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A Higher Calling— Eight More For Galileo

European Commission Vice President Antonio Tajani has announced in London that the consortium led by OHB System AG and Surrey Satellite Technology Ltd (SSTL) will build a further eight satellites for the European Union's Galileo satellite navigation program under the supervision of the European Space Agency.

The new contract will see SSTL continuing its role as payload prime, assembling, integrating and testing the navigation payloads in the U.K., while OHB System, as the prime contractor, builds the eight satellite platforms and executes the final integration of all the satellites in

Kepler technical facility in Guildford, U.K. Under the contract, SSTL is fully responsible for the construction and test of the navigation payloads. SSTL will manufacture the electrical harnesses and the electronics to interface the navigation payload with the satellite platform. The remaining payload equipment will be externally procured by SSTL from European and other suppliers. SSTL's payload solution is based on European-sourced atomic clocks, navigation signal generators, high power travelling wave tube amplifiers and antennas and will provide all of Galileo's services.

Galileo is Europe's own Global Navigation Satellite System (GNSS), providing real-time positioning, navigation and timing services with unrivalled accuracy and integrity. It will be

Screen shots of Blue Sky Network's SkyRouter portal.
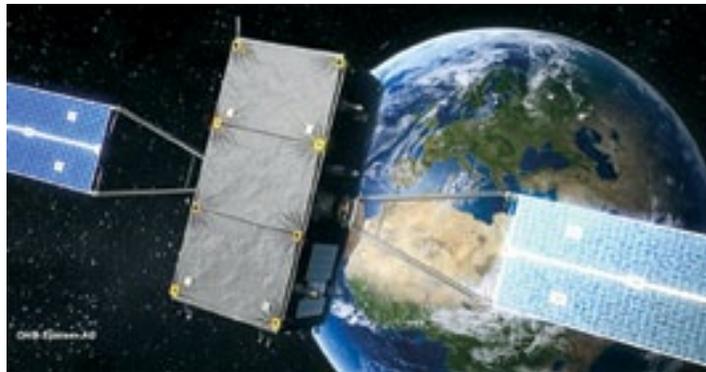
Artistic rendition of the European navigation satellite.

Germany.

The SSTL-OHB partnership is already building 14 satellites for the Galileo program and will draw on its heritage and experience to produce the additional satellites to demanding schedules.

Matt Perkins, SSTL Group CEO, said, "SSTL has played a key role in the development of the Galileo programme for nine years and we have the commitment, experience and track record to deliver this substantial contract. We are delighted to have been selected with our partner, OHB, to continue to play our part in building Europe's operational navigation system."

SSTL is assembling the Galileo program payloads at its recently opened purpose-built

interoperable with the American GPS system and Russia's GLONASS system.

The Full Operational Capability phase of the Galileo program is managed and fully funded by the European Union. The Commission and ESA have signed a delegation agreement by which ESA acts as design and procurement agent on behalf of the Commission.

Pole-To-Pole Provisioning

Satellite tracking, fleet management, and automated flight following solutions provider Blue Sky Network has been selected by Iridium Communications Inc. (Nasdaq: IRDM) as a location-based service (LBS) Premium Portal Provider of the new Iridium Extreme™ satellite phone.

This new satellite phone is the smallest, lightest, and most rugged handset on the market, with the ability to precisely track users everywhere on the surface of the planet through the world's furthest-reaching communications network. The Iridium Extreme seamlessly integrates with Blue Sky Network's robust SkyRouter web portal, which provides real time tracking and two-way messaging for mobile users.

With the Iridium Extreme handset, Blue Sky Network is providing users with the only pole-to-pole satellite phone capability combined with real time GPS tracking and emergency services. Blue Sky Network will also offer the Iridium AxcessPoint, which, when attached to the Iridium Extreme handset, provides a global Wi-Fi hotspot for devices such as smartphones, tablets and laptops, connecting

customers in ways never before possible.

In concert with the SkyRouter web portal, Blue Sky Network's offering of this handset will deliver to customers anywhere in the world one, in-hand solution for voice, data GPS, SOS, tracking and SMS. SkyRouter provides 99.999 per cent reliability and when coupled with a handset that is made to stay functional through the most hazardous of conditions. SkyRouter also ensures complete security.

Bundle Breaks The Century Mark

Vizada, now fully part of Astrium Services, has just announced its one hundredth contract for Global Maritime Broadband Bundles, which seamlessly integrate Ku-band VSAT, mobile satellite services (MSS) and Vizada's proprietary maritime communications platform, Vizada XChange.

Vizada was the first provider to offer all-in-one combined connectivity packages to the maritime community. Since launching the bundles in June 2011, more than 100 contracts have been signed, including with large shipping companies such as

Scorpio Ship Management. Thanks to this offering, Vizada guarantees the best broadband options and most extensive coverage.

The number of contracts signed and the positive customer response proves Vizada's top-position in the market for airtime combination packages across multiple satellite services. The bundles offer a great variety of choice to shipping companies: a combination of VSAT, MSS hardware and airtime can be chosen based on their specific needs. Upgrades to a plan with more bandwidth or to a next generation satellite service are possible during or after contract termination.

Vizada's Bundles are designed to fit the needs of clients who are looking for unlimited global coverage and cannot risk lower throughput or limited broadband capabilities. The addition of value-added services, such as Vizada's proprietary Vizada XChange platform guarantees a seamless user experience onboard, regardless of the connectivity service chosen.

No Sky View? No Big Deal

Gilat Satcom has announced the Company has released to market SuricatePRO™.

This is a new communication solution that provides people in underground and other closed facilities the ability to communicate over Iridium satellite phones. Providing coverage extension for these devices, SuricatePRO extends telephony throughout the facility without loss of signal quality. The product is the perfect solution for using Iridium devices without sky view. Satphone users in mines, secure military installations, underground facilities and remote locations without sky view can quickly
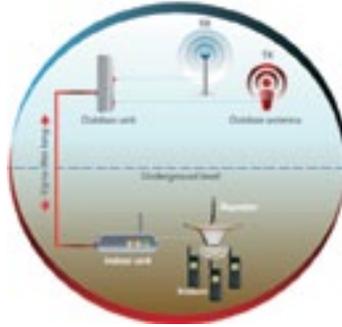
establish a SuricatePRO communication link that enables seamless communication with the Iridium satellite constellation.

Gilat Satcom's Mobile Satellite Director, Ami Schneider, said, "With SuricatePRO, we deliver telephone communication to formerly impossible-to-reach locations and secure facilities. Now, after only a very simple installation of small, lightweight equipment, Iridium subscribers can gain reliable access to the Iridium network."

SuricatePRO takes advantage of Foxcom's RF-over-fiber technology. To enjoy the benefits of SuricatePRO, customers need only to install outdoor and indoor units connected via fiber (up to 3 km). Immediately, Iridium satphone users in the room can access the Iridium constellation as if they had clear sky view.

Real-Time SATCOM Networks Monitoring

RT Logic, a Kratos company, has introduced a SATCOM Security Event Information Management (SEIM) product developed for the mission risks posed by the growth of end-to-end IP satellite communications.

The product, which monitors SATCOM networks, delivers real-time prioritized security and mission assurance alerts, alarms, compliance violations, and network situational aware-

SEIM screen with chassis, photo courtesy of RT Logic

ness. The appliance delivers a complete SEIM solution for the SATCOM environment, offering cyber security and mission assurance situational awareness and incident response. It's available in all-in-one and high-availability configurations, that scale to the mission needs of space and aerospace organizations of any size.

RT Logic, which supports the missions of nearly every U.S. space program, is addressing the changing threat landscape by developing a full cyber security product line. The solutions provide real-time cyber protection for new and existing space missions, and can retrofit existing critical national missions with no modifications to hardware, APIs, or Mission Software. The products are based on proven technologies with a TRL-9 heritage.

The products are based on proven technologies with a TRL-9 heritage. Solutions are available as individual products, integrated product suites, or enterprise security and mission assurance architectures. For more information, please visit: **http://www.rtlogic.com/cyber**

Proton Sends SES-4 To

Its Slot

International Launch Services (ILS) has successfully carried the SES-4 satellite into geostationary transfer orbit on an ILS Proton for SES.

This was the 20th SES satellite launched on ILS Proton and the 70th ILS Proton launch overall. The ILS Proton Breeze M launched from Pad 39 at the Cosmodrome on February 14th). After a 9 hour, 12-minute mission, the Breeze M successfully released the SES-4 satellite into geostationary transfer orbit.

This was the 373rd launch for Proton since its inaugural flight in 1965. The Proton Breeze M launch vehicle was developed and built by Khrunichev State Research and Production Space Center of Moscow, the majority shareholder in ILS

SES-4 is the largest satellite in SES's fleet, weighing 6.18 metric tons to be located at 338 degrees East; the largest neighborhood in the Atlantic. Built on the flight-proven Space Systems/Loral 1300 platform, SES-4 is a hybrid satellite featuring 52 high powered C-band coverage and incremental global capacity for video distribution, government and VSAT services. The satellite's 72 Ku-band payload will provide enhanced capacity across three continents, with coverage in Europe, the Middle East, Africa, Western Africa and

The ILS Proton launch of the SES-4 satellite from the Baikonur Cosmodrome.

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Latin America.

ILS President, Frank McKenna, said, "It is always thrilling to achieve milestones in our business but even more so when it is with a longtime customer, such as SES. With the ILS Proton launch of SES-4 this marks our 20th SES satellite launched on ILS Proton and the 50th satellite in the SES fleet. We are honored to be entrusted with launching the powerful SES-4 satellite and look forward to performing on all of our upcoming ILS Proton missions for SES."

"Once again, ILS Proton has come through for SES, enabling the expansion of our business into emerging markets with the launch of SES-4. This is the 50th satellite in SES's fleet and the third launch attempt by the powerful Proton launch vehicle proved to be a total success. We are thankful for the hard work and diligence of the collective teams of ILS, Khrunichev, SES and Space Systems/Loral on this mission for this successful launch," said SES President and CEO, Romain Bausch.

The Ka- Revolution

In 1999, Irving Goldstein wrote in "The Future of the Electronic Marketplace" that "the first global broadband Ka-band systems are not expected to be operational until 2001 or 2002". It seems that Ka- has been the future for a long time. The article envisioned Ka-band satellites to be conceptually similar to the 'flying car' imagery of the 1950s, a mind-blowing change in the technology which would literally transform the game.

Similar to the 'winged-machine' visions from the past, there didn't appear to be any serious progress materializing in the high-frequency band of Ka-. A few years ago, however, Telesat, Wildblue and Spaceway in North America began offering Ka- services for residential customers, but there had been little deployable advancement in the commercial sector—until now.

The revolution has really

begun this decade, starting with KA-SAT's launch in December 2010—a single satellite with 38 times the capacity of a standard Ku-band satellite. In October 2011, ViaSat-1 was launched with 140Gbps of data capacity, more than all the satellites covering North America combined. ViaSat-1 in North America, like KA-SAT in Europe, is capable of two-way communications with small dish antennas at higher speeds and a lower cost-per-bit than any satellite before. With the upcoming launches of Yahsat 1-B in April for the MENA region, and several other Ka-birds expected in space between now and 2015, including Inmarsat's Global Express, it is clear that the satellite industry's 'flying car' is finally making its way down the production line.

C-COM Satellite Systems has been involved from the early stages of Ka- availability in North America, manufacturing one of the first Comm-On-The-Pause vehicle-mount auto-pointing Ka-band antennas for the Telesat/Wildblue service. C-COM is in the final stages of completing certification for its new generation auto-pointing Ka band antenna systems for commercial use in North America, Europe, the Middle East and Africa. In the next few months, C-COM will roll out its production lines of 2 and 3-axis systems compatible with all the different Ka service providers.

75cm and 98cm antennas using C-COM's next generation high-precision platforms configured with the most advanced version of the 7000 iNetVu® controller (Model 7024, which support the latest DVB-S2/ACM modulation as well as Glonass and GPS Navigation Systems), will ship in the second quarter

of this year. Later in 2012, C-COM is expected to roll out a number of different Ka-related products for alternate market verticals. C-COM aims to become the global leader in Ka-band mobile antenna manufacturing, and continue its torrid growth in the Ku-, C-and X-band sectors, as well.

We are now in an age where satellite broadband has become economical for almost everyone. In the commercial world, this couldn't come any sooner, as the benefits of using Ka-, even just as a stopgap to remove some strain from existing Ku-band networks, are significant. Smaller antennas, lower power requirements, greater bandwidth at a lower price—all point to a revolution in the satellite broadband industry. The commissioning of all instrumentation on America's new Suomi NPP satellite has been nearly completed.

Severe Weather Forecasting

A powerful instrument designed to give scientists more refined information about Earth's atmosphere and improve weather and climate forecasts is now active and sending its first data back to Earth from America's newest polar-orbiting satellite.

The Cross-track Infrared Sounder (CrIS) will produce high resolution, three-dimensional temperature, atmospheric pressure, and moisture profiles that will be used in NOAA's weather prediction computer models to forecast severe weather days in advance. Over longer timescales this information will also help scientists understand climate phenomena such as El Niño and La Niña.

CrIS is one of five instruments aboard the Suomi National Polar-orbiting Partnership satellite (NPP), which NASA launched on October 28, 2011 from Vandenberg Air Force Base in California. Since it reached orbit, those instruments, including four used in space for the first time, are

undergoing extensive, initial checkouts before starting regular science observations.

"Having data from CrIS will improve the quality, timeliness and accuracy of NOAA's weather and climate predictions, which directly benefits everyone in America," said Mary Kicza, assistant administrator for NOAA's Satellite and Information Service.

The Suomi NPP team is expected to continue commissioning activities until the end of March. After that is complete NOAA will operate Suomi NPP, and process and distribute the data to users around the world.

"Suomi NPP instrument commissioning is going very well and the team is pleased that the satellite is taking the next step in its mission of providing this critical weather data to NOAA," said Ken Schwer, Suomi NPP project manager.

The Suomi NPP mission is the bridge between NOAA's Polar Operational Environmental Satellite (POES) and NASA's Earth Observing System satellites to the next-generation Joint Polar Satellite System (JPSS) which NOAA will operate.
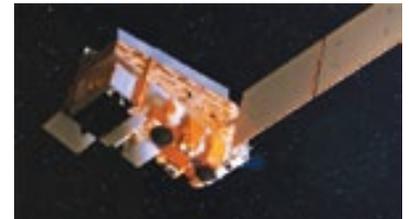
NASA's Goddard Space Flight Center in Greenbelt, Maryland, manages the Suomi NPP mission for the Earth Science Division of the Science Mission Directorate at NASA Headquarters in Washington. NOAA provided the CrIS instrument and the JPSS program provides the satellite ground system. NOAA also provides the operational support.

NOAA's mission is to understand and predict changes in the Earth's environment, from the depths of the ocean to the surface of the sun, and to conserve and manage our coastal and marine resources. Join us on Facebook, Twitter and our

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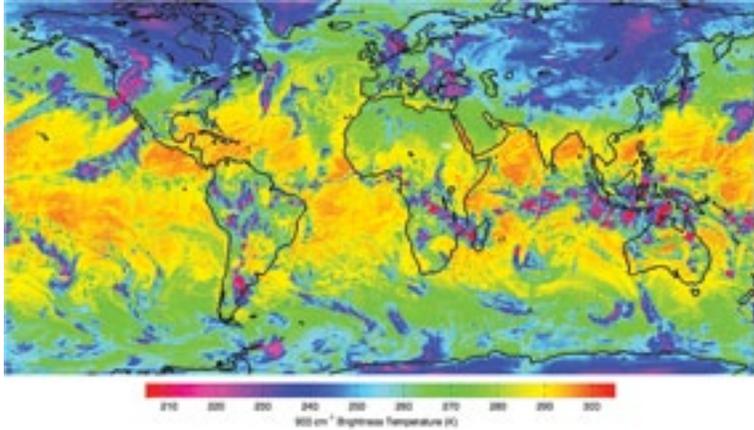
In this CrIS image the orange colors represent very warm sea surface temperatures, while magenta represents both very cold temperatures, as well as high-altitude cloud tops. When all of CrIS's channels are used, users and scientists can obtain detailed, three dimensional views of atmospheric temperature and moisture. Credit: NASA/NOAA

Earth Observation: The Mass Is The Matter

When The U.K. Government announced support to finance half of SSTL's newest radar satellite, it confirmed a trend NSR has seen cropping up in recent times: smaller satellites are gaining ground in both optical and now in SAR markets.

As more manufacturers are looking to address this market with finer ground resolution and smaller satellites at a lower cost (£200 million for four 300 kg. SSTL radar satellites), the effect is likely to be a reduction in the cost of data at the end user side.

In the optical realm, small satellites weighing 300 kg today can offer 70 percent to 80 percent of the capabilities of a traditional commercial EO satellite. These can also offer download speeds and an onboard memory of a 1-ton satellite launched for 10 years. It is a well-known fact in the industry that imagery prices fall at the same time as resolution gets better. For example, the cost of 2 meter PAN optical data has decreased by more than half since 2001. Even if radar data is still more expensive, the decrease is already showing in the low and medium resolution end of the market.

This is now a global requirement as reports surfaced late in 2011 about a contract signed between Japan and Vietnam to use NEC Corporation's 500 kg ASNARO platform to build for the Vietnamese two SAR satellites and a ground station for 46 B ¥ (around $590 M).

With an influx of new capacity on the market with these satellites, the overall price of radar data should decline even further. In its recently released *Global Satellite-Based Earth Observa-tion, 3rd Edition* report, NSR indicated that as small satellites (less than 500 kg) are getting cheaper to produce and launch, their numbers are expected to surpass medium and heavy satellites in the next 10 years.

What NSR considers is a trend in lower mass and more performing spacecraft is a commoditization of satellites that offer higher resolution imagery at a lower price. The barriers to entry for countries and operators that want their own infrastructure are thus coming down slowly and increasing the market pie. At £45 million (roughly $70 million), not only is the SSTL SAR satellite priced much lower than what the market is used to, but it has advanced performance as well. The highest resolution of SAR images with such a platform is six meters at a swath of 12 to 20 km. Just to compare what that means in terms of evolution, the current RADARSAT 2 satellite, launched in 2007 at a cost of over $500 million CAN offers 3 meter resolution for a 20 km swath (albeit at a higher altitude).

The aim of the British Government is openly stated: bring down the cost of data to reach a wider set of potential customers with smaller and cheaper satellites, and it starts at the hardware level. The end result is that a game changing process could well be underway in the EO market with manufacturers such as SSTL, IAI, NEC, and MDA who address this issue. If they are successful, it will mean that mass is part of the equation for the EO data market to expand.

