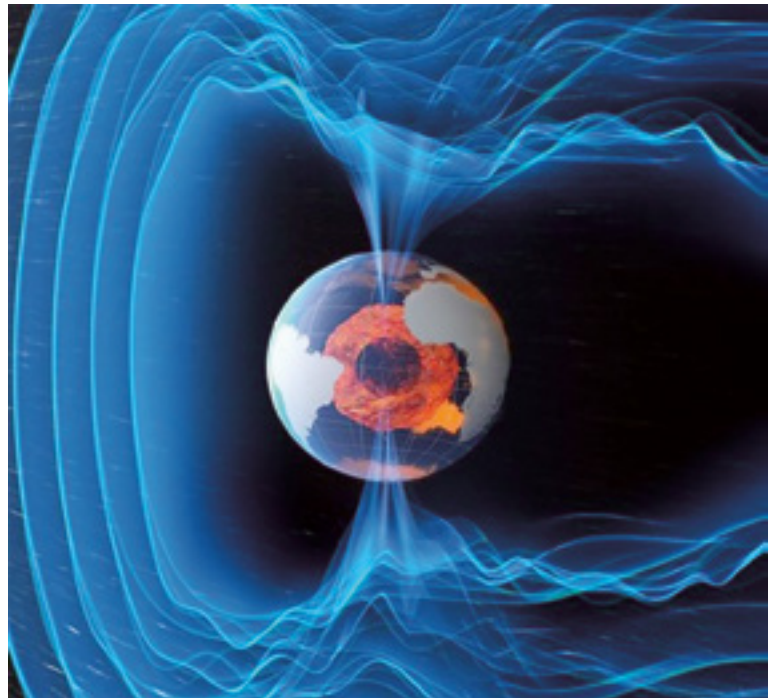
These high-precision and high-resolution measurements will improve scientists' understanding of the Earth's magnetic-field structure, evolution and interaction with the solar wind.

Scientists hope the data also will shed light on why the magnetic field, which shields the Earth from cosmic radiation and harmful charged particles in the solar wind, is weakening.

The three identical satellites, which were lifted into orbit by a Russian Rockot launcher, will be positioned so as to simultaneously acquire measurements in three different locations and time zones.

They are carrying three measuring instruments that will directly contribute to the magnetic field studies:

- A vector magnetometer to measure the components of the magnetic field in space
- A stellar camera giving the orientation of the vector magnetometer in space
- A Leti-designed absolute scalar magnetometer (ASM) for measuring the intensity of the field without drift or bias, i.e. without systematic error, and with unmatched precision and resolution. The ASM's ability, unique in the world, to simultaneously measure the direction of the field will also be implemented in an experimental mode.



The magnetic field and electric currents near Earth generate complex forces that have immeasurable impact on our everyday lives. Although we know that the magnetic field originates from several sources, exactly how it is generated and why it changes is not yet fully understood. ESA's Swarm mission will help untangle the complexities of the field. ESA/ATG Medialab.

When they reach their orbiting positions 450 and 530 kilometers above Earth, the satellites will provide simultaneous measurements from three different positions at different local times. To prevent interference in the highly sensitive measurements by the crafts themselves, Leti's absolute scalar magnetometers will be deployed at the very tip of booms extending nine meters from the rear of each satellite platform

"The Swarm mission's three absolute scalar magnetometers, which underscore Leti's advanced sensor design-and-performance capabilities, provide the mission with critical technologies for understanding past, present and future dynamics of the magnetic field," said Laurent Malier, CEO of Leti. "This is a tribute to the technological excellence that characterizes Leti's divisions and to our commitment to collaborate with French and European technology partners."

"We developed an architecture that is free of the orientation effects common to all standard scalar magnetometers based on magnetic resonance to take full advantage of the ASM's performance" said Jean-Michel Léger, manager of Leti's Space Applications Program. "These instruments represent the latest and most effective technology available to measure key characteristics of the magnetic field."

Developed from conception to space readiness with technical and financial assistance from CNES and scientific support from IGP, the Leti magnetometers are Leti's third contribution to studying the magnetic field from space. Nuclear magnetic resonance (NMR) magnetometers, designed and developed with CNES support, were part of the 1999 Oersted and 2000 Champ missions.

Designed for a 14-month data-gathering mission, the Oersted satellite is still sending data back to Earth.

CNES-IGP researchers will be in charge of scientific validation of the data provided by the absolute scalar magnetometers.

The magnetic field models resulting from the Swarm mission also will further scientists' understanding of atmospheric processes related to climate and weather, will help improve the accuracy of navigation systems and will have practical applications in many different areas, such as space weather.

For further information regarding CETA-Leti, select:
<http://www.leti.fr/en>

Year In Review 2013

In August of this year, Futron released its most recent forecast of global supply and demand. Futron forecasts demand for Fixed Satellite Service (FSS) 36-MHz transponder equivalents (TPEs) in three dimensions over a 10-year timeframe; geographically, by application, and by frequency band, with granularity as shown in Figure 1 on the following page.

- Deployment of capacity expanding technologies, such as new frequency spectrum, frequency reuse, spot beam technology, and dynamic power allocation, will allow satellite service providers to create specialized



Figure 1: Demand Forecast Dimensions

Frequency Band	Region	Application
Ku-	North America	Video Contribution
C-	Central America/Caribbean	Video Distribution
Ka-	South America	Direct-to-Home (DTH)
X-	Western Europe	Backhaul
	Eastern Europe	Network Services
	Middle East / North Africa	Mobility
	Sub-Saharan Africa	Military
	South Asia	
	East Asia	
	Southeast Asia	

product offers tailored to specific market segments. While many operators and customers associate higher throughputs with deployment of Ka-band capacity, the underlying technologies may also be deployed in a C- or Ku-band environment.

- Growth of consumer-oriented services, such as Direct-to-Home (DTH) video and mobility-based broadband technologies. In part, this is fueled by expanded willingness to pay for anytime, anywhere connectivity on the part of the consumer market.
- Growth in global mobility applications; the lion's share of this market is maritime, but there is a new generation of aviation services that appears to be gaining market acceptance.
- Military demand for commercial satellite communications (COMSATCOM) has slowed relative to peak spending levels, but is still growing, albeit with more churn and smaller contracts. To the extent that the slowdown in demand reflects a gap between demand and procurement, pent up demand may be growing to drive cyclical growth on the other side of the turning point.
- The ongoing shift in purchasing behavior from (commoditized) wholesale transponder capacity to end-to-end solutions and managed services moves the industry up the value chain, increasing providers' share of the wallet and creating provider stickiness.
- Technology innovation, such as electronic propulsion and dynamic power allocation (and possibly lower cost launches), will have broad implications for satellite design and construction, which, in turn, can change the cost structure of new capacity deployment.

Futron's 2013 forecast anticipates nearly six percent annual growth worldwide through 2021. Much of this growth is driven by demand for Ka-band service (approximately 22 percent Compounded Annual Growth Rate [CAGR]), with more moderate (approximately 2.5 percent CAGR) growth for C- and Ku-band service.

Among the specific applications in the forecast, greatest (double digit) growth is expected for Direct Internet Access (DIA) and Mobility. DIA primarily comprises consumer broadband, but is increasingly used for small businesses/home offices and some limited backhaul. Growth for DIA will be driven by high throughput satellite (HTS) availability and is expected to be greatest for Ka-band. Demand is expected to grow most quickly in traditionally undersupplied areas, such as East Asia and Southeast Asia. The greatest share of mobility demand is for maritime Ku-band services, with significant concentrations in Asia and South America.

Network services, particularly wireless backhaul and corporate networks are also growth drivers, though perhaps not as aggressively. Both of these service areas are poised to take advantage of high-throughput Ka-band deployments (possibly high throughput Ku-band as well), although this demand will be incremental to still healthy demand growth for C- and Ku-band services.

Two exclusions from the forecast should be noted: 3G and 4G wireless backhaul has still not been proven in practice to be economically feasible (despite several theoretical examples), and incremental demand stimulated by O3b's launch of high-throughput medium-Earth orbit (MEO) service has been included. As time allows these models to be proved out, these could be sources of incremental growth beyond the current forecast. Nevertheless, demand growth for both of these services seems greatest for Ka-band (including some cannibalization of current Ku-band demand) and still in traditionally underserved areas, including South America, Eastern Europe, Middle East and Africa, and South Asia.

Figure 2 below shows all forecasted applications in declining order of their anticipated compound annual growth rate (CAGR) between 2012 and 2021.

Similarly, Futron forecasts by geographic region. One recurring theme that can be seen in geographic growth is that regions with smaller starting demand grow roughly 50 percent faster than their higher demand counterparts, yet regional share of total global demand is fairly stable. Specific examples of the smaller markets/faster growth forecast are shown in Figure 3, while changes to the geographic distribution of demand over time are shown in Figure 4, both located on the following page.

Supply

At the global level, the total amount of fixed satellite service (FSS) supply in the C-band, Ku-band, and Ka-band is forecast to show strong growth by 2016. Despite widespread interest in new Ka-band services, much of the increase is related to strong growth of Ku-band capacity, which is the largest element of the current supply. Significant Ka-band deployments will dramatically increase the base of Ka-band capacity.

However, Ku-band continues to be the principal commercial band in terms of installed base and new capacity forecast to come online, accounting for approximately 52 percent of the TPEs added globally. The surge in overall supply—a 27 percent aggregate increase in supply during a five-year time span—is largely driven by increases in Ku-band TPEs, the unrivaled workhorse of the satellite industry. C-band is a mature and well-understood market segment is expected to experience small to flat growth during this timeframe. (Note that O3b, which is not a geostationary satellite service, is not included in our supply analysis.)

In addition to healthy overall increases in supply, there are several technology and industry trends that could alter the balance (and analysis of) supply over

Figure 2: Forecasted Growth by Application

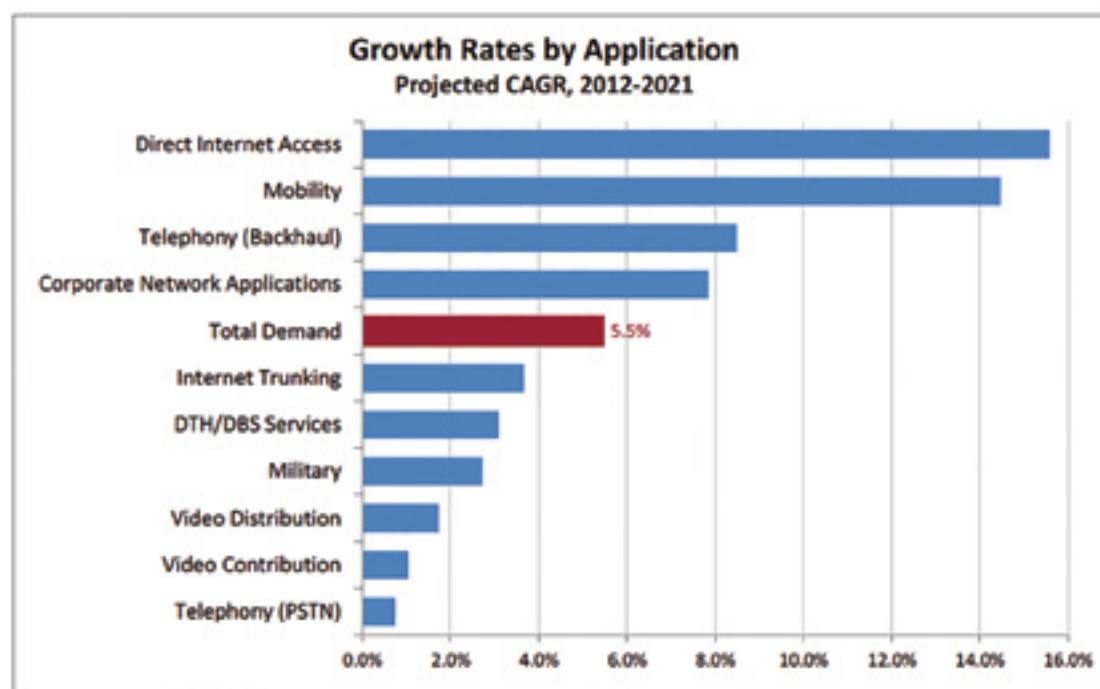


Figure 3: Comparative Growth Rates for Demand

Region	CAGR	Region	CAGR
Sub-Saharan Africa	7.9%	Middle East / North Africa	5.8%
Southeast Asia	7.8%	East Asia	5.3%
Central America	6.1%	South America	3.9%
Eastern Europe	5.4%	Western Europe	3.3%

Figure 4: Global Distribution of TPE Demand, 2011 and 2021

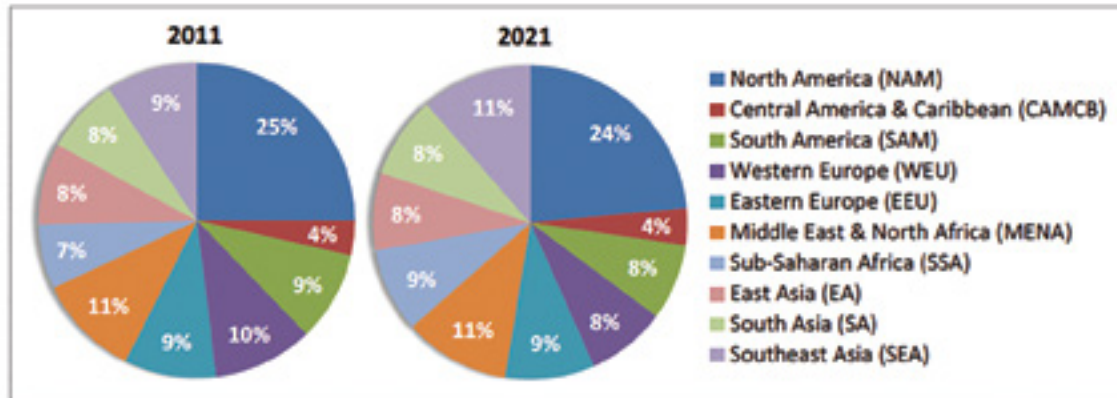
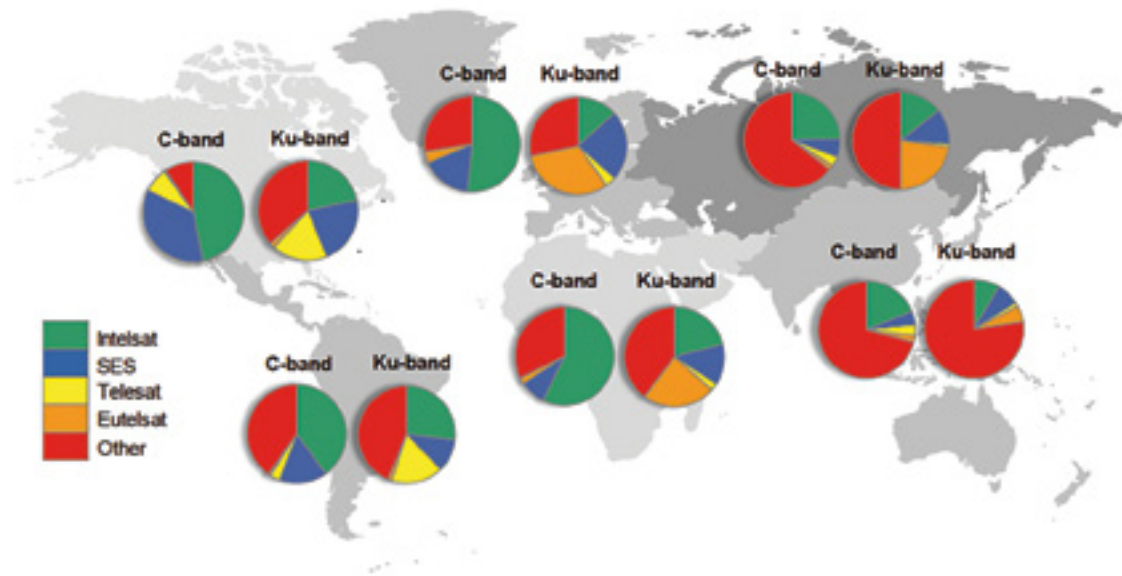


Figure 5: GEO Commercial Fixed Satellite Capacity Supply Distribution



the longer term. Increased use of spot-beam technology is among these; as the market migrates towards spot-beam technology, both in the Ku- and K-band's, supply (vis-à-vis demand) factors will become even more localized.

So while in aggregate the industry appears to have matured to the degree that global supply generally tracks well with global demand, Futron forecasts several pockets where supply and demand are mismatched. Importantly, the relative sizes of these mismatches will decrease as the industry moves to more spot-beam coverage.

Thus supply may be carefully managed by the industry to meet the anticipated needs of local market conditions. Fleet optimization, via asset repurposing within a single fleet or acquisition/disposal between operators, suits the efficiency objectives of operators, and also serves to keep global supply in check at any given point in time. Other factors affecting supply include spectrum allocation, the availability of multiband equipment, and innovative supplier and customer partnering arrangements. Figure 5 shows the concentration of supply by region and by band, among the "big four" providers. It is interesting to note the significance of "other" players in providing Ku- service to East Asia and South Asia.

Comparison of supply and demand forecasts has allowed Futron to develop a point of view regarding price trends. While different regions and applications may have variations from the mean, overall our expectation is that pricing for C- and Ku-band pricing will remain fairly stable. Pricing for Ka-band capacity, particularly new capacity first coming online during the 2013–2016 time period, may show greater volatility in pricing.

One significant factor for new Ka-band services is promotional pricing to entice customers to accept the long lead times and execution risk associated with pre-launch purchase commitments. Customer expectations for cost reduction via migration to Ka-band may be elusive, as customers reframe price comparison from cost per infrastructure unit (e.g., TPE or MHz) to cost per throughput unit (e.g., Gbps).

Figure 9 on the following page shows Futron's forecast for total revenue associated with the demand forecast. Futron expects the global FSS market size to be approximately US\$20 billion in 2021, with an optimistic scenario approaching US\$25 billion.

At a global level, regional distribution of demand moves relatively slowly. North America will retain its role as a major buyer of satellite capacity for the foreseeable

Looking forward, Figures 6 and 7, displayed on the following page, reveal how strong growth in all bands, including Ka-, which is excluded from the capacity snapshot in Figure 2. Figure 7 also shows decreased market concentration, as the collective market share of the top four operators falls from nearly 50 percent to approximately 40 percent.

Global

Although specific opportunities and utilization depend on supply and demand conditions in specific geographies, looking at supply and demand from a global perspective is instructive in gleaming the impact of specific trends.

One complicating factor in considering transponder demand is the impact of different capacity transponder types. To address this complication, particularly for a forecast period in which HTS are expected to emerge, Futron presents its global demand forecast in terms of throughput in Figure 8.

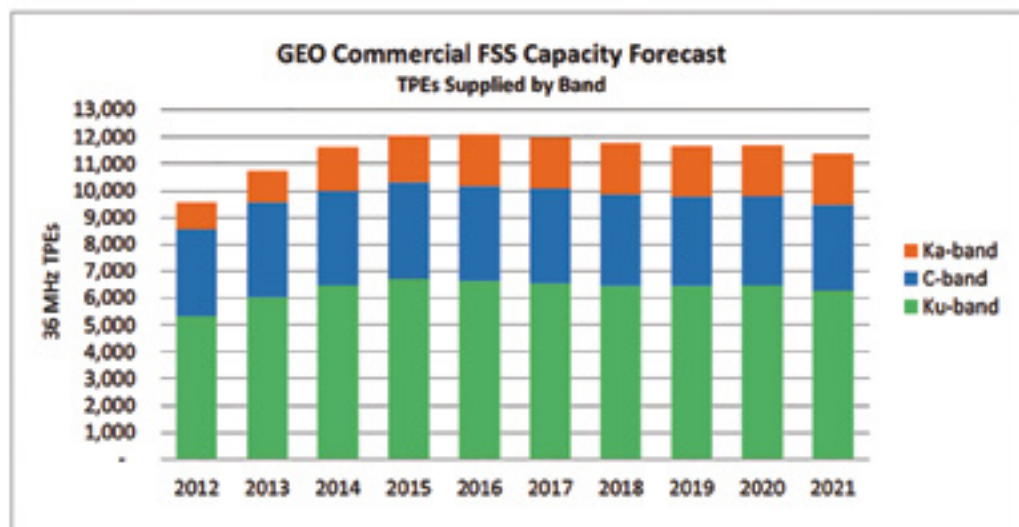
As was the case with the 2010 forecast, the current optimistic scenario shows more upside opportunity than the pessimistic scenario shows downside risk. The greatest drivers for the optimistic scenario are video services, especially distribution and DTH, cell backhaul, and Ka-band DIA.

For video, the differences between scenarios are based on changes in compression schemes, rate of phase-out of standard definition (SD) channels and periods of dual high definition (HD)-SD illumination, and availability of terrestrial alternatives.

For backhaul, scenario differences are based on ultimate demand for wireless services (based on general economic conditions) and the rate of migration to higher-bandwidth intensive technologies (e.g., 3G, 4G), whereas for DIA, the main driver of demand growth will be the pace of service availability.

In particular, the pace of Ka-band consumer-targeted supply growth will determine who has first mover advantage in providing service to traditionally underserved regions. Consumer broadband services via satellite should expect competition from terrestrial alternatives, but where there is currently a race-to-market; those broadband services are expected to formulate "sticky" products that will allow for customer retention, even as new options become available.

Figure 6: GEO Commercial Fixed Satellite Capacity Supply Forecast



future, even with a shrinking overall global share of the market. The regions becoming more prominent on the world stage this decade are those whose infrastructure is racing to keep up with demand, specifically Sub-Saharan Africa and Southeast Asia. Demand growth in these markets is fueled by consumer broadband (DIA), Mobility, and Corporate Networks applications.

Another factor driving regional differentiations in growth is government intervention, as exemplified by the case of India. This forecast reflects a great deal of regulatory and national policy uncertainty for India, whose market potential is strong, assuming a favorable regulatory environment. In other markets, the key government/regulatory issues focus on spectrum allocation, which could affect traditionally underserved markets, like Sub-Saharan Africa. *Figure 7* on the next page shows the anticipated global distribution of demand globally for 2012 and 2021.

Overall, the FSS market continues to be strong and is expected to show sustained growth as technology empowers greater levels of customer service delivery along a spectrum of price points. Despite threats that U.S. Government's challenging procurement environment over the next two to three years may suppress overall demand during that period, the long-term outlook remains strong.

The 2013 Futron Forecast of Global Satellite Services Demand provides forecasts by application, by region, and by frequency band (including C-, Ka-, Ku-, and X-band) measured in both transponders and throughput. Additional features include a five year supply transponder supply forecast, as well as commentary on technology developments, key market drivers and potential growth inhibitors, and pricing trends. Detailed data charts in the Appendix offer sufficient granularity to enable user-defined further analysis.

About the author

Sima Fishman currently leads

Futron's Corporate Strategy Practice, advising corporate, government, and financial clients on business issues of relevance to the satellite, telecommunications, government contracting, and space industries. She has extensive experience serving clients in the U.S., as well as Africa, Asia, and Latin America. Ms. Fishman typically leads engagements involving financial and economic analysis and she specializes in cutting through complexity to facilitate actionable decision making. Recent client work has included expert witness testimony, financial due diligence, regulatory assessment, economic impact analysis, and market forecasting. Email: sfishman@futron.com

For information regarding Futron's Forecast Of Supply & Demand
http://www.futron.com/2013_Futron_Forecast.xml

Figure 7: GEO Commercial FSS Satellite Capacity Supply Forecast - Major Operator Fleets

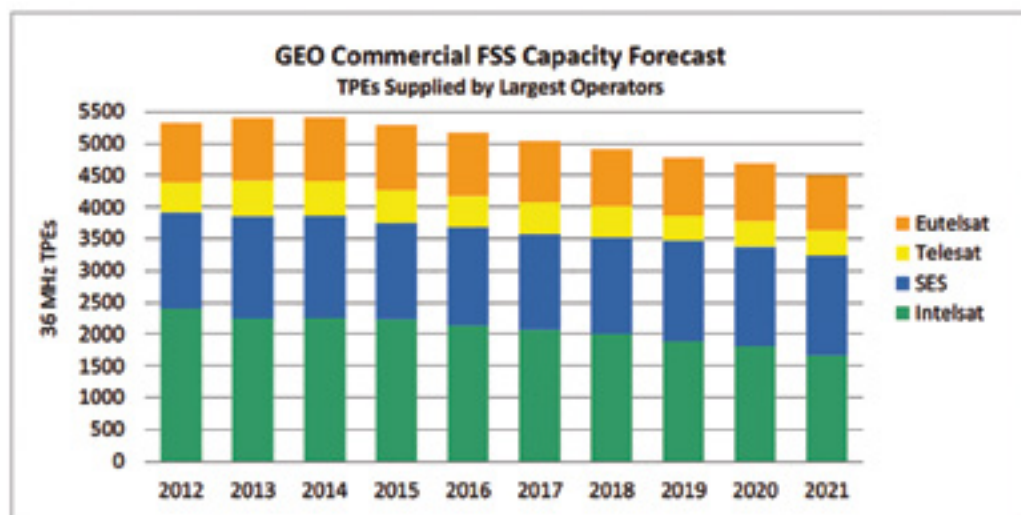


Figure 8: World Baseline Demand in Gbps, Scenario Comparison

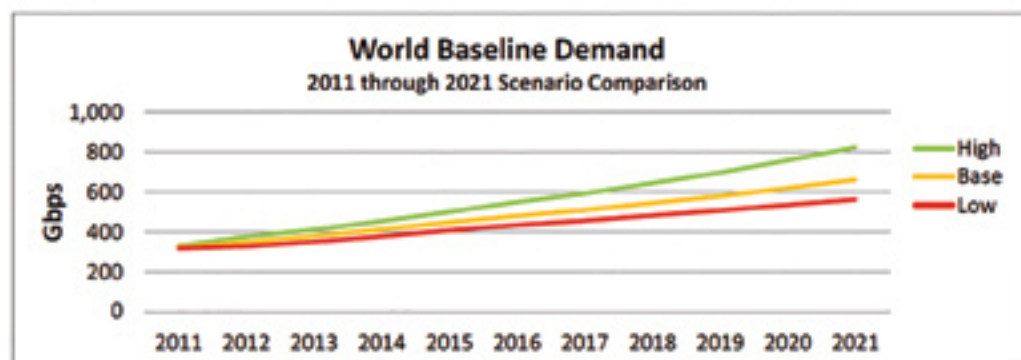
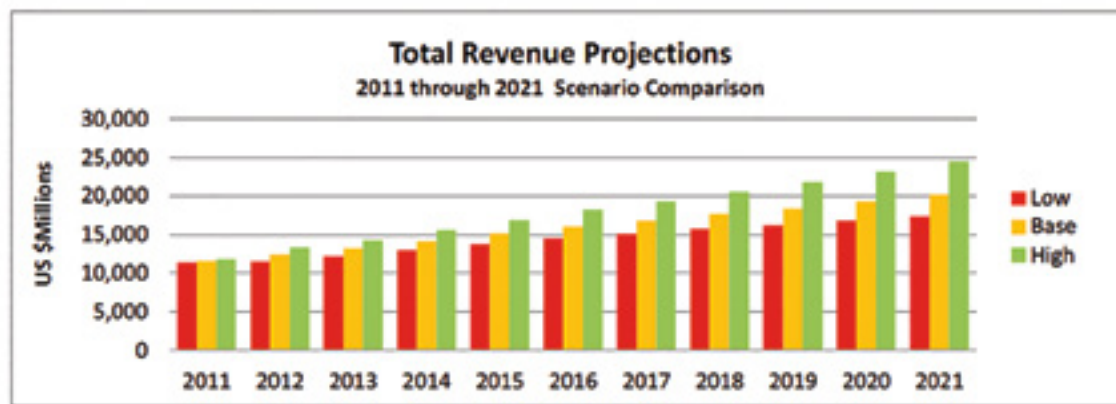


Figure 9: Total Global FSS Revenue Projections



By Tommy Konkol Dybvad, Director of Customized VSAT, Astrium Services

Connectivity is driving the development of ever more sophisticated technology in the offshore oil & gas sector. The so-called Digital Oilfield concept harnesses satellite connectivity to drive safer, more efficient, more environmentally friendly and, in the end, more profitable operations.

High throughput connectivity enables the use of bandwidth hungry tools, such as drilling software that harmonizes data from a wealth of sensors, and delivers it to stakeholders on the platform and on shore. Through collaboration based on accurate, real-time data, drilling has become safer and more efficient.

However, before any project reaches the Digital Oilfield stage, the exploration of the location has to occur, and connectivity is becoming increasingly important within the highly competitive seismic survey sector that serves this crucial function.

Seismic survey vessels generate huge amounts of data on the rock formations below the seabed, enabling the location of possible natural resources. This data is usually either periodically collected by helicopter or stored and delivered when a vessel returns to port. But with high throughput connectivity, the data can be delivered almost instantly. The advantage—clients chartering seismic survey vessels can change the survey plan according to the data received.

For instance, if an interesting formation is discovered, a new survey in the area can be conducted immediately, rather than returning to the site at a later date. This means surveyors can make the best use of their time at sea, to conduct the most efficient surveys possible—using these highly advanced vessels to their fullest capabilities is imperative in saving time and money.

Provisioning enough bandwidth offshore for these kinds of operations is still today a special job, but recent projects are changing views on what is considered high bandwidth at sea. Marlink recently completed delivery of Ku-band VSAT services based on a 12Mbit/s dedicated return link for the Atlantic Explorer, a Petroleum Geo Services (PGS) owned seismic survey vessel. The high throughput link was an upgrade to Atlantic Explorer's existing Sealink customized VSAT service supplied by Marlink.

The service was used during a four week North Sea survey project, and enabled the seamless transfer of survey data to shore, where the information could be reviewed and addressed while the Atlantic Explorer was still at sea. This enabled survey schedules to be amended based on the survey's findings as they were generated. This saved time, costs and resources for the PGS' client, as there was no need to wait for data to be delivered on return to port or collected by a helicopter.

Taking into account overheads and packet loss, the link enabled throughput of approximately 5GB per hour. To place that throughput into context, this is about 50 times more throughput than an average offshore vessel needs for heavy operational and crew use.



The Atlantic Explorer at sea during engaged in survey operations.



Simon Møkster Shipping vessel at work.

A link of this scale was necessary in order to facilitate the transfer of survey data. The connection was ordered by PGS in mid-May of 2013 and was live by the end of June, using the existing 1.5m Ku-band antenna on board Atlantic Explorer. A Marlink engineer installed a new 40W BUC (Block Upconverter) prior to the survey, to enable the higher throughput, which was activated while the vessel was at sea. The configuration and service provision reflects Marlink's approach to project based VSAT, where it's possible to quickly provide extended capabilities for vessels requesting extra temporary or permanent bandwidth.

The service provision for Atlantic Explorer represents the cutting-edge of what Marlink refers to as customized VSAT; the kind of services used by the offshore industry, because every platform and vessel have different requirements. This sort of high-level connectivity is not an off-the-shelf product. The delivery supported PGS in providing an extremely high-end service to its client. In the competitive seismic survey market, being able to offer advanced capabilities flexibly, such as the electronic delivery of survey data from vessel to shore, makes all the difference. With customized VSAT, it's possible to extend capabilities and move into project-based VSAT, where special connectivity requirements for specific jobs can be met in a short period of time. This assists the survey industry with innovation for client offerings.

Standardized Platforms

We are perhaps in a golden age of IP based technology development for oil & gas exploration and production, with powerful software (drilling, and so on) providing a platform on which to improve working practices and to enhance decision support through globally distributed workforces. The forthcoming introduction of High Throughput Satellite (HTS) services—such as Intelsat EPIC—will see further expansion in this environment, as software developers create tools that are suitable for heavier data transfer via fully supportive networks.

These specialized tools are becoming increasingly important in this competitive industry, especially when you consider the need to maximize the production potential of field and operations in even harsher conditions that are located further offshore. Availability of bandwidth, then, is vital for drilling and engineering software in order to support the industry with its daily operations and during expansion into deeper waters. The same can be said for the growing emergence of the use of standardized, non-maritime specific software platforms by vessel owners and operators in the offshore vessel arena.

Traditionally, IT for use on platforms and offshore vessels has been of the bespoke variety. There's a good reason for this, as it has to operate under parameters not normally found on land, i.e., the IP connection isn't as stable, so the software has to be written to deal with this fact. However, it is becoming apparent that standard applications can benefit operations, now that VSAT links and coverage are much more stable and available; especially in the business and administration side of running a fleet of service vessels for oil platforms.

Simon Møkster Shipping's 23 strong fleet of offshore supply and specialist vessels, for instance, is now fully connected to the Microsoft Lync platform through the Sealink customized VSAT service. The stable connectivity has enabled the established Norwegian offshore vessel operator to roll-out Microsoft Lync, a

standardized business collaboration and communication platform across its organization on land, and at sea, resulting in operational benefits in addition to substantial savings in the cost of crew calling.

Using Lync via Sealink enables bridge and engine room teams to access low-cost and reliable, telephony, video conferencing, instant messaging and data sharing. Stability and high uptime is vital for an operator to place so much emphasis on fleet management in a connected platform, but custom dynamic allocation of dedicated bandwidth through Closed User Groups (CUGs) enhances reliability, especially for bandwidth hungry and business critical applications. Lync is fully integrated with the Simon Møkster company telephone system—calls from terrestrial and mobile networks, and other Lync users, can be made to vessels and received via Lync. A unique VoIP solution has also been implemented for crew members from the Faroe Islands, which reduces their calling costs by at least 50 percent.

The use of standardized software enables significant IT efficiencies; Lync enables collaboration across the whole organization making every Simon Møkster vessel a remote office. The improved file and document sharing, and communication aspects introduced by Lync have provided

tangible improvements in ship operations but in order for them to function fully it required a secure and reliable VSAT network.

The same requirements for connectivity are relevant for another offshore vessel owner, Eidesvik. As a company at the forefront of deploying new technology solutions, such as the FellowSHIP—Fuel Cells project—Eidesvik understands the importance of connectivity for its vessels. The Norwegian company operates a modern fleet of highly specialized vessels in three main segments; Supply and Logistics, Seismic survey and cable laying, and subsea. Several of its vessels are developed by Eidesvik's own project department in close cooperation with naval architects and clients, who are active in offshore fields worldwide. With such a diversified fleet and distributed operational area, the company's communication requirement is defined by the needs and requirements of each vessel and client. As the standards communication requirements are high, requiring stable bandwidth, VSAT is the primary means of connectivity.

Vessel navigation equipment for example needs the necessary throughput in order to download various updates for charts, port information, lights and publications etc. The SMS/QA system also synchronizes over VSAT to the shore office, ensuring that critical reports are always available to everyone who needs them. Of course, VSAT fulfills another key need and one which is becoming increasingly in focus; providing high levels of connectivity for crew, so they may keep in touch with family and friends and use the Internet for entertainment when off duty.

Other critical applications used by Eidesvik include standardized business platform IBM Notes/Domino. Like Lync, Domino supports much needed collaboration between experts. Use of applications such as this for modern offshore operations is all about focusing information technology on the objectives of the business and the needs of the IT department. The business drivers include improving operational safety, protecting the environment and optimizing resources. Eidesvik's chosen collaboration tool offers the collaboration required, but also, through robust design, synchronizes and works very well over VSAT connections.

VSAT is the true enabler of IT in the offshore oil & gas sector. From seismic surveys locating resources and complex IT solutions for maximizing their production, to enabling safe and efficient operations of the supporting vessels, the industry depends on reliable, high throughput connectivity.

Providing stable connectivity is not always straightforward; conditions are harsh and requirements vary dramatically. However, by working closely with vessel owners and operators, complex networks with high levels of reliability fully support all of the operations in offshore exploration and production.

About the author

Tommy Konkol Dybvad has more than two decades experience with maritime VSAT services. As a sales executive in Norwegian Telecom during the early nineties he was one of the pioneers within maritime VSAT, introducing services to the Scandinavian oil, offshore and ferry markets. He has since held several positions in Telenor Satellite Services, which was later acquired by Apax in 1997 and in 2011 by Astrium Services. Today Mr. Dybvad is working as Director for Customized VSAT at Astrium Services.

By Jack Jacobs, Vice President + General Manager of Product Management, Honeywell Aerospace

Around the world, on the ground and in the air, consumer electronic devices such as smartphones, e-readers, tablets and laptops, consume more and more bandwidth, placing increased demand on satellite connectivity and infrastructure.

Demand for data traffic is expected to grow by a factor of 50 for smartphones and a factor of 62 for tablets. In addition to the bandwidth, the sheer number of consumer electronic devices is poised for explosive growth over the next few years. By 2016, it is estimated that 71 percent of all mobile traffic will be used for watching videos.



Honeywell's Ovation™ Select cabin management system

As well, a recent survey from Honeywell Aerospace revealed that 86 percent of air travelers expect Wi-Fi onboard their flights and almost nine in 10 fliers feel frustrated with the current level of access. Simply put, more people than ever before will use their data-hungry devices in all locations, including in the air—the current Ku-band satellite network cannot accommodate or support this exponential growth and demand for bandwidth from passengers.

How do we make certain airlines, OEMs and passengers have access to a network that is able to handle the increased demand for bandwidth? By creating a global Ka-band network that will be more than a 60 percent faster user experience than alternative systems in the Ku-band network today.

Honeywell Aerospace has spent the past year and a half working with partners, OEMs and others to make this Ka-band system a reality.

In 2012, Honeywell signed an exclusive agreement with satellite operator Inmarsat to provide global in-flight connectivity services to business and commercial aviation customers around the world via Inmarsat's high-speed GX Ka-band satellite. Under this agreement Honeywell will design, build and deliver the hardware needed to access Inmarsat's Ka-band constellation.

Honeywell moved quickly to establish a design baseline for the aircraft system that transmits and receives signals from Inmarsat's Ka-band satellites. In March of this year, Honeywell announced it had finished the preliminary design review of the terminal with Inmarsat—a crucial step to keeping the program on schedule.

In April, Honeywell and Boeing announced they had entered into a technical services agreement to research and develop technologies for the next generation of high-speed, in-flight wireless connectivity on Boeing platforms, including the 787, 777, 747-8 and 737NG. This agreement allows Boeing and Honeywell to jointly research, test and develop the hardware, software and potential services that will tap into Inmarsat's GX Ka-band satellites and begin the necessary activities to support Honeywell's new GX Ka-band equipment installation aboard new aircraft in 2015.

Honeywell will be the value-added reseller of airtime to the business aviation vertical for the high-speed GX Ka-band service. Since entering this strategic agreement with Inmarsat, Honeywell has signed distribution partner agreements with several key players in the aircraft connectivity space, including ARINC Direct, OnAir, Satcom Direct, Satcom1 and Aircell. These companies will sell and support the Ka-band service provided by Inmarsat and Honeywell to business aviation operators worldwide.

Inmarsat's first satellite will launch in late 2013. By early 2015, when the service is available worldwide, Honeywell and Inmarsat will be able to provide connectivity speeds of up to 49Mbps to the aircraft, giving passengers truly global, in-flight Wi-Fi service so they can shop, access email, connect with friends on social networking sites, enjoy live streaming for entertainment and more, and experience the same connectivity they have at home or at work.

As we close out 2013 and move into 2014, passenger demand for high-speed, in-flight Wi-Fi will continue to grow in demand. As airlines look for the best and most cost-effective solutions to enhance the passenger experience, Ka-band looms ever larger as the only solution that will provide consumers with the speed and reliability they expect while traveling.

In concert with this need, Honeywell is also developing products and services that can take advantages of Inmarsat's Ka-band infrastructure to revolutionize the way the crew, operations and maintenance users can access real-time data to increase safety and reliability while reducing costs. The birth of the "connected aircraft" is taking place in front of us and the possibilities have just started to unfold.

The in-cabin entertainment system encompasses Honeywell's leveraging nearly 40 years of cabin suite expertise and the latest digital technology to bring Ovation Select to the market. This technology delivers media content in crisp surround sound audio and vivid high definition (HD1080p) video. The system lets passengers receive and respond to email, access the Internet, host video conferences and make telephone calls. The result? Every seat becomes its own office or theater in the sky.





The key benefits include:

- **Hi-future**—Ovation Select is easy to install and highly scalable. When today's state of the art becomes yesterday's technology, Ovation Select is ready. It will adapt. And remain a streamlined springboard to whatever the next big thing is for business productivity and ultimate entertainment.
- **Hi-def**—1080p resolution will surround you for the highest definition in video for multi-player gaming, 3-D moving maps as well as the latest news, weather and sports. The all-digital surround-sound audio completes your highly immersive sight and sound experience.
- **Hi-speed**—Honeywell's Satellite Communications and Cabin Gateway System delivers unprecedented connectivity. High-speed data, crystal clear voice connections and in-flight BlackBerry® messaging complete your office in the sky.
- **Hi-touch**—The intuitive, icon-based touchscreen interface offers you complete navigation of the entire cabin system.

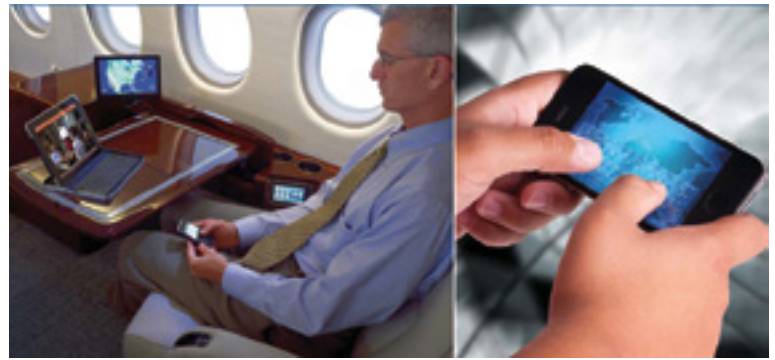
There are two control units for use by cabin passengers and crew. The first one allows passengers to easily control the entire Ovation Select system with the Select 200 Personal Control Unit (PCU). This touchscreen device can control all environmental, entertainment and business components from a single, intuitive interface. The 4.3-inch diagonal display with a 4x2-inch active display area is typically located at the VIP seat(s) but can also be used as the master galley controller in smaller cabins. The second unit is the Select 100 Personal Control Unit (PCU) that provides all of the same control functions as the Select 200 PCU, in a form factor that is approximately one-third the size.

The Honeywell Ovation Select Cabin Management System (CMS) seamlessly brings news, sports, movies, gaming and music take to the skies with the latest digital technology, Ovation. As technology evolves, Ovation Select easily accommodates tomorrow's devices.

Passengers control their environment, from lighting, seats, temperature, galley and window shades, all via the use of easy-to-identify icons. Ovation Select can be customized with unique backgrounds and languages, including a 3D model of their aircraft rendered inside the JetMap™ HD moving map.

Ovation Select is reliable. The system design, diagnostic tools and global support network keeps the cabin system available. Play Ovation Select allows passengers to play with the following entertainment features:

- **Blu-ray Movies**—passengers will be able to watch the highest definition movies available with Blu-ray™ players, which also are backward-compatible with DVD and CD standards, allowing one standard to be used for all three types of disk media. The HD widescreen monitors are the latest in LCD technology and each one can be connected to any of the cabin video sources.
- **HD Audio Video On Demand**—Ovation Select's new single-box HD AVOD allows for the storage of up to 1.5TB of audio and video entertainment content and includes a subscription service that offers access to "early window" and classic motion pictures as well as TV shows. Best of all, everything can be either wirelessly streamed to a passenger's iPad or via the digital backbone to any, or every, monitor in the cabin.



- **Music**—passengers will be able to access more than 170 audio channels with XM Radio®, with up-to-the-minute headlines, business news, sports and weather, as well as at least 70 quality music channels throughout North America.
- **iPod®, video game consoles and more**—passengers can enjoy music and video from their iPod®, play their favorite gaming system, or enjoy other carry-on electronics such as video cameras. With the Media Dock and Auxiliary Panel, content can be accessed from any PCU or Touchscreen and shared throughout the cabin.
- **Surround Sound**—passengers will experience the highest quality sound with a wide dispersion characteristic, reducing localization and creating an unsurpassed acoustic balance throughout the cabin. The amplifier can drive the PA, mid/high, full-spectrum, and surround speakers and subwoofers. In addition, with Ovation Select, laptops or smart phones can be used to send and receive email, call friends and family, surf favorite websites, keep current with social media and watch TV.

The system's modular architecture uses a robust and open Ethernet backbone, which allows the latest, and even future, technology innovations to be easily and rapidly integrated. Ovation Select hosts an IP-based network, where audio and video distribution, command and control, as well as 28 VDC power are all distributed via a single Ethernet cable.

The system features fully integrated 1080p HD widescreen displays, nVelop™ surround sound and a real-time 3-D HD moving map. The system accommodates anything from USB drives and laptops to HD gaming systems, and shares the content throughout the cabin.

Available with Honeywell Global Support, Ovation Select is designed to minimize single-point failures. This means a single failed component won't affect the other components within the network. An advanced onboard diagnostics tool continuously monitors the entire system, end-to-end.

Real-time status to the crew is provided in a manner that they can easily understand. Recommended actions to resolve the issues are even presented. As new equipment is introduced, or a failed component is replaced, the system updates the new unit's configuration automatically. The Honeywell global support network—including the SPEX® exchange and rental program and Honeywell Cabin Protection Plan (HCPP)—backs up the components—replacements are provided immediately. The system's auto-loadable software feature combined with this comprehensive support allows an aircraft to return to service quickly.

Ovation Select is much easier to design and install than legacy Honeywell systems. In addition, the architecture requires less wiring and fewer hardware components. It's also easily configurable via the web-based Master Configuration Tool. All of this results in set-up time and labor cost savings. The scalable system design reduces hardware lead times through common components that fit all aircraft platform sizes. This second-generation, all-digital architecture provides the highest degree of flexibility and scalability.

The current platforms for Ovation Select include Falcon 900s, Boeing Business Jets, and the Embraer Legacy 650.

See more at:

<http://aerospace.honeywell.com/products/cabin-entertainment/integrated-cabin-systems/ovation-select#sthash.17NdyMh8.dpuf>

About the author

Jack Jacobs is Vice President and General Manager of Product Management, with responsibility for the Safety and Information Management product lines across commercial, business aviation, and defense portfolios at Honeywell Aerospace. In this role, he leads a multi-site \$1B portfolio of products and services. Jack is also leading the growth initiative for the "Connected Aircraft" of the future.

SatBroadcasting™: Growth – Or No Growth The Varying Viewpoints Of The Experts

Year In Review
2013

By Chris Forrester, Senior Contributor

There seems to be some confusion as to whether the overall satellite FSS industry, which includes the 'big six' satellite operators (Intelsat, SES, Eutelsat, Telesat, SkyPerfect-JSat and Optus), are likely to flat-line over the next few years, or whether there remains prospects for growth.

The concerns regarding growth started in October—initiated by a detailed report from the media team at investment bankers Morgan Stanley. The report did little to bolster investor confidence in the industry's leading FSS players SES, Eutelsat and Intelsat. Morgan Stanley had held a dialog with "three highly experienced professionals in the FSS industry," and said, "We focused on High Throughput Satellites (HTS) supply and demand dynamics and the expected industry returns for the next three to five years. Our contacts believe the industry has entered a no-growth cycle and that returns should edge down over the next three years, as oversupply translates into sub-optimal utilization rates."

The Worry List's Number One Item—HTS

Morgan Stanley continued, "HTS will struggle to find a market of their own: Our contacts believe that most HTS were launched before their operators had secured enough backlog to allow them to beat their cost of capital. This will likely lead HTS operators to start commercializing existing applications (Trunking, GSM, VSAT) and compete against traditional Ku-band satellites. It may also lead HTS operators to try and differentiate themselves from Ku-band through lower prices. This usage of HTS would be sub-optimal, however, it would seem like a plausible response from management teams looking to drive HTS returns as close as possible to their cost of capital."

Number Two on the worry list was consumer broadband, where the picture appeared somewhat brighter. "Our contacts are most bearish on HTS-powered consumer broadband. Competition coming from terrestrial networks and the rollout of optic fiber is a major issue, as these networks are seen as more user-friendly than satellites."

However, Number Three on the bank's list discussed a "cycle of over-supply" and this topic, while not new, is of growing concern to market watchers and the satellite industry in general. The bank said, "Our contacts identify three main threats to the growth of the satellites industry. By order of importance, (i) competition from terrestrial networks, (ii) the rollout of HTS that has not been fully thought through and will compete against the incumbents' core business, and (iii) oversupply of Ku-band capacity in some markets. Our experts forecast flat growth in video and flat growth in data. In data applications, they expect a decline in Government applications, VSAT in Europe and in the U.S., and a strong decline in trunking, offset by solid growth in Maritime, Aero (broadband on airplanes) and Oil & Gas."

Which leads to Item Four and the inevitable consequence that "Returns will edge down." The report said, "Our experts are adamant the FSS industry has entered a no-growth cycle. This will likely translate into Utilization rates below long-term averages, which could then hurt returns. Our contacts estimate that a satellite whose utilization rate is below 80 percent in its third year of existence will likely never hit its cost of capital. Another interesting rule of thumb is that, per our experts, an HTS generating less than \$150m of revenue in year three will probably never hit its cost of capital. This is usually when it starts offering applications beyond what it was originally designed for."

SES: "We think launch delays, margin dilution from HD+ and the slow ramp-up of some recently launched satellites put guidance at risk."

Eutelsat: "After years of solid growth, military services look poised to decline in the medium term on the back of budget cuts in the U.S. Also, pricing pressure in data Services is worse than expected and may continue in 2014."

Concern Five suggested that Ka-band could compete on the video segment in some emerging markets. "Our contacts do not believe Ka-band on HTS can compete against Ku-band in video in the developed world. This is essentially because payTV platforms usually have a large and well-established subscriber base that would be hard to shift into a new technology and new orbital slots."

However, they believe the HTS technology is good enough that it can be used for video applications. This means that, in those emerging markets where payTV platforms have smaller customer bases, the broadcasters could decide to adopt

Ka-band instead of Ku-band. This has not happened yet, however, it may possibly happen in Africa and parts of Asia in the future."

The bank then distilled these elements for SES and Eutelsat.

"SES has been launching a lot of capacity recently (available capacity +22 percent between 2011 and 2016). We estimate 45 percent of the capacity launched between 2012 and 2016 targets applications and/or markets that may be negatively impacted by oversupply (VSAT, GSM, Broadband, Africa, Europe, and so on). We think this could lead the group's utilization rates to remain at, or below, 80 percent in the medium term and put the returns of some of the most recently launched, or yet to be launched, satellites under pressure. SES generates c.30 percent of revenue from data and voice."

As far as Eutelsat is concerned, the bank said, "Our contacts are not optimistic on the possibility that military budgets can pick up in the near-term. They also think KA-SAT will likely never generate the level of profits it was originally expected to deliver before it was launched."

SES: "SES has a strong video business (70 percent of sales). It pays a c.5 percent percent dividend yield which is not at risk."

Eutelsat: "Industry demand is strong owing to the introduction of HDTV globally and the launch of new TV platforms and channels."

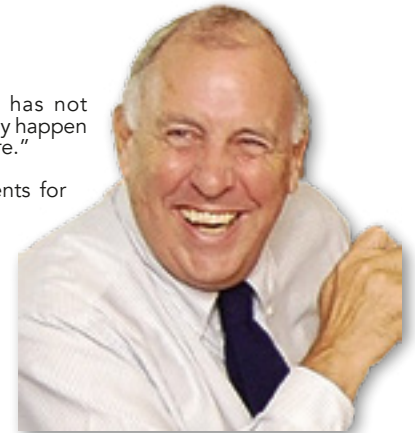
Changing the business model of KA-SAT will, per our experts, not make a material difference. Competition from terrestrial networks is fierce and the design of the satellite means it will struggle to service other applications besides consumer and professional broadband. ETL derives c.12 percent of revenue from military and c.30 percent coming from data, overall."

Despite this doom and gloom, there were signs of optimism. For example, the bank sees new markets emerging, especially for HTS services. "Our contacts are pretty positive about HTS unlocking some growth potential in mobile broadband (broadband on large cruise ships and airplanes) and Oil & Gas applications (broadband connectivity for businesses located in remote and hostile locations, such as the middle of an ocean). However, they estimate these markets will remain pretty small in revenue terms and will only partly offset the cannibalization created in trunking, VSAT, GSM, consumer broadband."

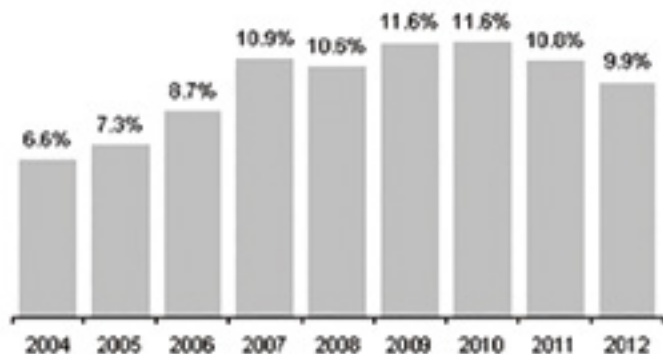
This directly affects so many aspects of the industry. There's SES' O3b, and Eutelsat's KA-SAT, which both represent investments in these areas. However, Telenor's new Thor 7 satellite, which is very much an HTS craft and has a target of maritime-type services, will launch next year. Intelsat also has enormous investments in its new EPIC series offering HTS services.

The bank said, "The cost of launching an HTS is high and there is nothing like a half-sold satellite to drag down the returns of a company's fleet. Therefore, our contacts believe that, in order to fill up these satellites, there is a genuine risk these HTS may increasingly target the more traditional FSS applications such as VSAT, enterprise and Government solutions, mobile backhaul, and such. To sell some of the unused capacity, our contacts suspect some operators will also be tempted to offer lower prices as the marginal cost of an HTS is very low once it is up and running, and management teams are under pressure to produce some form of return on investment."

The bank's returns analysis illustrates how ROIC and ROCE have generally risen between 2004 and 2010 before declining in calendar 2011 and 2012. "Our experts believe that the satellite industry goes through cycles," continued Morgan Stanley. "At times, demand will grow much faster than supply and push returns up. This cycle then reverses and returns come down closer to their long-term average levels. Our contacts believe that the combination of (i) the rollout of terrestrial infrastructure (ii) the expansion of HTS, which often struggles to find a market of their own and (iii) unfavorable supply/demand dynamics in Ku-Band will most likely

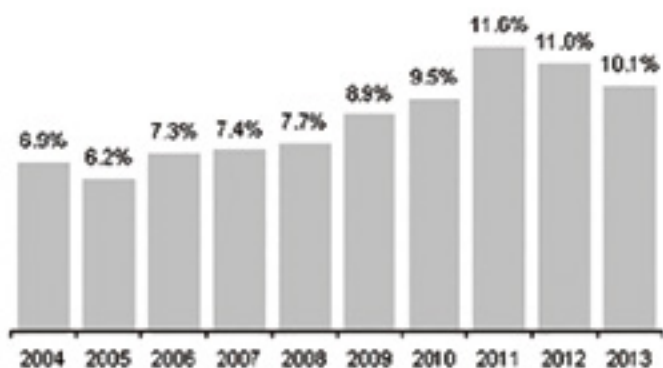


SES – Return on Invested Capital (ROIC)



Source: Company Data, Morgan Stanley Research

ETL – Return on Invested Capital (ROIC)



Source: Company Data, Morgan Stanley Research

lead industry returns to come down over the next few years. The emergence of this new cycle is expected to be most visible in the shape of relatively low utilization rates and falling ROCE and ROIC. Meanwhile, it is conceivable that revenue and EBITDA continue to grow though, as a lot of new capacity is commercialized."

The bank insists their report is not all 'doom and gloom.' "Some regions and some applications continue to grow. Specifically, our contacts are unanimously bullish on Latin America, where both data and video are expected to grow fast over the next few years. The same applies to large portions of Asia. With SES-6 (49 transponders), SES-8 (21 transponders) and SES-9 (53 transponders, 2Q15), SES will benefit from this.

These three satellites represent 45 percent of the capacity SES will have launched between 2012 and 2015.

With GE-23 (acquired in 2012), Satmex (acquired in 2013) and ETL 65WA (to be launched in 2016), ETL will also benefit from fast-growing demand in those regions. However, GE-23 and Satmex were purchased at a relatively high price, and ETK 65WA will only be launched in three years. Therefore, it seems fair to say that SES has anticipated the shift toward LATAM and APAC earlier and in a much more organic way than Eutelsat has."

"Our contacts' feedback suggests two things in our view," says the report: "(i) it will be very difficult for the incumbents to put through net price increases across the entire fleet as long as oversupply negatively impacts a number of their key markets and (ii) oversupply may lead utilization rates to remain below the levels seen in 2008-10 even if case demand in LatAm and Asia proves stronger than expected. We now believe some of the assumptions previously factored in our bull case

Market share, by region

	SES	ETL	INTELSAT	TSAT	OTHERS
North America	41%	0%	43%	8%	8%
Western Europe	24%	37%	17%	3%	19%
Africa	15%	18%	36%	2%	29%
Latin America	16%	1%	36%	6%	41%
Eastern Europe	5%	6%	20%	0%	69%
Asia and Oceania	8%	1%	13%	2%	76%

Source: Company Data, Morgan Stanley Research

seem overly optimistic, and cut our bull case valuations for both ETL and SES. Our new bull case valuation for SES is 25 euros per share versus 27 euros per share, previously, and 28.5 euros per share for ETL vs. 32.5 euros per share, previously. We cut our bull case valuation on the back of lower pricing and utilization assumptions. We now forecast bull case terminal utilization rates of 85 percent for SES and 83 percent for ETL (negatively impacted by KA-SAT) vs. 90 percent previously. We also forecast flat prices at best over the next three years vs. 3.5 percent inflation previously.

"Our new bull case assumptions suggest bull case upside of 15 percent for SES and 22 percent for ETL. We leave our price targets in line with our base case, which suggests no upside to the SES share price and just +6 percent to the ETL share price. Eutelsat and SES have undeniable virtues. They have solid balance sheets, a reasonable dividend policy and falling CAPEX might, in the medium-term, lead them to consider special cash returns. However, we believe their lack of cyclical bias, falling returns and the presence of important structural question marks will likely limit their stock performance in the medium-term. We remain 'Equal Weight' on Eutelsat, whose valuation we think already reflects some of the structural challenges we have been focusing on for a few months now. We remain 'Underweight' SES, whose multiples look more full."

Counter Argument

In other words, elements are not exactly looking up if the Morgan Stanley report is to be wholly taken as is, especially for the likes of Intelsat and Eutelsat in particular, which are both investing heavily in HTS. However, within days of the release of the Morgan Stanley report, a counter-argument appeared from the experts at Northern Sky Research (NSR). One strong phrase used by Morgan Stanley was that 'High Throughput Satellites' would struggle to find a market. NSR, in an October 16th report, firmly states that the bank has misread the current trends in the market.

"Overall, NSR feels that the Morgan Stanley report authors have, to a large degree, misread the current trends in the FSS sector and that they have treated some specific, real issues with too broad a brush stroke in how they impact the entirety of the FSS sector. In the narrowest of terms, the Morgan Stanley report was nominally meant to assess the revenue growth outlook for SES and Eutelsat over the next three to five years. Within this very specific context, the report did correctly highlight a number of real issues that will likely have an impact, both positive and negative, on SES' and Eutelsat's revenue performance through to 2018," said the NSR rebuttal.

However, NSR goes on to say, "Where the Morgan Stanley report falls down, and in quite a dramatic fashion, is how it parlayed these specific issues related to SES and Eutelsat into a relatively scathing assessment of the overall FSS sector and, in particular, for emerging HTS services. NSR could engage in a long, point-by-point critique of the Morgan Stanley report on where we have agreements and disagreements; however, the most fundamental issue that seems to have been missed by the report's authors is what NSR sees as the true necessity of the satellite industry to move down the path towards HTS. And, interestingly, the Morgan Stanley report raises many of the issues of why this needs to happen but fails to make, or incorrectly makes, the connections."

"The Morgan Stanley report falls down, and in quite a dramatic fashion, in how it parlayed these specific issues related to SES and Eutelsat into a relatively scathing assessment of the overall FSS sector and, in particular, for emerging HTS services."—NSR

"In particular," says NSR, "the Morgan Stanley report notes that, to their 'surprise,' the main threat to growth in the FSS industry comes from terrestrial networks and fiber. Specifically in terms of data-type applications, NSR would actually agree that terrestrial networks and fiber are the greatest long-term threat to revenue growth. However, Morgan Stanley more or less interprets the FSS sector's response to the fiber and terrestrial network threat, which is the launch of new HTS, as a failure to date and endlessly laments about the negative impact that HTS' capacity is having on FSS revenues by driving down pricing on classic C/Ku-Band capacity."

NSR's simple answer to this assessment is that if the satellite industry did not change, it was already on the path of losing this business anyway, regardless of the short-term impact on C/Ku pricing. "A specific case in point is the trunking segment. Even Morgan Stanley's researcher noted that C-/Ku- leasing revenues for trunking only represent 2 to 3 percent of Eutelsat's and SES' revenues base. The connection that Morgan Stanley has fundamentally missed is that the new HTS architectures—here NSR includes any spot-beam, high frequency reuse payload as well as the medium Earth orbit networks (MEO-HTS) like O3b—will be able to recapture some of this market demand and even likely grow the revenue

base for data services and applications that were fading from the classic C-/Ku- capacity repertoire. This includes not only services such as trunking but also consumer broadband access, VSAT networking and other related data markets."

NSR's clear view is that the satellite industry today must make the investment in the new HTS architectures in order to remain relevant in the mid- to long-term to clients for data-type services. "Does that mean there won't be negative impacts short-term? Of course there will. In any industry in transition, competition among players will be high, mistakes will be made, and markets misread. Part of the process of learning what can be done with the new HTS architectures and what will emerge in terms of business that could not even be initially imagined is part of the process."

When Thaicom first undertook development of its IPSTAR project, did it ever imagine that a core service would become cell backhaul services for SoftBank in Japan? Yet, this has turned out to be the case and has caused a revelation in the industry about the types of services and applications that can be successfully addressed with HTS capacity. A related example would be the strong uptake of Thaicom-4/IPSTAR capacity in Malaysia for government-backed rural connectivity/social inclusion projects.

"Another interesting emerging niche application that few expected is for SNG services with Eutelsat's NewsSpotter service apparently being the "hot thing" for the SNG crowd at the 2013 IBC Conference."

NSR labels the transition that is occurring in the FSS sector—a transition that will admittedly take many years and not without some stumbles on the way—as the "bifurcation" within the FSS segment. In this model, all of the different satellite services and applications that in the past were only served by the same architecture of widebeam C-/Ku-Band capacity will gradually segment into different types of satellite architectures with each architecture best designed to serve, and grow, specific satellite applications and segments," said NSR.

"NSR continues to fundamentally believe that classic FSS C-/Ku-Band capacity, with its unbeatable point-to-multipoint strength, will continue to successfully serve the classic sectors."—NSR

"There will always be some overlap between the architectures, especially during the period of transition; however, in overarching terms, NSR continues to fundamentally believe that classic FSS C-/Ku-Band capacity, with its unbeatable point-to-multipoint strength, will continue to successfully serve the classic sectors like video/media distribution to consumers as well as applications that require a professional grade of point-to-multipoint services. HTS capacity will see much of its capacity used for consumer-class point-to-point services like broadband access, but also overlap significantly into the point-to-point and point-to-multipoint areas for professional services where the cost per bit is the dominant decision point for the end client. Finally, MEO-HTS architectures (i.e. O3b) will play best in the point-to-point professional category of services like trunking and backhaul."

NSR asks "Will every HTS that is launched be successful? No, just as in any technology driven industry there are always leaders and followers, those who successfully interpret the market and those who significantly misread the market trends. Will the industry be able to completely avoid oversupply and internal price competition between operators? Again, the answer is "no," as every operator has to develop their own strategy and, if one of them stumbles along the way, their missteps will have unavoidable consequences on those around them.

"But should the emerging HTS services already be judged largely as a failure or a threat to the existing services? In NSR's view, absolutely not. The satellite sector must find ways to better serve its clients, and one absolutely key criteria of success in the future will be to drive fundamentally down, and keep driving down, the cost per bit delivered across a whole spectrum of services and applications. The trend towards HTS is creating what NSR has labeled the "bifurcation" of the market. But to already wholesale condemn the bifurcation of the market as done by Morgan Stanley shows a major lack of insight as to where the sectors needs to go in the coming years. Only by truly understanding the long-term trends can industry experts, including our banker and financial advisor colleagues, be able to judge the real prospects of each player in the sector."

About the author

Senior Contributor Chris Forrester is a well-known broadcasting journalist and industry consultant. He reports on all aspects of broadcasting with special emphasis on content, the business of television and emerging applications. He founded Rapid TV News and has edited Interspace and its successor Inside Satellite TV since 1996. He also files for Advanced-Television.com. In November 1998 he was appointed an Associate (professor) of the prestigious Adham Center for Television Journalism, part of the American University in Cairo (AUC), in recognition of his extensive coverage of the Arab media market.

"In any industry in transition, competition among players will be high, mistakes will be made, and markets misread."—NSR

By Jos Heyman, Senior Contributor

At the time of writing, it is predicted that we will see 192 spacecraft launched with 81 launches. As to their purpose, the following table provides a break-up.

Three launch vehicles, including one from Iran, failed to place their payloads in orbit.

This total of 189 is the highest ever attained for a single year since spaceflight began in 1957. This high number is particularly attributable to about 75 so-called cubesats that have been (or are still to be) launched during the year. This increase in the number of cubesats is a manifestation of the miniaturization of electronic equipment and the affordability of the cubesat concept to small operators and educational institutions. This is a trend that, beyond a doubt, will continue into the future.

One of the initiatives during the year was the increased interest in the management of asteroids and other objects in space that pose a potential threat to Earth. Clearly, these initiatives were driven by the meteorite explosion that occurred over Russia in February of 2013. As a result, Russia wants to place beacon transmitters on asteroids, in particular on the asteroid Apophis that is expected to travel close to Earth in 2036.

At about the same time, Professor Scott Hubbard at Stanford University appreciated that it may not be easy to keep track of all of the asteroids that travel around the solar system, as most of them consist of black carbon that blend with the black background of space, making it quite impossible to see them. He also estimated there are a million of these asteroids that are longer than 100m in the solar system although, he admitted, most of them spend most of their time far away from Earth.

He has proposed a program to track down the hundreds of thousands of unknown asteroids that could pose a threat to Earth. Once an asteroid has been detected, calculations can be made to determine where the asteroid will be 50 to 100 years from now and attempts can be made to alter the asteroid's orbit.

In April 2013, NASA outlined its proposed asteroid retrieval mission—a small asteroid would be captured by a robotic spacecraft and towed back to Earth's vicinity so that crews could visit it to learn more about the threat asteroids pose, the resources they represent, and to help perfect the technology needed for

eventual flights to Mars. Such would involve a 7m, 500 ton asteroid and, according to Aviation Week & Space Technology, NASA's budget request for 2014 would include \$100 million to get the project underway. The captured asteroid would be placed at the second Earth-Moon Lagrangian Point (EML2), above the Moon's far side. The program envisages a test flight in 2017 followed by a rendezvous and capture mission in 2019. The asteroid would then be hauled back to cislunar space by around 2021.