*NSR's **Global Satellite-Based Earth Observation, 3rd Edition** information*

Satellites Tapped For Disaster Response

Matching the power of satellite technology to disaster risk reduction and emergency response here on Earth is the subject of a new publication issued by the United Nations Office for Outer Space Affairs' Space-based Information for Disaster Management and Emergency Response (UN-SPIDER).

The report—*Space-based Information for Crowdsource Mapping - Report of the Secretariat*—stems from expert meetings that individually engaged the talents of over 80 experts and practitioners from over 20 countries.

Those meetings, held in Vienna, Austria and Geneva, Switzerland were organized by the UN-SPIDER with support of the Secure World Founda-

other social media channels.

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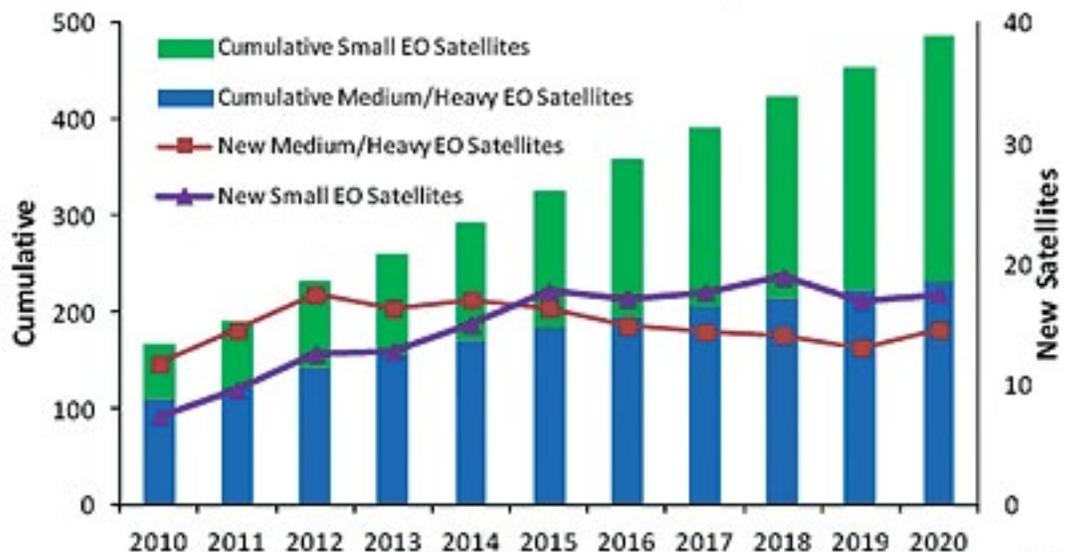
tion (SWF) and the Government of Austria.

For the past several years, advancements in technologies have made it possible for virtual communities such as OpenStreetMap, Ushahidi, Sahana, CrisisMappers, Virtual Disaster Viewer, Google MapMaker and Innovative Support to Emergencies Diseases and Disasters (InSTEDD) to provide increasing support to disaster preparedness and emergency response efforts.

Central to this virtual effort is the ability to access and take advantage of satellite-gleaned imagery of the Earth, as well as the use of other space-based technologies, particularly, telecommunications satellites and global navigation satellite systems.

"This report shows that crowd source mapping and space technologies are natural partners," said Dr. Michael Simpson, Executive Director of Secure World Foundation. "Our challenge going forward is to ensure that the lines of communication between them are well-nurtured so that they can fulfill their potential to improve human lives."

In the issued report, a number of observations, recommendations and next steps are noted, such as:

Crowdsource mapping is an interdisciplinary field bridging many areas of expertise, including the need to access and use space-based technologies. In order to understand how such technologies could contribute to the work of the volunteer and technical communities, there is a need to better define how the many fields come together to support Crowdsource mapping activities and, more specifically, the common questions being asked by all those involved.

- Crowdsourcing of geospatial data and information, including space-based information, can enable an end-user with a specific need to have access to geographical knowledge from both domain experts and ordinary citizens, leading to better decision-making

in the area of disaster risk management and emergency response.

- The "swarm-and-surge" capacity (i.e. the convergence of volunteers to address a specific problem), access to local knowledge and the delivery speed of the products are the main strengths and advantages of crowdsourcing.

- There is need to map the specific information needs of the end-user community—the actual disaster and emergency response managers dealing with the problem —and, more specifically, how that community has been able to access and use the information provided by the volunteer and technical communities.

- Crowdsource mapping is distinct and builds upon "crisis mapping". Crisis mapping was understood as live mapping that focused on crises, with the term "crisis" encompassing slow-burn crises to sudden-onset disasters, and also includes political and humanitarian crises. Crowdsource mapping is a step further, one that takes into account actions and activities that support the full disaster management cycle—not only for emergency and humanitarian response.

"Secure World Foundation is very pleased to work in cooperation with the UN-SPIDER," said Agnieszka Lukaszczyk, SWF's European Program Manager based in Brussels, Belgium and a key organizer of the crowdsourcing meetings.

"The report is unique in that it draws upon the expertise of space authorities, disaster managers, and individuals from the crowdsourcing community to help build bridges between each other to work in the area of disaster management," Lukaszczyk said. "This report

signals and strengthens the cooperation among these three communities."

For more information on this newly issued report, contact *Agnieszka Lukaszczyk* of the Secure World Foundation.

Fairing Well

RUAG Space played a major role in the Vega project and is responsible for the development of the launcher's payload fairing and onboard computer.

With Vega, the family of European launchers can now also cater to the smaller end of the market. Measuring in at a height of some 30 meters, this launch vehicle is designed to carry small to medium-sized satellite payloads into low Earth orbits. Vega can carry a payload of approximately 1,500 kilograms to an altitude of 700 km, making it particularly suitable for deploying satellites designed for Earth observation, meteorology and scientific studies. Vega has a lift-off mass of approximately 137 metric tons.

The new launcher was developed as part of an ESA program funded by Italy, France, Spain, Belgium, the Netherlands, Switzerland and Sweden. The industrial prime contractor is the Italian consortium ELV, while the launch service provider is the company Arianespace, which also runs the French Guiana-based launch operations for the Ariane and Soyuz launchers.

Vega's payload fairing is built by RUAG Space in Zurich. The fairing, which is nearly 8 meters long, forms the nose cone of the rocket. Prior to launch, it protects the satellites from high temperatures, solar radiation, dust, moisture and rain at the launch site.

During the first few minutes of flight, the primary job of the fairing is to protect the satellites it encapsulates from extreme noise, frictional heat and mechanical loads. Once the rocket has passed through the Earth's atmosphere after the critical first three minutes of flight, the fairing has fulfilled its purpose and can be jettisoned.

The engineers at RUAG

Space have more than 40 years' experience in making sure that the rocket nose cone survives those all-important first three minutes intact. Since the early days of the European Ariane program, Switzerland has been responsible for producing the nose cones of the western European launch vehicles. RUAG Space is now the world's leading supplier of payload fairings using composite technology. RUAG fairings are used on both the European Ariane 5 and the American Atlas V 500 launch vehicles.

The Vega fairing uses the same sandwich construction as the Ariane and Atlas fairings. It consists of four shell sections with an aluminum honeycomb core covered with layers of

carbon fiber reinforced plastic. With a diameter of 2.60 meters and a length of nearly 8 meters, the fully equipped composite fairing weighs just 530 kilograms thanks to its innovative design. The exterior of the fairing is covered with cork insulating tiles to protect it from the frictional heat generated as it passes through the Earth's atmosphere.

The launcher's onboard computer and the telemetry antennas are built by RUAG Space Sweden. Compared with the onboard computer used in Ariane 5, the Vega computer offers far more processing power, yet is significantly smaller and lighter.

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4,000 TV Channel Barrier Surpassed

Eutelsat Communications has announced that the number of channels broadcasting through its satellites hit the milestone of 4,000 at the end of 2011. This new landmark reflects almost 30 years of uninterrupted channel growth since the first TV signals broadcast in Europe from Eutelsat's pioneering communications satellites.

The threshold was crossed with the launch at Eutelsat's 7° West video neighbourhood of Rotana Cinema, devoted to classic and contemporary films in Arabic and part of the Rotana entertainment group. The figures show the continuing attraction of Eutelsat's video neighborhoods that have absorbed 2,000 additional channels over the last five years.
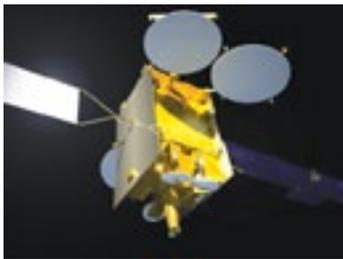
ATLANTIC BIRD-7

The fastest impetus is at positions serving TV markets in the Middle East, Africa, Russia and Central Europe where Eutelsat continues to expand resources, most recently with the launches in 2011 of ATLANTIC BIRD 7 (7° West) to serve viewers in North Africa and the Middle East, and W3C (16° East) for viewers in Central Europe and French-speaking Indian Ocean islandsChannel expansion in Russia and Africa saw a significant boost with the arrival of Eutelsat's high-capacity W7 satellite which more than doubled resources at 36° East. A 100 percent digital universe, HDTV on the uptake With switch-off at the end of 2011of the last satellite channels broadcasting in analogue, Eutelsat is the first leading satellite company to be operating in a fully digital universe.

The transition to digital has driven rapid expansion and diversification of thematic television and is now driving the emergence of HD. HDTV, which broke through by satellite into western Europe in 2005, has progressed to all TV markets served by Eutelsat's satellites and today accounts for 7 percent of all channels.

Pay-TV and Free-to-Air (FTA) broadcasting continue to expand in parallel. Sixty per cent of channels on Eutelsat are pay-TV, available through over 40 platforms serving markets in Europe, Russia, the Middle East and Africa. Forty percent are free-to-air, with the highest concentration of FTA at Eutelsat's flagship HOT BIRD neighborhood and at 7° West. Eutelsat broadcasting milestones

- 1983 - Eutelsat transmits first satellite TV channel in Europe
- 1995 - Launch of first commercial digital (DVB) channels
- 2001 - 1,000 channel milestone reached 2005 - Launch of first HDTV channels
- 2006 - 2,000 channel milestone reached
- 2008 - 3,000 channel milestone reached
- 2011 - Switch-off of analogue satellite broadcasting

Capacity Contract To Drive DTH

SES has announced that Media Networks Latin America (MNLA) has signed a long-term capacity deal to expand its payTV service across Central America and the Caribbean.

Under the milestone partnership, MNLA, a unit of Telefonica Digital, has secured multiple transponders on SES' AMC-4 satellite in order to launch a new DTH wholesale payTV service reaching new audiences with a combined lineup of international and regional SD and HD channels.

The SES spacecraft AMC-4, strategically located at 67 degrees West, allows

AMC-4

MNLA to meet the DTH demand in Central America and the Caribbean as well as other future growth markets with its existing ground infrastructure, including its teleport in Lima, Peru. AMC-4 was deployed in 2010 and provides expansion capacity in Latin America for a broad range of applications, such as rural telecommunications, VSAT networks, e-learning, payTV and mobile broadband.

With the relocation of AMC-3 to 67 degrees West at the end of February in 2012, SES is further strengthening and complementing its coverage and offering from this orbital position.

Among The First For The Beam

Spacecom, operator of the AMOS satellite fleet, has announced that IO Sat, a provider of satellite broadband data services for small and medium size businesses, is one of the first customers providing its services on the AMOS-5 communications satellite.

Spacecom's AMOS-5 satellite, serving Africa from the 17 degrees East orbital position with C- and Ku-band beams, recently began commercial operations. IO Sat is using ample capacity on the satellite's C-band beam to offer an array of data, voice and video applications to clients requiring services in Africa.

The Swiss Sweep Space With Janitor Satellite

It won't be a winged space tow truck with a big hook to snag space debris, and a bumper sticker that says, "Don't follow me, I'm lost" but...

Serious concerns and hopeful solutions abound regarding the proliferation of debris orbiting the Earth. This pertains to primarily jettisoned rocket and satellite components that can cause potentially immensely expensive damage and collisions.

Enter... the Swiss Space Center at EPFL (École Polytechnique Fédérale De Lausanne) which is announcing today the launch of CleanSpace One, the first generation of satellites specially designed to clean up space debris. The following is the post from the EPFL's website...

The Earth's orbit is full of all kinds of floating debris; a growing crowd of abandoned satellites, spent rocket stages, bits of broken spacecraft, and fragments from collisions are rocketing around the planet at breathtaking speeds.

NASA keeps close tabs on at least 16,000 of these objects that are larger than 10 cm in diameter. When an operational spacecraft such as a satellite collides with one of them, serious, costly damage can result; often the satellite is complete destroyed. And the collision itself then generates thousands more fragments, further exacerbating the problem.

"It has become essential to be aware of the existence of this debris and the risks that are run by its proliferation," says Claude Nicollier, astronaut and EPFL professor. To move beyond mere rhetoric and take immediate action to get this stuff out of orbit, the Swiss Space Center at EPFL is launching CleanSpace One, a project to build the first prototype in a family of "de-orbiting" satellites.

The project developers have chosen a symbolic target for the initial CleanSpace One launch: either Switzerland's first orbiting object, the Swiss-

CleanSpace One
Space debris removal satellite will be sent by EPFL

Space debris represents an increasing risk for operational satellites. Developed at Ecole Polytechnique Fédérale de Lausanne (EPFL), CleanSpace One will be the first space debris removal satellite to demonstrate technological concepts.

16,000 debris bigger than 10cm are known to surround Earth.

2 Ejection
Altitude: 630-750 km

3 Approch
Speed: 28,000 km/h

4 Rendez-vous phase

5 Grappling

target orbit

1 Launch

CleanSpace One
Size: 30 x 10 x 10 cm
Predicted launch: 2015-2016
Mission: De-orbit an obsolete satellite

6 and disintegration
Temperature: more than 1000°C

Infographie Pascal Coderay / EPFL
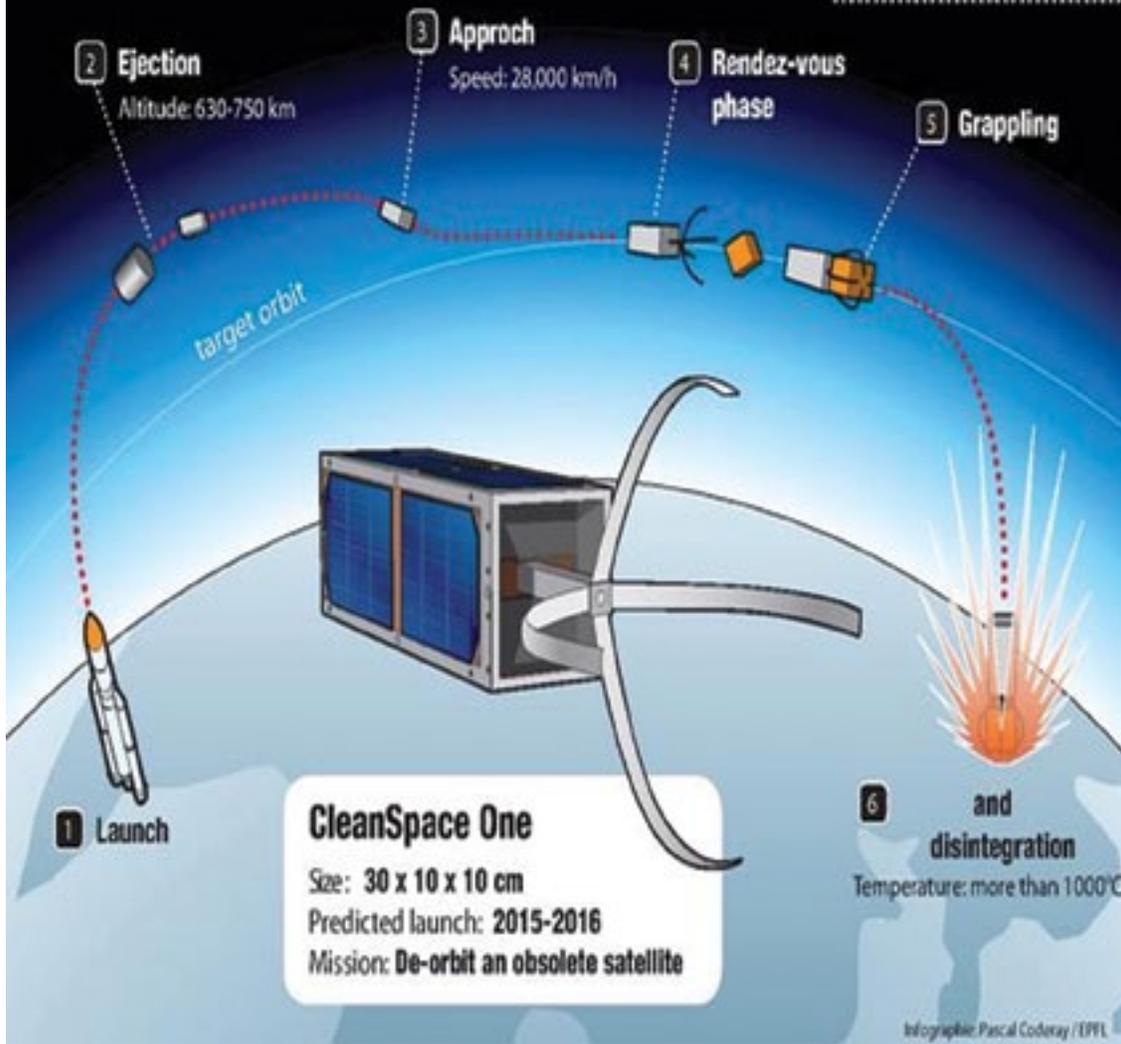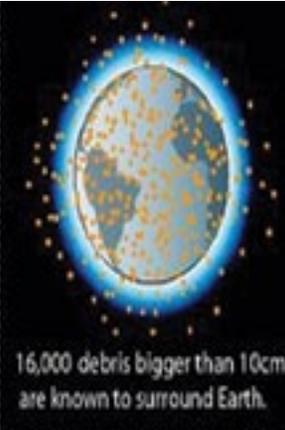
will "de-orbit" the unwanted satellite by heading back into the Earth's atmosphere, where the two satellites will burn upon re-entry. Although its first model is destined to be destroyed, the CleanSpace One adventure will not be a one-shot deal. "We want to offer and sell a whole family of ready-made systems, designed as sustainably as possible, that are able to de-orbit several different kinds of satellites," explains Swiss Space Center Director Volker Gass. "Space agencies are increasingly finding it necessary to take into consideration and prepare for the elimination of the stuff they're sending into space. We want to be the pioneers in this area."