China is gradually making its mark as a leading force in the commercial space market for developing nations by entering into deals for communications satellites for Sri Lanka, Turkey, Congo, Belarus, Laos, Nigeria, Pakistan and Venezuela. These contracts are for the satellite itself as well as launch services. Recently, there was also an indication that China would be willing to train foreign astronauts and send them to its proposed Tiangong space station.

Considering this trend, it is perhaps wise for the partners in the International Space Station to reconsider the possible participation of China in that program, especially with respect to access to the space station. With the Space Shuttle now firmly grounded and a future US crewed spacecraft still a long way in the future, the scenario should be contemplated where, for whatever reason, the Soyuz TMA spacecraft is grounded, either due to problems with the spacecraft itself or with the launch vehicle.

A Shenzhou spacecraft fitted with an appropriate docking module would be able to help out—this would, of course, only work if the Chinese have regular access to ISS. This need not be every three months—it could be a once a year exercise, just like the Japanese HTV contribution and ESA's ATVs. This could perhaps be a preamble to allowing the proposed Chinese space station to dock with ISS.

However, the likelihood that this could happen seems to be remote with the 'them-and-us' attitude that seems to be prevailing, not only in the United States, but also in Russia. Such an attitude does not serve anybody except the politicians who advocate such policies. This attitude will encourage the same distrust between the major powers as was experienced during the Cold War and the resulting 'space race.' Space should not be seen as a 'race course,' but rather an area where global trust between nations is encouraged.



The launch of the WGS-6 satellite via an United Launch Alliance Delta IV launch vehicle from the Cape Canaveral Air Force Station.

Objective	Launched	To be launched	Total
Scientific and technology	37	63	100
Crewed (incl. support)	12	3	15
Interplanetary	1	2	3
Earth observation	13	5	18
Communications	34	11	45
Navigational	3	1	4
Misc. military	6	1	7
Total	106	86	192

Year	Launches	Satellites
2003	61	90
2004	53	73
2005	52	73
2006	63	94
2007	65	115
2008	67	105
2009	75	124
2010	70	122
2011	80	130
2012	75	134

In the United States, the political stand-off between President Obama's administration and a hostile Congress has resulted in the budget sequestration process that has set a hard cap on the amount of government spending within broadly defined categories of spending. This was topped on October 1, 2013, by a total shutdown of government operations for 16 days.

In the case of NASA it has been reported that its overall budget has dropped to \$16.9 billion, down from the \$17.8 billion approved last year. This has forced NASA to slow down the development work on its commercially operated ferry flights in support of the International Space Station, while space technology programs have been delayed or canceled and the launch of some small science missions are being postponed.

The head of US Air Force Space Command has warned that the on-going budget sequestration in the United States "will prove more devastating to US space capabilities than any threat an adversary could think up." He stated that if there is no budget flexibility soon, the impact on post-Afghanistan operations of missile warning, meteorological and navigation satellites, which are considered "must haves" for military operations, may be in danger.

As an outsider (the author is not a U.S. citizen), the sequestration process and the 16 days shutdown appears to be nothing more than an exercise in childish



Japan's Epsilon launches. Photo courtesy of JAXA.

one-upmanship to suit irresponsible behavior of political opponents rather than the welfare of the country. The process does not just impact on the agencies and programs directly concerned with the programs, but also have a ripple effect through the industrial and scientific community and beyond. These cuts will certainly have a long-term effect. Also, the process ignores money that has already spent on some of the programs that have now been canceled—talk about waste.

The year also saw some interesting developments in the official approach to space by Russia. These started with the failure of a Proton M/Briz M launch vehicle on July 2, 2013, which was the third failure of this launch vehicle in the past few years. Although the cause of this failure was investigated quickly and the use of the launch vehicle was resumed in September of 2013 without too much of an impact on the scheduled launches. However, the Russian Prime Minister replaced the head of the Russian space agency, Roscosmos, in October 2013 as he had failed to turn around the Russian space industry that has been plagued by launch failures and other aspects of mismanagement.

At about the same time, it was reported that the Russian government intends to reorganize the space industry to counteract inefficiencies and the misuse of funds. In this plan a new state corporation will take over all manufacturing facilities, which are currently under the control of Roscosmos and are grouped into 10 integrated structures. The new corporation will introduce a unified technical policy and save financial resources by consolidating developers and manufacturers. This plan is also intended to diminish the reliance on imported components and, instead, focus on domestic production. In the new arrangement, Roscosmos will act as an executive body and contracting authority for programs to be implemented by the industry.

Then there was the reversal of the Dnepr 1 launch program, which had been suspended in 2011 as too costly. However, at that time a number of satellites had been scheduled for two launches—the South Korean Arirang-5 and a batch of satellites for Saudi Arabia and several other countries. In May 2013, the Russian and Ukrainian governments decided to manage these two launches. Reading between the lines, it is possible that these unusual actions were driven by the Russian desire to be seen as a reliable launch partner in the international market.

It was good to note the introduction of Japan's new Epsilon launch vehicle while the Antares launch vehicle was resurrected. In addition, the SpaceX Falcon 9 launch vehicle gained operational status.

The year also brought a proliferation of satellites of a military nature. The USA and Russia, as well as the United Kingdom, France and China, as well as countries such as Germany, Japan, Brazil and India, now also have military satellites, or are considering them. To this, add the multinational character the USA's Wideband Global Satcom (WGS) system is moving toward with the participation of Australia, The Netherlands, France, Canada, Denmark and New Zealand in the mission.

The year also saw the addition of Azerbaijan, Austria, Ecuador, Estonia and Peru to the list of nations that possess satellites in orbit. Whether Sri Lanka should be added due to that nation's claims of owned transponders on a Chinese satellite to this list is somewhat debatable.

Meanwhile, North Korea and Iran are continuing their space programs, which seem to serve domestic PR as well as military operations.

That was 2013, the 57th year in space. As for 2014, please return one year from now for an update on what could be another historic year for the industry.

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 Tيروس News Bulletin and is also a regular contributor to the British Interplanetary Society's Spaceflight journal. Jos is also a Senior Contributor for SatMagazine.

SatBroadcasting™ Is 2014 The Year Of The Chicken... Or The Egg?

Year In Review
2013

By Mike Antonovich, Senior Vice President and General Manager, ATEME

No, I am not rewriting the Chinese astrological calendar, and it is still officially the Year of the Snake. However, in a satellite and broadcasting industry that is under highly disruptive change, I do wonder what the New Year will bring to us all.

In the beginning, there was television. OK, maybe not the exact beginning. Maybe just sometime during the last millennium. Really, really close to the end of that millennium. Like in the last six percent of that millennium. Either way, television as we have known it is in for dramatic changes. This is where the Chicken and Egg come into the picture.

As I've previously written, UHDTV (Ultra High Definition Television) is the latest digital video television standard that greatly expands the realism of our TV experience. UHDTV comes in two flavors: The 4K version (which, as it doubles the frame rate, will actually carry 8x more video information year before most consumers actually see it), and the 8K variant (which carries 16x the video information) and is scheduled to show up in Japan by 2020. So much for simple-to-understand terms.

The big question remains as to where and when the entire UHDTV ecosystem will come together. The Egg side of the equation is driven by the television set manufacturers in Japan, Korea and China, who need to keep factories humming after selling us all the plasmas, LCD and LED TV's we could possibly ever want. And trying to talk us into 3DTV's, which, if they weren't generally good regular HDTV's, would quickly be going the way of the eight-track audio player.

Still, the TV set guys really, really, need to drive the display market—and indeed they will. Let the marketing hype begin. We all need 84-inch and 100-inch televisions. Only, well, some of us need a 100-inch door to fit them in. And maybe a wall big enough to put it on.

The price of first-generation UHDTV sets is already lower than what we paid for

first-generation HDTV sets less than a decade ago. More than a dozen models are offered for sale today, and within the next two years you can expect most new sets sold will be "UHDTV ready." So, the Egg will have done its part. But where are the Chickens?

I really am a big fan of UHDTV. The images can be truly immersive and can give the "you ate there" experience. Much like the old joke about 300 channels on TV, but nothing to watch, the problem today is that there are no announced plans for any of today's giants in linear television distribution to launch UHDTV channels. No live sports channels. No live movie services. And, except for Japanese public broadcaster, NHK, no terrestrial networks. There isn't even an Aquarium Channel to watch colorful fish you never have to feed and never have to change the water.

Simply blowing up today's HDTV images four times larger is a Stupid Pet Trick that will get old pretty fast. So the Chickens in this allegory are, of course, the linear television networks, who, naturally, have quite legitimate reasons why they aren't rushing into a potential UHDTV Fool's Paradise.

As I write this article,
UHDTV goes
nowhere without
a simpler
and more



economical means to transport it over satellite, broadband or terrestrial networks. First and foremost, there isn't even an "official" standard for how to carry UHDTV signals (natively eight times larger than HDTV signals) over

HEVC (which will reduce that bandwidth by roughly half) yet. That finalization of the standard will arrive in early 2014.

Oh, and one little problem with the HEVC is that it is written largely to support the "progressive" versus the "interlace" video systems. Progressive, as many know, refers to one full frame of video following another, while the interlace standard transmits essentially half the information twice as often. While most would agree that high frame rate progressive is indeed the television production medium of the future, roughly 70 percent of the world's programming is still produced in interlaced formats—that won't change for another equipment-replacement lifetime. (Depending on who you ask, a "lifetime" in television is two seconds of dead air, a decade, or all of eternity; for this article, I'm going for the 10-year definition).

My company, ATEME, is not just a leader in UHDTV over HEVC encoding, but also has been a strong advocate for inclusion of interlace within the HEVC encoding standard. Tools will exist to support interlace within the new UHDTV/HEVC... Good.

However, the industry still hasn't actually defined a single wire interface for either encoders or the television displays. Today we all do UHDTV with four inputs into the encoders, four inputs into the display devices. It works for our "science projects" but is wildly impractical for broadcasters and consumers alike. Most television networks have barely paid off the costs of the standard definition to HDTV transition.

While we do have first-generation UHDTV cameras (and quite a few movie studios and producers of episodic television series are starting to originate productions in UHDTV for at least their program masters and for their libraries), what we don't have is a complete ecosystem of graphics, slow-motion, replay and other key components to support live UHDTV sports production, without a doubt the biggest driver for UHDTV adoption. Similar to HDTV and 3DTV, most programmers have not yet figured out how to charge more to advertisers or subscribers for all the costs developers must bear to provide improved television pictures to their audiences. So, don't blame the Chickens. They are a lot smarter than they look.

As the saying goes, "nature fills a vacuum." If our "Egg" display manufacturers are running hard, and our "Chicken" programmers are dragging their feet, who is to fill the gap between them? If industry rumors hold any value, it will be the non-linear Over The Top (OTT) entrants, such as Netflix, Amazon and Hulu, who will get this UHDTV party started.

Unlike our friends in the DTH, Cable TV and traditional over-the-air broadcast markets (who really don't have a means of fitting UHDTV signals into their existing channel bandwidth today), the OTT players have an easier path to market. It's called broadband Internet. Non-linear "file" delivery for movie and episodic television doesn't require "new" bandwidth to deliver UHDTV television shows. You can do it today with products ATEME and other manufacturers produce. As with today's file-based movie and television show delivery services, consumers can simply download files directly to the new "Smart TV's."

Yes, the files are larger and will take longer to download, but for early adopters who just plunked

down \$5,000 or more to be the first house on the block with a shiny new UHDTV set, this will be the first commercially available content they will find. With the new HEVC standard, and the improving broadband connectivity to consumers across the globe, launching or extending these services over the public Internet is possible and is widely accepted by consumers as well as by those who provide this connectivity; the cable and telco networks. It has become almost an "if we can't beat them, join them" approach.

With terrestrial broadcasters (who as of today really don't have the spectrum to support UHDTV signals) on the sidelines, and with the DTH and Cable TV distribution platforms facing "cord cutting" challenges to their traditional linear programming business models, will it be the OTT provider that fills the breach? Quite possibly, will they allow the OTT "Fox" to run amok in the Chicken's henhouse? If so, then just maybe 2014 will be known as the Year of the Fox...

Will the display manufacturers lay an Egg, and UHDTV fall as flat as Humpty Dumpty? Will the television platform operators and terrestrial broadcaster stay Chicken, or will they jump into the contest? Or, will they be outfoxed by the OTT platforms? Stay tuned—2014 looks to be a most interesting year.

About the author

Mike Antonovich has spent more than three decades in the broadcast, satellite, video fiber and video encoding marketplace. The opinions expressed in this article are his own, as nobody can put words in his mouth, nor shut him up. He presently serves as SVP & GM, Americas, for ATEME, and would be happy to inform you of his opinions on the future of our industry, or just maybe sell you a video encoder. Mike can be reached at mike.antonovich@ateme.com



A Clear Direction Emerges For In-Flight Internet

Year In Review
2013

By Don Buchman, General Manager, ViaSat Commercial Aviation Services

On October 31st, the Federal Aviation Administration created a loud buzz among airlines and airline passengers with their approval for the use of personal electronic devices below 10,000 feet.

The text of the FAA announcement read in part:

"Passengers will eventually be able to read e-books, play games, and watch videos on their devices during all phases of flight, with very limited exceptions. Electronic items, books and magazines, must be held or put in the seat back pocket during the actual takeoff and landing roll. Cell phones should be in airplane mode or with cellular service disabled—i.e., no signal bars displayed—and cannot be used for voice communications based on FCC regulations that prohibit any airborne calls using cell phones. If your air carrier provides Wi-Fi service during flight, you may use those services."

The reaction was delight and enthusiasm for the most part, but the Halloween announcement may have thrown a little scare into the in-flight Wi-Fi market share leader. With its air-to-ground (ATG) network not designed to operate under 10,000 feet, that company had to admit, "we can't do that now."

However, Satellite Can...

As we head into 2014, the long-term outlook for satellite in-flight Wi-Fi has never looked better. Three major players—Global Eagle Row 44, Panasonic Avionics, and ViaSat—are focused on improving services in North America and beyond. Even market-leader Gogo has stated that its long term strategy will be based on satellite communications.

Row 44 and Panasonic already have installed bases, performing with some success at Ku-band. With Ku-band capacity ubiquitous around the globe, these service providers have the advantage of bandwidth for connectivity and entertainment just about anywhere an airline wants to fly.

Meanwhile, JetBlue just went live with its new Ka-band service from ViaSat, with United to follow—United being one airline using a mix of different services.

All satellite in-flight systems have the advantage of connecting to the sky, rather than to the ground, so even while an aircraft sits on the tarmac, it is able to receive satellite signals. Airlines using satellite can light up the cabin with Wi-Fi

from gate to gate. According to IHS Inc., just over 4,000 aircraft will be outfitted for Wi-Fi by the end of 2013, representing only 21 percent of the global fleet—as you can see, there's plenty of room for growth.

One Nagging Issue: Why Don't People Use The Technology?

Just about everyone following the in-flight connectivity market continues to cite the dismal uptake of services to date. Typical comments include this one in a Bloomberg BusinessWeek story (Gogo's Problem: Inflight Wi-Fi Is Expensive, and No One Uses It, by Justin Bachman, 6-24-13) debating the merits of Gogo ATG service:

"Only about 6 percent of fliers on Gogo-enabled flights used the service in the first quarter, the company says." Even with faster satellite services now added to the market, the take rate is maxing out at about 10 percent of passengers.

That level of Wi-Fi use does not indicate that passengers are happy with those offerings or as "engaged" as the airlines would like them to be. An engaged audience on board is what airlines value and also what other potential partners hoping to tap into that audience are looking for. Until someone figures out the recipe for getting at least half of the passengers to jump online, there are limited opportunities for Wi-Fi to create the loyalty factor airlines want or the active audience that could represent meaningful additional revenue for airlines and airline partners.

Those Who Ignore History...You Know The Rest

Here on solid ground, we have seen a Wi-Fi story already play out. People have always liked the idea of being connected, but it wasn't always easy or affordable to do so. Remember when you had to buy a license and load a third-party application onto your PC to search for Wi-Fi hookups in your vicinity? If you found a network, only for an extra charge did you get a connection. The same scenario played out at the local Starbucks or at a hotel.



If you were lucky enough to have the expense account or budget to get that connection, it might be passable for minimal web surfing, but not much more. You were scratching for your share of bandwidth with many others and it seemed as though you were always the one left starving for bits for your online activities.

Then came the shift.

Hotels started offering free Wi-Fi. The coffee houses followed suit. Soon, airports, malls, restaurants, and other gathering places came to see connectivity as a perk that made their customers happy. And that was true even when those customers saw an advertisement or portal page in front of them, promoting the place of business or complementary services. Not only that, but the connection was better. Now you could tunnel into work with your VPN or watch some YouTube without frequent loss of service.

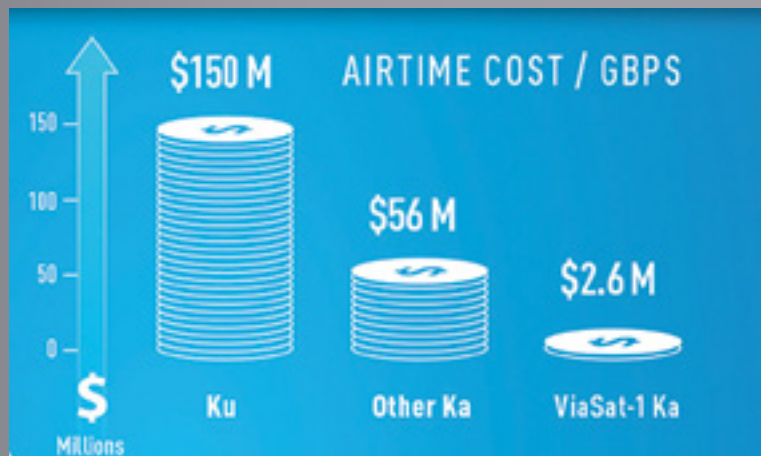
Should we expect passengers who come from free Wi-Fi in a hotel, to free Wi-Fi on the train, to free Wi-Fi in the terminal to be happy when that option is not available on the plane?

Stated simply in the previously noted Bloomberg BusinessWeek story is this comment from Tim Farrar, president of TMF Associates, a research firm in Menlo Park, California, "People have an expectation, and it's grown over the past few years, that Wi-Fi should be free."

The Market Is Already Responding

Satellite Internet has already come a long way in overcoming its reputation as a slow and expensive alternative for fixed service. Starting in January 2012, ViaSat's new Exede Internet for the home has won more than 400,000 new customers by focusing on providing a great value in price and performance. Customers are not just converting from slower satellite services; about 40 percent switched from terrestrial alternatives.

With that successful network on the ground already proving that 12Mbps service to every customer is an economically sound and successful business, it's ready to take flight. In fact, the economies gained from building the ground infrastructure and satellite system with the primary purpose of reaching consumers on the ground, the economics work out even better when extended to in-flight applications.



The key benefit that high-capacity delivers is in its bandwidth economics. With a single satellite carrying 100 times the capacity of a typical Ku-band satellite, at a similar capital cost per satellite, the economic equation becomes obvious.

There is no doubt of the growing demand among consumers for more and more bandwidth. Only satellite can keep up for in-flight services, and only high-capacity satellite, with that large "inventory" of cheaper bits, can provide the best value to the airlines.

Rather than a single bucket of bandwidth to the aircraft to be shared by all passengers, a 12Mbps service level for each seat is now possible. The economics are also such that airlines will have much greater flexibility when it comes to pricing service to the passenger. They could even give away a basic connection for email and browsing, just as you get your soda and peanuts or pretzels today, then provide passengers with an option to pay a little more to stream video or use other bandwidth-heavy apps.

O'er The Oceans

But what about the oceans, where passengers on long haul flights really need the benefits of connectivity the most? Where are those same consumer-based economies then?

There's a fix for that.

One ongoing debate about high-capacity (or high-throughput) satellite systems has centered on the tradeoff between optimizing coverage or optimizing total system capacity. One Ka-band mobile service provider, Inmarsat, has opted to launch a three-satellite constellation that will blanket the globe with Ka-band in one swoop. That option figures to serve some customers well who may choose coverage over capacity while giving up something in the bandwidth economics department (as seen in the previous chart.)

However, what if you didn't have to make that tradeoff? Enter ViaSat-2, the next class of high-capacity satellite. With a coverage area still targeted primarily to home Internet subscribers, it is designed to bust the myth of coverage or capacity, instead enveloping seven times the coverage area as ViaSat-1 combined with an equally impressive doubling of bandwidth economics.



As seen on the coverage map, ViaSat-2 is designed to retain all the economies of serving the residential customer first, and build out coverage south to the tip of South America, in the Caribbean, and maybe most importantly, over the primary air routes in the North Atlantic, building a bridge to high-capacity Ka coverage in Europe and the Mediterranean Basin

New Plane Orders Point The Way To Growth In 2014 + Beyond

Airlines also continue to order new aircraft. Just considering the two leading aircraft manufacturers, Boeing and Airbus, the total backlog at the end of 2012 was 9,055, up 847 units from the previous year, according to Aviation Week. That backlog is expected to grow when the 2013 year-end figure is announced, with both companies already adding about 2,000 orders through the end of September.

Airliner manufacturers want to get ahead of the curve. One example is a recent deal between ViaSat and Boeing Commercial Airplanes (BCA) who reached agreement to work together toward offering ViaSat Ka-band airborne satellite terminals as a factory line-fit option on Boeing commercial aircraft. Airlines will be able to specify ViaSat in-flight connectivity on new Boeing aircraft and take delivery of planes with the equipment already installed, with a target availability of 2015.

The expectations for in-flight Internet seem clear. Passengers want more speed, no matter how many people are connecting and airlines stand to gain more value and loyalty from their passengers if more people use it. Satellite communications is the right technology to deliver that kind of service, and only high-capacity satellite systems can provide both the great service and economics to satisfy both parties.

For additional information: <http://www.viasat.com/exede-in-the-air>

About the author

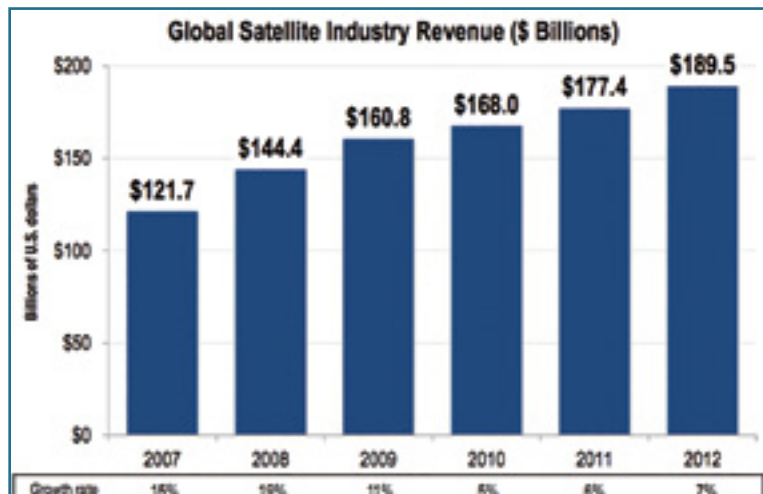
Don Buchman is General Manager, Commercial Aviation Services at ViaSat Inc. In his current position, he is responsible for directing the ViaSat team that is providing industry-leading high-speed Ka-Band mobile Internet into commercial aviation market segments. Mr. Buchman has been at the leading edge of communication system development for military and commercial applications for the past 23 years. During the past 15 years he has been employed at ViaSat, where he has played a leading role in developing several of the company's products, including several patented technologies. He took ViaSat into commercial high-speed mobile applications 10 years ago with the creation of the highly successful Yonder® service offering into business aviation, government aviation and maritime market segments. He is now leading the next wave of innovation by taking the award winning Exede® Internet service to commercial airline and business aviation customers.

By Alexandre Joint, Group Telecom Billing Manager, IEC TELECOM Group

The Satellite Industry Association has recently released an updated version of its 2013 comprehensive study of satellite industry data. This 2013 report, performed by The Tauri Group, looked at over 80 key companies worldwide—including all SIA members—and added market analysis and financial reporting to publish an in-depth analysis of the industry.

The study is based on year-end 2012 data from major players, representing four satellite industry segments. Here's some data contained in this report.

Overall, the satellite industry revenue was \$189.5 billion in 2012, a 7 percent growth that followed a +6 percent in 2011. Forty-four percent of this revenue was earned in the US.



This industry is at the crossroads of both the global telecommunications and space industries. There are more than 1,000 operating satellites, 38 percent being in use for commercial communications and 16 percent used for government communications. Smaller categories range from navigation to remote sensing and military surveillance.

All four segments surveyed posted growth. Satellite services (the largest segment) grew by 5 percent in 2012. Satellite manufacturing grew by 23 percent. Launch industry revenues rose by 35 percent while ground equipment revenues increased by 4 percent.

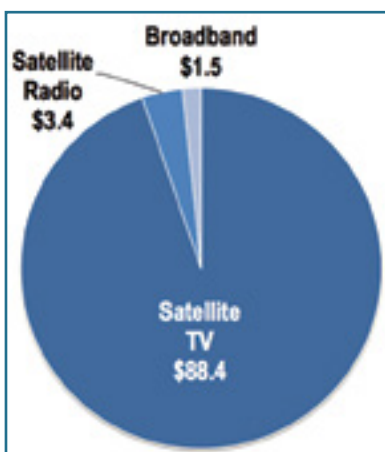
Looking at the long-term trend, Global satellite industry revenues have tripled since 2001, from \$64B to \$189B. That's an average 10 percent growth per year, with Satellite Services rising from 50 to 60 percent of all revenues in this period. Satellite manufacturing + launch industry went from 20 to 11 percent. Ground equipment remained stable at 10 percent.

Much can be said regarding each of the four segments.

Satellite Services include different categories:

- **Consumer Services** (satellite television, satellite radio and satellite broadband)
- **Fixed Satellite Services** (transponder agreements, managed network services including spaceflight management services)
- **Mobile Satellite Services** (mobile data + mobile voice)
- **Remote Sensing/Imaging Services**

Satellite services, the largest segment, grew by 5% - consumer services continues to be a key driver for the overall satellite industry



Satellite services revenues went up 5 percent in 2012 (following a 6 percent growth in 2011) to \$93.3 billion. This is by far the biggest segment of the industry, with almost 50 percent of its revenues. Some key data on consumer services:

Satellite television services account for more than 80 percent of all satellite services revenues, and 95 percent of consumer revenues. Increasing numbers of High Definition Television (HDTV) and cable distribution channels continued to drive revenues for satellite payTV, with subscribers up 4 percent driven by growth in emerging markets in Europe and Asia. The total number of subscribers is now over 160 million worldwide. Forty percent of this revenue is attributed to the U.S.

- **Satellite radio revenues grew by 13 percent in 2012 to nearly 24 million subscribers, mainly in the US.**
- **Satellite broadband service revenues increased from \$1.2 billion in 2011 to \$1.5 billion in 2012. Customer base grew 10 percent in 2012, with over 1 million subscribers (mostly in the U.S.). Interestingly enough, subscriptions grew for both established services and several new ones which entered operations in 2012.**

Fixed satellite services grew 4 percent, with transponder agreements revenues up 3 percent and managed services revenues up 7 percent, slightly slower than last year's 10 percent growth.

Mobile satellite services grew 3 percent, with mobile satellite voice revenues remaining flat while mobile satellite data grew 5 percent (compared to 4 percent in 2011). This confirms that as far as MSS are concerned, the future growth will be driven by data and IP applications such as VoIP and web services. Voice remains strong but is no longer a growth factor. In fact, even if the number of minutes consumed might go up, the associated global revenue will not.

Remote sensing revenues grew 20 percent. This specific segment, while still small, posted a high growth. Hopes are high for the next couple of years with markets ranging from utilities to offshore platforms to name just a few.

U.S. government spending drove growth in 2012, along with better-than-expected performance from industry leaders

Satellite Manufacturing

2012 revenues totaled \$14.6 billion (+23 percent vs 2011), with a U.S. market share nearing 60 percent. That's

strong growth but it also confirms the lack of global trends in this industry, with ups and downs in the last few years. While revenue grew, fewer satellites were launched in 2012 (81) than in 2011 (90). Revenue growth was driven by a greater number of higher value satellites.

Looking at the number of spacecraft launched, Commercial or Civil/Military communications satellites accounted for 50 percent of all launches. However, by value, communications satellites represented 67 percent of satellites launched in 2012 (37 percent commercial and 30 percent Civil/military).

The U.S. had a 67 percent share of the 2012 Commercial Satellite Manufacturing Orders (12 commercial GEO satellites ordered to US-based companies out of a total of 18 ordered worldwide). U.S. satellite manufacturing revenues increased 31 percent in one year. U.S. firms built one-third of the spacecraft launched in 2012 and 61 percent of U.S. satellite manufacturing revenues came from U.S. government orders.

Satellite manufacturing revenues grew by 23%, due to proportionally more expensive commercial GEO and government satellites in 2012



As far as manufacturing trends and innovation are concerned, it is worth mentioning:

- High throughput satellites (HTS) combine the use of several technologies for far greater efficiency, including frequency re-use, spot beams, and on-board processing to maximize available spectrum, primarily in Ku- and Ka-band. 23 HTS have been ordered and/or are being manufactured and 20 of those are already on orbit. This technology is increasingly popular with networks being set up by companies such as Eutelsat, Yahsat or Inmarsat for Ka-band. The next few years will witness a stiff competition in this market and its success on different kinds of applications (maritime, business ...) is closely monitored by analysts and the big players, given the heavy investments made.
- All-electric propulsion provides a significant reduction in satellite weight, but requires more transit time to reach final orbit. For the first time, orders were placed for all-electric propulsion commercial GEO communications satellites in 2012

Launch Industry

Launch industry revenues rose by 35% in 2012, even with fewer overall launches, but with more commercial launches and more expensive heavy government launches than 2011



This industry segment includes Launch Services and Launch Vehicles, for a total of \$6.5 billion in revenues in 2012, a 35 percent increase since 2011 that followed a 10 percent growth in the previous year. This is a significant number as we have to go back to 2008 to witness a more than 20 percent growth in this category. The 2009 to 2011 numbers had been rather stable around \$4.5 billion, with either positive or negative growth in those complicated times in the global economy in general and in this industry too.

U.S. market share was 35 percent of global revenues, derived almost entirely from launches of U.S. government satellites. Government customers remained the major satellite launch revenue driver in 2012, accounting for 64 percent of commercially-procured satellite launch revenues (up from 59 percent).

Despite fewer satellite launches in 2012, revenues grew due to more launches of larger and more expensive vehicles. The number of commercially-procured satellite launches remained relatively stable, with 52 launches occurring in 2012 as compared to 56 launches in 2011.

Orders to launch 25 commercial satellites were placed in 2012. Eight satellite launch orders were won by U.S. companies (up from only 3 in 2011). Europe retained the largest share of commercial launch orders.

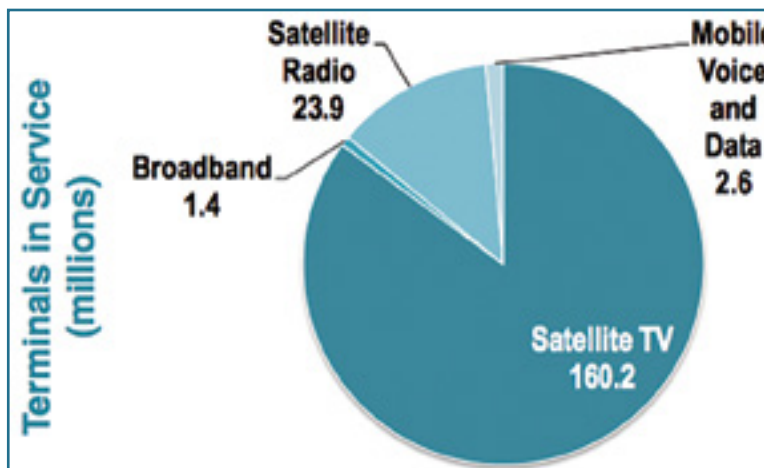
Ground Equipment

Ground Equipment encompasses Network Equipment and Consumer Equipment.

- **Network Equipment is:** Gateways, Network Operations Centers (NOCs) and Control stations, Satellite News Gathering (SNG) equipment, flyaway antennas and Very Small Aperture Terminals (VSATs)
- **Consumer Equipment is:** Satellite TV dishes, Satellite radio equipment, Satellite broadband dishes, Satellite phones and mobile satellite terminals, Satellite navigation stand-alone hardware

Global satellite ground equipment revenues increased 4 percent overall in 2012. Network equipment revenues grew 17 percent, driven by VSAT sales. Satellite TV, broadband, radio, and mobile voice and data equipment revenues grew 5 percent.

Ground equipment revenues increased by 4% in 2012, with slowing growth in consumer equipment and increasing growth in network equipment



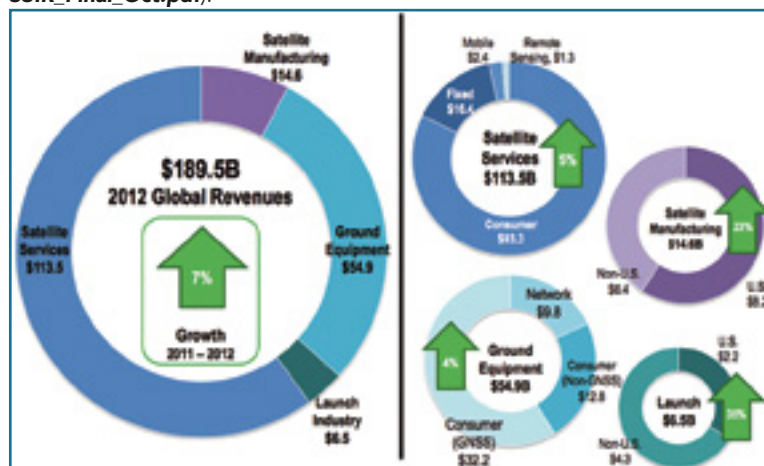
The number of terminals in service grew across all segments in 2012.

Satellite navigation equipment represents nearly 60 percent of overall ground equipment revenue.

A Positive Year

Overall, 2012 has been a positive year for all segments of the satellite industry, paving the way for 2013 and beyond. The main indicators mentioned in this study can be found below in a quick summary of the current state of the satellite industry.

The full report, prepared by the Tauri Group (<http://space.taurigroup.com/>), is available on the SIA's website (http://www.sia.org/wp-content/uploads/2013/10/2013_SSIR_Final_Oct.pdf).



About the author

Alexandre Joint is Group Telecom Billing Manager of the IEC TELECOM GROUP. In this position, he handles projects lifecycle management related to billing, airtime management and prepaid/postpaid service provisioning. This role includes internal and external requirements gathering, solutions implementation and development of techniques to improve engagement productivity, increase efficiencies, mitigate risks, resolve issues and optimize cost savings. An important part of this task is also about building synergies, team management and matching the needs of customers, staff and solution providers.

Prior to IEC TELECOM GROUP, Mr. Joint worked in a variety of positions, from Director, Marketing and Communications of a public shipping company to Support and Help Center Manager of a start-up company he co-founded in the web and GSM industry. During his six years with the IEC TELECOM GROUP, he held various positions from marketing to information systems manager for the Paris-based branch, to Telecom Billing Manager for the group.

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Executive Spotlight

Guido Baraglia, Board Member, Satellite Interference Reduction Group (IRG)

**Year In Review
2013**

Guido Baraglia, Board member of the Satellite Interference Reduction Group (IRG), discussed the current state of interference and the latest initiatives with *SatMagazine*. Mr. Baraglia, the Director at SAT Corp. (a KRATOS company), is a leading expert in Carrier Monitoring and Interference Geolocation, with more than 20 years of experience in combating RFI affecting telecommunication satellites. He's participated on panels at SAT 2013, CabSat 2013, the WBU-ISOG conference in Geneva, ITU workshops and is a referenced source on RFI mitigation.

SatMagazine (SM)

As a member of SIRG who's been intimately involved in interference reduction efforts, what's the outlook on satellite interference and measures to reduce and counter it?

Guido Baraglia

I wish we could say interference is a thing of the past like the horse and buggy, but we're facing several trends that all conspire to potentially create more problems. We're seeing an exponential increase in satellite usage. We have almost 50 percent more satellites being built for launch from 2011-2020 than the previous decade, and capacity is doubling with the deployment of more High Throughput Satellites. Use isn't limited to one sector, such as Direct-to-Home (DTH) television; there's also remarkable uptake in business communications, Internet service, the Oil & Gas industry, stock exchanges, broadcast as well as mobile telephony.

On top of more bandwidth and services, there's also a lower barrier to entry. Smaller and smaller VSAT terminals are sprouting up, particularly for the new generation of DTH Internet terminals operating in Ka-Band. Where we had fewer, but more experienced installers, we now have, more often than what we might realize, technicians with little to no experience in installing satellite terminals. This situation applies to nearly all verticals. Without proper skills, there are more problems originating from installation faults than ever before. Budget and cost pressures are often squeezing out basic elements such as equipment maintenance and staff training.

We're also seeing some technical innovations, such as the all-electric satellites. It's a promising "green" concept, but it will create issues for the techniques and algorithms everyone uses for geolocation.

The upside of is that the vast majority of interference is unintentional—there's more corrective actions we can take to mitigate it. The sunny, optimistic answer is that the satellite industry is positioned for exceptional growth. The cloudier side is that more capacity, users, and services will create more interference challenges.

SM

Given that prognosis, what are some of the promising international initiatives and recommendations?



Guido Baraglia

There are several industry answers, including Carrier ID, Operators' Training, and Type Approval to mitigate the effect of interferences on daily satellite operations. One of the more far-reaching and promising relates to the International Telecommunications Union suggestion that each individual administration controls its own spectrum, with nations setting up their own International Monitoring Stations (IMS). These would be equipped with monitoring and geolocation tools, which are the assets that provide detection, characterization and, most of the time, resolution of interference problems.

Considering the patchwork of satellite activity, the rationale to have an umbrella entity for a national territory makes a lot of sense. Nearly everyone has skin in the game so to speak; the satellite operators, service providers, national governments, manufacturers, the international community...we're all in this together. These international monitoring stations can operate as independent third parties to validate RF activity, and monitor and geolocate sources of interference.

Radio Space Frequency Spectrum is simply becoming more crowded, with too little orbital positions, frequencies and coverage regions for everyone who wants to own a telecommunication satellite. Obviously the ITU, as the regulatory body of all spectrum activity, has thought long and hard about how we'll all coexist.

SM

Is there a model for these international monitoring stations, and what would these look like?

Guido Baraglia

These installations have the ability to monitor, record and detect transmissions from any space station, the ITU convention for orbiting satellites transmitting towards Earth. And some of them also have the ability to precisely geolocate the source of any transmission, independently, whether it's legitimate or not.

There are two possible approaches to the International Monitoring Station, a scientific approach whereas the authority wants to receive and monitor all possible signals that come from space stations, independent of their origin, usage and orbit. This model requires considerable investments and highly trained engineers for the day-to-day operations and data analysis.

The second model is a more commercial approach to the signal monitoring and limits the scope of the monitoring station to commercial geostationary services and specific frequency bands only.

A scientific approach will allow the authority to receive signals transmitted from all types of satellites and for all types of services, including GPS, weather satellites, Earth observation satellites and so on. It will also allow monitoring of non-geostationary orbit spacecraft. Given the current usage of the satellite spectrum, the commercial approach will, nonetheless, allow the authority to monitor approximately 90 percent of the signals received from orbiting objects.

Essentially, an International Monitoring Station will look like just another teleport and to a certain extent, it is. Also, the tools used to monitor and geolocate signals would be common to most commercial teleport or satellite operators. What will change are the requirements for accuracy and repeatability of the measurements performed by an IMS.

Deciding which type of satellite, service and frequency band to monitor will help determine the required budget.

SM

Why would a country want to set up an IMS? Aren't their carriers or service providers doing that? What would be the benefit?

Guido Baraglia

Suppose commercial entity 'A' in one nation is having an interference issue with 'B' in another nation. Despite best intentions, it will be one word against the other. Clearly, there are advantages of having a 3rd party organization, possibly under the ITU umbrella, that's capable of detecting, characterizing, and eventually geolocating, the said anomaly and presenting the case to the international community. An authority recognized by the ITU that sits above external interests carries more credibility and weight and can more effectively and easily resolve disputes between countries or different entities whatever the disruption, service, or frequency dispute.

The aim for the ITU will be to build a bigger network of coordinated ground stations to verify and measure each anomaly in an unbiased way.

There's also the benefit of being able to monitor which entities can transmit over the national territory. There may be groups transmitting or setting up a network without proper authorization, or not following the basic rules to avoid interfering with other services or satellite networks. Using a mix of fixed and mobile ground stations, the regulatory authority can control most, if not all, of the traffic over the national territory, verifying not only what lands in the territory, but also the signals transmitted from within the national territories.

SM

Would international monitoring stations also play a role in national security matters?

Guido Baraglia

Yes, they certainly would. They can monitor and detect possible threats, whether that's deliberate jamming or unauthorized satellite use, and help verify the source of content that might be considered a threat.

While deliberate interference is obviously a small portion, only three to four percent, we've seen a lot more activity emanating from the Middle East in the past several years. Of course, deliberate interferences or denial of service have occurred since Captain Midnight in the late 1980's, but as a political tool, deliberate interference will continue to be used in this region, unless proper actions are taken by the competent authorities.

Also, if a nation has its own space program or satellite in orbit, an international monitoring station can help control and police the assets in space, protecting bandwidth and avoiding attempts to deny service if necessary. This becomes particularly important for nations that are about to enter a space program and have to contest for an available orbital slot against real and "paper" satellites.

SM

Which nations are currently doing this?

Guido Baraglia

According to the ITU Report SM.2182 there are seven International Monitoring Stations in the world: the U.S., Germany, Korea, China, Ukraine, Kazakhstan and Japan. An eighth one is being deployed by Russia, but hasn't yet made it to the ITU Report. The German installation is, in reality, the result of a MoU between seven European nations who are members of the CEPT—they are Germany, France, UK, Switzerland, Spain, Luxembourg and The Netherlands. This installation is operated by the German Authority on behalf of the MoU members.

SM

What challenges or hurdles are you hearing from the frequencies regulators?

Guido Baraglia

The long held perception is that the hardware and software for monitoring and geolocation of space radio services are too specialized and too expensive. Frequency regulators, however, can use the same widely available commercial equipment as that used by satellite operators or broadcasters. There's no difference in the tools, procedures or training between the commercial and the regulator way of monitoring. If private companies can afford it, so too can the frequency regulator authority.

Eventually a certain degree of cooperation can be envisioned between commercial entities and regulators, where if you have a service provider with a teleport, the authority could use that as the structure for the international monitoring station.

Another concern from the past has been how to staff these operations with the specialized expertise. However, today's tools and technologies having changed so much, that's not as big an issue anymore. A Level 1 operator today can now take on far more of the monitoring to mitigation cycle, rather than being limited to a small piece of the problem and escalating it up. Toolsets for detection and geolocation can be integrated together with a much higher degree of automation. You can pull data from monitoring, such as detailed signal-under-signal characterization, into a graphical interface for more complete analysis and geolocation. Staff can then do more than detect a problem; they can take the next steps to locate and resolve it. Bridges between the authority service database and the monitoring tools are more and more common.

Other advances, like map-based tools, make it easier to understand today's complex satellites' scenarios that involve more beams, switching, and transponders. A lot of your readers may not remember the old DOS-based computers before the graphical interface came along, but that was typical of the equipment. Now with today's intuitive displays, operators can more easily interpret and interact with the information. Using an interface where the data is overlaid and visualized on a detailed map greatly speeds up the geolocation and mitigation process.

SM

Are you optimistic?

Guido Baraglia

Absolutely. If each nation took part and implemented the International Monitoring Station concept, where they're actively monitoring the radio space frequency spectrum, then all parties would benefit from equal rights access and the use of it.

For further information regarding IRG: <http://sating.org/>

For SAT Corp. details: <http://www.sat.com/>

Careers: Is Human Resources Your Best Recruiting Option? Progressive Practices Versus Legacy Stagnation

Year In Review
2013

By Bert Sadtler, Senior Contributor

Companies today must re-assess their talent needs in order to remain competitive and drive growth. The satellite communications industry faces challenges all the while remaining ripe with opportunities. Employers must ensure they obtain a "great hire" to continually further ongoing business success.

Is Human Resources Your Best Recruiting Resource?

In traditional business models, the need for an employer to acquire talent is—and always has been—the responsibility of Human Resources (HR). The name "Human Resources" itself parlays to all, "We are all about the existing employees and adding new ones."

Well, if it were that simple, then candidates would be joyous in their anticipation of an interview with an

employer's HR team. Hiring managers would regard their HR as a partner/team member who solved business problems by proactively landing the correct individual to fit the position before the hiring manager's critical need ever reached a top priority.

The issue that too few business leaders are discussing is: How ineffective has HR become as a recruiting resource, and what should be done about that situation?

Where has HR lost its way? What has changed inside business that drives HR to attempt to succeed when the goal is unachievable?

Today's marketplace has become more complex and more specialized.

Employee benefits have become expensive and complex, and the trend is for them to become even more so. A benefits expert can deliver significant value to their employer, especially where critical analytics are concerned. However, the person who excels at analytics does not necessarily possess equal expertise when it comes to pursuing promising talent for the company.

In addition to maintaining a command of analytical data, Employee Relations has become its own complex field of specialization. Today's businesses have minimal margin for error in hiring critical talent. Employers have to get it right, every time. Recruiting is less about résumés and stale interview questions. Most candidates have rehearsed answers to predicated behavioral and situational questions that will be asked of them.

Best-Practice-Recruiting today is solving a critical business problem. To be effective, the recruiting resource must have a command of the business problem, the existing chemistry of the hiring manager as well as the ability to employ a dedicated amount of time to analyze the applicants in order to select the few who possess the technical and cultural fit to fill the position. Additionally, the individual who has a command of the business problem and enjoys pursuing qualified candidates does not necessarily have the expertise to also excel at digesting analytical benefits-related data.

Under the outdated traditional approach, employers are asking their HR Experts to be the jockey on the racehorse in the morning and then the center on the basketball team in the afternoon.

Are employers asking HR to provide more than should be expected? How can HR deliver market-value as the master of multiple disciplines?

My HR friends acknowledge (offline) that they can master one discipline or the other, but struggle when required to become experts in diverse and somewhat opposing disciplines. They have commented that today's business leadership wouldn't ask an Operations Expert, Marketing Expert, Finance Expert or Sales Expert, to possess expertise in multiple, opposing disciplines.

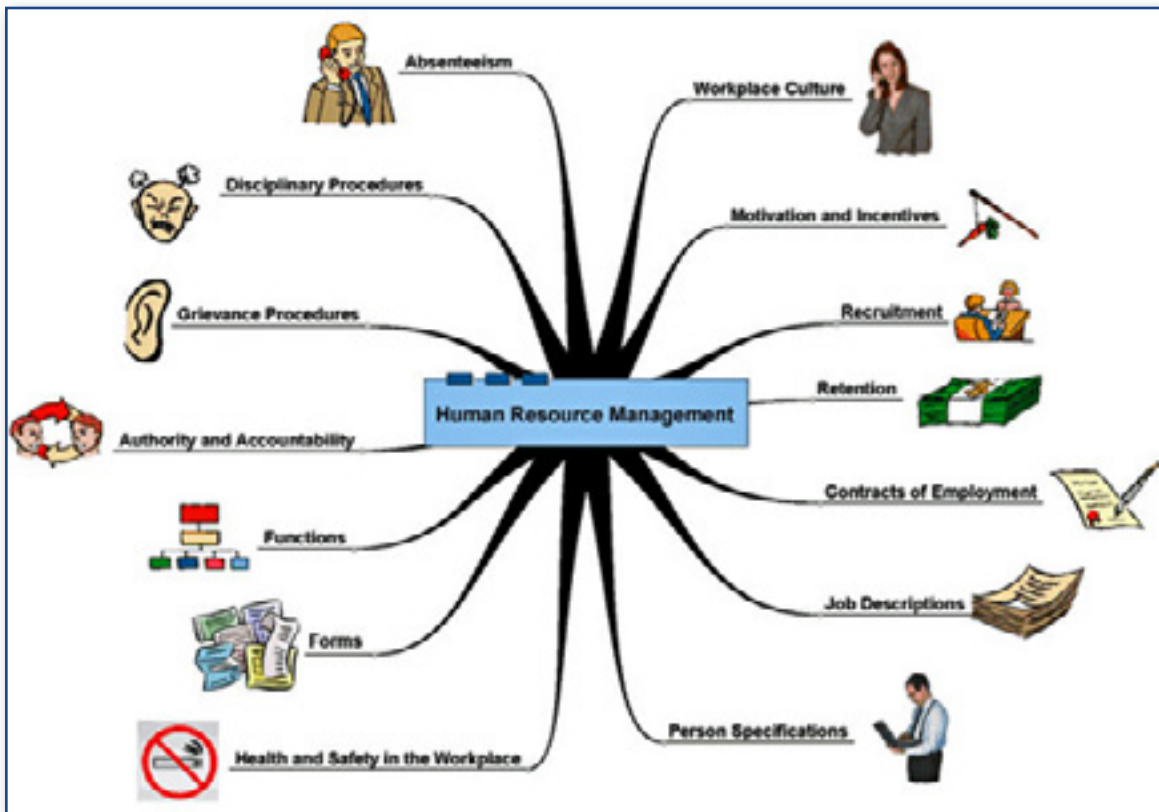
What is the harm in keeping the same HR model in place for as long as possible? Well, the consequences of the legacy model include:

Business is in a state of

constant flux must and make daily adjustments to remain relevant and valuable to their marketplace. Few companies would consider returning to a previous, older business model. Yet, some employers are attempting to freeze time by applying an outdated HR model.

In a simpler time, the requirements for HR to manage an employer's benefit package and also an employer's recruiting could have worked. Today's HR responsibilities have morphed into a complex and somewhat opposing field of disciplines.





- Employers hiring “the available candidate,” but not even interviewing the best candidates
- Getting candidate hiring correct is more crucial now than ever before... a failed hire becomes more expensive every day. Estimated costs of a failed hire are as much as 15 times that individual’s annual salary
- Business leaders with significant P&L responsibilities must follow an outdated policy where HR dictates the recruiting process without having a command of the business problem that must be solved. This results in the employer’s failure to hire the “Best Talent”
- With an analytical mindset, there is limited opportunity for the HR Expert to engage conversationally with critical talent and transition from stale interview questions into a business discussion
- Today’s recruiting is much more than trying to excite candidates with “a great benefit package.” As it is within their expertise, many HR Experts fall into a benefit presentation during their recruitment discussion, getting sidetracked, and fail to focus on the candidate’s ability to solve the critical business problem

On a broader level, following the legacy HR Recruiting Model may be saying far more about the employer’s inability to maintain marketplace relevance.

Larger organizations face a bigger challenge in attempting to improve their hiring procedures. Organizations that remain static in their hiring procedures will note that the more nimble, more creative and more adaptive organizations will pass them by in obtaining the most appropriate hires.

Where Is HR / Recruiting Trending?

Through some trial and error, today’s emerging HR model is centering Human Resources on disciplines that include:

- Benefits
- Employee Relations
- Related “inter-company priorities”

First, a member of senior leadership should be assigned the responsibility of acquiring critical talent in order to solve business problems. This senior leader is separated from the traditional HR responsibilities.

With the assignment to acquire critical talent, one avenue is to engage with outside professionals, and to include at least one expert who possesses a plethora of recruitment models.

Another step would be to develop a group of internal “business specialists” who report directly to the business unit—not HR—and who are responsible for solving business problems through the acquisition of needed talent. This is disconnected from the responsibilities of analyzing benefit related data and is measured solely upon acquiring the correct talent and is focused on longer term problem solving.

If talent is about business, and people are about talent, then shouldn’t Best-Practice-Recruiting focus on spending time with the prospective talent while discussing business issues?

No doubt, adjusting the legacy model may not be an easy path to follow. However, it certainly isn’t of benefit when your competitors are growing through the acquisition of great talent and your organization has fallen by the wayside.

Good hunting!

About the author

Bert Sadtler is an invited speaker who discusses the shift in the recruitment paradigm toward acquiring critical, senior level talent, as well as in analyzing the shift in the employer’s performance-based compensation model. Bert can be reached at: BertSadtler@BoxwoodSearch.com.

About Boxwood Search

As a dedicated, consulting resource to the employer, Boxwood designs compensation models to reflect the current trends and launch senior level recruitment campaigns to attract and acquire talent. Position examples include: CFO, COO, Senior Program Manager, Vice President of Sales, Director of Marketing, Vice President of Engineering, Director of Contracts & Compliance and Vice President of Business Development. Examples of industries have included: Government Contracting, The Intelligence Community and the Communications/Technology Sector.

Terrific Spatial Tales, Or, Rip-Roaring Yarns From The Early U.S. Space Games

Year In Review
2013

© Tom Leech, Author

The early years of the U.S. space program were challenging, stimulating, memorable, and even, on occasion, humorous. Gather any vets of those programs for a lunch or happy hour and the fun tales emerge.

Several of those gatherings are General Dynamics employees who worked on important early, and continuing, Atlas and Centaur space boosters and upper stages. Starting a couple years ago, many of those have sent in their tales as inputs to a possible book of humorous anecdotes.

Some of those tales date from the mid '50s, when the U.S. started to get serious about space activities, though initially the primary efforts were more for military applications vs. the many space operations ongoing today. Here are a few of those stories from GD people, in roughly chronological sequence and at locations in San Diego (main plant), Cape Canaveral (later Kennedy), Vandenberg AFB, and various related locales.

Getting Those Atlases Up From Robert Risley, Propulsion/Fluid Systems Design

Back then, this was not an easy task—during the final stages of a launch countdown at Cape Canaveral, most of the Tiger Team went to Hanger H and listened to the count on loudspeaker. The last few minutes before launch we would climb the ladder to the roof to see the liftoff—at least, some of us younger ones did. What an experience, to see the culmination of everyone's efforts and teamwork!

Those were exciting times. When there was a launch success, post-launch parties, thrown by the marketing department in a Cocoa Beach motel room, were standard fare. Failed missions were a huge disappointment to all team members, regardless of the cause. Everyone was anxious to pitch in and do their part in the failure investigation. The camaraderie in the program will never be forgotten.

Saving Eisenhower From Clay Perkins, Test Labs Instrumentation Design

My first job after getting my MS in physics at Texas U. was an analysis of the Atlas propellant utilization system (the notorious "PU System"—lots of jokes), which led to my crawling inside the engine compartment of the Atlas that launched President Eisenhower's Christmas message to the world in 1958—America's answer to Russia's Sputnik.

Atlas missile 10-B was sitting on the launch stand with fuel aboard, but the PU system was giving erratic signals. I was rushed to Cape Canaveral to help—this was only 10 months after I started work. My analysis and tests had focused on helium purge gas dynamics—things like what happened to the PU output when the tanks were pressurized?



After a day of testing and data analysis, nothing made sense. We weren't told why, but we were being pushed; as a last resort, I insisted on squeezing into the engine compartment to examine the base of the fuel tank.

With fuel aboard, this broke all safety rules, but I eventually managed to get permission. A safety man had to accompany me; that really helped!

Luckily, I was pretty skinny; with some effort I was able to squeeze up past the sustainer engine by loosening its skirt. With a flashlight I checked all the purge lines—no kinks, dents, or other oddities. I was on a headset and the entire blockhouse was listening.

In desperation, I put my ear against the tank wall, which was far easier said than done, and heard something odd. I pushed talk, "I just listened to the tank. It is going 'bzzzz,' instead of 'glug glug glug'."

Long pause, then, "WHAT?" was received in my headset.

I repeated and added, "The helium should be coming out in big bubbles, not little ones."

"I think you better come back up here. We need to talk."

By the time I made the long walk back to the blockhouse, it was clear to me that the fuel purge tube was partially blocked and that we had to pull the tubing, which meant detanking. Seemed simple to me, but all hell broke loose when I walked in and said, "You got to detank."

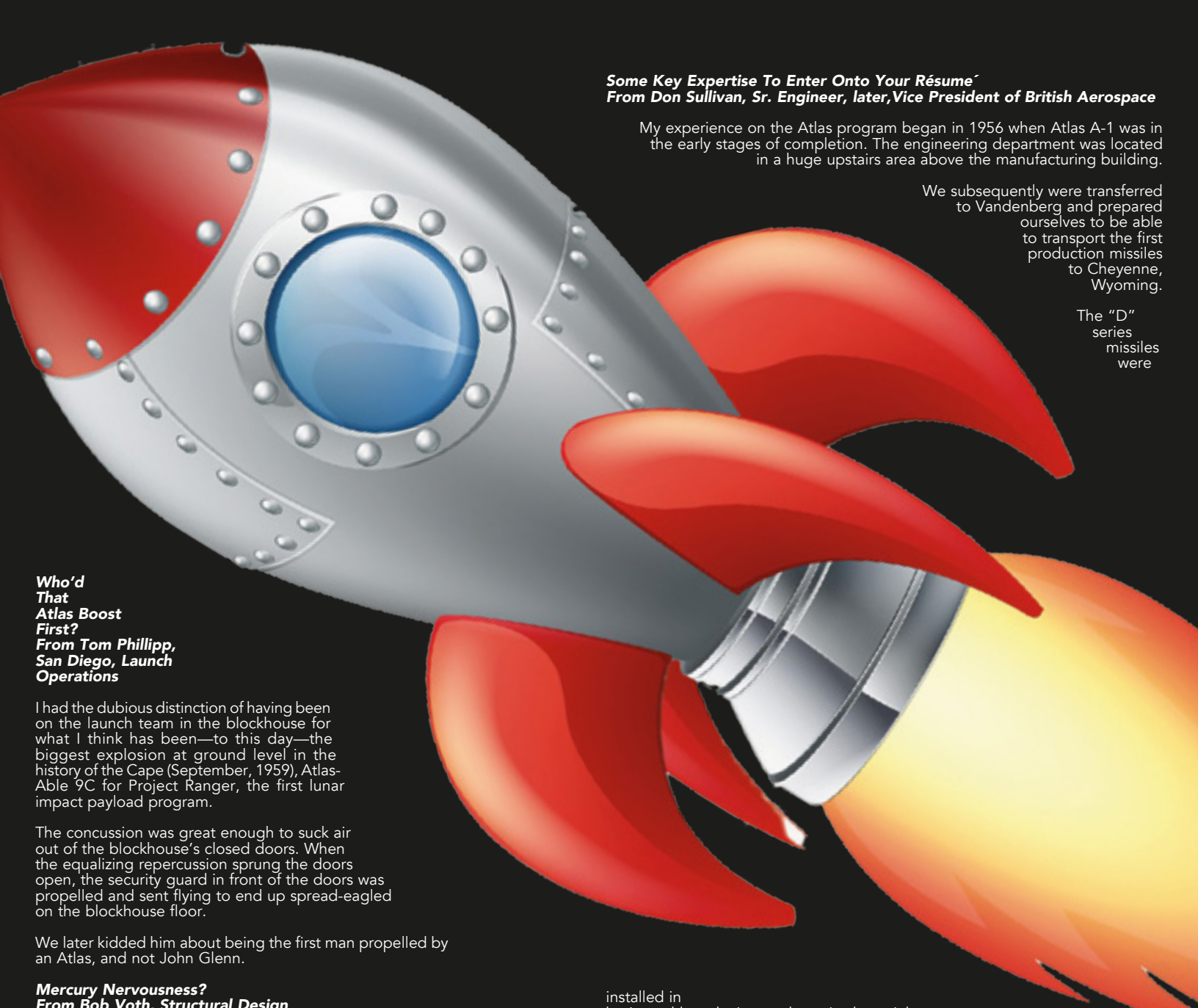
The test conductor (I don't remember who that was) wasn't having any of that; he knew how critical the schedule was—the rest of us had no idea.

After a great deal of conversation, I won (because the TC knew that a working PU was needed to make orbit)—they started draining the tank, while threatening to fire me if I was wrong!

Hours later a mechanic pulled out the bottom section of tubing and handed it to me. Sure enough, the perfectly standard 1/4-inch coupling at the tank wall—wasn't! It had a steel plate welded over its end with a tiny hole drilled through it—just the size to go "bzzzz."

The coupling was replaced, fuel tanking was started again, and I turned from suspected goat to a hero and President Eisenhower's voice was launched just in time on December 18, 1958.

Back in San Diego, a witch hunt found that the strange coupling had been made for the Point Loma battleship tank, but no one could explain how it got into the factory parts line.



Some Key Expertise To Enter Onto Your Résumé^{*}
From Don Sullivan, Sr. Engineer, later, Vice President of British Aerospace

My experience on the Atlas program began in 1956 when Atlas A-1 was in the early stages of completion. The engineering department was located in a huge upstairs area above the manufacturing building.

We subsequently were transferred to Vandenberg and prepared ourselves to be able to transport the first production missiles to Cheyenne, Wyoming.

The "D" series missiles were

Who'd That Atlas Boost First?
From Tom Phillipp, San Diego, Launch Operations

I had the dubious distinction of having been on the launch team in the blockhouse for what I think has been—to this day—the biggest explosion at ground level in the history of the Cape (September, 1959), Atlas-Able 9C for Project Ranger, the first lunar impact payload program.

The concussion was great enough to suck air out of the blockhouse's closed doors. When the equalizing re-percussion sprung the doors open, the security guard in front of the doors was propelled and sent flying to end up spread-eagled on the blockhouse floor.

We later kidded him about being the first man propelled by an Atlas, and not John Glenn.

Mercury Nervousness?
From Bob Voth, Structural Design

During the middle of the Mercury Program, several of the original seven astronauts were visiting the General Dynamics facility to review the progress on the next launch vehicle.

We were gathered around a drafting table in the mechanical engineering area. Charlie Pruckner asked them, "How does it feel to be launched into space?"

I believe it was Gordon Cooper who answered, "It is a bit disconcerting to know you are riding on low bid hardware."

How We Got To The Moon
From Bob Eidson, Propulsion Systems Engineer

During a visit to MSFC (NASA Marshall) to give the folks there an update on General Dynamics' testing of the Centaur (Cruiser Tank w/Boost Pumps, Engine Feed System Ducting, Pressurization System and Vent Valves, and so on), I showed a film of the LH₂ (Liquid Hydrogen) Tank Interior, which included Pressurization and Venting Cycles with the pumps operating and with a propellant level of about 60 percent.

Vigorous boiling of the LH₂ occurred during venting! One of the Germans in the audience commented (German Accent here) "I do not understand zis action!!"

A voice from the audience, a chap by the name of Werner Von Braun, responded "Did you effer open a can uff hot bier ???"

installed in horizontal launch sites and required special equipment called "The Erection Mechanism." I was given full responsibility to direct the installation, testing and operation of all the equipment required to erect the missile.

Once again, I loved every minute spent working on that system. I even prepared a trouble shooting manual called "The Erection Mechanism" by Don Sullivan. I soon became known as "The Erection Expert."

We worked many hours to activate the first group of Atlases that were being installed in an operational site. Near the completion of our schedule, we were visited by General Curtis LeMay, who was the top general in the Air Force at that time. He arranged for a group of Hollywood entertainers who had just finished putting on a show for the Air Force troops at Warren AFB the previous night. We had specific instructions to have our engineers on station at every support system to explain to the group how everything worked. I was directed to be prepared to erect the missile as soon as the group had completed their tour as a grand finale.

My location was at a panel near the launcher, approximately three feet above the main pad floor. When the group reached that location, a vision of loveliness stopped directly below my position. She placed her delicate little hands on the top of a hard hat that everyone had to wear and in her sweet voice asked me what my job was. I replied "I am the erection expert."

Her response was "Oh really" with a big smile. General LeMay almost swallowed his cigar but had to immediately clear the area as I pressed the erection switch and the missile went vertical. The young beauty turned out to be actress Angie Dickinson.

Now this brings me to the real punch line that occurred almost 30 years later when an act of God occurred and I ended up on an aircraft sitting next to Angie. She was unbelievably friendly and talkative.

We were sitting in the first row of the aircraft and had no problem being served cocktails. She discussed her recent divorce from the orchestra leader Burt Bacharach, while I was dying to mention our previous encounter.

Three cocktails later, I mentioned the fact to Angie that we had met before. She looked at me and said she was sorry, but could not remember any previous encounters. I followed up by reminding her of her visit to an Atlas Missile Site with General Curtis LeMay. She immediately responded that she could never forget that event.

I took another gulp of my third cocktail and I asked her if she remembered meeting the "Erection Expert?"

She almost choked on her drink and immediately responded "Was that you!!!"

She talked about how, when the group returned to Hollywood, they could not stop talking about the huge missile that they had seen—she followed those comments by proudly stating, "I met the Erection Expert!"

Getting Proper Respect At Vandenberg From Bill Haire, Guidance Analysis

In the early sixties, when sent to Vandenberg to support Atlas/Agena space launches, we stayed in Santa Maria. Transportation was supplied via company taxi to and from Vandenberg, which ran twice a day (once early in the morning and again in the evening).

On one occasion, Jim Johnson and I were supporting an early morning launch which was eventually scrubbed. Returning to the General Dynamics compound (via way of either GE or Burroughs personnel, as we didn't have our own transportation), we were informed that we would have to wait around for the rest of the day until the evening taxi to Santa Maria came by.

After wandering around, or sitting on our brief cases all day, when the taxi finally

arrived, we were informed that it was already full and it could only take one of us.

This infuriated Jim, to the point that he told the taxi driver that room would be made for the both of us as we had been waiting all day. Jim added that he would kick the driver out and then he would drive the taxi. The taxi was a station wagon, and, finally, one of us (I can't remember which one) was allowed to lay down in the back for the long ride back to Santa Maria.

One Small... "Whaa..." For Mankind??? **From John Medina, Security**

General Dynamics was testing a vehicle for Hughes Aircraft Company at a building at the far end of the KM property, close to the Maxwell Labs Building.

All personnel were required to wear lab coats, caps, booties and white gloves. The article being tested was called 'The Moon Lander,' which was designed to take moon soil samples and send the results back to Earth.

One evening, all personnel left for their evening meal. I was the lone security person there. The structure housing the item was enclosed in a very large teepee-like tent.

I said to myself, "If that is going to the moon, I have to take a look at it." I unzipped the opening and walked around it, marveling at this structure. It was a giant tripod in configuration, with a small under-belly housing. Below that was a small scooper-like device. The legs of this giant tripod and vehicle were covered with gold foil.

After one more walk-around, I stopped and said to myself, "If this thing is going to the moon, my thumb print is going to the moon."

I took off my right-hand white glove and gently pressed my right thumb against the gold leaf tripod leg.

The vehicle was successfully launched and sent the data back to Earth—and one small thumb print landed on the moon.

I've told no one about this before. Now, when I look up at the moon, I remember Neil Armstrong and the rest of the astronauts, and my one small thumb print that hitched a ride on a gold leaf tripod leg.

Atlas Payloads – Up, Up And Away... Really From Roland Sedlund, Advanced Programs

In the 1960's and 1970's, we were receiving many requests for programs which could be adapted to the Atlas F launch vehicles, which were declared surplus by the Air Force.

One request we received was from a company which saw a need for launching the ashes from deceased persons into orbit. I suggested calling this program "Up your Ashes," but the program never flew. Hmmm, perhaps because of an inappropriate name?

One More, From Your Fun Tales Collector Tom Leech, Business Development, etc.

In February of 1962, John Glenn became this country's first person to orbit the Earth, lifted there by the General Dynamics Atlas.

Scott Carpenter, Wally Schirra and Gordon Cooper followed, making for a 100 percent program success.