The design and construction of CleanSpace One, as well as its maiden space voyage, will cost about 10 million Swiss francs. Depending on the funding and industrial partners, this first orbital rendezvous could take place within three to five years.

About space debris— 16,000 objects larger than 10 cm in diameter and hundreds of millions of smaller particles are ripping around the Earth at speeds of several kilometers per second. From the beginning of the Space Age, Earth's periphery has been increasingly encumbered by all kinds of debris, primarily concentrated in Low Earth Orbit (less than 2000 km in altitude, where the International Space Station is orbiting) or Geostationary Orbit (35,786 km in altitude). Many of these objects are spent rocket stages or satellites that have broken up in orbit. If they collide with another orbiting object, say a functioning satellite, they can cause massive damage, or even destroy it. This is what

cube picosatellite which was put in orbit in 2009, or its cousin TIsat, launched in July 2010.

One satellite, three technological hurdles The cleanup satellite has three major challenges to overcome, each of which will necessitate the development of new technology that could, in turn, be used down the road in other applications.

After its launch, the cleanup satellite will have to adjust its trajectory in order to match its target's orbital plane. To do this, it could use a new kind of ultra-compact motor designed for space applications that is being developed in EPFL laboratories. When it gets within range of its target, which will be traveling at 28,000 km/h

at an altitude of 630-750 km, CleanSpace One will grab and stabilize it—a mission that's extremely dicey at these high speeds, particularly if the satellite is rotating. To accomplish the task, scientists are planning to develop a gripping mechanism inspired from a plant or animal example. Finally, once it's coupled with the satellite, CleanSpace One

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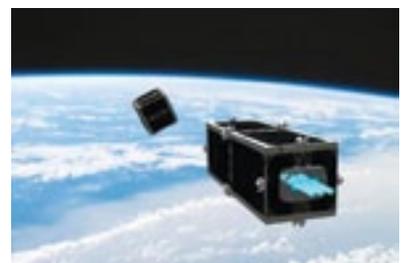
happened on February 10, 2009, when the U.S. satellite Iridium-33 exploded upon impact with the abandoned Russian satellite Cosmos-2251. The financial consequences of these collisions are enormous, particularly for insurance companies involved in the space sector; a sum currently estimated at $20 billion to insure existing satellites.

Cases such as this one are bound to increase in number. Even in the immensity of outer space, the increasing density of human-generated waste is becoming a problem. It's expanding exponentially, because each collision generates in turn several thousand more fragments, which, although smaller, are no less dangerous than a large, abandoned satellite. NASA, which tracks 16,000 of these objects, can only monitor the largest ones (greater than 10 cm in diameter)—but at these incredible speeds even a simple paint chip can seriously damage a solar panel or the window on a shuttle. To avoid the largest objects before they get critically close, the International Space Station must constantly alter its orbit. It managed to do this again just recently, on January 29, 2012.

Last year the Swiss Re insurance company published a study showing that every year, there is a nearly one in 10,000 chance that a 10 m2 satellite traveling in a sun-synchronous (600-1,000 km) orbit will collide with a piece of space debris larger than 1 cm.

Author: Emmanuel Barraud
Source: Mediacom

Small Satellites Make History

The first satellites entirely designed and built by Hungary, Poland, and Romania are now orbiting Earth after today's successful maiden flight of ESA's small Vega launcher.

The latest addition to Europe's versatile family of space launchers, Vega carried nine satellites, seven of them built by European universities. This group of ESA-sponsored educational CubeSats included Goliat from Romania, PW-Sat from Poland and Masat-1 from Hungary.

The unique opportunity to launch the first satellites from these countries was made possible by a fruitful collaboration between the ESA launcher and education programmes.

"Since Vega's first mission was a qualification flight, ESA decided to offer the chance to European Universities of a free ride into space for small scientific or educational payloads," noted Antonio Fabrizi, ESA's Director of Launchers.

Following the agreement to include an educational payload, including up to six CubeSats, on Vega's first flight, ESA issued a call that led to a flood of proposals from universities all over Europe.

As a result of the overwhelming response, the number of available CubeSat slots on Vega was increased to nine. Seven university teams eventually made it in time, including UniCubeSat-GG and e-st@r from Italy, XaTcobeo from Spain and Robusta from France.

The student teams took advantage of a rare and invaluable hands-on opportunity to design, develop and operate their own space missions.

University of Bucharest's Goliat being integrated into the first P-POD. Credits: ESA / A. Reyes

ESA provided technical expertise and educational support for integrating, testing and preparing the satellites for launch.

"The launch of these CubeSats on Vega, each carrying scientific or technology experiments, represents a huge educational achievement both by ESA, the student teams and their countries," said Giuseppe Morsillo, ESA's Director of Policies, Planning and Control, who is responsible for the ESA education programme, as well as for relations with ESA's Member States.

"This success is particularly important for Romania, Poland and Hungary, as a clear demonstrator that investing in space also means bringing bright young talents – the workforce of the future – to the front line, so promoting and reinforcing from its very basis the competitiveness of our economies."

"Romania, Poland and Hungary have a history of participation in several European space projects and activities," commented Karlheinz Kreuzberg, Head of the ESA Director General's Cabinet, whose team is also responsible for establishing cooperation agreements with non-ESA EU Member States and preparing their eventual membership of ESA. "The next major step has now been achieved by these countries with the deployment of their first national satellites, extending the ground for collaboration on new, collaborative, European space ventures."

Giuseppe Morsillo concluded, "This step is also very important as it helps in reinforcing the dialogue with European countries from ESA's perspective of increasing the number of its Member States by progressively including other Member States of the EU.

"The transfer of ESA's space knowhow to new partner countries can also definitively pass through an educational exchange."

Achievements For Maritime Entertainment

Intellian has announced two new t80 antenna systems that will start shipping in March the Intellian t80 and t80W, which are ideally suited for 80ft. plus yachts requiring a compact antenna size with global satellite TV service reception.

The 3-axis stabilized Intellian t80 antenna locks onto satellites quickly and provides seamless operation in all regions, offering global coverage. Built-in as standard, the internal GPS combined with Intellian's patented Wide Range Search (WRS) provides the fastest satellite acquisition possible. Multiple HD receivers can be connected to the system as standard, providing a truly hands off global coverage depending on the regions visited.

The Intellian t80W incorporates the patented WorldView™ LNB (Low Noise Block-Down Converter), which automatically switches the polarization and local frequency depending on the satellite the antenna is tracking onto; all of the switching information is contained in the antenna control unit (ACU). As the satellite TV provider is selected electronically, there is no requirement to purchase multiple LNB modules, reconfigure complex systems and manually change the LNB unit inside the antenna dome each time the vessel crosses into a different satellite service region.

The t80 antennas have a built-in DVB-S2 decoder to allow users to track a satellite by using a DVB-S2 carrier. For uninterrupted viewing of HD DIRECTV programming, an upgrade kit will be provided. The upgrade of the antenna will allow simultaneous reception of Ku- and Ka-band satellites for uninterrupted viewing.

The t80 antenna has a broad elevation range, from -15° to +110°, enabling

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operation in all conditions and the cross level axis ensures uninterrupted viewing even when the antenna is near the equator. Weighing in at only 180 lbs, and the inclusion of an internal shock absorption system, makes this antenna one of the lightest and strongest in its class of antennas.

The t80 dome is designed to complement the new v80G VSAT antenna, providing customers with a compact dual antenna solution for communications and entertainment. All Intellian antenna systems are designed, manufactured and tested to withstand the company's industry-leading standards for vibration and extreme shock in all sea states and weather conditions. VSAT and 3-axis TVRO warranties are now increased to an industry-leading two years for parts and one year for labor, while the i-series 2-axis antenna warranties are increased to three years.

No Additional Equipment Needed

SkyTrac Systems has another combined integration project with EuroAvionics GmbH & Co. SkyTrac Systems has been selected by EuroAvionics to provide a SkyTrac programmed Iridium 9523 modem that can be embedded in the EuroNav 7 Situational Awareness System, the latest product development from EuroAvionics.

The EuroNav 7 is a moving map and task management system that will now have

the option to provide flight following and satellite communication, without the need to have additional SATCOM equipment installed. GPS position data of the aircraft will be sent directly from the EuroNav 7 through the Iridium satellite network for display on SkyTrac's web based SkyWeb software. The combined solution will also provide email messaging and voice communication options.

U.S. Connectivity Clobbered By The FCC

With a statement issued by one of its officials, the FCC has all but negated years of work from both the FCC and the mobile satellite industry in developing a hybrid satellite-terrestrial system to offer connectivity across North America.

LightSquared could not proceed with its LTE network due to GPS interference issues. This is somewhat the picture that NSR envisaged in its study Mobile Satellite Services, 7th Edition when it described

"….*several key announcements and major changes in the regulatory environment expected to take place in 2011*" that led NSR to stop forecasting the MSS-ATC market.

There will be a lot of things said about undoing what the FCC did in 2003 to promote seamless connectivity across the United States by this decision, but lo and behold… there is still spectrum left after this saga that the U.S. desperately needs to use, but not for an MSS-ATC system… for now anyway. NSR re-affirmed its belief that "…a market of any significance for integrated dual-mode MSS-ATC devices is unlikely to occur in the foreseeable future " due to mounting challenges the industry has faced. NSR identified the GPS industry's challenges to the FCC allowing LightSquared to deploy 40,000 base stations as the major regulatory development impacting the satellite communications industry in North

America. Even with support, albeit tenuous, from Sprint, LightSquared's story was going nowhere fast and may end up as another example of a good idea gone wrong.

Starting with Globalstar's revocation of their ATC licensing agreement with OpenRange in 2010, to the GPS adjacent frequency interference issues, the MSS-ATC marketplace fell out favor in terms of regulation and business cases after garnering support from a financial powerhouse such as Harbinger Capital Partners and seeing billions of dollars spent on satellites and ground infrastructure to meet stringent FCC gating requirements.

Even if DISH acquired MSS-ATC S-band spectrum from bankrupt TerreStar and DBSD, it still has to find a way to get the FCC to agree to a well thought-out plan to gain significant revenues from a dual satellite and terrestrial network. It is therefore doubtful that it could be interested in the LightSquared spectrum, which needs more thoughtful planning from the operators as well as the FCC to operate in the vicinity of GPS frequencies.

Saying that '…it could take years for current generation GPS devices to be replaced with modern, robust systems", NSR noted in its study that the MSS-ATC gloomy future was a result of lack of general investor support for operators who in turn failed to deliver on promises to regulators and shareholders, missed satellite operations deadlines, and ultimately did not prove convincingly that what is technically possible is sometimes not practically feasible.

LightSquared will probably go back to its satellite-only business plans or try to sell its assets before going under. But with bandwidth being scarce, many wireless operators will be on the lookout as regulatory and business environments for L-band take time to resolve. Because of these delays, DISH, which has yet to figure out how to deploy its own ATC network, will probably not buy LightSquared unless it's

for pennies on the dollar. And even if it did, it could present a severe case of monopoly in the U.S. MSS market.

All there is left from this battle is valuable spectrum that can eventually be cleaned-up of GPS interference issues. Perhaps then a 'beauty' contest for this precious asset for the mobility segment could be held for another operator to snap it up and take it down another road. This story was authored by NSR's *Claude Rousseau*, Senior Analyst, NSR, France.

For more information on NSR report, access this link:

http://www.nsr.com/

Supertanker Solution

ORBIT Communication Systems, a subsidiary of Orbit Technologies Ltd. (TASE:ORBI), and Milano Teleport, the largest independent teleport in Italy, have received new orders for a complete VSAT solution based on ORBIT's OrBand™ C-band VSAT system and Milano Teleport's C-band satellite capacity and value added services.

The solution will be installed on supertankers owned by one of the world's leading shipping companies based in Greece. In mid 2011, ORBIT and Milano Teleport supplied the tanker company with a single C-band system, satellite capacity and value added services for testing purposes. The customer examined a broad range of performance parameters to ensure that the C-band VSAT solution was able to meet the complex challenges and demands of maritime communications.

The VSAT solution was found to meet these key criteria, which included stringent requirements regarding quality of service and data transfer rates, as well as global coverage. Orbit's OrBand systems together with the services of Milano Teleport will be used by the customer to support various broadband applications, including central-

ized management and control from company headquarters, VoIP telephony, VPN and internet connectivity for the ship's crew.

Reflecting the success of the initial installation and this new order, the shipping company plans to equip its entire fleet of tankers with this VSAT solution during 2012 and 2013.

Accordingly, ORBIT and Milano Teleport anticipate that significant additional orders will be received over this period to meet the broadband communications needs of the entire fleet. ORBIT's recently launched OrBand system represents a new paradigm in maritime C-band VSAT solutions. Small enough to be shipped as a single, fully assembled and tested unit in a standard 20-foot container, OrBand is designed for quick and simple single-day installation. This is a major time-saver vis-à-vis the customary 2-3 days required to install equivalent solutions.

The system's extraordinarily compact form factor makes it ideal also for smaller vessels that cannot accommodate traditional C-band solutions. This means that OrBand can be installed while ships are on routine port calls, substantially driving down operational costs and eliminating the need for vessels to await dry dock.

MASER Makes Microgravity More Meaningful

At 9.32 UTC on February 13th, the microgravity rocket MASER 12 was successfully launched from SSC's launching facility Esrange Space Center.

MASER 12 reached an apogee of 260km and the experiments on board spent six minutes in microgravity. MASER 12 carried five ESA financed microgravity experiments for studies of:

- The effect of microgravity on white blood cells
- T-cell activation in microgravity
- Blood cell transportation and movement in blood vessels
- Solidification process on binary Au-Cu alloy through x-ray radiographic observation
- The behaviour of propellants in spacecraft tanks

"This was a long awaited launch, and the scientific teams are really enthusiastic. The countdown was very tense but no room was given to inculcated risks: we are only happy
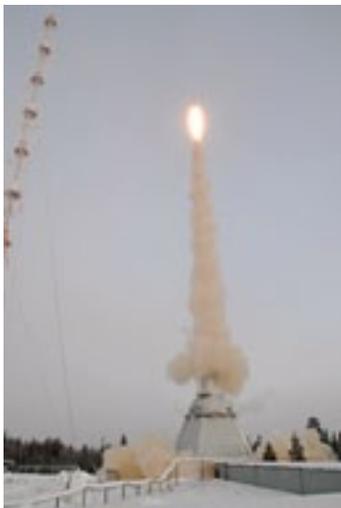
The launch of MASER 12, photo courtesy of SSC.

if we have 100% success, I believe we caught the whole prey" says Mr. Antonio Verga, Project Technical Officer, ESA.

MASER is an SSC sounding rocket programme for research using microgravity as a means of investigation. SSC is the prime contractor for the Maser 12 mission, which is carried out for the customer ESA. This includes the responsibility for all experiment modules, the service module, the recovery system and the rocket motor as well as launch and recovery.

The First Time For Vega

After years of design and preparation, the Company can announce the successful launch of the first Vega by the European Space Agency (ESA).

Vega placed two scientific satellites and seven picosatellites into orbit. Thanks to this success, Arianespace now has the largest range of commercial launch services. Vega has been designed to launch payloads of up to 1,500kg at an altitude of 700km. This means that Europe now has a new vehicle to launch all its scientific and institutional missions. After the success of this maiden launch, Arianespace will be in charge of the commercialization and exploitation of Vega.

With Ariane 5, Soyuz, and now Vega, all of which are operated from the Guiana Space Center, Arianespace is the only launch service and solutions company that can place any payload into any orbit: telecommunications satellites, scientific or Earth observation satellites, constellations and missions to the International Space Station.

Following this historic success, Jean-Yves Le Gall, Chairman and CEO of Arianespace, said, "Bravo Europe! Congratulations to the European Space Agency, to the Italian Space Agency, to the Centre National d'Etudes Spatiales and to all our industrials partners. This success comes after 9 years of cooperative development. Well done Europe!"

Even before this first launch Arianespace and ESA had already signed the first commercial launch service and solutions contract, for the European Union launch of Sentinel-2 and Sentinel-3 spacecraft on Vega.

Lifting off from the Spaceport's ZLV launch site, this no. 1 Vega deployed nine spacecraft into orbit. It carried Italy's LARES laser relativity satellite, the small ALMASat-1 technology microsatellite demonstrator from the University of Bologne, and seven CubeSats developed by more than 250 university students from six different countries.

This flight was performed under responsibility of the European Space Agency, and its goal was to qualify the overall Vega system—including the vehicle, its ground infrastructure at the Spaceport, and operations from the launch campaign to payload deployment.

The Vega is powered by three solid propellant stages and a liquid-propellant fourth stage. It was developed by the European Space Agency, Italy's ASI space agency, and the French CNES space agency. Production is handled in an industry team led by industrial prime contractor, ELV SpA. Vega's flexibility enables varied payloads to be carried – from a single passenger to mixes of satellites, microsatellites and cubesats.

NASA Stretches For The Stars With New Budget

NASA has announced a $17.7 billion budget request for fiscal year 2013 supporting an ambitious program of space exploration that will build on new technologies and proven capabilities to expand America's reach into the solar system.

Despite a constrained fiscal environment, the NASA FY13 budget continues to implement the space science and exploration program agreed to by President Obama and a bipartisan majority in Congress, laying the foundation for ground-breaking discoveries here on Earth and in deep space, including new destinations, such as an asteroid and Mars by 2035.

The NASA budget includes $4 billion for space operations and $4 billion for exploration activities in the Human Exploration Operations mission directorate, including close-out of the Space Shuttle Program, and funding for the International Space Station, $4.9 billion for science, $669 million for space technology and $552 million for aeronautics research.

The budget supports NASA's continued work to develop the Space Launch System, a new heavy-lift rocket to carry astronauts to destinations such as an asteroid and Mars, and the Orion crew capsule in which they will travel.

Included are resources for final preparation and manufacturing milestones for Orion's 2014 Exploration Flight Test 1 and preliminary design reviews of major Space Launch System elements.

NASA has prioritized funding for its partnership with the commercial space industry to facilitate crew and cargo transport to the station. The

The European Space Agency's first Vega rocket lifts off from Guiana Space Center in Kourou, French Guiana in a flawless launch debut. Photo courtesy of ESA /Stephane Corvaja.
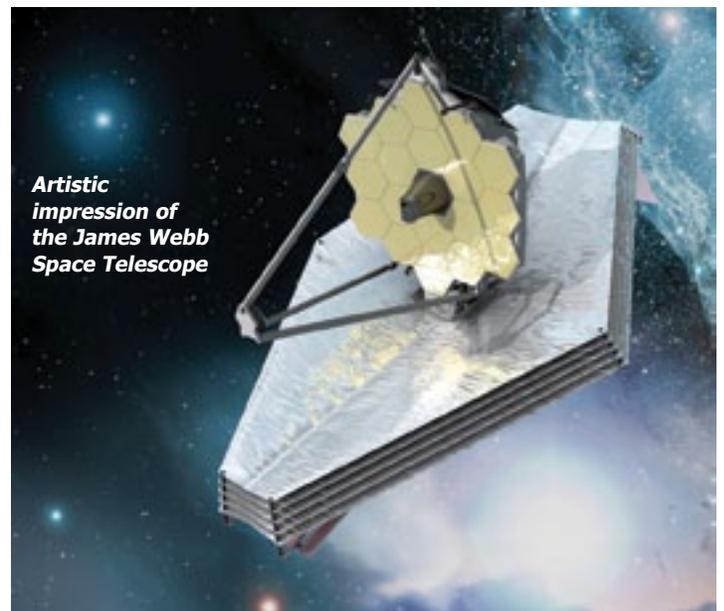
Artistic impression of the James Webb Space Telescope

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the service divested and is purchasing less hardware. Also, there is a reduction of about $500 million in research, development, testing and evaluation, but the Air Force continued its focus on modernizing key components that will maintain the service's technological edge, Bolton said. "Funding for intelligence, surveillance and reconnaissance and space remain a priority," he added. "We will continue to develop programs in ISR ensuring we are supplying this skill set to the joint warfighter and coalition partners."

"We are reducing the force by 9,900 Airmen, which will reduce the end strength of active duty, Guard and Reserve to around a 501,000 total force," Bolton said. "This allows us to appropriately size the force structure to the strategy and hardware we are going to have in the inventory."

The Air Force is proposing a 1.7 percent military pay raise in fiscal 2013 and a 4.2 percent raise in basic allowance for housing and 3.4 percent raise in the basic allowance for subsistence as a continuing growth of compensation for service. "We are budgeting more than $700 million for family programs including child and youth programs and child development centers," Bolton said. "We will continue to take care of our folks; we just need to ensure it is being done efficiently under tighter fiscal constraints."

Housing is a key ingredient to taking care of Airmen and the Air Force is close to reaching its goal of 53,000 privatized housing units force-wide with over 40,000 units in place and the remaining units to be ready in fiscal 2013. "We've increased our family

housing budget by $93 million and this will allow us to meet our goal," Bolton said.

Looking back to the 2011 requirements—military action and support in Iraq and Afghanistan, supporting NATO missions in Libya, along with humanitarian support to Japan following a major earthquake—Bolton reinforced the reach and responsibility placed on today's Airmen and emphasized the importance of providing them the tools required for a versatile force. "We will continue to do everything we can to provide them with the tools they need to continue to be the best Air Force in the world for decades to come," Bolton said.

God In The Satellite Just Got Bigger With GLC

Learning about God just got bigger... SatLink Communications Ltd. is extending its long-standing agreement with God's Learning Channel (GLC) to broaden its reach into Asia.

The religious satellite broadcaster already delivered on Satlink's AsiaSat 5 C-band Multiple Channels Per Carrier (MCPC) digital platform to the Asia Pacific region and Middle Eastern markets and is now increasing its channel penetration with the addition of on ABS1 satellite at 75 degrees East on the Ku-band.

God's learning Channel is a satellite network dedicated to spreading the Christian gospel worldwide. Originally set up in the American Southwest in 1982 by husband and wife team Al and Tommie Cooper, it has since grown to global proportions. A key consideration in the selection of Ku-band was the fact that several other free-to-air religious channels are already broadcasting on this frequency, offering a greater potential for viewers who are channel hopping to discover God's Learning Channel.

GLC joins SatLink's growing bouquet of religious networks, which also features the Daystar faith-based TV network, in spreading their messages to the Asian audi-

ence. Al Cooper, founder and President of Prime Time, commented, "Our aim is to spread the word of God to as many households and churches around the world as possible. Being a religious broadcaster we have a strong affinity to Israel and we see benefit from both a technology and theological perspective in using SatLink's satellite services located as they are in Jerusalem connecting the three continents of Europe, Middle East and Asia."

Award For Bullet-Proof Reliability

This Company is the dominant manufacturer in the Single Channel per Carrier (SCPC) area of the satellite industry.

Comtech EF Data Corporation announced today that in the recently published 12th Edition of the VSAT Report by COMSYS, it was named the dominant

manufacturer in the Single Channel per Carrier (SCPC) area of the satellite industry.

The report identifies that the provision of SCPC links to support mobile cellular backhaul remains an important business. Mobile cellular backhaul continues to account for a majority of the new growth in the SCPC market, primarily in Africa and Asia with Latin America expected to expand rapidly in the next two years. The report further explains that SCPC has a reputation for bullet-proof reliability, with strong sales into the military, government and maritime markets.

"The most common applications for SCPC modems are where maximum efficiency is needed in high-priced satellite capacity environments and where dedicated clear channel capacity is required," commented Simon Bull, senior consultant for COMSYS. "Comtech EF Data has worked hard to refine bandwidth efficiency. We believe that their

latest Advanced VSAT Solutions product line represents a significant step forward for the company in addressing the shift from dedicated circuits to shared systems."

The VSAT Report is known as the definitive study on the satellite industry, which enables telecommunication and IT managers, existing and prospective system operators, manufacturers and integrators to stay competitive and increase profitability. COMSYS bases the VSAT Report on primary research involving site visits and interviews.

"We are honored to be recognized as the leader in bandwidth efficiency and SCPC modems," said Daniel Enns, senior vice president strategic marketing and business development for Comtech EF Data. "We will continue to deliver solutions that enable users to reduce OPEX/CAPEX and to increase satellite link throughput."

The Advanced VSAT Solutions portfolio provides high-performance satellite-based communication solutions for a diverse range of applications, including mobile backhaul with RAN optimization, IP trunking and backhaul, maritime and offshore networks, corporate and enterprise networks, emergency and disaster recovery. Incorporating advanced technologies developed by Comtech EF Data, AHA Products Group, Memotec and Stampede, the solutions provide unmatched performance, industry-leading bandwidth efficiencies and network optimization—while minimizing total cost of ownership.

The New Space Race: The Quest For Venture Capital For Small Satellite Technologies

by William F. Vartorella, Ph.D., C.B.C. of Craig and Vartorella International, Inc.

Is another "Sputnik Moment" on the horizon? Can the privatization of spaceflight become self-sustaining? And profitable? These are underlying, unstated questions being ruminated by venture capitalists (VCs) poised to enter the next space race. The growth arena is hybrid communications across multiple, cost-effective platforms. "On-demand content delivery" is the mantra. Futurists proclaim that the era of personal satellites is just over the horizon. And for good reason. Your smart-phone. It has voice, data, camera, GPS, celestial navigation, solar, aurora, and scores of "apps" monitoring weather, glaciations, sea temperatures, real-time location of endangered species—whatever your interest and it's affordable. Add solar panels and you essentially have a small, hand-held satellite platform ready for innovation—and funding.

According to NASA, the processing power in your cellular phone exceeds that of the current generation of smaller spacecraft. More importantly, cellular innovations portend new, disruptive technologies (patents) and "apps" in next-gen satellites. This is a convergent opportunity for inventors who have not explored the cosmos as a platform for funding. "Plug-and-play" design has enormous potential for space, as design costs plummet.

VCs compete to be ahead of the adoption curve, positioned for the "next big thing," the next "Sputnik Moment." Old Economy investment is staid. Nature abhors a vacuum. New, hip, technology-savvy money is flowing in to fill the void. The *2010 Innovation Report: Twelve Key Technology Areas and Their States of Innovation* tracked patent activity in crucial high-technology arenas between 2009 and 2010. Of the 12 industry segments, "aerospace technology" posted the largest overall increase in patent activity, with a 25 percent increase. Key was the 108 percent increase of the space vehicles and satellite technology sub-sector.

Today's buzz is "*hosted payloads*," a direct outgrowth of the *2010 U.S. National Space Policy* white paper, which focuses on innovative, non-traditional means for "space access" and share-the-ride costs for government payloads aboard commercial spacecraft. Separately, the sometimes maligned Soyuz platform is perfectly positioned for the smaller satellites destined for the next generation of missions.

These three factors—patent activity, hosted payloads/reasonable cost for space access, and the availability of a proven, cost-effective launch platform—bode well for VC firms interested in a technology play in the low-digit ($) millions range.

Yet venture is conflicted with the implications on global policy dialogue and debate, re: the convergence among radio-communication services, satellite orbits, and band use debated at **WRC-12** and beyond. Legitimate VC questions revolve around the definition of "bringing into use" a satellite and whether satellite technology can keep pace with fast-moving terrestrial innovation. This confounds venture's ability to define your patent (or break-through nano-satellite design), market, cash need, and Exit Strategy in one long sentence. The answer, as we shall see below, is to define it for them.

While they may not be conversant with **ITU** recommendations on broader access to orbital slots and satellite frequencies, they do understand satellite broadband access services are the revenue engine within the satellite sector. VC firms are anxious to tap the estimated $9 billion in revenues by 2020, if analyst firm **Northern Sky Research** (**NSR**) is accurate in its assessment (satellite broadband Internet and VSAT networking to enterprises). But smaller, more focused investment avoids competition and presents the opportunity for capturing a niche, exploiting it, and exiting on a reasonable timetable.

Small is Beautiful
By definition, we mean low-mass (less than 1,000 kilos) satellites. Projections call for spacecraft in the 300-kilo range that can be deployed from design to detectors-on in less than two years. Let's examine factors that should interest VCs on the prowl:

- **Risk-sharing**: **Euroconsult** estimates some 75 percent of the roughly 350 small satellites launched or scheduled are penned by civilian and military agencies—91 percent when academe is included. According to an aging study by **Coopers & Lybrand, LLP**, only 40 percent of growth companies have relationships with U.S. universities and only half of these functions properly. A poorly understood and rarely used entrepreneurial approach with VCs involves a college partnership and the qualification for jobs-creation and other State incentives where satellites are designed or manufactured. Risk-reduction and in-kind and actual cost sharing raises any project's visibility with venture.

- **Cutting-edge approaches to bleeding-edge global problems**: Key advantages of small satellites are apparent when one factors in Earth observation, technology demonstration, and "space science." These dominate roughly 80 percent of the application environment and—here's the bait for venture money—they often use off-the-shelf technologies with consumer ties. This is a "bullet point" for small satellite companies with fresh patents in their elevator pitches to investors. **Access to new global markets**: Micro-, nano-, and cubesats lower the bar-to-space access for developing nations. For venture firms interested in Asian or African markets, for a small investment they get access to decision leaders and the intelligencia, plus any lucrative national incentives. Essentially, they are buying a platform for other investments, with low risk and potential for high rewards.

- **The trend is their friend**: The breadth of satellite missions will narrow from the mega- to the micro- as technology expands. **DARPA** is rethinking satellite size, cost, and design time, with an eye to smaller "fractional" spacecraft that are "single-capability" focused (imaging, communications, etc.) and capable of flying in formation with shared resources. Risk is reduced, as if one in the "flock" fails, others share the workload. This—and the fact that most of these satellites are targeted for LEO slots—mean costs and technology access and competition are assured. Investors seek that "Sputnik Moment," with reduced risk, cost

controls, and an investment within the realm of three to seven years, rather than the current 15-year lifespan of bigger, more robust, complicated, and expensive satellite platforms. The current penalty for smaller satellites—launch costs per kilogram—is a side issue when one considers bundling payloads and spreading the risk among several newer, smaller, more nimble players. Universities understand this and have developed consortial approaches. So must inventors and investors through bundling resources to acquire critical financial mass for launch. For those who remember the **OSCAR 1** (*Orbiting Satellite Carrying Amateur Radio*) launch in 1961, the spring used to eject OSCAR from its host spacecraft cost an astounding $1.29 (yes, one dollar and twenty-nine cents). And that satellite was powered by three 18-volt mercury batteries. Occam's Razor applies here: the simplest solution is the most plausible and the one that resonates with investors.

NASA is scheduled to demonstrate a new optical communications system (via laser) in 2016 which will allow the streaming of high-definition video from Mars in just minutes rather than the 90 minutes currently required for high-resolution images. One of the test modems apparently is ideal for communicating with small, low-powered satellites in LEO.

"It's Not The Principle Of The Thing…It's The Money…"
An advantage of a VC model for small satellite projects and "apps" is a lack of gross dependence upon governmental "subsidies." These distort markets and act as bars-to-entry to all but the big players in the space sector. For entities already in the industry, with positive cash flow, accessing debt capital with highly-attractive rates is a real possibility. Equity capital for "seed" money and start-ups is scarce, using current approach models. Big deals, say, in the satellite broadband and TV capacity, are logical VC targets, particularly in the $100 million+ range as they provide investors flexibility in the Exit Strategy. But two things kill deals for the start-up: starvation strategies by venture investors which tie cash infusions ("tranches") to "do-or-die" metrics and the small deal mentality that a few $ million invested cannot squeeze a reasonable profit for time and expertise required for due diligence and oversight. Plus, VCs realize that new market entrants face the dilemma of "low-hanging fruit". Early-adopters in some of the key satellite service sectors (broadband, HD) have already been picked and devoured. This pushes new, disruptive technologies in these and allied fields into competition within a maturing (if not mature) strategic marketing environment. In terms of VC, these "cash cows" become "sacred cows" and a bar-to-entry to new competitors in their own right. Now new entrants are forced to present a profit profile rather than some more prosaic growth model. It's a game-changer in the dialogue with "money," as the potential investor has to think dividends and a shorter timeline for Exit (IPO, buy-out, merger, etc.).

"Open Innovation" As The New and Improved
Funding Paradigm
The path to securing capital should embrace a strategy known as "open innovation," which changes the value proposition. Essentially, the hybrid model proposed here takes the disruptive technology of new, small satellite innovations and enters it into the mix of embracing external and internal ideas and market paths. One + 1 no longer equals 2. It equals at least 3 and likely some multiple of 3, depending upon the market force of the idea (e.g., "email" or "social media"). Iridium essentially has followed an open innovation model, with its creation of an ecosystem where different companies can work outside Iridium's ideation sphere. One potential outcome for an invention without a clear channel for funding might be licensing either independently or

through a joint venture. A paradigm shift occurs from an R&D "reduction to practice" to a first-in marketing approach. More importantly, such projects no longer are "seed" or start-ups. The dialogue with venture capital changes to Early Stage, which is less hurdle-ridden. It also means that a satellite company can focus upon core competencies, leaving open the door to "Eureka" moments by developers within and without the palace walls. Cost-shifting to the private sector is key, as it re-structures the dialogue from Big Government to the Small Entrepreneur for the exploration and exploitation of space and removes the impediments of cost + and the "Big Brother" mentality.

The Truth About Venture Capital

The problem is not a lack of potential venture capital, but rather a lack of high-quality, viable deals in which to invest. The deals that VCs salivate over are not start-ups with disruptive technologies, but the three-to-five-year-old firm with profits that is poised for market dominance or a leveraged buyout. Even "boutique" venture firms are rarely interested in equity plays of less than $10 million. Start-ups and some cash-starved Early-stage companies see $1 million deals as "windfalls" no matter how much stock or patent rights they have to sacrifice. And contrary to conventional wisdom, most venture capital firms are not interested in controlling their portfolio of companies. They, unlike "angel investors," bring more than cash—they bring expertise and a fresh perspective, known in the trade as "smart money."

The "Seven Deadly Sins" of Pursuing Venture Capital

As the author pointed out in Funding Exploration, scientists and entrepreneurs often fall short in the quest for cash for relatively simple reasons:

1. Focus upon end results: successful requests for venture funding should center upon how the project helps a VC firm meet core aspects of its Mission, marketing goals. In other words, how does the project fit into a VC's "portfolio of companies". This is the flaw of "unenlightened self interest". It's not about you. It's about the investor, market dominance, and strong profits.

2. Creation of a concept for which no funding source is in sight ("the mirage"). People invest in people, not ideas. As you develop your patent, "killer app", or business model solution for the small satellite arena, always keep in mind who your target funders might be.

3. Development of a project done better, elsewhere, for less money ("reinventing the wheel"). Before you get too excited, do a comprehensive patent search and read outside your field of design to see what is on the shelf or being marketed. *R&D Magazine* and *NASA Briefs*, as well as the medical device and automotive trades, are "must-reads". With the move toward converging technologies, knowing the strategic competitive landscape globally is crucial.

4. Lack of appreciation for marketing concepts of "new, improved, or free" ("Corporate Culture 101"). Read *Advertising Age*, *BrandWeek*, and invest in a relatively new college textbook on marketing that addresses social media and the ever-decreasing product spiral, competition, and time-to-market. And know your competitors, intimately.

5. Misjudging the financial requirements ("exploring the cosmos on a dollar-a-day"). There is a difference between "value" and "cost" and you need to understand how to value your nascent company (and,

"no," valuation is not solely based on your financial statement).

6. A project too good to be passed up by funders ("insidious narcissism"). The Next Big Thing in your mind may be Yesterday's News. VCs still have wounds from the "dot-com" debacle.

7. A corporate Board comprised of experts and inventors rather than money-men and marketers ("The Trojan Horse"). Remember: if you had the money, you would make the rules and not look for an infusion (life vest or "game-changer", depending upon your perspective) of cash. If you are an inventor, you'll likely end up "chief scientist", with a Board seat, stock, and part of the Exit Strategy. (Note: if you think you'll "buy-back" the company or get venture to stay in beyond the agreed-upon time-frame, think again. "Space Assets" are edgy enough for VCs; their private view will probably be a buy-out by one of the Big Players, not an IPO.)