Advance to 1997 to a Coronado book signing by the three Navy pilots, all San Diego residents and authors of *From Wildcat to Tomcat*. One of the pilots was Wally Schirra.

After hearing about my having worked on the Mercury Atlas program, he signed my copy, "Thanks for the lift—it was not a blast."

So there you go, upward—really—and onward. I invite readers to scratch their chuckle memory banks and email me their own amusing anecdotes, whether from their days with General Dynamics or other space organizations (tleech@san.rr.com).

About the author

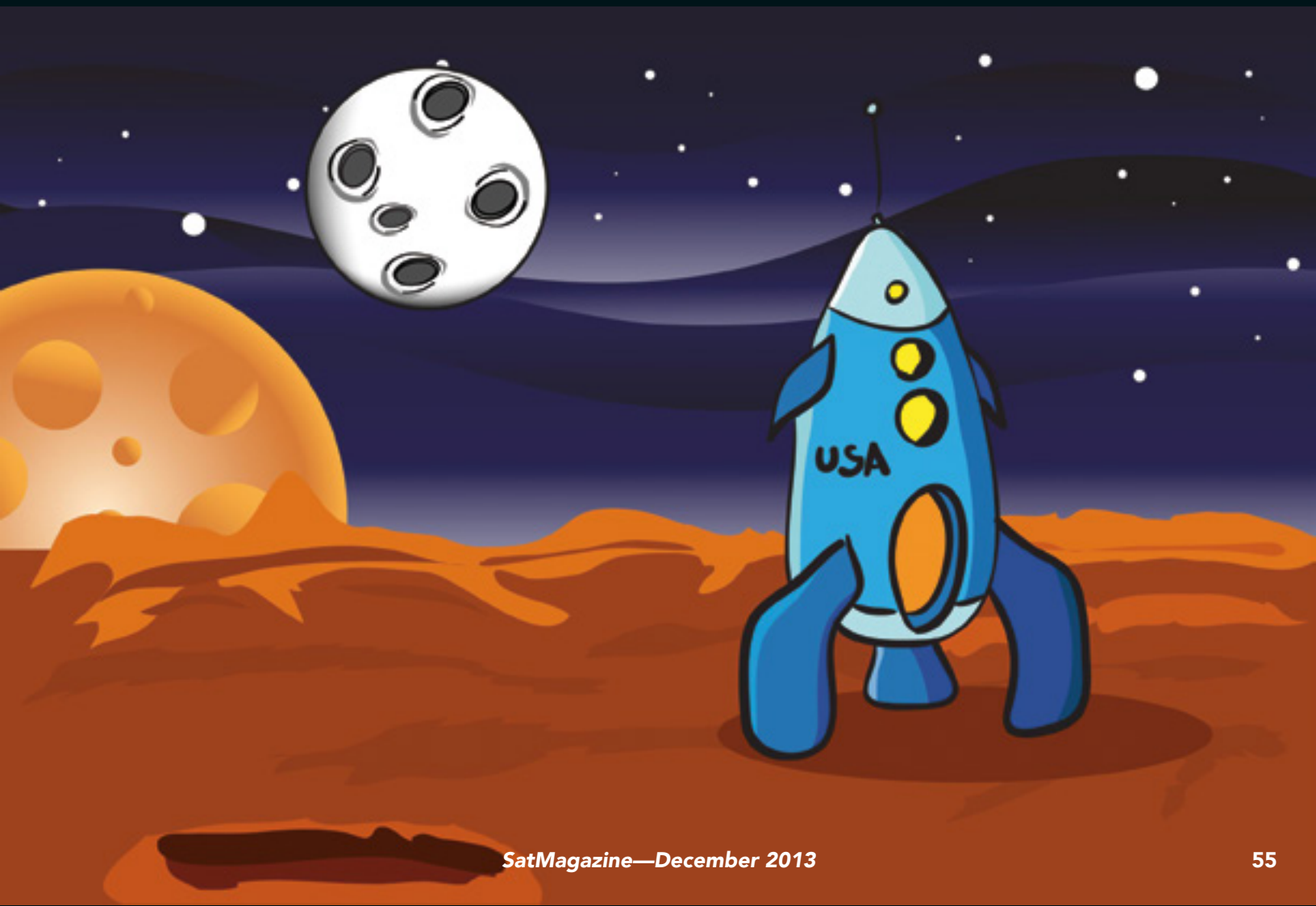
Tom Leech is a long-time free-lance writer and columnist with more than 200 articles in *San Diego Magazine*, *Smithsonian Air & Space*, *Presentations*, *Executive Update*, *Frontier Airlines In-Flight Magazine*, *The Toastmaster*, *Sales & Marketing Excellence*, *Manage*, *Master Salesman*, *Business Journals*. For *San Diego Magazine*, Tom was a regular contributor of feature articles, *Business Columnist*, as well as the Editor of the *Online Outdoors Forum*.

He is also the author of several books: *How To Prepare, Stage & Deliver Winning Presentations* (AMACOM), *Say It Like Shakespeare* (McGraw-Hill), *Outdoors San Diego: Hiking, Biking & Camping* (Premier) and *On the Road in '68: a year of turmoil, a journey of friendship* (Presentations Press). His other hat is as presentations/public speaking coach.

Tom may be contacted at tomaseb@aol.com. And the author has a special thanks to General Dynamics' rocket propulsion colleague, Bill Ketchum, for connecting me to the *SatMagazine* editorial team.

To obtain Tom's recent book, "On the Road in '68: a year of turmoil, a journey of friends," [access this direct amazon.com link](#). (paper back or e-book)

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Event Satellite Players Fly Into PTC's "Big Tent"

Year In Review
2013

By Timothy Logue, Senior Director, Marketing and Sales, Thales Alenia Space

For the information and communications technology omnivore, the annual Pacific Telecommunications Conference in Honolulu early in the New Year always offers a feast of new perspectives, new opportunities and new business associates as well as friends to meet.

For those more focused on the satellite communications world, the choices will be almost as broad as PTC's "Big Tent" approach, which is delivered every year for attendees. The annual PTC conclave will gather at the Hilton Hawaiian Village from January 19-22, 2014, with much of the formal satellite activities taking place during the first two days, though receptions, parties, suite-based meetings and quiet conversations over Mai Tais by the beach will continue throughout the conference.

Never not bold, the World Teleport Association will kick off the satellite focused portion of the conference with a workshop Sunday morning, January 19, entitled "The Death of Fiber: Why Satellite is the Most Relevant Technology." Given the long predicted demise of satellite communications as the world is "fibered," this panel will certainly negate such conjecture. The session will feature:

- WTA Director Lou Zacharilla as the immoderate moderator
- Feisty Down Under Upstart Newsat's Diego Paldoa, Vice President for Europe and the Americas
- John Hane III, Counsel to Pillsbury Winthrop Shaw Pittman, a start-up and upstart veteran himself.

"TED-style" presentations and discussions are promised that will easily replace that second cup of coffee for the jet lagged.

Next up on Sunday afternoon will be a roundtable on "Commercial Mobility Demand—Expanding the Bandwidth Paradigm for FSS and HTS." This roundtable is organized by another PTC-supporting satellite organization, the Asia Pacific Satellite Communications Council (APSCC). This session, chaired by Chris Baugh, President of Northern Sky Research, will also feature proponents of both increasingly unconventional, conventional fixed satellite services solutions for mobile platforms—planes, trains, ships and others on the move—and the newer high throughput satellite options. Pierre-Jean Baylier, President of SpeedCast; Terry Bleakley, Regional Vice President, Asia-Pacific Sales, Intelsat; and Scott Sprague, CCO of Newsat, will bring their regional knowledge to bear from their respective home bases in Hong Kong, Singapore and Australia on this latest battle of "who's got the correct solution."

Satellite manufacturers and launch services providers will take their turn under the baton of Peter Jackson, CEO of PJSquare and well-known former CEO of Asiasat, during the annual PTC satellite luncheon. Under his direction this year will be Richard Currier, Senior Vice President, Marketing and Sales, Space Systems Loral; Stephane Israel, Chairman and CEO, Arianespace; Tim Logue, Senior Director, Marketing and Sales, Thales Alenia Space; Barry Matsumori, Senior Vice President, Commercial Sales, SpaceX; James Simpson, Vice President, Missions and Programs, Boeing Satellite Systems; and Phil Slack, President, International Launch Services.

Those interested in satellite related topics will be able to maintain the pace into the afternoon of Monday, January 20, with the annual satellite Executive Insight Roundtable, whose theme this year, "New Strategies, New Business Models for Satellite." This roundtable will deploy an all-star line-up of speakers moderated by Susan Irwin, President, Euroconsult USA, and Patricia Cooper, President, Satellite Industry Association. They will probe an all-star cast on the key topics of the day for the satellite industry, including Mark Dankberg, CEO, Viasat; Steve Collar, CEO, O3B Networks; William Wade, CEO, Asiasat; and Leo Mondale, Managing Director of Inmarsat's Global Xpress venture, which will have begun, like O3B, deploying its global broadband satellite system as 2013 rolls into 2014.

The formal part of the day will finish out with a Topical Session—"New World, New Satellite Technology Solutions," moderated by Tim Logue, Senior Director, Thales Alenia Space. This panel will focus on new technologies where space comes down to Earth. Panelists will include Stuart Daughtridge, Vice President, Advanced Technology, Kratos-Integral Systems, who promises to discuss noise-canceling headphones for your modem; Vern Fotheringham, Chairman and CEO of Kymeta Corporation, which is developing innovative antenna solutions for many applications using metamaterials; and Patrick Wong, Managing Director, Comtech EF Data Corporation, who will discuss how to get high quality "goodput" rather than just output at reasonable prices for satellite communications links.

For those who can absorb all of the promised new viewpoints in the first two days, one final speech will be well worth attending. On Tuesday morning, Robert Brumley, Senior Managing Director of Pegasus Global Holdings, will discuss his new venture, Laser Light Communications, which promises to bring fiber like throughput from a MEO satellite constellation. It may be no small coincidence that the satellite related sessions of the conference will begin and end with a knowing nod towards the long discussed rivalry between fiber optic based and satellite based communications, but with completely different answers to the traditional question: "beat them or join them."

Register for PTC'14 at this link:

<https://registration.ptc.org/ptc14/index.cfm>



The venue: Hilton Hawaiian Village

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Advantech Wireless

Year In Review
2013

By David Geleman, Founder, CEO & Chairman of the Board of Directors

Advantech Wireless experienced a number of major "wins" during 2013—the company won the prestigious 'Most Innovative Product of the Year Award' from Satellite Markets and Research at the Vision Awards Ceremony during SATCON 2013 for the SapphireBlu™ Series of GaN HPAs. Altogether it's great recognition from industry peers.



In 2013, Advantech Wireless continued its expansion into emerging markets that included South East Asia, India and South America. New offices were opened in Kolkata, India and Advantech do Brasil, a new company based in Sao Paulo, Brazil.

"At the same time, we have experienced substantial growth in traditional markets such as the U.S. and Europe, even during these difficult economic times," Mr. Geleman said. "We expect to continue to do very well in these markets in 2014, especially in the military and broadcast sectors."

The SapphireBlu™ Series of HPAs opened the door for to the lucrative and growing DTH market, one that has been traditionally reserved for indoor Klystrons or linearized TWTs. Now, the SapphireBlu Series HPAs represent a superior alternative to indoor Klystrons or linearized TWTs for a fraction of the cost. Comments from current users have been extremely positive and the company expects to capitalize on the momentum and grow their market share significantly in 2014.



"In the military sector, many clients have confirmed the expansion of their network in 2014," added Mr. Geleman. "We expect to more than double demand for very powerful High Power Amplifiers especially in Ku-, S-, X- and Ka-Band."

"2013 exceeded all expectations with increased customer confidence in our innovative and cost-effective solutions. For the first time in the history of Satellite Communications, we were able to saturate all transponders of the satellite with a single 13m antenna and a single amplifier per polarization."



Advantech Wireless'
2.5kw Sapphire series.

On the VSAT product line, Advantech Wireless recently presented a game-changing terminal design which is set to dramatically improve and simplify the provision of VSAT terminals for use with High Throughput Satellites. The new terminal features a fully integrated Ka-band transceiver and VSAT modem that is able to receive the entire data capacity of a 500MHz Ka-band satellite transponder, representing more than 1.8Gbps of traffic, and route the content appropriately.



Advantech Wireless has been selected by SAVIS Tecnologia e Sistemas to provide a geographically redundant Military Satellite Communication Network System for SISFRON, the largest border security program in Latin America.

"We have a proven track record in providing communication equipment to key defence agencies in deployments around the globe and we are pleased to provide the most advanced end-to-end VSAT solution, which includes high power, lightweight, compact and cost-effective products to our government and military customers," said Geleman. "As a global company, we are committed to creating best in class technologies to meet and exceed our customers' needs. For both commercial and military needs, Advantech Wireless is uniquely positioned to satisfy the most demanding requirements, on land, sea, air or space. Advantech Wireless is delivering real-world solutions today with more than 20 years of proven field technology and main offices around the world."

Advantech Wireless is a leading-edge wireless broadband communications solution provider. Since 1988, Advantech Wireless designs, manufactures and deploys networking for broadband connectivity, broadcast solutions, video contribution and distribution, mobile 2G, 3G and LTE backhaul and DTH & DTT video distribution, using satellite and terrestrial wireless communications. The company's products include VSAT Hubs and Terminals, world-leading GaN technology High Power Amplifiers (SSPAs), Block-Up Converters (SSPB), Frequency Converters, Satellite MCPC/SCPC Modems, fixed and deployable Antennas, Antenna Controllers, Terrestrial Microwave Radios, Routers and ruggedized military products.

To learn more about Advantech Wireless, access their infosite at:
<http://www.advantechwireless.com/>

About the author

Mr. David Geleman founded Advantech Wireless in 1988, serving initially as President and, since March 2006, as Chief Executive Officer. Prior to founding the Company, Mr. Geleman has held various positions at Nortel Networks, including Manager of the Transmission Networks Division, where he managed and supervised teams that developed several key Point-to-Point (P2P) radio systems. Mr. Geleman holds a Master's of Science degree in Electrical Engineering (MSEE), specializing in Wireless Communications and Broadcasting from the Moscow Institute of Telecommunications.



Asia Broadcast Satellite

Year In Review
2013

By Mohamed Youssif, Chief Operating Officer

Asia Broadcast Satellite (ABS) was established in 2006 as a Bermuda company. This is a young and fast growing global satellite operator, with an entrepreneurial and creative business approach. ABS has offices and executives based in Bermuda, United States, Dubai, South Africa, Germany, Philippines, Indonesia, Malaysia and Hong Kong.

ABS is majority owned by the Permira funds, which are advised by European Private Equity firm Permira. The Permira funds acquired ABS in 2010. Historically, the Permira funds have been a leading investor in the satellite industry with substantial ownership stakes in Intelsat and Inmarsat.

ABS operates a fleet of five satellites and has procured three satellites, allowing ABS to provide global coverage to our customers. These satellites include: ABS-1, ABS-1A, ABS-2i, ABS-3 and A degrees East and 116 degrees East. The high powered ABS-2 satellite will be launching in January of 2014.

The two other planned satellites include the new Boeing 702SP satellites, ABS-3A and ABS-2A, which are scheduled to launch in 2015 and to be slotted at 3 degrees West and 75 degrees East locations, respectively. We are also evaluating the business case for additional satellites serving premium, high growth regions.

In addition to the successful expansion of our global fleet, we have invested significantly in our ground facilities and teleports in the Philippines, Bahrain and Tel Aviv. ABS has signed a multi-year and multi-million dollar contract agreement with FOX International Channels Philippines Corporation (FIC) for MCPC services, playout and satellite capacity on ABS-1 and ABS-2 satellites.

We have made several senior executive appointments in 2013 globally as we continue to grow and expand our leadership level and expertise. Henry Au-Yeung is the Chief Network Officer (CNO) primarily responsible for network and teleport operations. In Africa, Felix Damiba is the Managing Director responsible for business development, sales and operations. We have hired a number of sales, engineering and risk management executives joining us in Africa, Dubai, Hong Kong, Malaysia and the United States. They bring a wealth of experience in sales and customer relations. Also, I have the privilege of joining this exciting company as the Chief Operating Officer (COO) responsible for global sales and revenue.

The satellite service industry continues to grow in spite of the massive developments in terrestrial and wireless technologies. For instance, WiMax communications pose a threat to satellite signals transmitted in the C-band frequency. In countries where WiMax services have been introduced, there have been significant interference issues and services interruptions for satellite ground stations and related services.

We at ABS are continuing to work with International Regulatory Bodies, such as the ITU, Industry associations, administrations and other satellite operators, to lobby and protect our satellite spectrum and networks. Discussions on spectrum sharing will be continued at the next World Radio Communication Conference in 2015 (WRC-15) and ABS will be participating in the various working groups of the ITU R sector and following the discussions.

We are also seeing oversupply of capacity in certain markets. With more satellites being launched by governments around the world, and fierce competition from regional satellite operators, there are concerns of sustaining supply on certain regional markets. For us to remain relevant in these times of oversupply, we have looked at creative ways to procure satellites and deliver capacity to end users more affordably. ABS' strategy of signing a multi-satellite procurement contract with Boeing for all-electric propulsion satellites (ABS-3A and ABS-2A) and with SpaceX for dual launch service has allowed ABS to get similar economies of scale as that of larger operators. As a result, ABS' cost-per-transponder price for a 50 transponder satellite that can be built in less than 26 months is similar, or less than, that of a large 80 to 90 transponder satellite with a 30+ month program and a much larger Capex investment.

In January 2014, the launch of ABS-2 will bring valuable and extended capacity at our prime location 75 degrees East. ABS-2 will have 89 active C-, Ku- and Ka-band transponders (more than 135 C- and Ku-band 36MHz equivalent transponders). Serving four continents, ABS-2 will have excellent coverage over Africa, Asia Pacific, Eastern Europe, the Middle East and CIS/ Russia regions. Direct-To-Home (DTH) services will be provided on six dedicated, high-powered Ku-band beams, as well as multiple connectivity options. Connectivity requirements for MEA (Middle East, Africa) and SE Asia will be accommodated by high-powered C-band beams. The Ka-band beam will offer cost effective solutions for commercial and military applications in the MENA region.

ABS-1 will be redeployed to 159 degrees East in the first half of 2014 and will be renamed "ABS-6." The satellite will provide excellent coverage over the Pacific Ocean and East Asia region at its new location. The high-powered C and Ku-band beams will be highly suitable for maritime, VSAT, TV distribution, IP trunking and Cellular backhaul services.

Our two procured Boeing 702SP satellites (ABS-3A, ABS-2A) remain on track and are targeted to launch in 2015. ABS-3A at 3 degrees East will bring 48 C- and Ku-band 36MHz equivalent transponders into the Americas, Europe, Africa, the Middle East and extending into the Atlantic Ocean region. ABS-2A at 75 degrees East will be equipped with 5 dedicated Ku-band beams covering Russia, India, South East Asia, Africa and the MENA region.

These satellites are among the most technologically advanced and cost effective commercial satellites using cutting edge technology and will provide additional coverage over the Americas and the Atlantic Ocean.

Moving forward, ABS is committed to the long term global growth of the company by exploring innovated opportunities to increase its fleet and global footprint. We are continuing our efforts to secure more expansion slots and leveraging our orbital locations by bringing in new satellites that will compliment and expand our global fleet.

For additional information regarding Asia Broadcast Satellite, access:
<http://www.absatellite.net/>

About the author

Mohamed Youssif is the Chief Operating Officer for Asia Broadcast Satellite.



By Tore Morten Olsen, Head of Maritime

2013 has been a significant year for VSAT coverage growth, technology innovations and major contract wins. The market continues to demand greater coverage to ensure link availability in mainstream and remote maritime regions whilst the increasing number of value adds and VSAT products is improving the value proposition for the maritime clients. This will continue to evolve especially with the introduction of the next generation HTS satellite networks.

In February, we signed a multi-year renewal agreement with Intelsat for C-band capacity to be used by our customers in the Mediterranean, Atlantic Ocean, North Sea and Gulf of Mexico. We extended this in the summer with a significant contract for 100MHz of additional Ku-band capacity on the Intelsat 907 satellite, to serve North Sea and European waterways users.

This capacity will serve an increased requirement for high bandwidth by the oil & gas industry in the North Sea, a market sector that leads the way in high-end requirements for completely customized VSAT networks. Companies like Petroleum Geo Services, who asked us to provide a 12Mbit/s dedicated return link for their seismic survey vessel Atlantic Explorer earlier in the summer (*Editor's note: read more concerning this subject on page 32 in this issue*) are at the very cutting edge of VSAT usage. Our services are often used for highly demanding and often hazardous operations as well as day-to-day running of drilling platforms and offshore vessels, so the stability and reliability of the link is vital. In order to meet these high-end requirements, we have to ensure we have more than enough capacity available at all times, for now and the future.

In October, we also announced VSAT coverage extensions with two other key space segment partners. Enhanced capacity on Eutelsat's E36B will provide improved services and more bandwidth for users operating in the Mediterranean and Middle East, in addition to the area North of Norway and Russia (Barents Sea). We already offer coverage from multiple satellites over these regions, ensuring high service performance and availability for ship-owners operating there but our commitment is to always have coverage available for changing needs and new customers.

Also announced in October was new Ku-band capacity on SES' AMC-21 satellite, enabling more comprehensive coverage over the US. As part of the capacity extension deal with SES, we moved from AMC-9 to AMC-21, which provides enhanced coverage over the Gulf of Mexico, the Caribbean Sea and part of the North Atlantic Ocean, so customers, especially in workboats and the leisure sector will see improved performance and availability of their satellite services.

The coverage extensions in 2013 support our entire service portfolio including standardized VSAT services for core sectors such as maritime transport, leisure and fisheries. The capacity is providing vessels with an attractive solution for their data and voice requirements. Ku-band VSAT exceeds the speeds of the fastest L-band services while offering unlimited data, but we have also seen significant growth among our broadband MSS users with Fleet Broadband, a product which may be better suited for some segments of the market.

With many ship-owners focusing on dual strategies of crew welfare in order to attract and retain the best people, and vessel efficiency in order to reduce costs, the availability of more, less costly data is an important development. For crews, offering low cost voice calling, reliable email and access to the web for browsing and social media is today a real necessity. While for vessel efficiency, the use of engine monitoring applications, e-documentation and replication of servers on land, as examples, is growing significantly. By sharing vessel and fleet data, shipping companies are taking greater control of fleet activity and are seeing tangible savings. VSAT services now offer the bandwidth and coverage required at affordable fixed monthly costs, so operating expenses can be optimized even further.

Many major ship-owners upgraded to Ku-band VSAT in 2013. In April, German ship operator Hartmann Reederei selected our standardized Ku-band VSAT services for its diversified fleet of 74 vessels. By upgrading its existing Inmarsat E&E services, Hartmann sought a new communications platform to cater for its most important needs: Improve crew retention, increase operational efficiency and facilitate IT management remotely.

Based on the WaveCall Ku-band service and XChange solution, this is the largest major contract to-date using new bandwidth allowance packages that we developed to maximize value for customers upgrading from L-band services. The packages provide a significant bandwidth increase for crew connectivity at a very low per MB cost, with add-on data packages available if needed. Revenue from offering improved crew connectivity is offset against fixed and predictable service costs, enabling Hartmann to choose a service that enables far more bandwidth and flexibility. The new bandwidth allowance packages come in affordable increments of 5, 10, 20 and 30 GB to meet different consumption needs among ship owners.

In August, we announced another major customer for our standardized VSAT services. CMA CGM Group, the world's third largest container shipping group, selected us to upgrade the majority of its fleet to WaveCall VSAT, again in combination with the XChange solutions platform. WaveCall will be installed on over 35 CMA CGM vessels, including the CMA CGM Jules Verne, one of the largest container vessels in the world. As CMA CGM's fleet covers global trade routes, extensive Ku-band coverage was a key requirement when choosing WaveCall. The proposition to CMA CGM is based on a cost-effective 5GB/month data plan, which enables a significant increase in email, web browsing and voice calling, when compared to the 200MB/month FleetBroadband packages used before.

In addition to expanding our coverage, we have also worked hard at improving the procurement and installation aspects of VSAT, which have traditionally and understandably, been quite complex in the maritime sector. As part of our work to make standardized VSAT a highly defined product, we have developed a concise antenna installation and commissioning system that will support engineers and crews to have vessels fully connected in just 24 hours.

This means that Ku-band services can be installed during scheduled port-calls anywhere in the world, without affecting a vessel's operational schedule. With field engineers all over the world, we are able to board a vessel in port and have the VSAT connectivity up and running very quickly as long as the operator and owner agree to support the process by preparing certain aspects in advance.

So, coverage really is key in the maritime SATCOMs arena, but 2013 has also been a significant year for technology development at Astrium Services, with significant upgrades to our XChange network management platform and our value added portfolio of business tools for shipping companies.

We have also been involved in many cutting-edge projects, such as the development of hybrid networks offering least-cost routing from a choice of carriers, on ferries in Scandinavia. Looking forward, we will continue to grow VSAT coverage across the oceans and closely follow the development of HTS for maritime users. With reliability and high speed links over HTS even in very remote areas, the potential for shipping customers to offer even more crew welfare facilities and reduce operational costs further through vessel efficiency is very high.

Because of this, our commitment is to continue to develop the value of our broadband solutions through continued focus on innovation and coverage improvements, helping maritime stakeholders to further benefit from advanced satellite communication solutions. We will make these services as widely available as possible to all of our customers in the coming years.

Further information regarding Astrium Services Maritime:
<http://www.astriumservices.com/business-communications-maritime/>

About the author

Tore Morten Olsen holds a M.Sc in Telecommunications from the Norwegian Technical University from 1993, and has participated in Executive MBA programs at Wharton Business School in the United States, Insead in France and Stockholm School of Economics in Sweden. He has 19 years of experience in the satellite communications sector, starting out as a technical product manager in 1994 and moving on to hold several senior management positions with Telenor, Marlink and Astrium Services.



By Kurt Peterhans, Chief Executive Officer

It's one thing to tag yourself as an industry leader, but quite another to have the numbers that back up the assertion. Axiros, a Germany-based company focused on open device and service management, is able to do both. With an installed productive base of more than 127 deployed solution platforms worldwide and as the leading subscriber device management system—deployed and productive at more than 35 percent of Europe's top 50 operators and carriers—the company has earned its position atop the telecommunications industry.

Founded in 2002, Axiros is 100 percent management-owned and self-financed and prides itself on a highly flexible business approach. Additionally, the company is a leader in the TR-069 protocol, having played a key role on the Broadband Forum, a non-profit industry consortium dedicated to developing broadband network specifications. "We keep a laser sharp focus on customer needs and industry shifts," said CEO Kurt Peterhans.

Axiros' solutions are delivered across fixed and mobile networks for consumer, enterprise and M2M markets. They are scalable, flexible, modular and open, giving providers the ability to manage and support any protocol, device, or service at any time. Products offer a fast time to integration and a very short release cycle, resulting in an impressively high return on investment.

Over the past few years, Axiros has made a concerted effort to extend its reach beyond Germany. In the past six months alone, it has closed deals with Mobily in Saudi Arabia, Optimus in Portugal, Spectranet in Nigeria, Vodafone Iceland, and Une in Columbia.

In addition to its Munich, Germany headquarters, Axiros has sales and service subsidiaries in Milan, New York, Aarau, Sao Paulo, Lisbon and Kasaan.

Peterhans attributes much of the company's success to his team's unyielding commitment to performance controls: Market position; innovation and performance; productivity; product appeal; liquidity and cash flow; and profitability. "From day one, we've made a concerted effort to always keep these parameters—along with customer service—front of mind," he said.

The Move Into Satellites

The move into satellite as an access technology is new territory for Axiros. The company recently signed a deal with ViaSat, whereby ViaSat will leverage Axiros' technology and expertise for its own satellite services as well as for those it resells to other satellite providers. The deal marks ViaSat's first deployment of the TR-069 protocol over satellite and, Peterhans says, the move presents exciting possibilities in the satellite market.

"I have no doubt that satellites will have a major impact on all the players along the value chain—manufacturers, operators, service providers, equipment vendors and end-users, from government to broadcasters to individual Internet users," he said. He says that his company is already seeing surging demand for bandwidth and feels strongly that high throughput satellites will accelerate this trend.

"Service providers are making plans to capitalize on these growth opportunities by adding new hubs, upgrading to faster remotes and deploying larger networks," he said.

Looking Ahead

Peterhans believes that the fast, flexible approach that has served his company well in the past will be instrumental to its continued success. "Absolutely, we must be responsive to customer needs," he said.

Other factors that he deems critical to making inroads in the satellite industry include highly efficient business operations and a fully optimized network that allows providers to understand exactly how it's being utilized by each individual remote across the entire deployment. "Any inefficiency represents bandwidth that can be reclaimed and marketed," he said.

Also on his list is open device and service management. "This is really at the heart of the industry's future because it touches every aspect of the communications business. It's where key events are managed and important decisions that impact profitability, growth and differentiation, are made. It's also the place where you get to know customers and respond to their needs."

Peterhans believes it will be critical that these platforms drive productivity inside the Operations Center, offer flexibility so that users can customize to individual tasks, and automate core operations, such as troubleshooting. Outside the OC, he says, there will be an increasing need for solutions that are constantly available on any mobile device.

"Workflow customization, automation and mobile access enable superior customer service and lower costs and risks," he said. "A device management solution is the window into satellite networks. It should provide a deep and broad view, detect and resolve inefficiencies at the individual remote level, and provide insight to how bandwidth is allocated across every remote. With this view, you can turn every bit of bandwidth into revenue."

Other features include the ability for customers to view real-time data and bandwidth utilization reports, and the ability for them to interact with the network through self-service features, such as ordering additional bandwidth or changing the service level.

He believes all of this should lead to an open API feature that enables service providers to create tailored apps for their customers.

This open system is where Axiros is firmly rooted and, as Peterhans sees it, where the industry is heading. "An open technology enables the NMS to connect with other business systems, such as billing and inventory, integrate with terrestrial networks, and even provide inter-network roaming with other service providers. That's the key to gaining greater insight across a customer base, network and business," he said. "With the right protocol, you can quickly adapt to change and find new ways to grow your business."

Additional Growth Opportunities

Peterhans says that the industry is constantly in a state of flux, and already, he can see other opportunities for growth. Ultra-HD, new broadband applications and other advanced services continue to increase the demands on satellite communications systems. Service providers will need answers to a set of questions they have yet to ask.

"Ultimately, the winners in the satellite industry will be those who are smart about how they distinguish their services, are hand-in-glove with their customers and operate at peak performance. More than ever, device and service management will be the game changer."

For more information regarding Axiros, please visit:
<http://www.axiros.com/>

About the author

Kurt Peterhans possesses more than 14 years experience in business and IT management. While working for companies such as Microsoft, Lucent, Vodafone and International Network Services (I.N.S.), he headed up national and international projects as a management consultant. At o2 Germany GmbH, Kurt worked as a senior process manager, responsible for IT operations, IT change and configuration management. His professional interest is in ICT and IT project management, process management, ITIL, PRINCE2, CobiT and IT Governance. His particular interest is IT business alignment—that is, to make IT more efficient and profitable through economic means.



Bridge Technologies

Year In Review
2013

By Simen K. Frostad, Chairman

Looking back as we reach the end of 2013, it feels as if the sun really came out this year. Not just during a long spell of unusually fine summer weather, but also in the sense of a resurgence in business confidence after the long drawn-out economic chill since 2008.

It won't seem that way in some of the hardest-hit regions, and I don't imagine that too many financial experts consider the global economy to be in great condition even now, but in our industry it feels as if 'cautious optimism' is prevailing over the wait-and-see attitude everyone feared during the past five years.

This has been reflected in a surge of activity for Bridge Technologies and an incredibly busy year fulfilling big new contracts, accelerating the R&D effort, extending our existing solutions, and launching new product ranges. Even during the 'recession' we managed to achieve record growth increases year-on-year, so now that the climate is more positive there's been an additional impetus to that trend. 2013 has been quite a ride.

However, the industry's reaction to recent straitened times has had some long-term effects: Buyers want more elegant solutions that provide tighter integration and lower costs. Aside from looking for a competitive deal on initial investment, buyers are more sensitive than ever to the small gains in operating cost savings that add up to large gains when rolled out across a sizeable infrastructure. These are now such a large part of the ownership cost that they can easily outweigh the importance of the initial investment in a buying decision. So a robust multi-talented, highly integrated solution that offers great value, low maintenance costs and big energy savings over a useful life extended by frequent upgrades (preferably at no extra charge) is the holy grail for today's buyers.

Fortunately, we provide all of the above, and these requirements have always driven our product design. Based as we are in Norway, it's natural for us to consider eco-friendliness in everything we do. Our high-performance hardware probes consume just 35W, compared to the hundreds of watts required to run a server-based product and keep it cooled. When you roll that out over the hundreds of installations our larger network customers deploy, it adds up to some big savings.

An operator can achieve big savings, too, from the infrastructure streamlining made possible by more efficient and accurate technology. Protecting against the possibility of failure is expensive: it means operators have to replicate systems to provide secure backup capability. Anything that can minimize the reliance on backup infrastructure offers potential gains.

One of the most exciting Bridgetech product launches this year is our VB273 Intelligent Satellite Redundancy Switch (see *product photo below*): A smarter, more sophisticated way of automating redundancy switching that goes far beyond the relatively crude capability of previously available solutions.



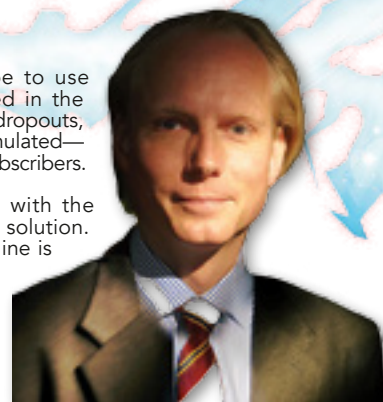
Accuracy in monitoring systems saves the customer money. It provides tighter control and greater reassurance—all of which adds up to a sounder basis for planning and infrastructure design, as well as quicker resolution of operational faults.