"This Ain't Rocket Science"

It has been said that General Ike Eisenhower and the boys invaded Europe based upon a one-page summary. In the film industry, the cardinal rule is the reduction of a film synopsis to one sentence which provides plot, genre ("High Noon" meets "2001: A Space Odyssey"), who's "attached" (meaning an actor signed), distribution deal (hopefully), and budget. If you cannibalize the above, you have a one-page document with a 25-word or so Executive Summary (the "elevator pitch"—so named for the time it takes for the average elevator ride and a conversation with a busy investor), the absolute tightest of narratives that addresses SWOT (strengths, weaknesses, opportunities, threats) and how your small satellite project will deliver a return-on-investment (ROI) in "x" years at "y" rate, plus—and this is crucial—how your deal fits within the broader VC portfolio of companies and a perfect fit in terms of investment size and risk. And remember this, if nothing else: VCs read the Executive Summary first, followed by your one-page attached briefest of financial statements, then the narrative. What is being described here is the top-line analysis of the bottom-line for investors. If they like this document, you'll likely get the opportunity to provide the full-blown Business Plan for the ritualized due diligence by the VCs experts and the evisceration of your numbers and market assumptions by the meanest bastards on the planet (whose memories will survive in the names of your grandchildren, if you get the "green light").
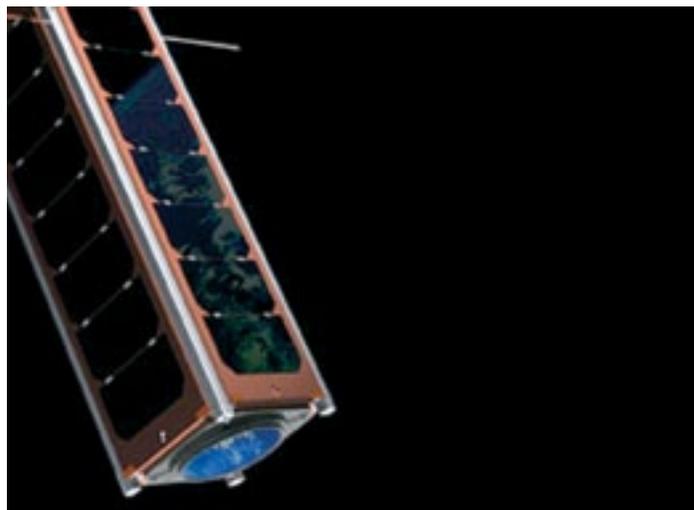
"Mission Impossible"

Having a salable Mission Statement is critical: Charles A. Rarick and John Vitton have linked a simple and cohesive Mission Statement with a 16.1 percent average return on stockholder equity for companies utilizing them. Cash is, to borrow a phrase, "The Final Frontier". And in these economic times, cash is important and leveraging to the hilt can be suicidal.

Branding is key: establish with a simple, easy-to-recognize and remember name and logotype. Entrench it and create a bar-to-entry—namely make it difficult to poach, confuse, or ambush. Expand it into new territories and customer bases as part of a consistent, robust global strategy. Envision it as preeminent, pervasive, persuasive, and protectable. Your widget and company name need to be memorable to a VC team. It has to be "tip-of-the-tongue". First impression may be the final impression.

A Venture Capital "Cheat-Sheet"

The author will have to go into a "witness protection program" once these get out, but here are the basics going through the minds of venture types about you and your small satellite project. Assumption: you have done your homework and your project falls within the VC's financial and portfolio goals and objectives.

1. Who are these people and what is their reputation within the scientific/engineering community? Who can we call within the satellite industry to vet these guys and see if this idea has any remote merit and possibility of success?

2. Do we know members of their Board? Any of our executives participating in their projects?

3. Is any of the science controversial? Are we prepared for robust debate?

4. Who's their bank? Financial situation? Audits? Annual Report?

5. Track record? Any problems on the financial or publicity side?

6. What's the inventor, CEO like? Presentable? Not a "Trekkie?"

7. Who else is being solicited for investment? Friends or foes? Bank support?

8. How does this project meet our investment profile? Risk assessment? Market implications? Good fit for our portfolio of companies?

9. Do they understand our corporate culture? Who's their "sponsor" here?

10. Proposed project: innovative, positive, high profile? Core values?

11. How are we/they measuring success with this project? Are we on the "same page"?

12. How/when will outcomes be apparent? Will we have to micro-manage any of this? Are these guys financial "adults"? Are they prepared for us to inject a COO into their corporate structure?

13. Do we want to spread the risk around? Are there other venture companies who would help with this? Are there State incentives that they qualify for that we can tap to reduce our risk? Any free training of workforce available in-State? Will their team re-locate if necessary?

14. Patents. What does legal think on the risks/rewards of these intellectual properties? Are these guys litigious by nature?

15. What kind of bang for our buck are we getting here? Is there an Exit Strategy and is it feasible/profitable?

A Cautionary Tale
Imagine your scientific endeavor in terms of a technology-driven "S-curve". It generally takes a business initiative the same amount of time to develop and capture 10 percent of the market, as it does to move from that point to 90 percent on the continuum. Simply, a competitor enters with an equal product (or a superior one) and, in say, five years grabs 10 percent of the market and five years later your business finds itself out-flanked and out-of-business.

A Crib Sheet For The Small Satellite Inventor, Entrepreneur
Here's a Checklist of Key Questions for you to ask:

1. Who is the best person in your VC organization with whom to discuss our concept?

2. How many proposals in our sphere do you get annually and how many do you fund? (Try to find at least a one-in-five ratio.)

3. During the past three years, what was your average investment?

4. Are there any published/unpublished restrictions that we need to address?

5. Do you fund R&D or strictly implementation? (Trick question: usually VCs don't like to do both. R&D falls usually within the realm of Government, friends and family, or "angel investors".)

6. Patents: who retains what and under what circumstances?

7. What is your perception of technology and funding trends in the satellite arena?

8. How does your "peer review" process work and timeline?

9. Will you fund a project that is also getting public or corporate $$$? Will you be there with cash for later round investments?

10. Is there a proposal in the pipeline that is similar to ours and under active consideration?
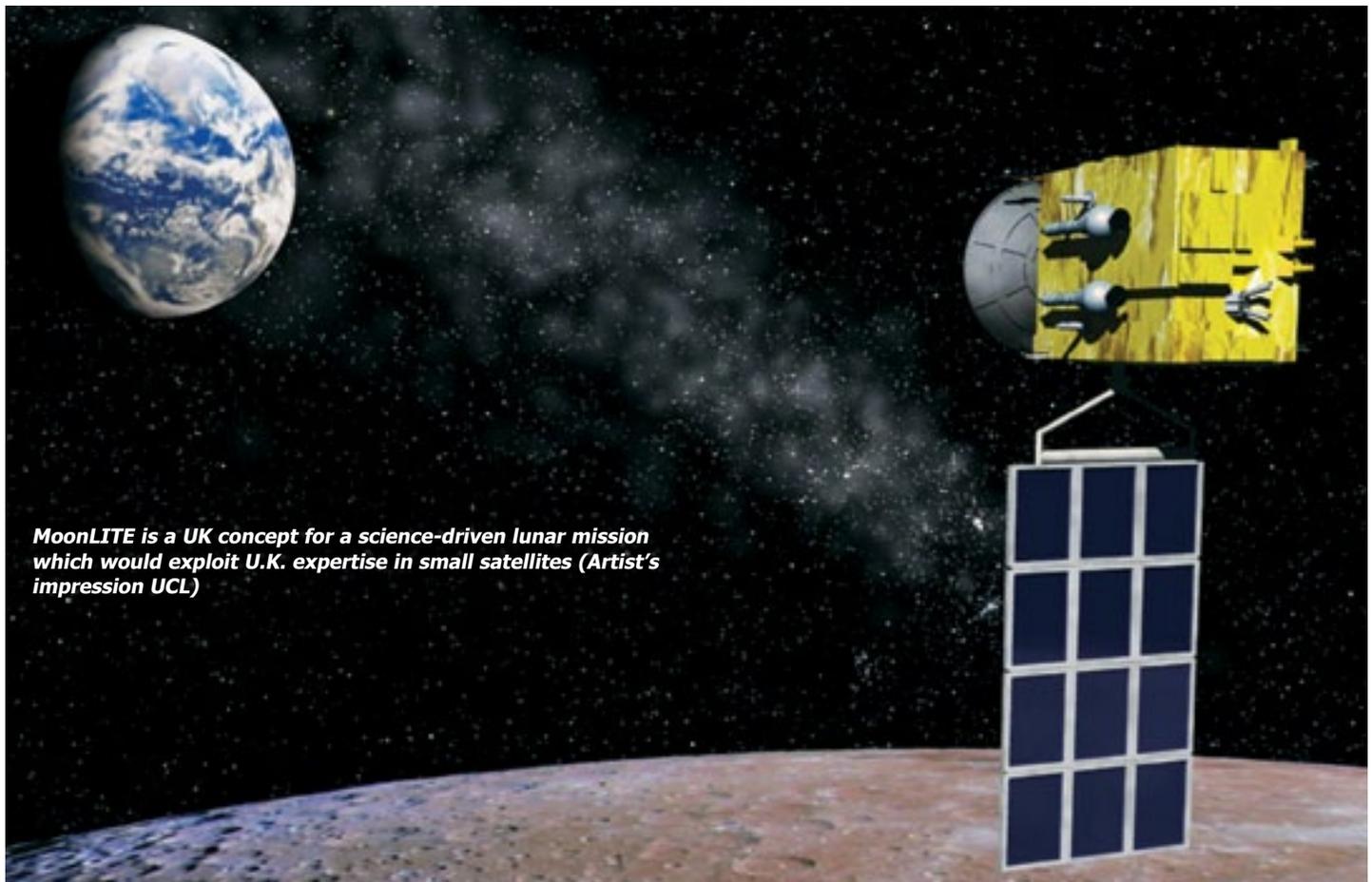
MoonLITE is a UK concept for a science-driven lunar mission which would exploit U.K. expertise in small satellites (Artist's impression UCL)

11. Exit strategy: your expectations and requirements. Are there exceptions?

12. Gut feeling: chance of investment?

Identifying a strategic source of funding is 70 percent of the battle. The Executive Summary, Business Plan, and Exit Strategy are 30 percent of the effort. The game-winners are in the numbers and the Executive Summary. On the numbers, best strategy is a best-medium-worst case approach, in columns. Show you understand the market and plan to dominate it. Monte Carlo Economic Theory says this: one-third of all projects make $, one-third break even, and one-third lose $.

Any SWOT analysis needs an "edge-of-the-world" vibe and hard-headed numbers for the near-Earth-orbit of cloistered boardrooms and investors for whom "rocket science" is a term of derision.

Perception:

- *Satellites are on scrap heap of space exploration*
- *Blaze-of-glory risk at launch*
- *Terrestrial technologies move at speed-of-innovation; orbiting satellites age with "proven" technologies with costly redundancies*
- *Latency issues*
- *Long investment horizon*
- *Threat of a million pieces of space junk lurking in the LEO environs*
- *Solar disruptions*

- *Geopolitical issues, access to space*
- *Interference issues*
- *Rules, regs, and restlessness of money*
- *Communication wars of attrition—which technology will the last man standing embrace?*
- *Brand vs. wholesaler approach—specific brand attributes which lead to brand equity or wholesaler of access, etc.*

You get the picture; then, there's this reality as shown at the top of the next page:

If we apply 2010 VC investment across a host of industries (pharmaceuticals, automotive, etc.), this chart profiles a reasonable expectation of what small satellite companies might expect. Blue = percent Deals; Red = percent $. Source: chart created from PricewaterhouseCoopers/National Venture Capital Association MoneyTree Report; Data—Thomson Reuters.

The meaning is simple: position your efforts to fall within the Early Stage portion of this graph. An "open innovation" approach, plus inclusion of a university partner, and qualification for State incentives is a paradigm shift from the inventor, hat-in-hand, begging for money. It's all about bringing cash or in-kind to the table through partnership and incentives, understanding the venture portfolio of companies, and having a patent/"Killer app" that performs well in terms of risk-reward and falls dead center within the VC firm's available capital.
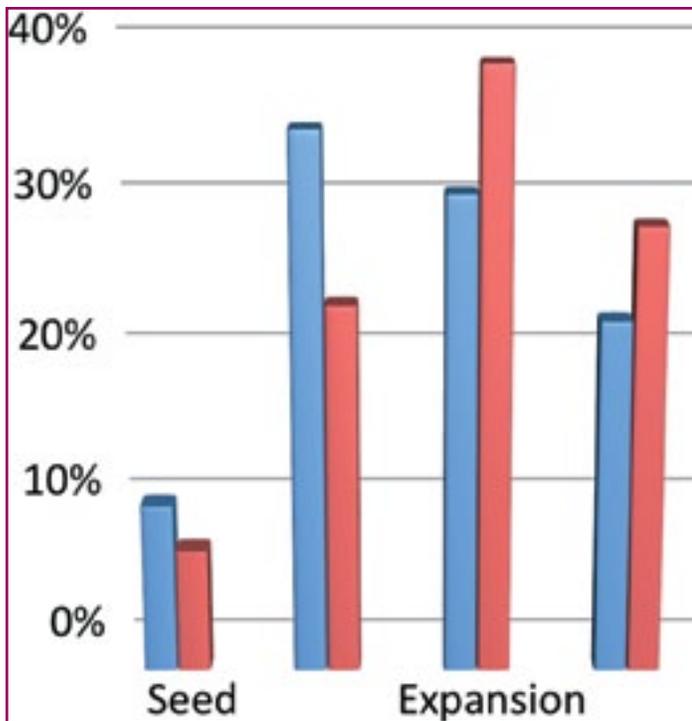
Preparing For "The Raise"

1. Get your patent(s) underway and reduce-to-practice, even if initially through "virtual prototyping", as is done in the aerospace and automotive communities. This will probably be accomplished via cash infusions from friends and family or "angel investors." Put up some of your own money. "Sweat equity" has no value; "skin-in-the-game" does. "I cashed out my 401-K for this prototype" has "juice" with potential investors.

2. Spend three days streamlining a three-page top-line analysis that encompasses financials, Executive Summary, and a tight narrative. Do the numbers first; Executive Summary that describes the small sat project, market dominance, cash needed, risk-reward, and Exit Strategy; then, finally, tight narrative with market, note on competitors, SWOT summary, use-of-funds, timeline for Exit, and bios for principals. Get it vetted by an attorney who knows the sector and your CPA. Use this to troll for VCs.

3. Simultaneously, create a sharp, crisp Business Plan. Maximum 20-page narrative, topped with Executive Summary, and five pages of financials. Key personnel bios: 250 words each, detailing stellar track records + professional photos. Remember, people invest in people, not ideas. A CEO with five successful start-ups that ended profitably is the "real deal" for venture. The "mad scientist-inventor" is fine, but not the photo with a "Beer: it's not just for breakfast anymore" T-shirt.

4. Invest in a serious logotype and fine, tactile business stationery and business cards. Elegant, simple, professional. Success has its own feel.

5. Develop a plan of attack, assuming a "target-rich environment" of potential investors. Make the rounds at the Venture Capital Conferences, research Private Investor Networks (PINs), and—if you choose to look to Deal Brokers, well, caveat emptor. Expect an up-front "consulting fee" (usually to revamp the Business Plan) + 5 percent of money raised (either on an exclusive or non-exclusive basis) paid at escrow of the first tranch + reasonable expenses and, say, 2 percent of the company non-dilutable until IPO, buy-out, merger, etc.

Finally, a word from the late Arthur C. Clarke, The Exploration of Space, 1951:

If we have learned one thing from the history of invention and discovery, it is that, in the long run—and often in the short one—the most daring prophecies seem laughably conservative.

About the author

Wm. F. Vartorella, Ph.D., C.B.C., is Executive Vice-President of Craig and Vartorella International, Inc., a Camden, SC-based strategic research and marketing firm active globally in disruptive, emerging technologies and green, sustainable communications solutions. In 2010, he organized "FlyVenusCom," a worldwide network of ham radio experimenteers, scientists, and CW operators working in close coordination with the Japanese CubeSat Venus communications probe, UNITEC-1, to try to receive and decode very weak and low bit-rate signals from the failing satellite.

The author of more than 100 scholarly and professional articles and papers, Bill's research has ranged from the costs affiliated with small Mars probe missions and the private sector to satellite imaging of historic corridors, re: historic preservation, and the role of venture capital in the next generation of electric vehicles. He received grant funding to study satellite communications and transnational issues in developing countries and, separately, helped build-out a broadcast quality television studio with government surplus gear for less than $10,000. Bill holds both commercial and amateur FCC licenses. The co-author of Funding Exploration—the standard reference text on securing non-governmental support for science and engineering, Vartorella's work has appeared in The Journal of Human Performance in Extreme Environments, Advertising Age, Educational & Industrial Television, and QST, as well as professional and trade publications related to motorsports sponsorships, Hollywood film finance, and fundraising. Bill's firm is an associate sponsor of an experimental, open-wheel electric racecar.

He belongs to the IEEE Vehicular Technology Society and is a Fellow of both the Royal Geographical Society and The Explorers Club. He is a frequent speaker at professional conferences, including those held at the University of Cambridge, The Smithsonian Institution, and in the rainforest of Guyana. Vartorella has trained more than 7,500 executives worldwide skills related to board development, securing funding from non-governmental and venture capital sources. He frequently pens or critiques Business Plans for Start-ups and Early Stage companies seeking venture capital. He can be reached at ***globebiz@camden.net.***

Unlocking New Opportunities In India Via Satellites

by Deepak Mathur, SES' Sr. Vice President of Commercial Sales for Asia-Pacific and Middle East

Indian TV viewers and Internet surfers never had it so good. Seven DTH operators, 500 plus TV channels, MSOs and cable ops who are upgrading the ageing analogue infrastructure, broadband services—have all given them a slew of choices. And all of this is becoming possible thanks to satellite communications and broadcast services being offered by satellite operators.

Consider: India is now Asia's leading DTH market and by 2016 will account for 72 percent of the region's DTH subscribers. Between 2012-2016, seven Indian DTH operators are expected to add more than 25 million subscribers. Broadband users (fixed, wireless, wimax, 3G) are expected to climb to about 140 million from around 30 million in end-2011 over the same period. Of the 30 million achieved so far, around 13.3 million are fixed line broadband. But the targets set by the Indian telecoms regulator under the National Broadband Plan are higher: 75 million (by end 2012) and 160 million (by 2014). Mindboggling numbers, right? The fact is that by leapfrogging costly fiber installs with the reach, reliability and immediacy of satellite, innovative providers are satisfying pent up demand for quality content and connectivity at a record pace.

In six short years, DTH operators have exceeded 30 percent of India's multichannel payTV market. DTH subscribers stand at about 45 million today. India is now the largest DTH bastion in the world and is setting the example for other emerging markets. Much of the success has been driven by high quality services and programming at affordable prices. Indian subscribers, for example, can get about 220 channels for three to four dollars a month. That includes 15 to 18 HD channels, VOD and DVR, along with distance learning and religious content choices.

Then recently, the much-maligned-in-the-past cable TV sector is racing to meet the deadline set by the government to digitize the top four metros of Delhi, Mumbai, Chennai and Kolkata by mid-2012. Once they meet that, the next challenge will be to digitize the entire national cable TV infrastructure by 2015, leading to the total switch off of analog signals. Clearly a battle royale is on between DTH and cable TV to gain supremacy in India's 150 plus million TV homes.

Satellites are playing a lead role in the transformation of India's media and entertainment market. In partnership with **ISRO** [the **Indian Space Research Organization**], **SES** is committed to helping India's DTH and telecom service providers introduce a next generation of access to television and information for the masses.