Much of our R&D effort focuses on raising the level of accuracy customers can expect from a monitoring system, and one innovation we've introduced this year as part of our rolling program of free software upgrades is the capability to trap microbursting, which most monitoring solutions miss because it can occur between sampling intervals.

Accuracy of data to support decision-making has been the design goal for another Bridgetech launch this year. QoE (Quality of Experience) monitoring aims to provide validation of the quality of service as perceived by the viewer. But for many years QoE systems have been based on an algorithmic simulation of the 'average viewer' and statistical weighting techniques similar to those employed in market research. These techniques are derived from the telecoms industry where panels of listening experts were quizzed on their impressions of sound quality over phone lines. It is a somewhat inappropriate way of assessing QoE in a broadcast/media context, with the methodology providing built-in statistical fuzziness rather than empirical precision.

A more rational approach would be to use the objective criteria commonly used in the broadcast/media industry (jitter, frame dropouts, buffering, etc.) to collate a real—not simulated—picture of the service quality reaching subscribers.

So that is what we are introducing with the Bridge Technologies Objective QoE solution. The first product in this new product line is the VB288 content extraction system (*product photo below*). The VB288 delivers visual content extraction, status displays and alerts to a virtual videowall display that can be viewed through any browser in any location, giving engineers—at the operations center or on the move—instant feedback on service quality. The



Objective QoE solution means media providers can now look forward to exact and detailed data on the viewer experience, and better business as a result.

We are fortunate in being able to work very closely with our customers, and there's a constant stream of product development ideas that comes from this dialog. When the customers we work with are pioneering new industry developments it means we stay ahead of the wave too, and we've been pleased to be first in the industry with integral support for MPEG-DASH in our monitoring systems, and with a solution for the first DVB-C2 rollout.

These up-and-coming industry changes are inevitably accompanied by some 'retirements' as technologies become outmoded or rejected by the market. The waning interest in 3D is evidenced by the number of operators dropping it from their offering, with Netflix among the latest. But one door opens as another shuts, and looming on the horizon for 2014 and beyond is UltraHD—which will keep the industry busy for some time to come.

To learn more about Bridge Technology products, access their website at: <http://www.bridgetech.tv/>

About the author

Simen K. Frostad is the Chairman of Bridge Technologies.



By Casper Jensen, Vice President, Maritime

With the official establishment of Cobham SATCOM in October 2012, the focus in 2013 has, amongst others, been on bringing together two of the biggest maritime communication brands—SAILOR and Sea Tel—into a single organization.

Progress is good—we now have a fully aligned global sales force capable of supporting customers across both portfolios. A new integrated R&D function consisting of the combined expertise of SAILOR and Sea Tel engineers is already paying dividends in terms of faster and more efficient development of new antenna technology.

In fact, using the established SAILOR 900 VSAT platform as a starting point, our new sub 1m antenna, SAILOR 800 VSAT (pictured below), took just six months to go from concept to market, so we are satisfied with our engineering progress to date. This new 83cm antenna has been well received in the market, as it offers the same RF performance as competing 1m Ku-band antennas in the market. This is important in the maritime world where on many vessels, real-estate is at a minimum, but with SAILOR 800 VSAT, we are offering an antenna that can function on more reliable and stable Ku-band services, at a much smaller size than antennas usually required for this level of performance.

In addition to technology development in 2013, we have also worked hard to integrate the global service function of SAILOR and Sea Tel. In maritime SATCOMs, service capability is vital, as it is a truly global industry. Having cross-trained and up-skilled our network, and increased the number of service centers throughout the year, we feel that Cobham SATCOM is in a strong position in terms of supporting our customers and end-users.

Potential Transition

The maritime communications market itself is on the cusp of a potential transition. With Inmarsat Global Xpress (GX) scheduled to go live during 2014, and with global coverage by end 2014 (according to Inmarsat), some fleet and vessel operators considering a communications upgrade may take a 'wait and see' stance.

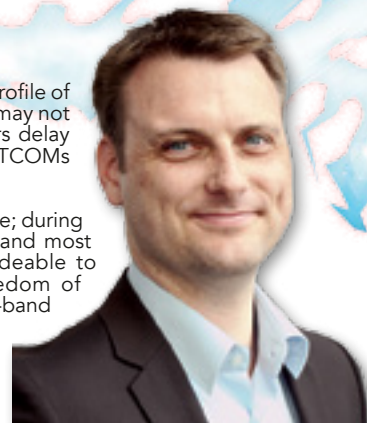
Cobham SATCOM is a GX launch partner. The new constellation will enable a next generation of maritime communication services, so it's understandable that some shipping companies might delay their decision. The need for more bandwidth continues to be a growing demand need across the industry; there is considerably greater demand today for IP data than there was even two years ago, driven by the desire to cut costs and provide crew welfare facilities.

Fuel is the largest single cost for shipping companies and by using applications designed for vessel and fleet optimization, significant savings can be made. Even a few percentage points off the cost of fuel is enough to persuade the industry that new technology designed for, in example, engine monitoring and route planning, is a wise investment.

Collaboration is key here and a core aspect of these systems is that they share vessel and fleet data with the organization on land, which, of course, is where the

SATCOMs aspect comes in. With the profile of optimization growing in the market, it may not be efficient that owners and operators delay when it comes to upgrading their SATCOMs to enable the use of such technology.

Our engineering answer to this is simple; during 2013, we have designed our newest and most popular antennas to be field upgradeable to GX, which gives end-users the freedom of choice. It's now possible to select a Ku-band service, with fixed monthly costs and more bandwidth than legacy L-band services (of which we have supplied over 500,000 terminals for) and still consider moving to Ka-band when services are available, without the cost or inconvenience of replacing your antenna or electronics on board. With this capability, there is no need to 'wait and see,' as it's possible to upgrade now and still switch to GX later.



Continued Development

2013 has, again, been an interesting year for our FleetBroadband products, as we have actively developed specific market sectors where smaller vessels are the norm, such as commercial fishing and workboats. These industry sectors have similar demands as the shipping sector, but with fewer crew and smaller vessels. We have found that SAILOR 150 and 250 FleetBroadband are ideal products for this market.

FleetBroadband has been a highly successful product since 2007, not the least of which has been within the merchant market. However, the shift in usage of SATCOMs at sea and the demand for more data means that Ku- and Ka-band VSAT are now seen as serious options when considering coverage, bandwidth and costs.

Thousands of vessels use FleetBroadband (we have shipped more than 30,000 terminals) and will continue to do so, which is why we are still very much involved in development for one of our best performing products ever produced. In addition to enabling Multi-Voice on our entire SAILOR FleetBroadband range in 2013, we also introduced new solutions, including the SAILOR FleetBroadband Dual Antenna solution, which we launched at the Nor-Shipping exhibition in June.

Consisting of two SAILOR 500 FleetBroadband solutions and a Dual Antenna Control Unit (DACU), which can automatically switch between antennas without loss of connectivity, the system overcomes challenges experienced when a single antenna may become obstructed by superstructure, masts, rigging and other equipment on board. This makes it ideal for specialist vessels that use critical IP applications over FleetBroadband, where loss of connectivity could significantly affect the outcome of a costly or hazardous operation.

Regardless of future services, the status quo in 2013 was mostly unaffected. Ku-band is growing as ship-owners understand the benefits of more bandwidth and fixed communication costs whilst novel uses or new markets support a very active FleetBroadband user-base. How much of the market, in terms of antennas, GX will attract is of interest of course, but with our most advanced SAILOR and Sea Tel Ku-band antennas based on the latest generation of satcom technology already Ka-band ready, ship-owners and operators can be prepared for the transition when it comes.

Additional details at: <http://www.cobham.com/>

About the author

Casper Jensen holds overall responsibility for developing and implementing strategies for Cobham SATCOM's maritime satcoms and radio product range. After earning an Engineering Masters degree, in 1999, he joined Thrane & Thrane. He now leads the maritime activity at Cobham SATCOM, an organization that was formed following the acquisition of Thrane & Thrane by Cobham plc.



European Communication Services

Year In Review
2013

By Eran Avni, Chief Executive Officer

European Communication Services (ECS) enjoyed solid growth in 2013. Our chief markets in Europe, Africa, the Middle East and Central Asia all showed promise and our business continued to expand this past year.

ECS provides End-to-End TV and radio distribution services through premium satellite packages and leading cable operators. We work with broadcasters seeking to augment their market footprints and enlarge their businesses—primarily to specific audiences. Specializing in broadcast solutions for DTH, DTT and IPTV, we offer TV Channels and broadcasters secure access to satellites, cable operators and terrestrial packages throughout Europe, Africa, the Middle East, North and South America, Asia, and Australia.

The most important part of business today is finding the best method to marry traditional broadcast together with New Media solutions. This combination is proving to be an excellent business area for ECS and being able to provide technology packages fitting both sides of the equation make us a one-stop shop. With markets facing finance challenges, including those in Europe, we excel in bringing cost effective solutions together with reliable technologies and services.

As a nimble player, we create solution tailored for our clients. Working together as partners, we bring them new ideas based upon our vast market knowledge, extensive market research, deep understanding of technology, and exciting business relationships. Giving our customers the technologies that provide the most effective penetration to reach their target audiences is our greatest advantage.

To reach every corner of the globe, our turnkey media delivery solutions meet our clients' varied needs and provide solutions in numerous formats due to our unique business model that brings consultancy and market analysis as well as the full set of technical know how required to establish and deploy the best solutions for our customers.

For instance, this past year we expanded operations in Asia. For a number of broadcasters, we provide full solutions from playout to signal backhaul to content distribution. Our 24/7 monitoring teams ensure that their channels reach their audiences. In another case, we are using OTT technology to bring a broadcaster's content to all of its customers—where ever and whenever they choose to view content. All together, the blend of technology and content makes the future exciting.

I would have to say that this year we really saw a growing interconnection and integration of traditional broadcast and New Media. As we specialize in developing markets, we put together exciting solutions.

For some customers, due to the paucity of fiber networks and stable Internet connections, we used backhaul satellites. Infrastructure in their local markets was not developed enough for uploading their content files to our FTP server for playout. However, as technology is pushing forward quickly, we supplied a solution, at their request, that included OTT solutions and brought the channel out as a mobile application. In their market, broadcast may not possess the infrastructure, yet our client is not waiting around and is already moving into the mobile arena.

During the past year, and we believe that this will continue into the future, Africa and the Middle East have been a strong focus of our work. We have identified two intertwined trends for the international broadcast industry...

- Local or regional channels seeking access to a world-wide diaspora market
- European-based channels seeking broader access to what we call their 'home markets'

This is true in Diasporas in South America as well as in the Middle East, Asia, and Africa. This has led to business development for ECS around the globe on projects that reach audiences 'back home' and all around the world. Integrating various models through multi-platform broadcast solutions is key to future development of African and joint European-African markets. ECS is excited by these markets and is developing business practices to serve these needs.

ECS also helps open up the growing OTT universe for a client's viewers via our IPTV Platform Services, our Over-The-Top (OTT) Solution, and Cloud services. With immediate access to hundreds of channels, our IPTV platform provides options and innovative services such as Video-on-Demand (VoD) and Catch Up TV for viewers who want to watch a program, post-broadcast. This service is part

of ECS' growing OTT universe.

The comprehensive Over-the-Top solution offers multi-screen OTT video distribution for telcos, broadcasters and content owners. On multiple devices, from tablets to smartphones, laptops to PCs, online TVs to IPTV, viewers can browse, chat and interact simultaneously, with a superior viewing experience, which lengthens customer capture penetration time.

The solution produces an exceptional, seamless, interactive HD viewing experience by leveraging TV broadcasting and the Internet. Enabling live and On Demand content streaming over any type of network, from Wi-Fi, 3G, 4G / LTE to Fixed and Satellite, this solution delivers fast channel switching in under a second to ensure a high level and enjoyable experience for viewers.

The ECS Cloud OTT Solution features:

- Highest Quality—Unparalleled Interactive HD viewing experience
- Multi-device—TV, PC, Smartphone, Tablet, IPTV, plus more
- Full Featured – Multi Screen, Catch-up, DVR, Live Record and full interactive EPG Listing
- Fast channel switching
- 24/7 Help Desk— Comprehensive Monitoring and Support service
- Total Management—Billing, Analytics, Monitoring and Reports
- Simple to use—Shortens product time to market
- Cost Effective— Reduces resource costs
- Scalable for growth

Another growth area for the company is our Transportable Flyaway systems, which go where the news happens. Working with our broadcast partners, we can rapidly deploy our systems to extremely remote locations so that your feeds reach their destinations. We offer state-of-the-art mobile production units as well as complete fly-away resources. Our vehicles are fully equipped with SD & HD cameras, sound mixing consoles, monitors and technical staff, to ensure your needs are met. We also provide a complete range of audio, lighting and other equipment necessary for coverage of your events. We work with GPS equipped systems with high quality digital capabilities (we have analogue, if required). By connecting to our UK-ground station, we provide playout services, as needed.

Further information at: <http://www.ecs-tv.com/>



By Susan Saadat, Vice President, Sales

This has been another successful year for ETL Systems, and this is shown by the company's recent international growth. Former Intelsat and Harris Caprock SATCOM executive Susan Saadat, who was appointed as Vice President to lead the new venture, takes us through ETL's year.

The year 2013 has been one of advancement and change for the satellite industry. A live sports game was broadcast in 4k for the first time, July saw WBU-ISOG pass a resolution to make Carrier ID compulsory, and the impact of High Throughput Satellites has opened new opportunities for many companies, while others have yet to find their place in the market.

For ETL Systems, a global designer and manufacturer of RF distribution equipment based in the UK, 2013 has been defined by growth. The British brand opened a regional headquarters in Washington DC in February to take advantage of ongoing and rapid expansion on the continent. The expansion will support ETL Systems' already strong presence in the U.S. market, which accounts for more than 60 percent of its total annualized broadcast, satellite communication, system integration and government orders.

ETL is now aiming to grow its presence in North America by providing faster sales support and making more face to face visits possible, alongside extra on-the-ground hardware and software technical support.

To help drive the international focus from the new U.S. office, Bill Pryle was appointed as International Sales Manager after joining ETL from ATCi. Bill spent more than 25 years with ATCi, where he was responsible for sales to the Eastern U.S. region and specialized in government and commercial SATCOM projects. Alongside sales, he has strong engineering experience in the design and installation of satellite teleports. He has already worked closely with ETL's RF distribution products and brings a sound knowledge of the US and International satellite markets with him.

ETL experienced an increase in sales during 2013, partly due to the advancement of specialist RF products, including the launch of a new switch matrix / router—the 16x32 Valiant RF Matrix, which is the newest addition to the V-series range. The family, designed and built at ETL's base in the UK, includes the 128x128 Vulcan Matrix Router, the 64x64 Vortex Matrix Router, the NEW 16x32 Valiant Matrix Router and the 16x16 Victor Matrix Router. All are capable of remote control via serial or Ethernet port with SNMP and web browser interface. The Valiant Switch Matrix was launched for the first time at SATELLITE 2013.

Early take up of the V-series products included ETL's VTX-10 matrix being used by a major international sports broadcaster in Singapore to upgrade its downlink system. ETL's NGM-21 has also been used by a tier one telecoms service provider for the upgrade of downlink stations in the Asia region and ETL's Modular system chassis has been installed by one of Asia's fastest growing satellite operators with a mixture of splitter and combiner modules for receive and transmit paths.

ETL has worked with global satellite operators for many years, and these SATCOM users form the backbone of our customer base. The whole range of standard and custom build products has been used by satellite operators, in both TT & C, monitoring and traffic management roles.

When satellite operators wanted to transition from IF to L-band for a lot of their signal routing, ETL was there—our hot swap matrices are in use all over the USA and Europe in leading Earth stations. When satellite operators needed to add high resilience line amplifiers, we were again able to develop products to provide solutions.

In example, a leading European satellite operator wanted to upgrade their approximately 120 RX and TX signals. They used ETL's modular system. On the RX chain, each signal firstly hits a variable gain, variable slope compensation amplifier—this is designed to compensate for cross site cable losses as well as to balance levels as they come into the main equipment room across the RX feeds.

Each feed then hits a custom-build 4-way active splitter, again with variable gain, but independently settable for each OUTPUT of the splitter. This means that one (or more) weak channel can be boosted as required to again give a balance and optimize RX signal performance. The TX chain is similar with combiners and amplifiers again balancing feeds and cable losses.

A second example encompasses a new Middle Eastern satellite operator who is using ETL's NiGMA L-band switch matrix for its fan-out or distributive RX signal

distribution and for its fan-in or combining TX signal routing. They selected ETL NiGMA due to its very good RF performance and the strong requirement for resilience—NiGMA's 2-stage architecture means one RF card for each input and output, de-risking the whole ground station considerably.

ETL is also advancing in the military sector, playing an important role in the development of a new military radio product which provides tactical satellite communications to aid soldiers on the move in hostile environments. This crucial technology uses a new antenna with the ETL custom build mode which can then be fixed to a vehicle or soldiers backpack to enable ultra high-definition radios to be used for L-band satellite communications. ETL's specialist engineering team worked together with its client in developing a design concept through to delivering product ready units which have recently been successfully implemented and deployed.

The ETL NiGMA L-band switch matrix, in RX and TX formats, is being used by at least six NATO governments for intelligence gathering duties, as well as general traffic and data management, and TVRO applications. In general the NiGMA matrix / router is selected in this sector for its exemplary RF performance. ETL has rapidly established an important niche in the government and military sector, particularly for some high performance and often custom build products.

As well as L-band we have also provided a substantial number and size of IF switch matrices, based on NiGMA, TiTan and other technologies to this sector - again for use in down and uplink applications.

ETL has a wider offering of products for tactical HQ's as well as main Satellite Ground Station sites, such as Automatic Gain Control Amplifiers and Hybrid Splitter / Combiner shelves connecting multiple modems to remote VSAT terminals and often providing 10 MHz referencing, LNB and BUC powering.

ETL is going through an exciting period of growth and the brand is synonymous with quality, reliability and great customer service. This is emphasized in everything from the new products being designed, through the manufacture process and to ensuring customer service and aftercare is to the highest possible standard. In 2014 ETL is looking forward to the completion of a new international headquarters in the UK and many other exciting developments.

The company's success was also rewarded in 2013 when it received its third Queen's Award for Enterprise: International Trade, the highest honor which can be given to a UK company. It recognized the company's growing international trade and the fact its resilient RF distribution products are well known for quality & reliability. This success even led to a Royal visitor—HRH the Duke of Gloucester KG GCVO. The company has also experienced sales in new markets including Australia, South Korea, Japan, South Africa and Indonesia.

For further information, access: <http://www.etlsystems.com/>

About the author

With 25 years of sales, management and engineering experience in satellite communications, Susan joined ETL in 2013 to lead the company's recently launched North American headquarters in Washington D.C. She combines her strong engineering foundation and solid track record of achieving high level growth and top line revenue to expand ETL's presence in the Americas.

Susan is recognized for her skills in growth strategies, business operations, process improvement and ROI projects and initiatives. Prior to ETL, Susan held positions at Thrane & Thrane, Caprock, and Intelsat. She was also co-founder of Paragea Communications, a spin off of Comsat that designed and manufactured Very Small Aperture Terminals (VSATs). Susan was recently elected to serve for a two year term on the Board of Directors of Woman In Aerospace. Susan graduated with a Bachelors degree in Electrical Engineering from Syracuse University, NY, a Masters degree in Electrical Engineering from the University of California, Berkeley, and an MBA from George Washington University.



By Jay Monroe, Chief Executive Officer

Globalstar has not had an easy ride. Technology issues in recent years have truly tested the company's ability to fulfill its commercial potential. But with its new state-of-the-art satellite constellation in place, and very big plans to put user-friendly satellite phones in the hands of millions of consumers, Jay Monroe, CEO and Chairman of Globalstar explains that the MSS game is about to change.

If I were to name the overarching virtue that embodies Globalstar in 2013, and makes me most proud of our people and our achievements, it is our resiliency. Globalstar has always been a pioneer. However, being a pioneer is never easy. The technical challenges our network has faced over the past few years are well documented.

However, in August 2013 we completed our new, second generation network. As we embark on 2014, we can honestly say that ours is the only live, complete, second generation satellite network in existence. While our competitors still need years to fully replace their tired constellations, Globalstar's is online and operational. And we did it fully-financed, free of the massive debt commitments that burden so many others in our industry.

We were the first to offer a satellite handheld phone in the consumer space in 2006. Now, after investing more than a billion dollars in our second-generation network, we are all set to build on that solid foundation in a big way.

We estimate that there are around two billion people living or working in areas that are either underserved or even totally unserved by terrestrial and traditional cellular networks. These include populations in emerging economies, as well as workers carrying out duties in remote areas, doing often dangerous jobs that help keep traffic flowing in our cities, that ensure businesses stay up and running, and that keep our homes warm. Also there are those heroic individuals providing emergency care in war zones and where natural disasters have devastated terrestrial infrastructure.

Companies operating in energy, mining, forestry, heavy construction, commercial fishing, utilities, transportation and business continuity rely on us, as do NGOs and governments which need our support for military, emergency preparedness, and humanitarian relief activities. Together with individual recreational users, people in over 120 countries trust Globalstar for their mission-critical and lifeline communications.

With our new network, we are poised like never before to deliver superior quality voice, duplex and simplex data products and services, including our ever-popular and emerging SPOT-branded consumer products to an eager marketplace.

Thanks to Qualcomm-based CDMA technology, Globalstar calls are free of the latency delays that can otherwise make communicating difficult or impossible. Side-by-side tests with other satellite networks have demonstrated our market-beating quality—it's crystal clear sound. You can even hear a whisper.

At the same time, we remain the low-cost provider in the MSS industry. Our commercial strategy during the tough years was to offer service packages at price points that really resonated with businesses, and government agencies, battling with budget cuts and recession, and with ordinary - and indeed extraordinary - people as they enrich their lives with all kinds of leisure and adventurous pursuits. This is a legacy we are enormously proud of and even over our new powerful network, we remain committed to delivering products and services at prices people can afford.

The market recognizes what we've accomplished, which is truly gratifying. During the troubled years, we drove customers into the hands of our competitors. Now they are coming back to us. Government and blue-chip enterprise customers alike have returned to the Globalstar family: ARPU and network usage are on the rise. They tell us why, and their reasoning could not be simpler—Globalstar's superior call quality and real-world affordability.

Now our big challenge in 2014 is to spread the word—Globalstar is back, stronger and better than ever, with lots of new market-friendly products.

It's in mass-market retail where we really see the chance to change the rules of the game. Unlike anyone else in the SATCOM industry, delivering affordable, game-changing products to end-consumers has always been at the heart of Globalstar's business. The innovations we are set to introduce next year take this to a whole new level.

There are some challenges ahead in 2014 that will really test our market—challenges that smart providers can turn into commercial opportunities. For instance, Wi-Fi gridlock is looming on the horizon in the US, with users in cities suffering reduced Wi-Fi performance. Last year alone, mobile data traffic in the US increased by 70% percent. Globalstar is uniquely positioned to offer an immediate solution to this Wi-Fi squeeze. Due to where our satellites are located, and the spectrum we use, we can effectively 'terrestrialize' our services.

Soon the FCC will authorize Globalstar to provide LTE services, a terrestrial broadband capability. We could never ordinarily do this ourselves—we leave this to the big telcos—but our spectrum offers quantifiable value to these players when bolted onto their own networks.

Tests have shown that if the telco and Wi-Fi providers leverage spectrum made available from Globalstar, they can immediately deliver a 33 percent increase in the US Wi-Fi capacity. Our spectrum helps them create a giant pipe, and get the data traffic flowing: This technology will roll out aggressively in 2014.

We are making MSS meaningful in new and innovative ways, while generating a secondary revenue stream, effectively earned in a whole new business. We can see this model being replicated elsewhere.

We are launching a number of products in the coming months. Including SPOT Trace, SPOT Gen3 and our new STX3 chipset. STX3 is our smallest and most efficient simplex unit. This will enable us to work closely with our growing network of VARs to further penetrate the exploding M2M market with smaller, more cost-effective applications and products.

Our new tracker product for consumers and businesses is SPOT Trace, with its launch in November 2013. Priced at just \$100, this tiny unit can be placed in a car, or snowmobile, tractor—or any asset to be protected from theft. If the device detects movement, an SMS gets sent to the owner and the vehicle is tracked.

SPOT Gen3 is the next generation of the SPOT Satellite GPS Messenger aimed at outdoor enthusiasts and adventurers. We launched it in North America in July and sales are booming. We roll out in EMEA and elsewhere in the coming weeks and months.

Just wait until the mass consumer market sees what we have in store for 2014. We have offerings coming down the pipe that will change the way people think about satellite telephony.

Meanwhile, in 2014, the lines that differentiate MSS and FSS will continue to blur. We will be watching closely how users respond - and of course we'll leverage opportunities as they arise.

A constant source of pride is the impact our products have on people's lives. Our SPOT trackers, which have always been popular, have to date been used in over 2,500 rescues—often saving lives—around the globe.

We look back at 2013 with pride in our resiliency, our technological and commercial innovation, and in our steadfast commitment to our customers.

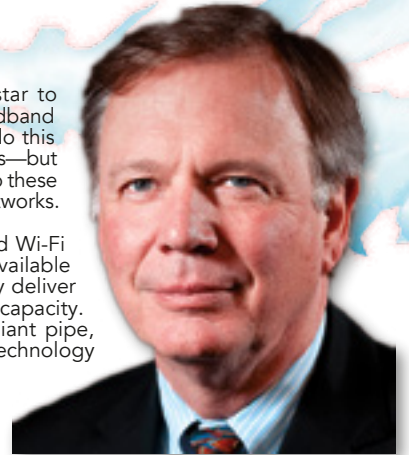
We look ahead to 2014 with unbridled energy and excitement: We are set to introduce a whole new world of communication and connectivity to millions.

For more company information, please access their website at <http://www.globalstar.com>.

About the author

Jay Monroe is Chairman and CEO of Globalstar LLC, one of the world's leading Mobile Satellite Services providers. He has held the Chairman position since the purchase of the assets of Globalstar by Thermo Capital Partners in April 2004, and was appointed CEO in January 2005. Mr. Monroe directs the daily operations and manages the company's long-term strategic growth. Since becoming CEO, Mr. Monroe has launched several major initiatives to extend the quality and reach of Globalstar's service and expand its portfolio of voice and data solutions.

Mr. Monroe has been the majority owner of the Thermo Companies since the group's founding in 1984. Mr. Monroe has overseen operations in a wide variety of companies at all phases of growth from startup through maturity. Under his direction the Thermo Companies founded or acquired companies in diverse industries including power generation, natural resource development, industrial equipment distribution, real estate, telecommunications and leasing services. Mr. Monroe is on the Board of Directors of Thermo Capital Partners and several of its portfolio companies. Mr. Monroe is a graduate of Tulane University in New Orleans.



By Jorge Potti, General Manager of Aerospace

2013 is turning out to be an exciting year for GMV in the Space market. This year, GMV has renewed appraisal at level 5 of the Capability Maturity Model Integration (CMMI) model. Renewal of appraisal at this level represents recognition of GMV's ongoing quest of quality as the driver of excellence and sustainability.

In the commercial space market we've already seen the launch of six geostationary telecommunication satellites that are being controlled using GMV technology: Azercosmos' Africasat 1a, Eutelsat's Es'hail 1 (Eutelsat 25B) and Eutelsat 3D (Eutelsat 7B/Eutelsat W3D), Hispasat's Amazonas 3 and SES' Astra 2E. In addition, the first four O3b satellites and six more Globalstar second generation spacecraft were launched in 2013. And we expect three more telecom satellite launches before the end of the year: Amazonas 4A, Astra 5B and Thaicom 6 (Africom 1).

GMV continues to be the number one worldwide independent provider of ground control systems for commercial telecommunication satellites. Today, the total number of operational telecommunications satellites being controlled with our products is 150 and there are 35 more now being manufactured that will also be controlled using GMV technology.

We've also seen a significant development of GMV in the satellite navigation market. The company is the undisputed European leader and a world class provider of navigation signal ground segment processing. We are, therefore, playing an increasingly important role in both of Europe's flagship navigation programs, EGNOS and Galileo. We have continued to invest in our magicGNSS navigation product line and this is certainly a key success factor of our international growth in the field, with remarkable achievements this year in Russia, South Africa and South America.

We are proud of our participation in a number of Earth Observation missions that have been or are due to be launched in 2013: Landsat-8 (LDCM) and Swarm. In these missions, GMV provides a significant number of products/key elements ranging from mission planning, satellite control, flight dynamics to data processing.

Other noteworthy missions include Ingenio and Paz, Spanish national Earth Observation satellites (optical and radar) in which GMV is responsible for the entire flight control segment, mission planning and user services. We are also very proud of having been contracted by Eumetsat for the development of the Meteosat Third Generation Mission Operations Facilities.

GMV has continued to support the European ATV—yet again, the cargo resupply vehicle (this time ATV-4, named Albert Einstein), successfully docked with the ISS and flawlessly performed its five-month mission.

We have also chalked up significant achievements in the area of onboard guidance, navigation and control systems (GNC). This past year we've seen the successful launch of the VEGA launcher and we successfully completed the design phase of the formation flying PROBA-3 mission, in which GMV is responsible for the entire formation flying subsystem, including the GNC. During 2013 we also inaugurated a fantastic robotic testbed that will provide us with unique validation capabilities of advanced GNC technology.

We are also making significant progress in the remote sensing applications field, winning a number of contracts such as a cartographic production contract from the Emirate of Abu Dhabi; this involves the drawing up of the Land Use/Land Cover (LULC) and habitat maps that will serve as the primary baseline ecological dataset underpinning the Emirate's environmental conservation activities over the next decade.

GMV's continuous challenge has been, and continues to be, (profitable) growth. Last year we made a significant effort to develop GMV's international base

including the development of subsidiaries in Poland and Romania. In total, our space operations today are run through subsidiaries in the United States of America, Germany, France, India, Spain, Poland, Malaysia, Portugal and Romania. It remains a challenge and a company driver to develop operations strongly in those countries and further expand GMV's worldwide presence.

As part of our growth strategy, GMV is also reinforcing its investment in the development of competitive products that will foster our internationalization effort. Keeping our innovation and technology edge is also critical for us and this requires continuous investment in R&D programs. Also critical for us is to continue progressing in the added value chain by being able to provide our customers with a wider offer.

In addition to continuously adapting our technology even further and producing new versions of our products and solutions, we are looking forward to the resolution of a significant number of competitive procurements in which we are involved. Some of them correspond to space programs where GMV has a large participation, such as EGNOS, Galileo, Copernicus, Meteosat Third Generation, Euclid, IXV, Exomars and PROBA-3. We are also looking forward to the start of the implementation phase of the Exomars Rover Control Center in the first half of 2014. Additionally, very important for us is the evolution of the telecommunications satellite market over the next years and which new satellite procurements are starting in the coming months.

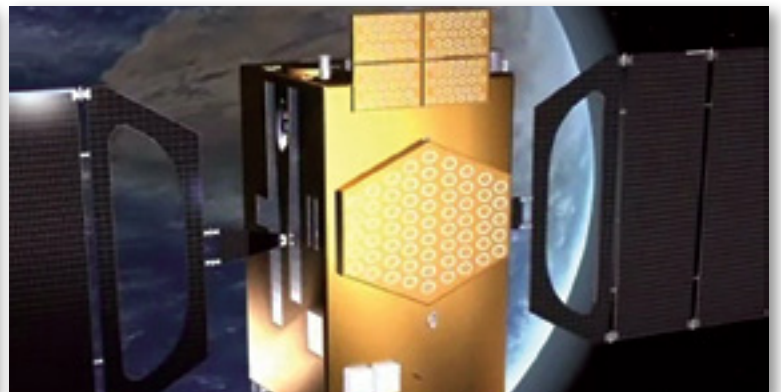
During 2014 we expect a significant number of satellite launches that will be relying on GMV technology. They include Astra 2G, ATV-5 (Georges Lemaître), Eutelsat 3B, Eutelsat 9B (EDRS A), Gaia, the first Galileo-FOC satellites, additional Globalstar birds, the experimental reentry vehicle IXV, MEASAT 3b (Jabiru 2), additional O3b satellites, OCO-2, Optus 10, Paz, Sentinel 2, Star One C4, TDRS L, Thor 7 and Turksat 4A & 4B. As you can see 2014 will be yet another challenging year for us.

To learn more about GMV's space operations, please access <http://www.gmv.com>

About the author

Jorge Potti is responsible for all GMV Aerospace operations worldwide and manages a large multinational team of about 500 professionals. Jorge has more than 25 years of experience in the space business and he has been working for GMV in a variety of positions ranging from Project Engineer, Project Manager, Division Head and Business Development Director for a wide variety of programs in orbital dynamics, mission planning, control centers, GNC, GNSS and operations for the European Space Agency (ESA), the European Commission, Alcatel, Alenia, Astrium, Eutelsat, Hispasat and Thales.

Since becoming General Manager in 2009, he has successfully led GMV to a cumulative growth of close to 50 percent in Space and made it the world's number one ground systems supplier. Under Jorge's leadership, GMV has achieved level 5 of the CMMI® (Capability Maturity Model Integration). Jorge graduated with honors as an Aeronautical Engineer in the Polytechnic University of Madrid (Universidad Politécnica de Madrid) in 1986 and has a General Management Program from the IESE Business School, Navarre University (Universidad de Navarra).