On The Horizon

Switch back to the year 1999. Number crunchers and analysts expected that there would be just two operators with three to five million subscribers. However, a liberal DTH policy encouraged three times as many players, who are investing in what could be one of the best dividend paying payTV markets in the world. Low monthly fees, inexpensive *set-top boxes* (**STBs**) and access to 200 to 300 quality channels have combined to make DTH an entertainment and information value and staple in India. The explosive DTH growth has taken virtually everyone by surprise and serves as a business model for other emerging markets.

Cable operators looking to win in this market would take this opportunity to grow ARPU by offering more channels, including broadband, DVR and video on-demand. With currently 10 to 15 real HD channels being served currently, we expect this figure to increase in 2012, offering greater premium choices to India's sophisticated and growing middle class.

Satellite's success isn't limited to the impressive rejuvenation of Indian television. VSAT network operators are having an equally important impact on the region, delivering high-speed broadband and life-changing, web-based services. Government agencies and businesses, from banks to gas stations, in India's biggest towns and cities and most remote villages and farms are increasingly relying on satellite to connect, compete and prosper.

Unlocking A Brighter Future

The lack of information can be a debilitating barrier to success and opportunity. India's farmers, for example, have long sold their wheat and cotton harvests to middlemen without real-time access to the fair market value of their hard-earned crops. Satellite enables portals such as **e-Choupal** to link remote farmers with up-to-the-minute crop prices, pest control tips, planting demos, even sharing examples of best practices aimed at driving ingenuity, sustainability and profitability. As a result, rural connectivity has enabled many of India's farmers to better prepare in managing and building a better future.

Along with access to real-time market information, satellite is also changing the way people interact with their local government. Digitalization is playing a key role in driving productivity in remote locations, connecting villages and linking them to crucial government programmes to enhance security, efficiency and even remote learning. Today, thanks to streamlined, internet-based solutions via satellite services, getting a birth certificate in an Indian village no longer has to take weeks or months. It's a web transaction that requires mere minutes.

The potential of satellite communication abounds especially with the evolving demands of India's new global economy. SES is privileged to be able to play a role in enabling India's new economy.

In conjunction with ISRO, SES satellites are home to the largest VSAT networks in India, with more than 120,000 VSAT terminals. These networks carry a wealth of important services, from telemedicine, e-governance initiatives, agricultural data, banking and stock information, as well as sophisticated business connectivity applications, all aimed at fueling local, regional and global access.

DISH TV, Asia's largest DTH provider with over ten million subscribers, and **Bharti AirTel**, India's largest telco with more than six million subs, are contributing immensely to India's new information age on SES satellites. Our prime orbital slots at **95 degrees** and **108 degrees East** are home to India's premier DTH neighborhoods, which is enabling premium global news and entertainment to flow into Indian homes at mass market prices.

India's DTH leaders have become experts in the field, as they grapple with distributing content in 7,000 towns, cities and villages at two to four dollar ARPUs, undeterred and strategically focused on the bigger picture. They see a brighter future of more channels, choices, advanced services and revenue growth. SES is sharing global knowledge and new ideas with our DTH provider customers across India in an effort to help them realize their ambitions, while incubating the lessons from India into other emerging markets.

Trends To Watch

There are some exciting trends gaining traction that are sure to drive growth and optimism across the region. High resolution and regional content will greatly enhance the viewer experience with increasing relevance.

Look to HD to gain significant traction over the next three to four years, as DTH audiences grow more discerning in their preference for HD, offering better picture quality over standard definition programming. HD content will help to usher in tiered programming packages, enhancing consumer choices and driving up monthly subscription rates.

With 22 official languages and eleven of them commanding well over 30 million speakers, tailored regional content will further entrench DTH throughout India and provide an additional layer of premium choices over the next three to seven years. This means that communities across the diverse fabric of our Indian society can be equipped with real-time information, relevant to them in their distinct regional environment. With the trend towards new channels and viewing shares moving away from the mainstream national channels to regional channels, consumers will increasingly be more discerning, demanding tailored local news, but also be exposed to advertising content relevant to their lifestyle, grooming a next generation of savvy consumers. The cost of advertising on these channels is expected to be significantly lower than national channels hence increasing their appeal to local advertisers. As regionalized content and ad campaigns gain momentum, this will be a tremendous driver of revenue spurring local economic growth.

With more than 30 million ethnic Indians living and working overseas in search of new challenges and opportunities, this also presents a golden opportunity for Indian broadcasters to reach out and connect the wider expatriate Indian communities. With a proven track record in building DTH communities around the world, SES can share its expertise and experience to be a strategic partner for Indian broadcasters looking to scale new heights and connect with the wider Indian community globally.

Market Commitment

By 2016, India will have 141 million payTV homes, or 84 percent of total TV homes. PayTV households will create revenues of US$10.3 billion. Including DTT and free DTH, India will have 117 million digital households, or 70 percent of total TV homes, by 2016.

With such impressive growth rates coupled with increasing competition, it has become increasingly important to provide back up with high quality replacement and expansion capacity to match the growth ambitions of our key customers. SES understands this and is committed to the long-term success of India's DTH and VSAT markets with our prime orbital slots at 95 degrees east and 108 degrees east.

Under the guidance of ISRO, SES is focused on enabling the delivery of a wealth of new services, from quality HD to localized programming and access to information for all. Satellite is enabling a special delivery of new opportunities and a brighter and connected future across India, and SES is honored to be part of this historic transformation, enabling DTH and VSAT operators to explore new possibilities and expand on their unprecedented success.

*Figures quoted are from *Informa Telecoms & Media and Media Partners Asia 2011* reports.

The SES-8 satellite, expected to launch in 2013, will be slotted at 95 degrees East and will carry 33 high power Ku-band transponders and will be co-positioned with SES-6. Image is courtesy of Orbital Sciences Corporation.

Antonovich On SatBroadcasting™

The Challenges Of New Media

by Mike Antonovich, Vice President, Sales + Marketing, Roberts Communications Network

This is a really exciting but challenging time in the satellite industry, especially in the media and broadcast sector. Those who know me personally already know that I don't actually know all that much, but what I really do know are lots of smart people in lots of important places, so I've called on a number of my friends to offer insights. Most aren't in a position to publically comment without their employers dropping a ton of bricks on their desks, so I'll just simply call them "Programmers Anonymous". If I share the secret handshake they will cut off my fingers, so don't ask who I've consulted with!

Most folks know that the growth in the linear channel business by satellite has slowed; Ku-band DTH is essentially full, and C-band CATV distribution is essentially flat, as the conversion to increasing amounts of HD delivery has not increased overall C-band consumption due to the advance in MPEG-4 compression, DVB-S2 modulation and other technical advances. There is a short-term opportunity to help customers "bridge" from their existing MPEG-2 delivery to more efficient MPEG-4 delivery, but, of course, in some respect satellite operators would be handing programmers a knife to cut off their own nose, but given the exceedingly long relationships forged between programmers and the satellite operators in North America and Asia, I expect they will work together to make it happen. In Europe, given the lack of "bridge" Ku-band DTH capacity, this will be a more difficult challenge.

From the satellite customer perspective, of course, this is not bad news. The industry has found more ways to get more mileage out of satellite bandwidth, which on a channels-per-MHz basis, is more cost-effective than ever, and truly, for simultaneous delivery to hundreds, thousands or millions of destinations, there still is nothing more reliable.

One place where the C-band satellite distribution market does have the potential for growth, however, is in more regionalized satellite distribution; historically, cable television services began as one national feed and evolved into East Coast/West Coast networks (time shifted three hours apart). For a number of years, the major television networks have had regional feeds, breaking down the country in four, six or even more smaller geographic areas. The old analogy was "sell snow tires in the North, suntan lotion in the South". Some cable programmers are taking a look at the same model, given the new, lower economics of transporting digital television over satellite. The battle will now also be fought between satellite and broadband cable/telco networks as to who can gather all the last mile access within a smaller geographic territory. My money is still on satellite, at least for the next five years.

While linear television distribution (via DTH satellite and CATV/telco provider) continues to provide virtually all the real subscription revenues (on the order of 97 cents out of every dollar) to today's programmers, there are indeed many changes afoot. Today's consumers ingest increasing amounts of content through portals like Netflix and Hulu, with major efforts underway at industry titans Google and Apple on true television platforms. If they are successful, are today's cable MSO's going to be relegated to simply last-mile broadband providers, a simple commodity rather than a value-added service?

Most of the energy and interest from programmers is focused on the emerging forms of distribution in the mobile and non-linear format popularized by the ubiquitous iPhone and iPad, with the battle now fully joined by Android and Windows-powered devices. The under-25 generation simply spends a great deal less time "leaning back" watching traditional television offering and spend a great deal more time "leaning forward" over tablets and PC's, happily multi-tasking instead of immersing themselves the way we old folks do. The video landscape is in the midst of the biggest change in content consumption it has ever seen. While cultural relevance (being clued into the latest goings-on with the favorite television shows of your particular social circle) is as important as ever, viewers are no longer necessarily parked on the couch for prime time viewing on any given night. Increasingly, more viewers are watching these shows on mobile devices on their own schedule and appliances far removed from the TV in the family room. And this trend is very much on the upswing. One data point for you; NBC reported that they roughly served ONE MILLION live streams of this year's Super Bowl; pretty show-stopping when you consider how impossible that might have been even three years ago. Still, linear traditional broadcasting reached ONE HUNDRED ELEVEN MILLION consumers, and of course, 100 percent of the Advertising and carriage fee revenues emanated from old media. Still, keep one eye open for what comes next.

One of the sides of the industry that garnered a whole lot of sizzle over the last year was 3D television. Over the last 12 months, it has been a significant marketing gimmick to move the latest generation of flat panel televisions, and we have started to see a few flagship movie and sports channels in the U.S. and Europe launch. The industry is still defining and evolving to discover the best practices to produce and display HDTV, with a lot of energy going into projection and eyeglass-free technologies to get around some of the biggest consumer objections to 3D. If CES was any indication, 3DTV may well be supplanted by the new "4K" display technologies. 4K is a traditional two-dimensional television experience, but with twice the native resolution of today's high definition images. The images shown at

Antonovich On SatBroadcasting™

DIRECTV 10 satellite, image courtesy of Boeing.

CES were incredibly lifelike. Because the images are so good, the industry recommendation is to sit even closer to these big, beautiful screens, as the resolution is so good you don't see the pixel structure. This truly immersive television experience is, I believe, the industry's best chance to get viewers back on the couch.

The challenge with 4K is going to be in finding available bandwidth on DTH and Cable that can support these higher resolutions. It's tough, as there isn't even enough bandwidth to convert all the existing video sources to HD transmission. The real problem is not on satellite (except for Europe) but the lack of available bandwidth on the pipes CATV and telco operators deliver into the homes of consumers, where roughly 75 percent of all Americans actually get their television service. Still, it is my bet that a stalwart few of the biggest players in this game will stake the high ground and find a way to launch a few flagship 4K video services. Maybe not in 2012, but I'll lay even money that somebody launches a fulltime 4K by the end of 2013. And NHK network of Japan doesn't count; they are ALWAYS the first network to launch the newest and best broadcast technologies!

What keeps increasingly more and more television folks up at night is the ever-increasing access to "informal" television and outright piracy, which is increasingly enabled by Internet-delivered services. The hue and fury over the recent Stop Piracy Act is just the latest salvo in what may be an unwinnable war. Internet-delivered television is the Pandora's Box that destroyed the traditional music distribution business, and is an increasing threat to the linear television world as we know it. So what are programmers to do? Like the old saying goes, "If you can't beat them, join them". Finding ways to get license and subscription and on-demand revenues directly from end-users is one way out, but it displaces all the traditional business models, and nobody making money today is going down without a fight. Does the Internet fracture the traditional Basic Tier of cable? Will all channels be forced to go "ala carte"? The struggle to balance the

intellectual property right of content producers against consumer demands for access to all content everywhere, anytime and FREE is just beginning.

Now, we here at Roberts Communications Network firmly have one eye focused on the traditional linear channel services market, and the other eye focused on the emerging new media opportunities. We do our best to keep our eyes from crossing. We can and will continue to operate to more than a dozen satellite transponders from more than a 110 portable uplinks. We absolutely are believers in the reach and reliability of satellite communications, as we also operate DTH platforms for the "one to many", and we operate C- and Ku-band uplink sites for backhaul and contribution, taking full advantage of the "any to any" capabilities afforded by satellite.

But we are also very much immersed in "new media" businesses, distributing more than 500 terabytes of video content every month for our streaming video clients, serving live linear content and Video On Demand file-based video to Apple, Android, Google and Windows –based mobile devices virtually everywhere on the planet you can get reliable IP service. We have also developed some very sophisticated and unique Digital Signage appliances and applications that combine the "Information Kiosk" with the "advertising portal".

So, will it be satellite or fiber that wins out? The answer is ...of course, neither..and both! We are big believers in sophisticated hybrid solutions, making good practical use of both to build the best solution for our end-users.

The challenge for Roberts Communications Network and to all our fellow service providers remains to do everything well, keeping customer needs and objectives, even as they perpetually evolve, as our true "North Star". Our credo remains "Take good care of your customers and your customers will take good care of you!"

Special thanks to my friends in Programmers Anonymous. No actual broadcasters were harmed in the writing of this article. My good friends at *SatMagazine* have asked me to make this a semi-regular posting, as they are under the impression that keeping me busy may deter me from becoming a shoplifter, or even worse, a politician. Any comments on this piece or ideas for new articles are greatly appreciated.

About Mike Antonovich
Michael "Mike" Antonovich brings over 30 years of broadcast and satellite industry sales, marketing, operations and executive experience to his new position as Vice President, Sales and Marketing at Roberts Communications Network. The company operates a global video service network across 12 transponders and more than 110 satellite uplinks. He has formerly served at companies as influential and diverse as ESPN, Group W Satellite, PanAmSat, Genesis Networks and Global Crossing in a variety of leadership and executive positions.

Downlink Technology In Broadcast: Robust L-Band Distribution System

by Daniel Freyer, Founder, AdWavez Marketing

Satellite facilities requiring multi-channel, multi-transponder, and multi-satellite downlink signal reception, monitoring and L-band distribution include CATV and IPTV headends, DTH broadcast centers, certain government agencies and communications ministries, teleports, and even satellite TT&C (telemetry, tracking & control) sites that need to monitor large numbers of signals. The Etisalat super headend case is an excellent example of the kind of modern L-band distribution solution that makes business sense to deploy today in large scale downlink operations.

Etisalat is one of the largest telecommunications companies in the world and a leading operator in the Middle East and Africa (MENA). The Company decided to expand an existing CATV headend in the U.A.E. by adding a 700-channel IPTV infrastructure. The headend system required a massive state-of-the art, satellite signal downlink system to ensure signal quality, redundancy, monitoring and control. This article unveils, via a case study of the solution integrated by prime contractor Huawei and employing an RF distribution system from DEV Systemtechnik, how such a huge system of this type can be efficiently designed to achieve lower power, rack space, and cost.

Changing Mideast Lifestyles: More Entertainment. More TV

Headquartered in Dubai, Etisalat is the largest carrier of international voice traffic in the Middle East and Africa and the 12th largest voice carrier in the world. It operates in 18 countries across Asia, the Middle East and Africa, serving over 100 million customers, providing mobile and fixed video, data, and TV services. The company's next-generation IPTV service has been marketed to regional consumers under the brand names e-Life and e-Vision. "Etisalat has been a pioneer in the world of telecoms and entertainment, providing rich content to TV viewing customers in the UAE for over 11 years," says Matthew Willsher, chief marketing officer, Etisalat. As demand for more content and sophisticated features has grown along with viewer tastes, Etisalat has taken action to bring more channels, content and features to market. "Over the years, we have keenly listened to our customers and enriched their home entertainment as per their changing lifestyles," says Willsher.

In addition to local and regional Arabic channels, programming received through Etisalat's head end in the U.A.E. comes from international satellite distributed networks such as BBC, Eurosport, Fox Movies, Fox Sports, Discovery Networks, National Geographic Channels, ESPN, The Filipino Channel, Arirang TV,

NHK from Japan, Indian networks, Nickelodeon VH1, MTV Music, E!, and BET.

Meeting Channel Growth

As part of a major expansion with new channels and services, Etisalat decided to expand its head end to support a huge 700-channel IPTV system. It also decided to hire a system integrator to help upgrade its facilities. "For the largest IPTV platform in the World we required a massive satellite downlink system that can pull entertainment, news, and information from more than seven hundred satellite TV channels" says a Senior Manager of Etisalat. The integrator would be required to deliver a state-of-the-art system without causing any interruption or disturbance to the regular operation of the existing on-air CATV head end. The installation and all equipment had to be fully redundant with no single point of failure.

Following a bidding process, Etisalat selected China-headquartered Huawei as its prime contractor for the job. With USD 28 Billion in 2010 sales, Huawei (www.huawei.com) is a leading global information and communications technology (ICT) solutions provider whose products are deployed in over 140 countries.

For the satellite downlink RF distribution segment of the system, Huawei turned to the RF experts, DEV Systemtechnik (www.dev-systemtechnik.com), headquared in Friedberg, Germany. DEV's contribution to the system covers the part from the antennas to the receivers. (Top left in Figure 1). "DEV's high-performance L-Band distribution system ensures superior signal quality, redundancy, signal monitoring and controllability in less rack space, using less power, and for a lower total cost of ownership, which is important to Etisalat," according to Etisalat's manage involved in the project.

A total of 128 L-band signals are first split between the existing on air CATV system and the new system and then distributed to the 1+1 receiver sub-system by more than 70 rack-mounted distribution amplifiers (model DEV 2190). (P*lease see Figure 1.*)

State-of-the-Art L-Band Distribution System

The L-band Signal Distribution System relies on the DEV 2190, a next-generation L-band signal distribution and management appliance ideal for large satellite ground stations receiving many signals. This product (See Figure 2 Photo) accommodates up to 3 power supplies and 16 amplifiers in the front side of a 4RU chassis. The splitters and/or matrix switches are located in the back. Fixed and matrix distribution can be mixed. Each Chassis

allows for 16, 32, 48 or 64 outputs (matrix switches 4:x or 8:x) and a maximum of 128 outputs for splitters (1:x), if desired with mixed configuration and impedances (50 or 75 Ohm) for inputs and outputs. Optical inputs and redundant amplifiers are available as an option.

This solution delivers the highest commercially available level of RF performance in reliable, compact, space and power-conserving devices that reduce rack space cost, and power consumption, helping to minimize ongoing operational expenses for the facility.