By Pradman Kaul, President

For Hughes, 2013 was a stellar year. In North America, our HughesNet® Gen4 high-speed satellite Internet service continued to expand rapidly and lead the market, surpassing the 700,000 subscriber threshold this year. HughesNet Gen4 is built on the industry's most advanced network of high-capacity, Ka-band satellites, including EchoStar® XVII with JUPITER™ high-throughput technology and SPACEWAY® 3. Together, these satellite systems and compact, easy-to-install customer premises equipment represent a game-changing service capability, bringing consumers the world's fastest satellite Internet access in a last-mile network that is fine-tuned for continuous, reliable service across the United States, and via operating partners across most of Canada.

This year, to further expand distribution, we signed DISH Network LLC and Frontier Communications as wholesale partners, and DIRECTV as a sales agent. We also introduced HughesNet Voice, making available a double-play bundle of data and voice over satellite and bringing customers significant savings in long distance calling, together with advanced telephony features such as call forwarding to multiple phones and enhanced voicemail, including email and text notification.

In the enterprise arena, we launched HughesON™, our new brand for a comprehensive suite of managed network services, optimized to meet the unique needs of distributed organizations. This advanced portfolio of network and digital media solutions spans a wide range of applications—from high-capacity, high-availability networks, to digital signage for customer and employee communications/training, to managed security and WiFi.

HughesON solutions are provided as end-to-end turnkey offerings for enterprises, government agencies, and non-governmental organizations, leveraging their existing networking infrastructure for greater performance and affordability, and freeing them to run their operations while Hughes runs their networks. HughesON also offers a breakthrough branch gateway that uniquely combines high security, WAN optimization, and routing in a single device.

Recent extensive testing by the Tolly Group, a leading global provider of third-party validation services for network and IT products and services, has proven that HughesON Performance Optimization delivers high-capacity, end-to-end QoS and superior application performance over ordinary broadband networks. A number of managed service deployments are underway with major enterprises, including Hess, Bon-Ton, KFC, Sherwin-Williams, and Digital Cinema Distribution Coalition (DCDC), to name a few.

Other notable enterprise wins include multiple contracts with Row 44, a subsidiary of Global Eagle Entertainment that provides in-flight Internet access and entertainment to commercial airline customers. Row 44's service is powered by our HX technology platform on-board aircraft and with comprehensive Hughes service and support, including system operations, space segment, network

engineering and program management. The new contracts expand Row 44 coverage further across Europe and in Russia, and for the first time will connect North America and Europe with trans-Atlantic coverage.

On the international front, Hughes is proud to have been selected by Media Networks Latin America (MNLA), a Telefonica subsidiary, to supply our JUPITER high-throughput system to power the first Ka-band service in Latin America, including gateways, network management, and satellite terminals. In Europe, notable wins include BP Retail, who extended its current network contract for managed services by 7,000 sites through 2019, and Deluxe Digital, who selected Hughes Europe to provide managed services for end-to-end connectivity to 3,000 cinema locations across five countries. And continuing its solid growth of ATM sites across India, Hughes Communications India Limited (HCIL) received orders for 12,000 out of the 27,000 sites Hughes India was awarded from the Ministry of Finance ATM Project.

I'm also delighted to report that in September, Hughes was honored with the first-ever VSAT Service Provider of the Year at the VSAT 2013 Conference in Amsterdam for innovation in service delivery over satellite networks. In addition, Hughes Communications India Limited (HCIL) was awarded the 2013 Best VSAT Operator in India Award—for the sixth year in a row.

Looking to the future, we have already signed a contract for our next satellite, JUPITER 2/EchoStar XIX, which is on schedule to launch in 2016. At well over 150 Mbps, JUPITER 2 will be the world's highest-capacity broadband satellite and will enable us to bring high-speed Internet service to an estimated million or more new subscribers, including Central America.

The Hughes culture is all about innovation, and since pioneering VSATs almost 30 years ago, we have led the way in both satellite networking technology and services. Our greatest success this past year is further proving the business model of high-speed satellite Internet service for consumers and, thereby, significantly expanding the addressable market for VSATs beyond enterprise and government markets—call it the mainstreaming of satellite—connecting people no matter where they live, work or play.

Additional company information is available at their website:
<http://www.hughes.com/>

About the author

Pradman P. Kaul is president of Hughes Network Systems, LLC (HUGHES), a wholly owned subsidiary of EchoStar Corporation (NASDAQ: SATS), the world's leading supplier of broadband satellite services and network solutions using interactive VSAT products. With annual revenues of moer than \$1 billion, Hughes provides satellite-based enterprise and consumer services and networks, mobile satellite networks and terminals, and broadband LMDS point-to-multipoint systems.



By Dave Bettinger, Chief Technology Officer + Senior Vice President of Engineering

It's clearer than ever before that the satellite industry is poised for a major transformation. Satellite economics are dramatically improving at a time when satellite technology is approaching the performance standard of core terrestrial communications.

With change in the air, 2013 was the time to consider some pressing questions—to gain clarity on how and when a larger market for satellite would emerge, and what will change in the process.

Once again, High Throughput Satellites (HTS) dominated the conversation. Across the industry's major events and inside the pages of its trade publications, questions resounded. How big is the opportunity? How will these new satellite programs impact the value chain? What markets and regions will respond with the strongest appetite for HTS bandwidth?

On a broader level, we wondered how the industry will handle escalating growth, and what key vertical markets will advance to the next level, or begin to level off.

Thankfully, 2013 was also a year of answers. A year of key innovations and major announcements. A year in which larger plans and strategies were revealed. At the beginning of 2013, a new picture was taking shape. Twelve months later, we can see the landscape much more clearly.

Let's start with HTS. No other innovation to date can match the HTS promise to open the satellite industry to major new opportunity. It changes the game as far as capacity volume and data throughput. And HTS will usher in significantly better service economics.

What became clearer in 2013 is that enterprise will be a key market for HTS. While the consumer market will be larger on a per-site basis, enterprise will be larger in terms of overall value. NSR predicts that 60 percent of the revenue will go to the enterprise market.

Along with opportunity, however, HTS brings new technical complexities. Most significantly, the industry must adapt to new satellite architectures. HTS satellites encompass a wide range of bands, beam sizes and Earth orbits—each with its distinct strengths and unique physics.

In 2013, we began to dispel confusion about the difference between Ka- and Ku-bands for HTS, as well the value of closed, open and hybrid service models. We are now understanding the unique value of diverse models emerging to bring HTS capacity to market—from managed services developed by satellite operators and delivered through service providers to new levels of infrastructure sharing and collaboration.

These will co-exist with traditional business models. And success will require flexibility to adapt to any business model present or future.

In 2013, we saw continued demand for bandwidth surge across key vertical markets. For example, in the maritime shipping market, end-users are moving to applications like route planning, engine diagnostics and weather applications. Oil and gas companies are turning to VSAT to send large data files, operate ROVs and support greater use of video. Cruise ships have become essentially floating communities that want to stay connected using mobile devices.

This year, iDirect introduced the new X7 remote to meet these demands. The X7 is the first in our next-generation family of remotes, built on an entirely new multi-core hardware system. It is designed to help operators and service providers meet rising throughput demands, especially as HTS capacity comes online.

We were very excited to see significant demand for the X7 worldwide. And we look forward to supporting our partners as they leverage the iDirect platform to roll out new higher throughput services.

Mobility was a key theme in 2013, especially in the aeronautical market. Aviation is embracing connectivity in a big way. Major airlines are busy equipping their fleets with broadband systems and rolling out service offerings.

In January, United Airlines introduced satellite-based Internet connectivity for international travel, serving trans-Atlantic and trans-Pacific routes. They expect to equip 200 aircraft with satellite by the end of 2013.

In April, Honeywell and Boeing signed a technology agreement to develop faster, more reliable in-flight connectivity. And in September, Gogo announced a multi-million dollar deal to provide satellite wifi in an effort to expand its services.

These solutions are all using the iDirect platform and our integrated board modem technology inside airborne terminals.

We also saw growing demand in mobility for the military and government sector, especially for aeronautical applications. Satellite is becoming more and more essential to enabling troops to coordinate safe and effective missions.

In fact, we'll see the potential for new investments in satellite as a direct result of troop drawdowns. Militaries are shifting to an emphasis on more agile, sophisticated troops armed with the resources and technology to succeed.

NSR projects \$9.7 billion in service revenue at 10.2 percent CAGR by 2021. We do not see this trend letting up, even though we may experience temporary budget constraints in the U.S. or elsewhere.

The events this year not only push us into 2014 but into a whole new, more mature era for the VSAT industry. HTS provides a crucial springboard for VSAT to fully transform into a mainstream enterprise communications technology.

Next year, we will begin to see significant change driven by HTS. Key satellite programs, for which iDirect has developed the ground infrastructure, will be ready for action, Inmarsat's Global Xpress service is projected to go live. We also expect to see major global launches like Intelsat EPIC and significant regional programs such as Telenor's Thor 7.

There is a lot of work still ahead. As an industry, we need to make satellite technology fully interoperable with IP networking standards. We need to make satellite easier to deploy and use. We need to support higher throughputs and broader scale. And of course, we need to always drive toward lowering cost and complexity wherever we can.

It's a time of tremendous opportunity—and it will require new levels of innovation and collaboration.

To learn more about iDirect, their infosite is located at:
<http://www.idirect.net/>

About the author

Mr. Bettinger joined iDirect as the Director of Hardware Engineering in 1996 and took over responsibility of all hardware and software development as VP of Engineering in 2002. In 2005 he became Chief Technology Officer and is now responsible for the oversight of all technology decisions within iDirect and serves to drive the strategic direction for product development, technology alliances, along with mergers and acquisitions. Mr. Bettinger currently serves on the Board of Directors for the Global VSAT Forum and is an active member of the Telecommunications Industry Association, IEEE and the IPv6 Forum.

Previous to iDirect, Mr. Bettinger was a senior member of the technical staff at Hughes Network Systems in the Satellite Networks Division. Mr. Bettinger is a graduate of Virginia Tech with a Masters of Science degree in Electrical Engineering and has been awarded six patents in the area of satellite communications.



By Serge Van Herck, Chief Executive Officer

There was a great deal of buzz around 4K TV this year, also known as Ultra High Definition Television (UHDTV) and Newtec was involved with almost all of the major demonstrations around the world. These demos were with both Eutelsat and Intelsat at IBC 2013. The latter of the two demonstrated the world's first live sports match played out straight to the exhibition floor in 4K. Other demonstrations during the course of the year included with SES and Canal+ in Spain and Measat at BroadcastAsia in Singapore. All of these prove that the transmission chain is ready and able as soon as demand is there for this new technology. Of course, we have also been active in improving efficiency for the entire industry to benefit.

This year has been about developing new satellite transmission standards and helping the industry to reduce interference. We have been central to this alongside partner organizations DVB and the Satellite Interference Reduction Group (IRG).

Kick-started by Newtec a year ago, key players in the satellite industry are calling for a satellite transmission standard, specifically for professional satellite contribution links, which would extend the existing DVB-S2 standard. The Newtec S2 Extensions include; smaller Roll-Offs; advanced filter technologies; higher efficient MODCODs; more MODCODs fine-tuned for linear and non-linear operation; higher modulation (64APSK); and wideband (72 Mbaud). These extensions have been contributed to the new evolution of the DVB-S2 standard and have already been implemented on Newtec's modulators, modems and hubs. These S2 Extensions boost the satellite link efficiency up to 20 percent in Direct-To-Home (DTH) networks and 37 percent in other professional applications compared to DVB-S2—even up to 64 percent when using 72Mhz transponders.

We have also been recognized with an 'Outstanding Achievement' award at the ASBU BroadcastPRO Awards for the pivotal role we played in developing candidates for the new DVB-S2 extension. By continuous innovation to increase efficiency of communications over satellite, and therefore lowering both CAPEX and OPEX, satellite operators, service providers and broadcasters are now able to launch new services in a profitable manner. This benefits the entire satellite ecosystem and by extension end-users around the world.

We have also turned our attention to mitigate satellite interference. In 2011 we had given our unreserved support for the standardization and adoption of industry-wide counter-measures to combat interference. Since then, we have implemented Carrier ID in our equipment and brought the industry together by holding several sessions around the world increasing the awareness. In July, we joined forces with the Satellite Interference Reduction Group (IRG) to poll the industry about Carrier ID (CID). The headline results from our industry survey was that 93 percent of respondents suffer from satellite interference at least once a year, with more than half suffering at least once a month and 17 percent continuously in their day-to-day operations. This is again a significant finding for the industry and the rest of the results are available online in our Carrier ID Demystified e-book.

Newtec has signed a number of new deals around the world with different service providers and satellite operators operating in Ku- or Ka-band. Early on in 2013, Gazprom Space Systems (GSS) selected Newtec in a competitive tendering process. In the same month, RuSat, a satellite service provider for enterprise customers, Internet service providers, and government agencies in Russia, signed a deal, too.

In the United States, we were selected by California-based X2nSat to provide the equipment for a new B2B broadband and SCADA service.

In Africa we have become a key technology partner for NigComSat as it sets out to achieve its mission to provide cost-effective satellite broadband services to Nigerian consumers and SMEs, with planned services for West Africa, and we also signed an agreement to provide a VSAT Broadband Hub and thousands of VSAT terminals to Liquid Telecom, the leading independent data, voice and IP provider in Africa. A new partnership with Somalia-based Talia means a communications backbone infrastructure for the country in place based on our FlexACM® technology. A second major project for us was with SES to implement our S2 Extensions technology. New-generation modems are boosting the performance and efficiency of the SES-5 satellite backhaul infrastructure.

In the European market we have played an important role in further expanding the SES Broadband Services offering, which is Europe's largest satellite broadband network. In the Middle East Bentley Walker, one of the world's leading service providers for broadband satellite Internet, selected Newtec in its service coverage extension towards Libya using Newtec's Ka-band VSAT broadband platform on Avanti's HTS Hylas2 satellite. Last, but not least, Eutelsat's IP Easy broadband service, which was launched for the African region in 2012, is now also bridging the digital divide through the Caribbean footprint of the EUTELSAT 8 West A broadband system.

In March, the World Teleport Association (WTA) awarded the Newtec M6100 Broadcast Satellite Modulator with the prestigious accolade of Teleport Technology of the Year. The judges praised the new technology for providing the greatest contribution to the business and operational success of teleports by lowering costs, increasing efficiency, enabling new capabilities and providing access to

new markets. This year we launched our latest MDM6100 Broadcast Satellite Modem at NAB 2013, a next generation DVB-S, DVB-S2 and S2 Extensions modem specifically designed for broadcast applications. The M6100 is also ready to support the upcoming S2 Extensions and the DVB-CID standard. Today, more than three billion people watch TV every day, thanks to our technology.

During 2013, we won a number of large broadcast contracts including one with Arqiva, the communications infrastructure and media services company. It has selected the M6100 to upgrade parts of its network. Newtec's channel partner Sematron agreed with the framework deal which will upgrade Arqiva's DTH equipment refreshment program. On the topic of channel partner's, we have signed up more than 90 certified global partners operating in the satellite communication industry, covering over 100 countries across Europe, the Middle East, Africa, Asia, Australia, and North and South America. We have also extended our highly successful Multimedia Exchange Network over Satellite (MENOS) contract with the Arab Sates Broadcasting Union (ASBU) in a new multimillion euro deal. ASBU-MENOS terminals will now additionally be deployed over 48 regions in Algeria with two separate networks for radio and TV contribution and exchange.

The year ahead is set to be one of the greatest yet for the satellite industry with the Rio World Cup and the introduction of a new standard for the entire satellite sector with the upcoming DVB-S2 technology upgrades. The High Throughput Satellite (HTS) discussion is also entering full swing with many new players starting to use the technology in multiple business models but with a shift towards open networks and selling Mhz.

We also believe multi-service and multi-technology platforms will become key talking points in 2014 as operators and service providers look to squeeze even more out of their networks. Multi-service networks are networks that serve multiple customers (virtual networks), and carry multiple services (video, audio, broadband, voice) over the same infrastructure all with their specific quality of service targets, sharing the available spectrum, and managed from a central network operations center. Multi-service networks generate more business opportunities as well as save OPEX. A breadth of modulation and access technologies are selected to match different service profiles and space segment is allocated dynamically. An all-IP infrastructure facilitates hybrid terrestrial/satellite networks, which greatly reduces operational costs. As the era of single service satellite networks departs, the industry will be preparing for Multi-Service! We expect to see this high on many agendas in 2014.

Here's to another great year for the satellite communications industry.

To learn more about Newtec and the company's products:
www.newtec.eu/



2013 has proven to be an exciting year for NSSLGlobal as we continue to expand our range of products and improve services while maintaining high standards of customer satisfaction and unbeatable network coverage.

Headquartered in the United Kingdom, we currently have offices and/or teleports in the UK, U.S., Cyprus, Norway and Singapore. These regional offices make it possible to offer truly international service to our worldwide customer base through a global network of engineers who provide in-country support.

In the first quarter of the year we announced the introduction of ACM (Adaptive Coding and Modulation) combined with the new DVB-RCS2 standard across all our VSAT network hubs. This planned development was the first step in a series of advancements on improved services to our customers.

One of the services we provided, as a result of the DVB-RCS2, was to double our network return speeds free of charge. We recognized the changing requirements associated with Internet usage, especially with the rise of cloud computing and the need for sending data via the likes of Amazon Cloud, DropBox or WeTransfer, and we reacted accordingly to accommodate the wishes of our customers.

In April of this year we opened an office in Singapore. This was an important step in our commitment to an ever growing Asia Pacific (APAC) customer base, which requires sales and service support on their accounts within their time zones.

The APAC Market is developing quickly, with greater customer demand for global and local support. This results in customers being dependent upon us to provide a network that can support the latest real-time applications that saves them money and time.

As of September we announced our collaboration with BBC World News. This is an incredible service available on board commercial maritime vessels via Telemar Scandinavia and NSSLGlobal Ltd. BBC World News is now broadcast several times daily, providing crews with access to the BBC's unparalleled coverage of international news, current affairs and sport highlights. Customers can view this using our Ku- or C-band network without impacting on their data speeds through our Multicast services.

We have worked hard this year to advance our networks and bandwidth to accommodate the challenges presented by an ever changing industry and to meet the latest requirements of our customers. This year has been particularly exciting for us in terms of service advancement. We launched the Broad-IP FlyAway and extended our VSAT coverage.

Broad-IP FlyAway was our first venture into portable satellite coverage. Developed in-house, the FlyAway comes equipped with a Samsung Galaxy Smartphone and has an NSSLGlobal Smartphone Pointing App installed to operate on our Ku-band network. The concept behind the FlyAway was to produce a lightweight antenna that is easily portable and can be assembled and connected to the VSAT network without the need for an engineer.

Lastly, and our current big news, is the further expansion of our VSAT Ku-band network to include an additional two satellite beams covering the South Atlantic and Indian Ocean region. These two beams went active on October 15th. Combined with the current VSAT coverage, this creates the world's most comprehensive VSAT Ku-band network in the industry.

Current and new customers on commercial vessels and Super Yachts will benefit from the additional beams which come via our UK teleport based in Rugby. Using Intelsat's IS21 satellite, the first beam is primarily aimed at the commercial maritime sector. The satellite is positioned at 58 degrees West, with a large proportion of the beam covering the South Atlantic; south of South Africa across to Buenos Aires. This beam compliments the NSSLGlobal T11N North Atlantic beam that is already part of the global coverage we offer. The second, MID-IOR IS-702, covers the Maldives and Seychelles area, with the primary customer base stemming from the Super Yacht community.

This is an exciting time for the NSSLGlobal team. We are always working with our partners and customers to maintain and improve on our services. We pride ourselves on providing good value for the money by delivering excellent support in conjunction with continued enhancements to exceed customer needs."

More information regarding NSSLGlobal at: <http://www.nsslglobal.com>

About the author

Sally-Anne Ray is the Managing Director of NSSLGlobal, the independent service provider of satellite communications. NSSLGlobal supply customers in maritime, yachting, government and corporate markets, with innovative products, impeccable service and in country/port support.



By Patrick Shay, Executive Vice President of Sales and Marketing

ORBCOMM is solidifying its position as the leading player in the global machine-to-machine (M2M) marketplace. During 2013, the company continued to accelerate its transition from a satellite network operator to an integrated, multi-network provider of end-to-end M2M solutions across a diversity of vertical markets through strategic acquisitions; key alliances with industry leaders such as Inmarsat and Globalstar, new product development and organic growth.

Across all of our business sectors, 2013 has been a significant year for ORBCOMM in terms of tremendous growth for the company. Our third-quarter financial results, released November 7, showed that total revenue grew 22.4 percent year-over-year to \$19.7 million. Also, we reached 827,000 total billable subscriber communicators in September of this year. That represents an 11 percent increase in total billable subscribers year-over-year.

Exemplifying ORBCOMM's market leadership as a multi-network operator, we recently announced a strategic alliance with Inmarsat, the world's largest MSS provider, which brings together the technology, global distribution channels and resources of two industry powerhouses. Our two companies will create a standard satellite-based M2M platform and develop cost-effective hardware and flexible service pricing models for the global M2M industry. We are in the process of building a series of interchangeable modems powered by ORBCOMM's OG2 VHF network and Inmarsat's L-band network. These modems will have the same footprint, connectors, power input, and programming environment, allowing manufacturers and partners to drop in the appropriate modem that corresponds with either the ORBCOMM or Inmarsat network based on geography, message size and delivery speed. Customers will have a common platform for provisioning, billing and multi-mode access for M2M applications based on our Multi-Network Access Point Platform (MAPPTM). By setting the standard for satellite solutions in the global M2M market, three-quarters of the MSS industry focused on M2M will be sharing the same platform, which is an exciting development for this industry. Looking to the future, we will also explore additional synergies with Inmarsat to leverage technologies, capital expenditures, product development, satellite operations and ground infrastructure support for future satellite deployments.

In April, we completed two major acquisitions; GlobalTrak and MobileNet, Inc. GlobalTrak is an information services company that uses networks, sensors and proprietary software platforms to provide near-real-time situational awareness and intelligence for global logistic and security operations. GlobalTrak gives ORBCOMM access to a customer base that includes military, international, government, and commercial customers as well as expanded reach in growing regions, such as the Middle East, Asia and South America. GlobalTrak recently launched its state-of-the-art fuel monitoring system in Afghanistan, which is designed to prevent theft of mission-critical fuel transported for the U.S. Defense Logistics Agency and used by U.S. and NATO forces.

MobileNet is a provider of telematics solutions to the heavy equipment and rail support industries. This acquisition enables ORBCOMM to offer MobileNet's complete fleet management solution directly to original equipment manufacturers (OEMs), dealers and fleet owners. Leveraging the MobileNet acquisition, as well as long-time partnerships with Quake Global, Inc. and Tier One wireless carriers, AT&T, Rogers, T-Mobile, and Vodafone, we developed a complete end-to-end telematics solution for the heavy equipment industry. Targeted for OEMs, dealers, rental companies and fleet owners, the solution combines ORBCOMM's global satellite and cellular connectivity with a web-based analytics platform in a single, low-cost monthly subscription as well as state-of-the-art hardware designed for the rigorous requirements of the heavy equipment market.

Additionally in October, we completed the acquisition of Comtech Mobile Datacom Corporation's (Comtech) Sensor Enabled Notification System (SENS) operation, which includes satellite hardware, network technology and web platforms. SENS is a market leader in providing one-way satellite products and services to more than 20,000 subscribers worldwide through the GlobalStar one-way satellite network. This acquisition strengthens ORBCOMM's position as a multi-network operator, as we now offer connectivity services for three satellite networks, ORBCOMM, Inmarsat and Globalstar, and seven Tier One cellular networks, AT&T, T-Mobile, Telefonica, Telenor, Rogers, Verizon and Vodafone. We believe we are well on our way to becoming the leading provider of both satellite and cellular communications services for the global M2M industry.

This year, we added several new industry leaders to our customer base in our key vertical markets. We established major partnerships with three leading

heavy equipment OEMs. Doosan Infracore Co. Ltd., a premier global OEM and industry leader that manufactures a wide selection of construction equipment, machine tools and engines sold under the Doosan, Bobcat, Montabert, Geith, and other brand names, selected ORBCOMM to deliver an end-to-end telematics solution specifically tailored for Doosan through our MobileNet subsidiary. Doosan uses ORBCOMM's global satellite communications network combined with cellular communications through our Tier One wireless partners to track and monitor the location, status and performance of their equipment anywhere in the world.

In addition, Sumitomo, a leading manufacturer of excavators, asphalt pavers and other construction equipment, and Kobelco Construction Machinery Co. Ltd., Japan's second largest manufacturer of hydraulic excavators, partnered with ORBCOMM to provide wireless data connectivity for their global OEM telematics solutions.

In the transportation and distribution industry, ORBCOMM secured a new vendor agreement with Ryder System, Inc. Ryder selected ORBCOMM to deliver a comprehensive telematics systems solution tailored for their fleet of more than 30,000 dry van, refrigerated and flatbed trailers in both its lease and rental trailer fleets. Additionally, ORBCOMM's state-of-the-art ReeferTrak® platform, a powerful two-way tracking and monitoring solution for temperature-controlled cargo, was selected by several new domestic and international transportation and logistics companies including BP Logistics, Classic Carriers, Crowley Maritime Services, Direct Transport, Gangloff Industries, Integrated Airline Services, JASKO Enterprises, and John Christner Trucking, LLC.

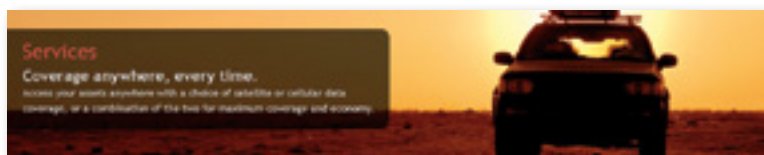
Through our GlobalTrak subsidiary, we have also developed a partnership with Savi Technology, a leading provider of sensor-based analytics and radio-frequency identification (RFID) solutions, to provide advanced location-based monitoring solutions to government and commercial markets.

We continued the company's geographic market expansion this year by successfully obtaining authorizations for use of the ORBCOMM system in Belize, Cayman Islands, Trinidad and Tobago, Turks & Caicos and the British Virgin Islands. In May, Cartrack (Pty) Ltd., a leading vehicle tracking and logistics company based in Johannesburg, South Africa, selected ORBCOMM to provide satellite data communication services to extend its current range of GSM logistics and telematics solutions. Cartrack is distributing the high-performance fleet management solution throughout the African continent via its growing brand and dealer network.

This year, ORBCOMM experienced substantial growth and success with our tracking, monitoring and control products and solutions. At the CTIA 2013 conference, the ORBCOMM GT 1100 was unveiled, a ruggedized, self-powered M2M asset tracking and monitoring device with solar recharging technology designed for tracking and monitoring intermodal containers, trailers and other remote unpowered assets such as construction and mining equipment. The GT 1100 also includes the CargoWatch™ web-based software application, which delivers near-real-time, essential alerts on asset status, location, history, and arrival/departure. We are very pleased that the GT 1100 was named the winner of CTIA's 2013 Emerging Technology (E-Tech) Awards in the M2M, Sensors, RFID, & NFC category.

We are excited about our next generation OG2 satellite network, which we expect to begin launching in first half of 2014. Recently, SpaceX successfully launched Canada's Cassiope satellite on the upgraded Falcon 9 version 1.1 rocket. The success of this launch is a significant milestone toward our first OG2 launch as it successfully demonstrated the new rocket's upgrades, including higher performance engines, larger tanks and a fairing that protects the satellites during the launch vehicle ascent. We are looking forward to bringing the benefits of our OG2 network to our customers, including larger message capacity, lower power consumption, faster message delivery, broader global coverage, and a higher level of performance.

We continue to focus on the growth and expansion of the company into key vertical markets and geographic regions. Building upon our current foundation as a global M2M solutions provider, we are committed to innovation in the development of our best-of-breed products and services and to delivering the most complete combination of network services, hardware and web applications to our customers.



To learn more about ORBCOMM, access: <http://www.orbcomm.com>

By Robert Kubbernus, President + Chief Executive Officer

The past 12 months have seen a marked turnaround in the fortunes of Signalhorn. Changes that we instituted after I acquired the company in 2012 began to show up on the bottom line. In its 40-year history, Signalhorn had been owned by some of the best companies in the business, including GE, Swisscom, Gilat and SES. Each owner contributed to the solid base of infrastructure, technologies, customers and a dedicated workforce that comprises Signalhorn today.

However, the company still was losing money. We were spending too much for satellite capacity we were not using, and we couldn't rationalize our employee base with our customer line up and revenues. In the past year, however, we reduced our space segment costs to about 34 percent of our revenues compared with a previous high of 55 percent, which was a significant improvement. We also right-sized our staffing levels to be more commensurate with our customer base.

Equally as important as these bottom line improvements, in 2013 we articulated a clear operating strategy centered on our customers. We discovered that we could grow our business with the core group of excellent customers we already have, not just going after new business. These are premium, triple-A customers that are utilizing only a small part of the services we could be providing them.

We began to focus on their entire range of end-to-end communications needs, not just satellite, becoming a one-stop shop providing terrestrial connectivity side-by-side with satellite. For example, we transitioned one of our customers—a Swiss firm—from a 100 percent satellite solution serving 300 retail point of sale (POS) locations to 100 percent terrestrial/DSL service with satellite as backup in certain locations.

Another key change involved our sales structure. We reorganized our clients into appropriate verticals and then staffed these designated markets with subject matter sales experts. This has resulted in an Enterprise area focused on point-of-sale networks and security and surveillance; Government and NGO customers; the Energy industry, particularly the oil and gas markets of Europe, the Middle East and Africa; and the Maritime industry.

Another major change in 2013 was shifting to a mentality where everything we do at Signalhorn is based on a customer's stated need, where that customer needs to go and how we can effectively get them there. We engaged in strategic discussion with many of our most well-established customers and made several important discoveries. They wanted a provider that goes beyond satellite—a company that also considers terrestrial and wireless, because that is where their needs are taking them. We knew that if we did not address this requirement for integrated communications solutions, someone else would. We have moved fast to work terrestrial and wireless into our solutions and then revisited those same customers to offer a brand new type of hybrid solution.

A big demand driver for hybrid networks is that companies cannot risk losing connectivity because a satellite or terrestrial link fails. When Signalhorn was founded in the early 1970s, the company had to spend a lot of time with potential customers simply driving home the benefits of a network.

Today, no business can succeed without a network. An outage can cost a customer millions of dollars in lost transactions or lost production. However, our hybrid solution of satellite, terrestrial and wireless ensures constant uptime and gives us the opportunity to serve our customers from the core to the edge of their enterprises.

Another strategic change in 2013 was our shift to focusing more on working with partners in key regions of the world. We now have 60+ service partners in more than 130 countries that provide the company with an understanding of the culture, business practices, and regulatory framework of those locations. This enables our customers to quickly navigate local regulations governing the approval and support of network installations, equipment upgrades, and ongoing operations. Our service partners collectively have over 1,000 highly trained employees located in the countries where our customers operate.

We expect to be well over the \$100 million revenue mark early in 2014, yet our infrastructure is probably running at only about 30 percent capacity. One of our goals for 2014 is to do a better job of leveraging that capacity more fully. In these next 12 months, I anticipate we will more than double in size, in staffing and revenue.

Right now, we are in advanced talks on two acquisitions. One of these companies will significantly expand our customer base in Africa, a key potential growth area for us in the energy sector. The second company we are talking with is a virtual network operator. In this case, the firm has no infrastructure, which will allow us to make better use of the people and resources at our technical centers in Leuk, Switzerland, and Backnang, Germany.

The pace of change in the industry over the past 20 years has been meteoric. We can be overwhelmed by such spectacular innovation and become increasingly numb to just what is possible and available. We are no longer selling the future, but are simply keeping up with clients' expectations and requirements. We mustn't be so busy delivering the bandwidth, transport, and hardware, etc., that we ignore what the client really needs: genuine actionable analysis to help make better business decisions.

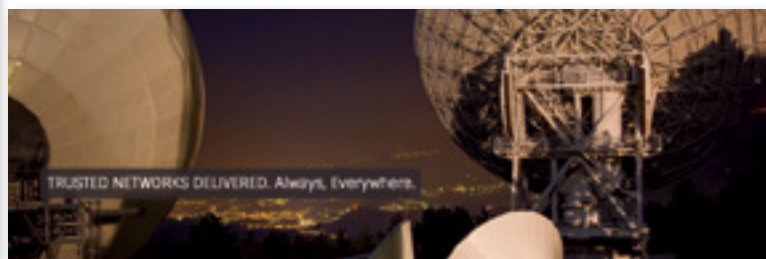
At Signalhorn, we worked hard in 2013 to fully engage with our customers and then develop the tools, systems and technologies they need for their businesses. We will continue that path in 2014. Our strategy is to develop value-added services that expand our capabilities far beyond the provision of satellite connectivity.

For information about the company, go to: <http://www.signalhorn.com/>

About the author

Robert J. Kubbernus is President & CEO of Signalhorn, a global provider of network services and communications solutions with global operations supported from Germany and Switzerland. He assumed the position in February 2012 when he acquired Signalhorn (then named GE Satcom) from its previous owner, GE. Canadian born, Mr. Kubbernus has more than 25 years of leadership experience in companies involved in telecommunications, IT and Network Security, e-commerce, plus other industries.

Prior to purchasing Signalhorn, Mr. Kubbernus was President & CEO of TrustComm, a Houston-based telecommunications company providing satellite and terrestrial services to corporations and government organizations. TrustComm, formerly known as Skyport Global Communications, operates from the Ellington Field Joint Reserve Base and is a major provider of telecommunications services to the U.S. National Guard, FEMA, U.S. Department of Defense, and others.



By Eyal Copitt, Senior Vice President, Sales, Africa, Asia + Marketing

2013 has proved to be a big year for Spacecom. With the successful launch and placement of AMOS-4 over Asia, we are now pushing further as we emerge as a multi-regional satellite operator.