Flexibility and Control of RF Routing and Distribution

"DEV's system also gives us more flexibility and control over incoming satellite RF signal routing and distribution, making it easier for us to expand in the future," says Etisalat's manager involved in the project. The Signal Distribution System is controlled and monitored via web interface or SNMP and enables the adjustment of gain and RF sensing thresholds as well as LNB bias current. The variable tilt functionality for extended L-band ensures a constant signal level over the entire frequency range, an essential feature for high-availability applications. Signal LEDs in the front panel show key operational parameters at a glance, for example, that the unit is properly functioning locally or remotely, that the power supplies are doing fine, the temperature of the distribution amplifier modules is within limits, and that the CPU is communicating properly with the system. It also indicates if there are alarms or error messages requiring operator attention. These features give Etisalat flexibility, and control in a cost-effective package.

In discussing the satellite RF portion of the project, a responsible Huawei representative says "We choose DEV Systemtechnik because of reputation, recommendations, product range, functionality, German engineering and product reliability. DEV was very flexible during the delivery phase of the project and suggested a phased delivery in order to assist with the equipment installation process, which turned out to be very helpful. DEV guarantees 100 percent availability of all equipment, and signals exceeded our expectations in all respects. We got all that we required from the equipment plus the unique addition of SNMP and web page monitoring. System engineering changes proposed by DEV also proved to be very successful."

The solution that was implemented represents the latest in RF distribution technology of this type. Component redundancy, device level redundancy, and system design redundancy with extensive monitor and control features ensure continuous on-air operations.

Signal Recording Now Part of The Mix

Signal Recording captures signal properties in the input path of the system and records them in user-defined time intervals—so system administrators get topical feedback on signal changes over time and see the dependence of signal properties on environmental influences such as interference, precipitation, and temperature. DEV's L-band Signal Distribution System now comes with a Signal Recording function as a standard feature that gives ground station operators easy and affordable access to recorded RF signal parameters over time, which can help in efforts to identify and mitigate interference at head ends. Signal Recording allows a user to access the RF signal level of any L-Band signal and/or LNB feeder current directly via the web interface of the DEV 2190. Recorded data are displayed in a user-friendly graphical user interface, and can be exported. Systems already in the field can add Signal Recording by purchasing a software upgrade.

Quick Delivery, On-Site Training Always A Must

Etisalat's tight schedule for the project meant that Huawei, and therefore its key subcontractors like DEV were required to perform
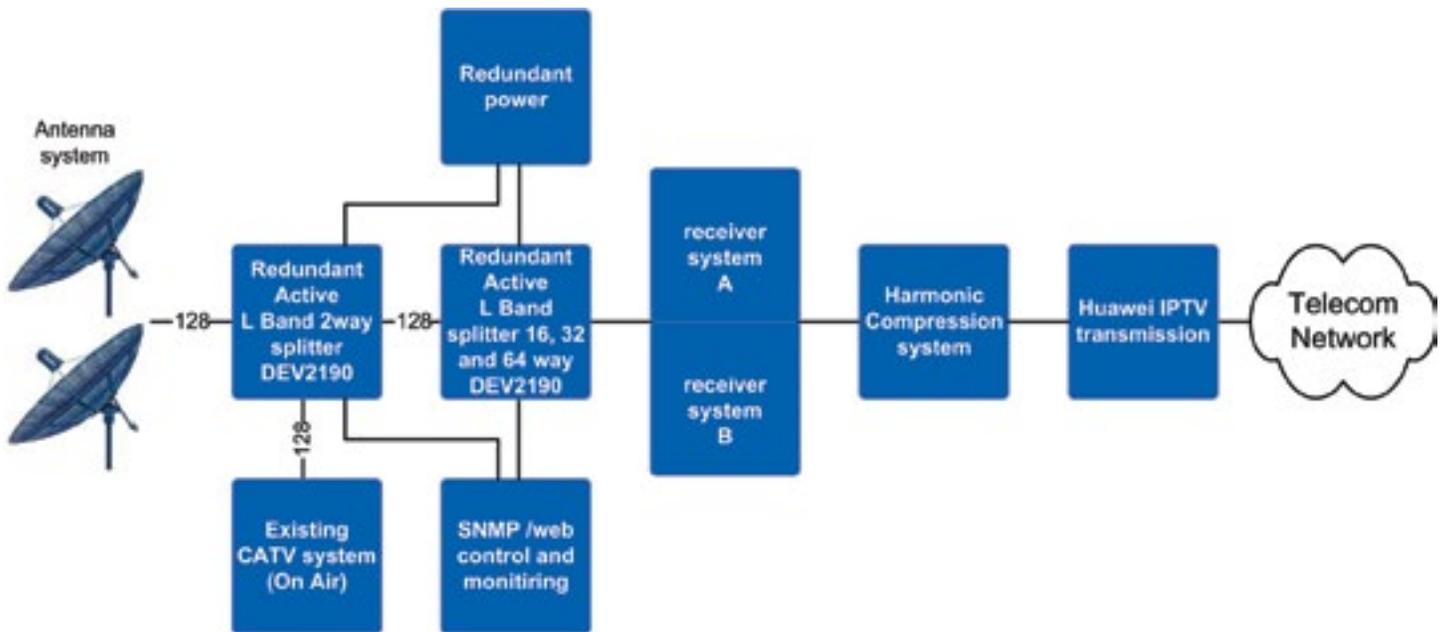
Figure 1: A functional view of the Huawei's IPTV system for Etisalat.

exceptionally. "We had to deliver very fast and started to produce equipment even before we received a formal order," says Joerg Sommerschuh, DEV's area manager. "A lot of on-site service was necessary, especially factory acceptance tests and support for the deployment of the no-single-point-of-failure structure for the site acceptance test."

Making L-Band Distribution Easier
The Etisalat super head end case is an excellent example of the kind of L-band distribution solution that makes sense to deploy today in CATV and IPTV head ends. Other suitable applications include DTH broadcast centers, government satellite monitoring facilities, and teleports and even satellite TT&C (tracking, telemetry, and control) facilities that need to route and distribute large numbers of L-band signals. Extensive built-in monitor and

Photo: Etisalat Head end at Towi Al-Saman in Sharjah UAE Receives 128 signals from multiple satellites in Ku- and C-band.

DEV2190 L-Band Distribution systems in IPTV super head end downlink at Etisalat, UAE

control features, switching, and redundancy options—all without the added costs of an external M&C system required for some older generation solutions—make the new generation of L-Band signal management solutions easier than ever for operators. Given the many other challenges that satellite ground facilities face today, this should be welcome news to earth station designers and operators.

About the author

Daniel Freyer is Founder of AdWavez Marketing (http://www.adwavez.com), a marketing agency serving clients in the satellite and technology industries. He has over 20 years of global industry experience helping spacecraft manufacturers, satellite operators, service providers, broadcast and telecoms end-users, equipment manufacturers and system integrators grow their businesses.

DEV Systemtechnik develops and produces a complete range of leading-edge, high-performance products and systems for the optical and electrical transmission of Radio Frequency (RF) signals via coaxial cable or fiber for satellite, cable, and broadcast television head ends. DEV products include distribution amplifiers, splitters and combiners, switching systems, distributing matrices, routing products, multiplexers, and fiber-optic RF signal transmission systems – all built to meet the highest standards of system availability, reliability and controllability. Named several times to the Deloitte Fast 50 list, DEV has achieved a compound growth rate of 462 percent over five years.

New DEV Core Function Products (CFP) Hit Market
Known for its high-end products and RF signal transmission quality, DEV also recently started shipping the first models in its new CFP (Core Function Products) series of RF Switches, Combiners and Splitters, which are used to route and distribute RF signals within earth stations and head ends. DEV's new CFP series offers up to 70 percent cost savings for cable and satellite head ends by streamlining devices down to their core features, according to the company.

DEV says it can offer its CFP products at substantially lower cost than the standard full-featured versions of DEV products because the new CFP units come without all the extra power supplies, alarm, monitoring, and sensing features provided in DEV's standard models, which package in lots of additional features. Among the first DEV CFP models available are bi-directional RF switches, the DEV 1228 (up to 4x1:8) and the DEV 1236 (up to 2x1:16). Specified for the 10 to 2300 MHz frequency range, DEV's CFP switches offer excellent RF transmission quality, high isolation, flat frequency response and low ripple. Read more at: http://www.satnews.com/cgi-bin/story.cgi?number=2040537623

DEV America LP, the company's U.S.-based subsidiary is exhibiting at Satellite 2012 in Washington, DC., Booth: 1630.

A Market Forecast For High-Frequency, Space-Qualified, TWTs

by Deepak Gupta, Ph.D., MEng, DIS, CEng, FIET, Black Kite, Ltd.

Satellite communications use various frequency bands, ranging from L-band (approximately 1 GHz to 2 GHz) to Ka-band (approximately 26 to 40 GHz). Travelling wave tubes (TWTs) are specialized and essential components for SATCOMs and are required in both the space and ground segments to create an end-to-end communications chain. The TWT market is dominated by two world players, **L-3 Communications** in the U.S. and **Thales Electron Devices** in Europe, who together hold nearly 90 percent of market share, mainly in the lucrative Ku-and Ka-bands. Growing pressures for faster and higher quality communication services are driving the need to find more bandwidth to serve the increasingly hungry data and broadcast applications (*e.g.*, interactive gaming, HDTV). To satisfy this insatiable demand, higher frequencies are being considered, which necessitates the development of TWTs operating at higher frequencies, namely Q & V bands.

This article provides an overview of the history of Ka-band satellite development, focusing on the satellite requirements for Ka-band TWTs. Presented is a forecast of the number of Ka-band TWTs that may be required over the next decade. Satellite companies need to consider higher frequency TWTs, at Q- and V-bands, to maintain pace with communications requirements. Market drivers for this are being seen from governments, business and consumers. Satellite operators, space agencies and others are showing increased interest in higher frequency TWTs. From this data, an outline assessment of the potential size of a Q/V-band TWT market is offered.

Terrestrial Provision?

Demand for video and broadband services are continuing to increase, with rich multimedia applications exacerbating demand for higher and higher data rates, services such as HDTV, 3DTV, and interactive gaming. Some suburban communities are still not fully served by high, or even adequate, broadband data connections; some rural communities, especially in developing countries, but also in parts of N. America, are not served at all. Terrestrial providers are continually upgrading their infrastructure to provide higher data rates through, for example, fibre optic broadband and wireless technologies (such as **LTE** – *Long Term Evolution*), but the cost of serving hard to reach communities is still seen as prohibitive. Despite the high cost of launching a satellite and providing the necessary ground equipment and operations (say, three to five hundred million dollars), reaching many of these communities is likely to be feasible only via satellite. Satellite communications can therefore continue to play an important part and capture and maintain reasonable, if not significant, market share.

TWT history — A Traveling Wave Tube from Hughes, circa 1970s

Potential Drivers For Higher Frequency

(Q/V-band) Satellites

Satellite communication saw massive growth during the 1990's and early 2000's. Even at that time spectrum was recognized as the major challenge and satellite communication was predicted to move to Ka, Q & V frequency bands[1] fueled by broadcasting and data services across the Internet.

Digital communications and Internet technologies are now key infrastructures across the globe.

Several aspects have the potential to encourage development of high-frequency TWTs. Governments, business and the public all desire higher data-rate communications. European governments wish to eliminate the currently prevalent digital divide: as analogue-based services are removed/switched-off, the public are being encouraged to consume digital communications. Governments wish the public to make greater and better use of digital services in order to reduce cost, increase efficiency and to enable the provision of, and access to, richer services. To achieve the provision of economic and social benefits for citizens, the public require ubiquitous, fast and reliable broadband communications.

Service Drivers

Business nowadays relies upon Internet-based communications and services. Various sectors see potential for offering better, improved and novel services both to consumers (the public) and to corporate clients. This has been happening rapidly over the last decade or so and is set to continue, *e.g.*, within the Creative Industries sector (a sector that accounts for more than 6.4 percent[2] of the U.K.'s **GVA** (*Gross Value Add*), and one which is being supported by the U.K. Government).

The public are focused on services. These services, (*e.g.*, video streaming, loading personal video to social networking sites (*YouTube*), and gaming,) all demand high data-rates, a trend that is likely to continue as people move to using higher quality video (HD) and, in the future, 3D and 3D HD.

The military is also showing increasing interest in Ka-band and expanding their use of it, with manufacturers working on the technical challenges to achieve reliable *communications on-the-move*[3] (**COTM**), *e.g.*, for the **Wideband Global SATCOM** (**WGS**) satellites[4]; the military realize that Ka-band offers greater channel bandwidths and data throughput compared with lower frequency bands. For its operations, the military will wish to use applications similar to that used by the public, (*e.g.*, video streaming, (secure) internet access, high-speed data, voice/VoIP).

Socio-Economic Drivers

During 2009 and 2010, broadband provision to remote or rural areas was pulled into sharp focus as the European Commission offered significant funding to extend broadband reach into difficult-to-reach parts of the European Union[5]. **Avanti** in their January 2010 publication, *Connect*, citing a 2009 World Bank report, state clear socio-economic benefits in both the developed and developing world, with greater impact in the latter; for example, innovative services and applications, such as on-line education, are being developed to serve rural communities. There is thus considerable political impetus to ensure ubiquitous broadband connectivity.

Cost Drivers

The U.K. government estimates the cost of achieving 98 percent national coverage for fibre optic broadband is approximately 35 billion pounds. Cable companies have little incentive to serve the remaining 2 percent rural areas. Europe has more than 70 million homes with a terrestrial broadband connection of less than 2 Mb/s, and 24 million homes and businesses have no coverage at all.

Laying fibre or expanding a fixed-line (DSL) network is expensive and cable companies are unsure that such is cost-effective for rural locations. The large terrestrial cost makes satellite technology an attractive option, especially for these difficult-to-reach locations; a report to the *U.K. Space Leadership Council* estimates a global satellite broadband services market to be between 1.5 billion and 15 billion pounds by 2030[6].

This same report makes two key recommendations, namely that the satellite industry should migrate "existing satellite customers from older to new satellite services as a priority as new capacity becomes available" [meaning from Ku-to Ka-band], and "define further high-capacity satellite solutions with manufacturers and continue to develop innovative technologies, including the provision of seamless broadband and broadcast systems". As more and more customers move to Ka-band, it is inevitable that in order to satisfy continuing, voracious demand for higher data rates, further bandwidth will need to be made available.

Spectrum + Technical Considerations

Satellite communications traditionally provides access to broadband services through lower frequency bands (C- and Ku-), and more recently primarily through Ka-band spectrum. This spectrum is becoming crowded – spectrum for SATCOMs is at a premium and is the most valuable resource. Therefore, the problem to be solved is, "How can more data capacity be made available at Ka-band?"

Making capacity available at Ka-band significantly mitigates the need to manufacture higher-frequency (Q-and V-band)

equipment for the public. Some of the downlink Ka-band capacity is used to communicate with 'gateways' that connect users to the Internet. By freeing-up this downlink capacity, more Ka-band spectrum would be available for users. Communication with the gateways may then be achieved at Q-band. (Due to legacy consumer and business equipment (receivers), it will be difficult (and slow) to move users to a different frequency band without strong user incentives, *e.g.*, improved, new, or richer services, cost subsidies for new user equipment.)

To make effective use of Q/V-band, some technical challenges need to be overcome: the design and space-qualification of TWTs at high frequencies; achieving an attractive efficiency; understanding the link budget at Q/V-band frequencies – mitigating the increased effects of rain fade, buildings, and foliage. None of these are seen as insurmountable and some of these are already under partial investigation through various studies (*e.g.*, in Europe and Canada).

This article shows that these (and other) market drivers will create Q/V-band satellite deployments; the only questions are, "When?" and, "How big?" both of which are answered below.

The Current Context –
Ka-band Satellite Development

Before delving into the possibility and potential Q/V-band market, it is useful to understand where we currently are. Although there is considerable use of lower frequencies for satellite services (C and Ku-bands), we consider here only Ka-band, as that is likely to present a better guide to the development of Q/V-band.

Use of Ka-band (26.5 GHz to 40 GHz) had some initial serious consideration in the late 1980's / early 1990's. Developments during that decade led to eventual satellite deployments to use this band for broadcast and telecommunication services. Consumer uptake of Internet communications from around the mid 1990's and the advent of broadband communications helped to encourage the growth of Ka-band satellite communications during the latter part of the 1990's and into the current millennium. Satellite operators continue to provide high-data rate services and, to varying degrees, plan to launch more Ka-band satellites.

Satellite broadband continues to expand globally, as seen by recently launched Ka-band satellites, with new ones planned. For example, **Hughes**[7] launched its **SPACEWAY® 3** in 2007 to serve North America, and **Avanti**'s Ka-band **HYLAS 1** satellite was launched in late November 2010 to serve Europe. Ka-band satellite communication is growing across the globe; it promises fast broadband, Internet communications in order to satisfy consumer demand for ever higher increasing data rates and capacity.

Businesses are using media-rich services to gain and maintain a competitive edge; governments require high bandwidth both for secure internal communications and to communicate with their citizens, and the public (consumers) are tending to watch films, use social networking websites and browse the web simultaneously. Recent satellite launches[8] (Ku-band **Atlantic Bird 7** and hybrid Ku/Ka-band **W3C**) by **Eutelsat** demonstrate demand in both existing and fast developing markets, and confirms video as the key revenue application, generating more than 67 percent of Eutelsat's revenue[9] (Q1 of their 2011/2012 year).

There are an estimated 30 million locations across Europe without access to broadband[10]. The **European Commission** (**EU**) wants full broadband coverage in the **European Union** (**EU**) by 2013. Satellite is likely to play a significant role, *e.g.*, Avanti believe that they can gain market share due to the underserved rural areas.

Artistic rendition of Hughes Spaceway3

Nations within the EU are funding initiatives to reduce/remove the Digital Divide, as seen in the U.K. through government grant funding. Avanti's HYLAS Ka-band satellites (**HYLAS 1**, and **HYLAS 2** to be launched within the next 12 to 18 months, with **HYLAS 3** at the planning stage) will be able to provide significant broadband and broadcast coverage to rural and remote areas that are poorly, or not, served by terrestrial networks.

Ka-band offers high bandwidth and frequency re-use capabilities across multiple beams (*e.g.*, a four-color frequency re-use map for spot beams, allowing localized content), which has helped to drive its growth for SATCOM. There are possibilities for aircraft, railway, military, and other mobile applications. For example, **Telenor**'s satellite **Thor 7**[11] (due for launch at the end of 2013, with commercial service to be initiated as of Q1, 2014) will be fitted with a Ka-band payload to support the surge in demand for high bandwidth requirements from the maritime industry[12], and will deliver a bandwidth efficient service with high bit rates; it will cover areas including the North Sea, Norwegian Sea, the Red Sea, the Baltic Sea, the Persian Gulf and the Mediterranean. (Its main payload will be 11 Ku-band transponders to serve growing broadcasting requirements within Central and Eastern Europe.) The biggest driver today, and in the foreseeable future, is commercial high-speed Internet access.