AMOS-4 is focused on Asia, Russia and China and has a number of beams that reach Russia and Southeast Asia. Two of the satellite's Ku-band beams and one Ka-band beam will cover a variety of Asian regions to meet the needs of broadband providers, broadcasters, ISPs, telecom operators and DTH and DBS operators.

AMOS-4's prime orbital position will be at 65 degrees East, whereas its first stopping point is at 67.25 degrees East. Every communications service provider in the region—from telecom to broadband to broadcast—is able to access this satellite. We are targeting commercial as well as governmental organizations that have needs for reliable and powerful signals to meet their goals. We are excited by Asia and look forward to 2014 to announce deals and to generate more awareness for the AMOS brand.

AMOS-4 extends and strengthens the AMOS brand into new regions. Its Ku- and Ka- transponders create a powerful platform, enabling a wide range of cross-region, cross-band and cross-beam connectivity options to reach these regions' vast urban and rural areas. The satellite vaults us dramatically forward with new capabilities. By operating a network of satellites with AMOS-4 as an integral element, our company is continuing to fulfill our long-term objective to become a highly significant player in the global satellite communications market.

Prior to the AMOS-4 launch, our fleet was comprised of the AMOS-2 and AMOS-3 satellites, co-located at 4 degrees West, with AMOS-5 located at 17 degrees East. These satellites provide high-power coverage to Europe, the U.S. East Coast, Africa and the Middle East for Direct-To-Home (DTH) and Direct Broadcast Satellite (DBS) operators, Internet Service Providers (ISPs), telecom operators, network integrators and government agencies.

Our 4 degrees West 'hot spot' covers Eastern and Central Europe and the Middle East, while AMOS-5 at 17 degrees East covers Africa with connectivity to Europe and the Middle East. We are delighted to note that the fill capacity on all of these birds is high—and we are continuing to generate more deals to increase our customer base.

In 2014, we will be looking forward to the completion of construction for our next satellite—AMOS-6—whose launch is scheduled for 2015. To enhance and strengthen our presence in Europe, AMOS-6 will be co-located at 4 degrees West with AMOS-2 and AMOS-3 to create a more powerful 'hot-spot.' Its lifetime is planned to be at least 16 years.

The new satellite will be larger and more powerful than AMOS-2 and AMOS-3 combined and will offer 39 Ku-band segments, 24 Ka-band beams, as well as two S-band transmitters to provide a wide array of services. The satellite will be fitted with numerous new technologies that include electronic propulsion capabilities to save on weight and cost.

AMOS-6 will expand the AMOS brand reach into Western Europe and North Africa, add new Ka-band spot beams and eventually replace AMOS-2 when it ends its commercial service in 2016. We are closely monitoring the Internet broadband market in Central and Eastern Europe as this is likely the area which will have coverage from our Ka-band spot beams to provide powerful solutions for broadband service providers.

As we look at Africa and AMOS-5, we are pleased with our abilities to generate awareness and build our client base. In October, we announced two new wins in the growing East Africa broadcast sector. These two contracts, which together total more than \$9 million, are for migration from analog to digital broadcast technologies. For both DTT and DTH operators, we are providing service over one of our Ku-band transponders which specifically focuses on Central and East Africa.

In addition, we increased the AMOS brand's recognition with French-language broadcasters in 2013. We entered into an agreement with TV5MONDE Afrique, one of the major broadcasters in French speaking Africa. This deal delivers greater brand awareness within the French community and follows the deals we cemented into place with France24 and others.

As we look towards 2014, our team is looking forward to the challenges and rewards that are part of the Asian and pan-Asian markets and to continuing our growth in Africa. Our 4 degrees West 'hot-spot' over Europe, which also covers the U.S. East Coast and the Middle East, will remain an area of focus—especially as we draw closer to launching a new satellite for this region of the world.

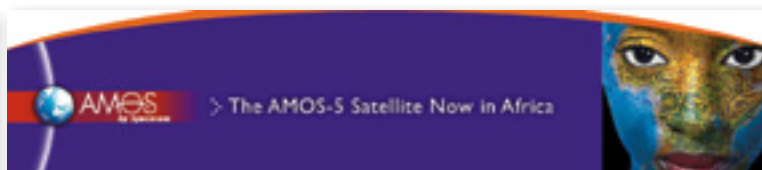
For more information concerning the company, select:
<http://www.amos-spacecom.com/>

About the author

Joining Spacecom in 2009, Eyal Copitt leads the Africa sales. Mr. Copitt brings with him over 20 years of worldwide consulting and sales experience, from which 15 were in the African IT and Communications Markets working with governments, private and national owned Telco's, the finance industry and education networks. Prior to joining Spacecom Mr. Copitt served as VP Sales Africa at Gilat Satcom and as the Africa District Manager at NetApp (NASDAQ: NTAP) where he was in charge of developing new markets in the African Markets.



AMOS-4 during its build process. Photo is courtesy of IAI.



Space Systems/Loral (SSL)

Year In Review
2013

By Rich Currier, Senior Vice President, Business Development

2013 has been an important year for SSL and for the industry. As a company we have achieved several important milestones including a series of new contract awards and successful launches. As an industry, we have seen steady growth driven by technology innovation and an underlying demand for consumer services and new opportunities to expand the world's ability to communicate.

The year's key milestones for SSL included the achievement of 2,000 satellite years on orbit and a contract to provide Intelsat with its 50th SSL-built satellite. SSL continues to have more commercial capacity on orbit than any other manufacturer, with the majority of its satellites providing service beyond their contractual lives.

2013 has been an important year in terms of new business for satellite manufacturers across the industry and in particular for SSL. Trends include broadening HDTV availability in regions of economic growth, high interest in UltraHD, and multi-mission satellites that enable testing the value of HTS capacity in new markets. Capacity for Latin America has been a noticeable driver of both contracts to build new satellites and satellites launched.

In North America, where the world's two highest capacity satellites were built by SSL, there continues to be strong demand for HTS satellites for consumer broadband. More than a million people in North America now subscribe to broadband over satellites built by SSL. As a result, in March, Hughes, a wholly owned subsidiary of EchoStar Corporation, contracted with SSL for a next generation broadband satellite that will provide more than 160GBps capacity, surpassing any previously launched.

The interest in all electric satellites and dual launch solutions continued in 2013 and SSL began actively offering its electric orbit-raising solution during the year. It is based on one of the industry's highest thrust, highest reliability propulsion systems. SSL began developing electric propulsion technology over 20 years ago with its first system launched in 2004. The company has an outstanding track record with 14 satellites with electric propulsion currently on orbit and more than 30,000 hours of successful on-orbit electric propulsion operation.

The SSL all-electric platform has the advantage of enabling dual launch on a variety of launch vehicles including the Ariane 5, Atlas V, Falcon 9, H-IIA and H-IIB, and the ILS Proton launch vehicle. It also has the flexibility to be launched in a single launch configuration. With a full range of offerings, SSL can help satellite operators evaluate whether all-electric, hybrid propulsion, or bi-prop systems present the best option for each business case.

As of the writing of this article in October, SSL counted a total of five new satellite contract awards for the year. In addition to the state-of-the-art broadband satellite for Hughes, the company was awarded four satellite contracts over the summer.

Japanese satellite operator, SKY Perfect JSAT contracted with SSL to build a new satellite called JCSAT-14. It will replace JCSAT-2A and expand its capacity to meet demand for telecommunications infrastructure in the Asia Pacific region.

SSL was also selected to provide Intelsat 34, which is the 50th satellite SSL will provide for Intelsat. It has been an honor to be a trusted satellite provider to Intelsat for many years and this is an important milestone. The satellite will provide Intelsat with capacity for Latin American media customers, as well as broadband for aeronautical companies serving North Atlantic routes.

SSL's fourth satellite contract award was from Eutelsat, to provide a powerful multi-mission satellite which leverages SSL's long-term experience with high-throughput payloads and satellites that serve multiple missions. EUTELSAT 65 West A will open new markets for Eutelsat for broadcast and broadband services in Brazil and across Latin America.

SSL was also selected to provide a satellite to Brazilian satellite operator, Star One. Star One D1 will be the first satellite of Star One's fourth generation and will support the 2016 Olympic Games in Rio de Janeiro.

SSL also completed and shipped five new satellites which were successfully launched and are performing on orbit. These include satellites for Hispasat, Satmex, Telesat, a shared satellite for Eutelsat and Es'hailSat, and a satellite for SiriusXM Radio.

With five contract awards and five launches to date at the end of October, 2013 has been a busy year for SSL. The milestones we achieved, which include more than 2,000 satellite years on orbit and our 50th satellite for Intelsat, underscore our leadership role and the many successes we have enjoyed. We expect the level of activity to continue into 2014 and look forward to further challenges and successes, which are what make this industry so exciting.

2013 was a great year for expanding communications capabilities to new parts of the world in ways that improve the human experience. What satisfies the people who work at SSL is not just working with great customers to help them achieve their goals, but also working together as a team with the entire industry to advance communications around the world.

Satellites have unique capabilities to enable applications such as telemedicine, distance learning, and emergency services. Satellite communications can be a catalyst for enhancing economic development in remote areas and promoting better understanding through the sharing of news and information. What drives us at SSL is the belief that the work we do helps to improve the human experience. Building exceptional and highly reliable satellites is something that we and our customers have come to expect, but more important than that, we believe that improving the human experience is the highlight of our achievements.

About the author

Richard Currier is Senior Vice President of Business Development for the commercial business at SSL, a full-service provider of communications satellites and space systems. Mr. Currier joined the company in 2012 and is responsible for the strategic marketing of SSL's products and services in its pursuit of growth and global market leadership worldwide.

Mr. Currier is a seasoned satellite and telecommunications executive with 21 years' experience in leadership and 32 years' experience in satellite and wireless communications, technology, and information systems. Before joining SSL, Mr. Currier served as vice president and chief technical officer for Loral Space & Communications. Prior to that he was president and chief operating officer of Loral Skynet, a global provider of fixed satellite services and integrated communication solutions. Mr. Currier began his career with AT&T Bell Labs, where he spent 17 years performing research and development in support of AT&T's satellite communication services. Over the course of his career, he has managed development programs for new satellite services in the UHF, L-, C-, Ku-, and Ka-bands.



The launch of SSL's Sirius FM-6 satellite via an ILS Proton Breeze M rocket.

Teledyne Paradise Datacom

Year In Review
2013

By Mike Towner, Senior Director of Sales and Marketing

This year, Teledyne Paradise Datacom once again expanded our line of solid state amplifiers and satellite modems to ensure our synchronization with the ever-changing dynamics of today's telecoms environment. We're meeting the market's demands for greater spectrum efficiency and higher traffic throughput with our new Q-Flex modem. Q-Flex is a new, ground-up design that is software defined – allowing it to grow with the network.

Earlier this year, we introduced our Q-NET network management system. Based on the powerful CodeMettle NMS platform, Q-NET was designed to serve satellite-based network operators with a means to manage their entire network from a central point of control, perform link diagnostics, graph performance, monitor transponder assets and dynamically assign bandwidth based on traffic requirements.

2013 marked another milestone achievement for Paradise with the initial shipments of our 500 watt Ka-band traveling wave tube amplifier (TWTA). What makes our TWTA different from our competitors is that the fact that all of the major components are designed and built by Teledyne, including the tube, HV power supply, Block Upconverter and Linearizer. The packaging and thermal system is patterned after the well-known Paradise Compact Outdoor SSPA. The vertical integration of this product gives us critical supply chain control in all phases of the product.

Part of the year was consumed with the design and deployment of some extremely high powered Gallium Nitride-based (GaN) SSPA's at S-band (4KW) and X-band (3KW) for government users. In addition, we were chosen to supply high-power SSPAs for GPS ground stations in China and Europe.

While many SSPA suppliers continue to use Gallium Arsenide driver components in their amplifier designs, Teledyne Paradise designs use complete GaN line ups with proprietary pre-distortion circuitry to optimize linearity for maximum usable RF power.

In the commercial market the introduction of our Q-Flex software definable modem provides the most economical means of addressing the cellular backhaul, and Oil and Gas segments. Coupled with our new Q-Net NET Network provisioning and bandwidth management system, the Q-Flex provides a true network platform that offers ultimate flexibility while also supporting higher data rates and advanced IP features in a single box solution.

The Q-Flex modem also offers bandwidth saving features such as 5 percent roll-off, MPLS compression, and ViaSat's patented Paired Carrier Multiple Access (PCMA) technology that allows transmit and receive carriers to occupy the same bandwidth. The Q-NET NMS will allow higher level network provisioning such as bandwidth on demand and automated carrier power management.

As is the case with any business with an aggressive growth curve, our biggest challenge is to meet customer demand while providing the required level of commensurate support. As such, we have identified key markets throughout the world and continue to invest in the infrastructure necessary to support the corresponding customer base. In addition to our U.S. based offices, we have offices in Thailand, China and the UK that are fully staffed with sales professionals and engineers.

Teledyne Paradise Datacom continues to look for ways to work with our partners to increase our value proposition. As previously mentioned, we currently are working with ViaSat in deploying the PCMA technology and CodeMettle with the integration of their NMS product with our modems. These partnerships allow us to offer customers the very latest bandwidth saving technology and minimize end user operating expense.

In 2014, we anticipate continued demand for satellite modems and corresponding networks to support cellular backhaul and oil and gas communications systems. The Q-Flex modem along with the Q-NET bandwidth management platform provides unique cost saving features that will continue to support the drive for companies to reduce operating expenses. In addition we are in the process of developing DVB-S2 extensions within our Q-Flex modem which will further enhance the bandwidth efficiencies.

In the RF world, the demand for high power SSPA's driven by expanding DTH markets in Asia and Latin America will continue to grow. Teledyne Paradise Datacom will continue to introduce leading edge technology offering the highest power density of any amplifiers on the market. Also, as downtime caused by failures becomes much more costly, hot-swappable, modular amplifiers with switch-less, soft-fail redundancy schemes will offer the protection of revenue streams that operators now require.

About the author

Mike Towner has served the satellite communications industry for more than 20 years with a number of well-known brands that include Scientific Atlanta, CPI, Cisco, Telecom

International, STM Wireless and Teledyne Technologies. Mike entered the industry after graduating Georgia Institute of Technology with a BEE and a few years later, obtained an MBA from Georgia State University. He now serves as Senior Director of Sales and Marketing with the Teledyne Microwave Solutions Group where he manages a global sales team for Teledyne Paradise Datacom.

About the company

Teledyne Paradise Datacom, LLC., designs and manufactures satellite modems, block up-converters, solid state power amplifiers, low noise amplifiers, and associated equipment for the terrestrial segment of the satellite communications market. In addition to the individual products, Teledyne Paradise Datacom offers customers the possibility of purchasing total electronic package solutions for many of their needs. The ability to offer the full range of related products, manufactured by a single company, is uncommon in our industry. Teledyne Paradise Datacom is also one of a very few commercial satellite Earth station equipment manufacturers with manufacturing and support facilities in both Europe and North America. This ability to manufacture and offer support in two continents differentiates the company as a supplier of satellite communications equipment.



Teledyne Paradise Datacom's Redundant LNA Systems
C-/X-/Ku-Band



Teledyne Paradise Datacom's Q-Flex satellite modem.

By Samer Halawi, Chief Executive Officer

The main challenge for the mobile satellite industry has been to find new ways to innovate—this has resulted in the satellite sector lagging behind the terrestrial world. This is evidenced by the fact that the mobile satellite sector only launches new products every 18 to 24 months. In a world where “bring your own device” is swiftly becoming the norm, we believe at Thuraya that innovating is the definitive pathway to success.

This year, Thuraya has made great strides with the launch of two SatSleeve devices in addition to introducing the IP+ land and maritime broadband terminals. We are working on a product development and launch strategy that will enable us to cater to a wider market, to ensure consumers’ requirements are fully considered, and to dramatically shorten product launch timelines.

We have set out to be the most innovative satellite company in the world with a focus on innovation in our products, services, distribution, and the way we conduct business generally. This has resulted in the creation of a new division dedicated to product and solution development and management. To bring fresh perspectives and ideas to the table, we have made key hires from the terrestrial world that will help us further innovate our products, solutions, and business models.

At Thuraya, we have the agility to adapt to our customer needs, which has been part of our legacy. This was demonstrated when we introduced our first satellite phone in 2001. Since then, we have sold more than 650,000 mobile satellite handsets to our customers in the energy, broadcast media, maritime, government and humanitarian NGO sectors. In 2013, we bucked the industry trends and delivered strong double digit growth, despite a tough economic climate. The MSS industry is changing and we need to innovate to succeed.

Thuraya’s transformational story has been a challenging but fulfilling journey. Over the last two years, we underwent a major transformation in our business, which included an expansion of our product portfolio, an optimization of our network infrastructure as well as the revitalization and expansion of our distribution network in key markets.

We are expanding our partnerships and distribution network with leading communication companies such as Australia’s Optus, Japan’s SoftBank Mobile, the Philippines’ Smart Communications and Taiwan’s Chunghwa Telecoms to bring the Thuraya SatSleeve to more users in these key markets. We have also streamlined our Service Partner network globally to allow us to reach more customers through an agile and capable distribution channel.

We are also placing more focus on understanding the business challenges our customers face on a daily basis and developing unique solutions that address these specific challenges—through technology, hardware and application development, as well as the introduction of new pricing plans that allow customers to tailor

their communications expenditure in accordance with their needs.

An emerging trend that we are seeing is the increased focus on data applications and services. With customers accessing more data via their mobile devices, Thuraya will be putting more focus on expanding the capabilities of our data product lines. We are noting a growing number of customers using the capabilities of the Thuraya IP+ to access data in real time. The government, media, maritime and energy sectors are the key market segments that are showing good traction for Thuraya IP+, and we aim to continue working closely with our Service Partners to build on the commercial potential of this particular product. We also see potential for Thuraya IP+ in the of machine-to-machine (M2M) sector.

Looking ahead, we need to ensure that we continue to deliver solid network coverage, bandwidth and high quality of service in order to keep pace with customer requirements. Thuraya SatSleeve is a great example of a product innovation that not only addresses the specific needs of customers by enabling them to turn their iPhone into a satellite-enabled device. Having our SatSleeve win the Lloyd’s List Innovation Award recently certainly emphasizes that we are moving in the right direction.

We are also exploring how we can leverage the heightened demand for data applications to develop the right MSS solutions to address the diverse needs of M2M communications, maritime operators and other industries that require reliable data access to boost operational efficiency. This will involve establishing a developer community that will add value by creating new applications and solutions that ride on top of our congestion-free network.

Overall, the MSS market presents us with exciting opportunities—innovation will be the key to success. Our strategy is strong and we are working with our partners toward the next level of success—all systems go.

For more information about the company and its products, go to:
<http://www.thuraya.com/>

About the author

Samer Halawi was appointed as Thuraya’s Chief Executive Officer in January of 2011. Drawing upon his extensive experience in ICT and the global satellite communications industry, Samer is responsible for leading Thuraya’s strategic positioning and driving its growth as a prominent global mobile satellite operator.

Before joining Thuraya, Samer played a leading role in starting-up and growing a new venture involved in the digital space and focusing on mobile content, IPTV, mobile advertising, and web management. Prior to that, Samer held during an 8-year tenure various positions at Inmarsat in global strategy and running operations for the Middle East, Africa, and Asia Pacific.

Samer’s other telecommunications experience relates to his roles at Flag Telecom and ICO Global Communications. His role at ICO followed a private placement for the shares of the company that he led during a three-year period he spent in investment banking in the Middle East.

Samer started his career in the automotive industry where he occupied several positions with Chrysler Corporation and Ford Motor Company.



Thuraya’s SatSleeve product.



By Ali Zarkesh, Business Development Director

2013 has been a year of refinement for Vislink. Due to growing data demands, the rise of HD, and with 4K now firmly on everyone's radar, it's becoming more important than ever to deliver technology that transmits quality video output efficiently. Vislink's goal has always been to expand its range of solutions to keep customers' one step ahead in today's ever-changing broadcast environment.

With the industry calling for smaller form factor technology, Vislink's products have been enhanced to meet growing demand for small, portable and lightweight equipment. Data throughput rates have also been increased across the board. Vislink is ready for 2014 and gearing up for the adoption of the latest technologies.

As smaller and lighter SATCOM terminals have appeared in recent months—fueled by expansion in the Ka-band transponder space—3G and 4G LTE products have also broken into the mainstream and are now being used to cover breaking news and some aspects of sports broadcasting. In turn, the traditional COFDM wireless cameras have become more flexible, with Vislink at the forefront of product innovation.

Vislink has capitalized on existing broadcast success to deliver a range of highly customizable products suitable for any broadcast task, benefiting from the ability to combine equipment from a number of Vislink brands to build bespoke solutions that meet individual customer needs.

Product wise, it's been a very busy period. The Mantis MSAT data terminal was first launched at the end of 2012, so 2013 has seen a number of improvements and updates. By offering larger reflectors of up to 120cm Vislink has been able to meet the industry's need for higher data transmission rates. Then, at IBC, a motorized version was introduced. This greatly improved the practicality of the MSAT terminal for first on-scene reporting or news gathering in remote or inhospitable locations. Taking under five minutes to go from onsite to on-air, the unit's simultaneous three axis motorization and one button auto acquire makes it ideal for news teams with even the most limited experience to start broadcasting live pictures back to base. This new addition to the MSAT range really puts the Vislink brand at the forefront of the industry's push for smaller, lighter antennas.

This year's IBC also saw new additions to the Link wireless camera range. The L1700 builds on from the highly successful L1500, which was the first transmitter to have swappable RF modules and in-built camera control. To help Vislink stay one step ahead of the competition, the L1700 system was designed with future proofing in mind. Not only is it a third of the size of the outgoing unit, it can be upgraded with new features via software downloads. The new design has kept the field swappable RF section to enable different frequency bands to be changed as and when required.

Similarly, Vislink's Gigawave INCAM range was enhanced to support Grass Valley's LDX camera series, delivering an in-built transmitter with H.264 encoding. Once again, taking customer requirements into account for the design, the focus was on the ease of use for the camera operator. Due to the design of the LDX series, the Gigawave INCAM is integrated into the rear of the camera body, giving significant advantages in terms of weight distribution and configuration.

In the SATCOM space, uptake of the Ka-band really took off this year. This trend wasn't only confined to broadcast markets—the surveillance sector also has an appetite for this type of communications set up—and the ability to be operational at a moment's notice, anywhere in the world, has pushed military and government procurement toward the commercial sector. Vislink has seen a rise in the use of off the shelf products in a military scenario. With the implementation and upgrades made to the Mantis MSAT range, Vislink has succeeded in making significant inroads into this arena.

Another ongoing challenge is the availability of frequency spectrum which is increasingly under threat from governments selling off space to mobile operators. As a result, Vislink, like many other companies, is being asked to provide solutions that deliver the same amount of data throughput while using less bandwidth than before. To address challenges like these, Vislink consistently puts a large part of the company's resources into research and development to make sure the company is always looking ahead and anticipating the customers' requirements.

Looking forward, the 2014 FIFA World Cup and 2016 Rio de Janeiro Olympics will help demonstrate the vital role that satellite technology plays in delivering reliable access to voice, video and data communications. With these large-scale sporting events just around the corner, and the entire world watching, it's going to be more important than ever that broadcast equipment and network infrastructure can be relied upon.

Fortunately, Vislink's latest upgrades and products can already help tackle this challenge. Vislink's new range of wireless camera technologies, for example, allow broadcasters the flexibility of being able to work in whatever frequency band that the organizers settle upon and not be limited to the already highly used 2GHz range. Changing consumer demand has also adapted plans for the future, particularly with second screen viewing becoming increasingly popular. Live TV is always going to be the hook to get viewers engaged, but online video is now a big player, and viewers are turning to mobile apps and social networks to enhance their engagement with TV content. Now, content created for YouTube and streaming services like Netflix needs to be of the highest quality. The rise of second screen devices has created new sales opportunities and Vislink's customer base is constantly expanding.

4K is another topic that's high on the agenda, with broadcasters talking about the possibilities this will give them. Camera manufacturers have already launched products to meet this new broadcast standard, so Vislink's R&D department is looking at more efficient encoding technologies to satisfy higher compression requirements. The need for high-quality 4K video will push encoding technologies into new areas, and Vislink's role within the broadcast industry will become more important than ever.

If 2013 was a year of refinement, then 2014 is going to be a period of growth. With the rise of Internet-ready content, and two large-scale sporting events on the horizon, demand for Vislink's equipment is expected to grow significantly. Indeed, 2014 will allow Vislink to build on its success from 2013 and help shape the broadcast industry's future. But no matter what the coming months bring, Vislink will continue to focus on the most important aspect of all—the customer.

For further information regarding Vislink, please access:
<http://www.vislink.com/>

About the author

Ali Zarkesh has been the Business Development Director at Vislink for almost two-and-a-half years. With more than 20 years of experience, 10 of which were within program management, Ali has worked at leading space and IT companies throughout his career such as Inmarsat, Astrium, Eumetsat, Vega and ComDev—as well as his current position at Vislink, a global provider of satellite communications technologies.

Having completed a BSc and then an MSc in Computer Science in the early 1990s, Ali started his career at Inmarsat as an engineer. Following an eight year stint as a consultant to Vega plc, Ali then held two senior management positions at Astrium and ComDev Europe before acquiring his current position of Business Development Director of SATCOM Products at Vislink. His role involves the direction and oversight of product development of the entire range of SATCOM products as well as defining the strategic direction and road map for future products. He also develops new business contacts and markets for the company.



InfoBeam: Late-Breaking Event

Launch-O-Rama: SpaceX, Orbital + SES—It's A Go—Falcon 9 Completes First Geostationary Transfer Mission



*SpaceX Falcon 9 on its launch pad with the SES-8 satellite aboard.
Photo courtesy of SpaceX.*

Space Exploration Technologies (SpaceX) successfully completed its first geostationary transfer mission, delivering the SES-8 satellite to its targeted 295 x 80,000km orbit.

Falcon 9 lifted off from Space Launch Complex 40 (SLC-40) at 5:41 PM Eastern Time on December 3rd, 2013. Approximately 185 seconds into flight, Falcon 9's second stage's single Merlin vacuum engine ignited to begin a five minute, 20 second burn that delivered the SES-8 satellite into its parking orbit.

Eighteen minutes after injection into the parking orbit, the second stage engine relit for just over one minute to carry the SES-8 satellite to its final geostationary transfer orbit. The restart of the Falcon 9 second stage is a requirement for all geostationary transfer missions.

SpaceX's launch of SES-8 is notably the first commercial communications satellite to be launched from Cape Canaveral in four years.

A previous launch attempt on November 25th was called off after several technical glitches occurred, including an issue with the rocket's first-stage liquid oxygen pressurization system. The company decided to skip a launch attempt on Monday to allow more time to recheck the rocket following a last-second abort on Thursday.

An onboard computer automatically aborted launch seconds before liftoff on Thursday when it detected the first-stage engine wasn't ramping up thrust levels as quickly as expected. The rocket was returned to its processing hangar for inspections. Engineers discovered oxygen had



The SpaceX Falcon 9 in a vertical position during pre-launch preparations for the SES-8 satellite. Photo courtesy of SpaceX.

gotten inside the ground-based engine igniter system.

"All known rocket anomalies resolved. Will spend another day rechecking to be sure," company founder and Chief Executive Elon Musk posted on Twitter on Monday.

"The successful insertion of the SES-8 satellite confirms the upgraded Falcon 9 launch vehicle delivers to the industry's highest performance standards," he added on Tuesday. "As always, SpaceX remains committed to delivering the safest, most reliable launch vehicles on the market today. We appreciate SES's early confidence in SpaceX and look forward to launching additional SES satellites in the years to come."

This mission marked SpaceX's first commercial launch from its central Florida launch pad and the first commercial flight from the Cape Canaveral Air Force Station in several years. SpaceX has nearly 50 launches on its manifest, of which more than 60 percent are for commercial customers, worth about \$4 billion, including 10 more International Space Station cargo runs for NASA

This launch also marks the second of three flights needed to certify the

Falcon 9 to fly missions for the U.S. Air Force under the Evolved Expendable Launch Vehicle (EELV) program. When Falcon 9 is certified, SpaceX will be eligible to compete for all National Security Space (NSS) missions.

The SES-8 satellite aboard the Falcon 9, for example, is expected to fly more than 22,300 miles above Earth and provide television, cable, broadband and other services to customers in India, China, Vietnam and elsewhere in Asia.

In the 1980s, the United States dominated the commercial launch industry, now worth about \$6.5 billion a year, according to a report by the Satellite Industry Association trade organization, whereas in 2012 the revenue from the global satellite industry was \$190 billion.

All of Falcon 9's structures, engines, and ground systems were designed, manufactured, and tested in the United States by SpaceX. 21st-century rocket. As the first rocket completely developed in the 21st century, Falcon 9 was designed from the ground up for maximum reliability from a blank sheet to first launch in four and a half years (November 2005 to June 2010) for less than \$300 million.



*Moving the Falcon 9 launch vehicle to the launch pad.
Photo courtesy of SpaceX.*



*SES-8 liftoff at Cape Canaveral aboard a SpaceX Falcon 9 rocket.
Photo courtesy of SpaceX.*



An upgraded Falcon 9 with safety and reliability enhancements and greater lift capability flew for the first time on the SES-8 mission. Designed for maximum reliability.

Falcon 9 features a simple two-stage design to minimize the number of stage separations. (Historically, the main causes of launch failures have been stage separations and engine failures.) With nine engines on the first stage, it can safely complete its mission even in the event of a first-stage engine failure.

Falcon 9 topped with SpaceX fairing is 224.4 feet (68.4 meters) tall and 12 feet in diameter (the fairing is 17 feet in diameter). Its nine first-stage Merlin engines generate 1.3 million pounds of thrust at sea level, rising to 1.5 million pounds of thrust as Falcon 9 climbs out of the Earth's atmosphere.

Falcon 9 has achieved 100 percent success on its six flights to date: June 2010 and December 2010 flights to orbit; a May 2012 launch of the Dragon spacecraft to the International Space Station (ISS) making SpaceX the first commercial company ever to visit the ISS; two of at least 12 launches of Dragon to the ISS as official cargo resupply missions for NASA, and launch of the CASSIOPE communications satellite for Canada's MDA Corporation in September 2013.

Why is the launch vehicle named "Falcon"? Falcon 9 is named for the Millennium Falcon in the "Star Wars" movies. The number 9 refers to the nine Merlin engines that power Falcon 9's first stage; one Merlin vacuum engine powers the second stage.

For more information regarding SpaceX: www.spacex.com

Orbital Sciences Corporation (NYSE: ORB), the builder of the SES-8 satellite, has reported that the Falcon 9 launch vehicle's final stage successfully separated at approximately 31 minutes into the mission, placing the satellite into a super-synchronous transfer orbit.

Over the next several weeks, SES and Orbital engineers will conduct a comprehensive series of in-orbit tests to verify all spacecraft systems are functioning properly before it is officially turned over to SES for full operational control and commencement of commercial service. SES-8 is the sixth Orbital-built GEOStar satellite ordered by SES, a leading global satellite operator providing a broad range of communications services.

"Early in the initial check-out and testing process, the SES-8 mission is proceeding smoothly," said Mr. Christopher Richmond, Orbital's Senior Vice President of Communications



SES-8 in flight atop the Falcon 9 launch vehicle.

Satellite Programs. "We are proud to continue to be a part of the SES team, helping increase communications capacity to meet the rapidly growing demand for telecommunications services in South Asia and Indo-China."

Orbital designed, built and tested SES-8 at its satellite manufacturing facility in Dulles, Virginia. The 3,200kg satellite features 33 Ku-band transponders of 36MHz capacity. In addition, SES-8 carries a Ka-band payload that, together with the Ku-band payload, consumes approximately five kilowatts of electrical power.

Designed for an anticipated service life of 15 years, SES-8 will be co-located with NSS-6 at an orbit location of 95 degrees East Longitude. Upon full activation, the satellite will provide expanded communications support for South Asia and Indo-China and additional capacity for Direct to Home (DTH), Very Small Aperture Terminal (VSAT), and government applications.

Orbital's highly successful Geosynchronous Earth Orbit (GEO) communications satellites are based on the company's GEOStar spacecraft platform, which is able to accommodate all types of commercial communications payloads and is compatible with all major commercial launchers.

The company's GEOStar product line includes the GEOStar-2 design, which is optimized for smaller satellite missions that can support up to 5.0 kilowatts of payload power.

Orbital has also developed the higher-power GEOStar-3 spacecraft design, delivering the next increment of payload power for applications between 5.0 and 7.5 kilowatts, allowing Orbital to offer its innovative and reliable satellite design to the medium-class of communications satellites.

With this launch, 148 Orbital-built satellites have been completed and delivered to commercial, civil government and national security customers during the last 30 years.

The SES-8 satellite is the 36th commercial geosynchronous communications spacecraft ordered by Orbital's customers around the world—31 have been launched to date and another five are now in design, production or pre-launch preparations.

For more information regarding Orbital: www.orbital.com

Romain Bausch, President and CEO of SES, said, "SES's maiden launch on board a Falcon 9 rocket is yet another example of our company's spirit of innovation and advancement of the commercial space industry."

We congratulate the SpaceX team for the success of a challenging launch campaign and our longstanding supplier Orbital for innovating with us in exploring new paths to orbit while delivering a brand-new, state-of-the-art satellite for Asia.

"Our customers are looking forward to the new capacity, and we are delighted that SES, in collaboration with SpaceX and Orbital, is all set to deliver following today's successful launch. Through the co-location with NSS-6 at 95 degrees East, SES-8 will not only provide incremental high performance capacity, notably for DTH services, it will also create greater reliability and additional security for customers. The SES-8 satellite will significantly contribute to SES's growing presence in Asia-Pacific."

The next SES launch is slated for early next year, when an Ariane 5 vehicle will orbit the ASTRA 5B satellite from Kourou, French Guyana.

For more information on SES: www.ses.com/4232583/en