During the first decade of the millennium, many operators showed direct interest in providing Ka-band communications. 2010 and 2011 were the years in which Ka-band reached adulthood. Operators and manufacturers made numerous announcements[13] of launches and planned launches of Ka-band satellites, and will now compete[14] with one another across various sectors (commercial, maritime, business). However, Ka-band spectrum is becoming congested, even full in various parts of the World. (**Telesat** see little available Ka-band capacity in Canada.) Operators are looking to use higher frequencies, *i.e.*, Q- and V-bands, either to augment services at Ka-band through hybrid communications, or to deploy broadband (and broadcast) communications in the same way that has been done at Ka-band.

By considering satellites that have Ka-band capability, we can estimate the number of Ka-band TWTs that are in operation and forecast to be in flight. (*See Figure 1.*) What this graph shows is that Ka-band SATCOM technology is now mature, with satellites due to come into service and with others planned in the near future. Some initial surge in Ka-band from 2004 has been witnessed (which may have happened earlier, if it were not for the dot-com bust during 2000 and 2001), with sustained Ka-band deployment starting in 2010 and expected to continue for several years. The expected number of Ka-band tubes during 2010 to 2014 is at least 120 per annum (including spares). The numbers for 2007 and 2012, which are off-the-scale, are skewed by Hughes' SPACEWAY® 3 and Jupiter satellites; ignoring these outliers, an approximate number of Ka-band TWTs per satellite appears to be approximately one hundred; to a first order approximation, this correlates with TESAT's claim that it manufactures some two to three hundred TWTAs per annum.

The Current Ka-band Market

Futron[15], a well-respected market research firm active in the aerospace and space sectors, forecasts strong and sustained world-wide growth in the satellite communications market. Its 2010 forecast report[16] indicates an overall growth during this decade from 4 percent to more than 12 percent, depending upon application and service. (Some applications (*e.g.*, video distribution, carrier back haul) are expected to have zero growth.) TV services represent the largest proportion of demand (in terms of transponders), and consumer TV markets continue to expand: a growth of more than 5 percent CAGR for DBS is expected over the decade.

Another market survey supports the strong demand for satellite TV. Its report[17] forecasts that payTV revenues will climb to US$173 billion in 2016[18] . On-demand revenues will increase much faster than subscription revenues, reaching US$5.7 billion (or 3.3 percent of the total) by 2016[19] . The U.S., the world's largest payTV revenue earner, may see its revenues drop (by nearly US$ 3 billion between 2010 and 2016), but Brazil and India are expected to see some "impressive" growth. The growth of on-demand is interesting as that implies more localized, targeted content, which may be better delivered by spot beams, the deployment mechanism for Ka-band (and potentially higher frequencies also).

Demand is being seen across the globe: Developing markets seek coverage to capture areas where there is little or no service (new and more capacity); developed markets seek high power capacity for more and improved services on the back of higher data rates and faster connectivity. The 'digital revolution' that is bringing digital, IP-based connectivity and services is strengthening. Rural and other hard-to-reach communities can be expensive to serve through terrestrial infrastructure; satellite communications will therefore continue to play an important and essential part, with demand in rural areas being stimulated through subsidised equipment and services. There is continued growth in the military market, which is increasingly relying upon the use of commercipercent percent over the decade.

To meet this demand, operators worldwide are launching and planning to launch more satellites with Ka-band capability, as this offers growth and new services respectively to operators and consumers. Operators are putting into service either hybrid satellites (multi-band) or dedicated Ka-band satellites. However, spectrum at Ka-band is filling-up.

Ka-band TWTs

Travelling Wave Tubes make up the largest component within the Microwave and Millimetre Wave *Vacuum Electron Device* (**VED**) market, with a market share of approximately 65 percent in 2010, and forecast to maintain that share in 2015[20]. Klystron and magnetron devices are next with respectively about 16 and 13 percent market share. TWTs also have the largest share within the space market at 53 percent (2010 and 2015).

Table 1 indicates that, over the next three to four years, the TWT market is expected to remain flat. However, other market indicators suggest that the Ka-band space-TWT market will be fairly buoyant given the planned satellite launches.

The Microwave and Millimetre Wave VED market is dominated by three main players, **Thales**, **L-3Com** and **CPI**, with 2010 market share respectively 26 percent (~$260 million), 23 percent (~$230 million) and 23 percent, respectively. Considering the non-space market, CPI leads with 30 percent market share and $230 million in revenue. Further detail are shown in *Figure 2*.

The Space TWT market (approximately $260 million) is dominated by two main players, Thales and L-3Com, as shown in *Figure 3*. 'Other' players account for an almost meager 11 percent of the space-TWT market.
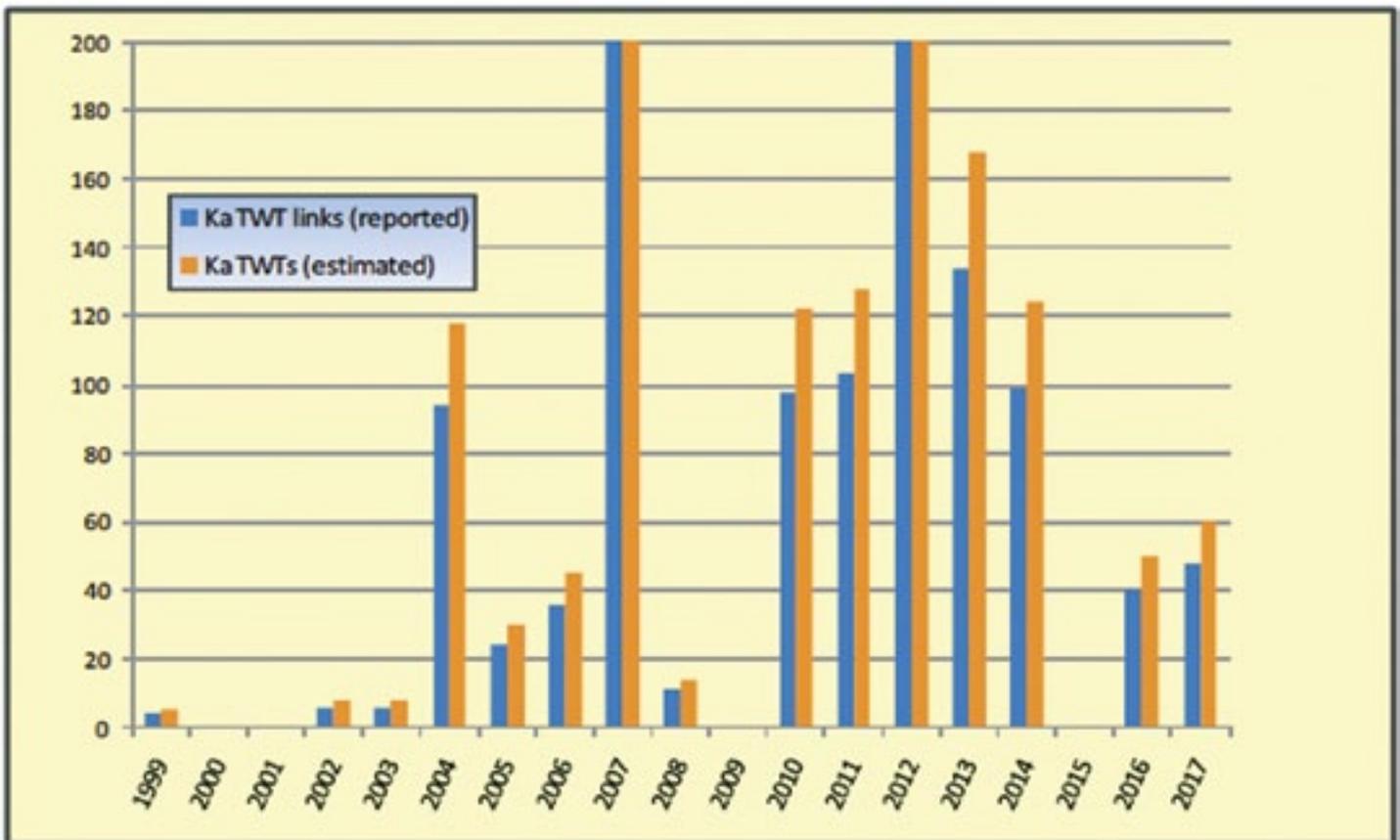
Figure 1. Estimated number of Ka=band TWTs per annum and forecast

Ka-band Applications

Principal applications for Ka-band are TV and data services as previously described. Other applications are also envisaged (outlined later in the article), and these other uses will put pressure on Ka-band spectrum availability. Later, some of these applications, e.g., airborne and military communications, may themselves use Q/V-band spectrum.

Meteorology— **ESA** has recently issued **ITTs** (*Invitation to Tender*) to provide "an operational satellite system able to support accurate prediction of meteorological phenomena and the monitoring of climate and air composition through operational applications for the period of time between 2017 and 2037." Some of these tenders call for Ka-band communications, *e.g.*, AO/160030, MTG-ITT36 Common Platform / Ka-Band Transmitter, and AO/160031, MTG-ITT37 Common Platform / Ka-Band Antenna[21].

Airborne Communications— **JetBlue** and **GoGo**, two U.S. companies, have set in motion their plans to provide air passengers high-speed broadband whilst in-flight. JetBlue have partnered with ViaSat to use Ka-band[22]. GoGo, building on their existing provision of air-to-ground communications, will use Ka-band satellite coverage to provide capability in the U.S. by 2013 and then globally by 2015[23]. In May 2010, **Northrop Grumman** announced[24] that it had successfully completed flight testing of an airborne satellite communications system, part of a network that will significantly enhance communications capabilities for war fighters. The flight-test used the communications terminal system installed on a modified business jet aircraft to connect with a **WGS** (*Wideband Global SATCOM*) satellite via the Ka-band link.

Military Payloads[25]—Countries are increasingly considering the use of commercial satellites to host military payloads either directly or through public/private partnerships. On behalf of the **U.K. Ministry of Defence**, Astrium will operate the Paradigm Secure programme on the **Skynet** satellites – military satellites operated by a private company. Another example is the agreement between the **Australian Ministry of Defence** and the U.S. **DoD** to contract to own/operate UHF capacity on an **Intelsat** satellite. Similar arrangements are also being considered for other bands, including Ka- and X-band, including the potential use of the **Inmarsat-5** satellites, notably, Ka-band satellites, for military services. The growing interest in, and use of, such payloads may support the deployment of more commercial satellites for both military and commercial services. As part of the **Global MilSatCom** conference[26,27], an associated half-day event considered the question, Why Ka-? Understanding the benefits and shortcomings of Ka-Band Mobile Satellite
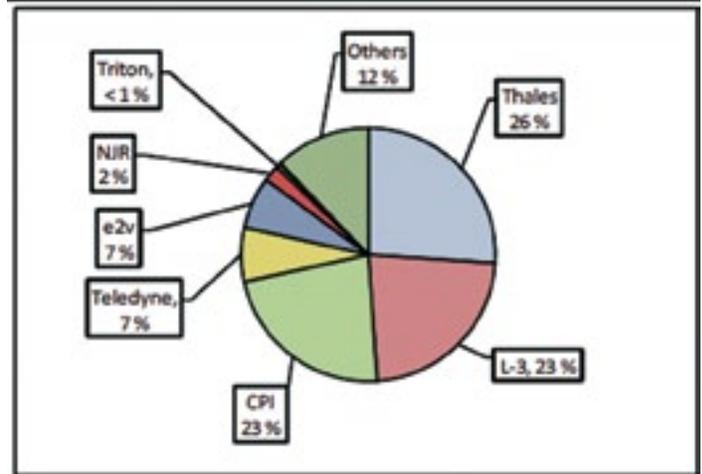
Figure 2. Total Microwave and Millimeter Wave VED Sales by Vendor, World Market 2010
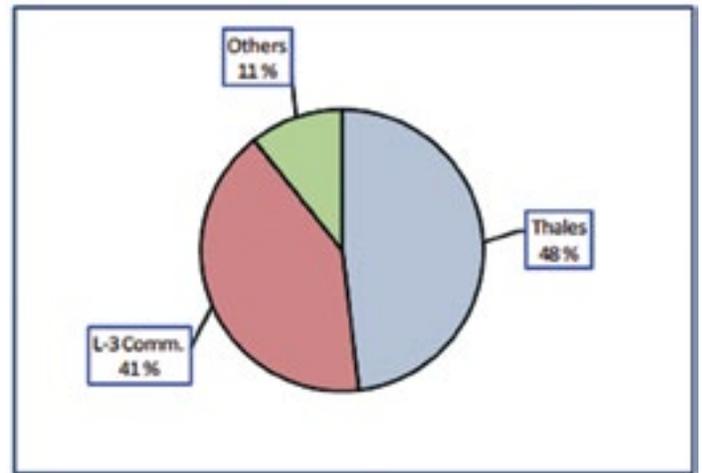
Figure 3. Total Microwave and Millimeter Wave Space TWT Sales, by vendor, World Market 2010

Systems[28]. A recent **IET** seminar[29,30] also considered the use of commercial satellites to host military payloads, including at Ka-band. Under a contract with the U.S. Department of Defence, **Hughes**[31] is conducting a study of commercial communications satellite system architectures to meet future tactical communications-on-the-move (COTM) needs of the U.S. military, using Hughes existing **SPACEWAY® 3** and future **JUPITER**™ satellites. The strong interest in using Ka-band for military SATCOMs certainly across both sides of the Atlantic is likely to put pressure on commercial uses of Ka-band spectrum,

Total TWT Device Sales								
World Market, Forecast: 2010 to 2015								
Forecast sales		2010	2011	2012	2013	2014	2015	CAGR (10-15)
Total TWT Device Sales	($ Millions)	660	658	656	654	652	650	-0.3%
Total TWT Device Sales - NOT Space	($ Millions)	405	405	405	405	405	405	0.0%
Total TWT Device Sales - Space	**($ Millions)**	255	253	251	249	247	245	-0.8%

Table 1. Total TWT Device Sales World Market Forecast

potentially increasing congestion. Use of higher frequency bands would help to meet demand.

Interest In Q/V-Band

As early as 1997, there was demonstrated interest[32] in the use of Q/V-band. Operating in the fixed satellite service (FSS) bands of 37.5 -40.5 GHz (downlink) and 47.2 -50.2 GHz (uplink), twelve organisations filed fourteen applications for Q/V-band systems with the FCC in September 1997, thus effectively staking a claim to these new frequencies.

In a 1998 **IEEE** paper[33], the commercial prospects for these 14 Q/V-band systems were studied, taking into account the technical challenges (*e.g.*, propagation effects) and the then current reality that Ka-band systems were still being developed and launched. The paper concluded that companies are unlikely to use Q/V-band until Ka-band is saturated, such congestion is starting to occur.

Evidence across satellite operators supports the views of agencies (*e.g.*, ESA) that Ka-band is likely to become congested and that new, higher frequency bands will be required. Demand for spectrum is across the globe, with that from developing countries being much stronger than in the developed World. Increasing interest from various user groups (the public, businesses, government and defence) in Ka-band will put pressure on available spectrum. Communication needs do not show any sign of slowing, but rather increasing almost exponentially. Such qualitative evidence is strongly supportive of the use of higher frequencies for SATCOMs.

Eutelsat[34]

Results of **Eutelsat**'s operations in the first half of 2007 – 2008[35] show strong growth for the company through TV and broadband services, with video providing some 75 percent of Eutelsat's consolidated revenues; data services also strengthened. HDTV services accelerated, driven by Poland, Russia and Turkey, with major broadcasters (including Sky) deploying services. Eutelsat are encouraging reception from a single dish by deploying satellites near each other, thus allowing users to receive more services at reduced costs. Compared to Ku-band, Ka-band technology is reducing costs[36] significantly.

In 2008, Eutelsat estimated that about 10 percent of the population was poorly served ("under-served") by DSL (Digital Subscriber Line), and that some 15 million households would not be served by DSL in 2010. They see Ka-band exploiting/serving this gap. Eutelsat are also interested in "value-add services", such as serving rail passengers.

KA-SAT Eutelsat's primary Ka-band satellite, has 82 spot beans covering Europe, part of North Africa and much of the Middle East. Primary services will be data and video, with service launch scheduled for May 2011. At the **Cabsat Dubai** conference (held from Feburary 8th through 10th, 2011), Eutelsat showcased their capability to deliver 3D TV *Direct-to-Home*[37] (**DTH**).

Artistic rendition of the KA-SAT satellite, courtesy of Astrium

Hughes Network Systems[38]

Hughes recognizes the demand for capacity that is fuelling the worldwide deployment of Ka-band satellites[39], as Ku-band is rapidly becoming saturated. The high bandwidth available at Ka-band and frequency re-use capabilities across multiple beams enables the delivery of more capacity at faster speeds to smaller dishes. Hughes is committed to Ka-band through their **SPACEWAY® 3** satellite and the use of **Avanti**'s **HYLAS** satellites[40].

The military are becoming increasingly interested in Ka-band technology. The U.S. DoD contracted[41] Hughes to investigate, and report back in July 2011, how commercial Ka-band communications satellites can meet their future tactical COTM needs.

SES Astra[42]

In contrast to other operators, **SES Astra** believe that Ka-band in Europe is under-utilized[43] (although Ku-band they say is congested). Currently, SES do not see a strong need to use higher frequency bands (Q & V), implying that they feel there is sufficient capacity. They are nevertheless aware that there are Q/V-band developments ongoing and believe that future growth and products for these bands are some five to ten years away.

Inmarsat[44]

Inmarsat currently do not see any need to use new satellite bands and potentially still see opportunity available in Ka-band. Their three new satellites, **Inmarsat-5** (**I-5**) constellation, are all Ka-band due to be launched in 2013/2014 at a cost of $1.2 billion[45]. However, in the Company's 2010 results, they recognize Ka-band spectrum difficulty and increasing competitiveness at Ka-band.

Telesat[46]

Telesat are considerably up-beat about the need for Q/V-band satellite communications and are doing the following in this respect:

- In discussion with ESA regards Q/V-band

- Intending to launch a hybrid satellite in 2016/17 containing a Q/V-band payload

- Recognize population migration in Canada from urban/suburban to rural where there is no coverage, thus giving rise to a new customer base. Recognise that Ka-band spectrum over Canada is full

- Involved in two Canadian Space Agency (CSA) studies: One project, funded by the Canadian government, is a Q/V-band costing study, the other is investigating the use of 40 GHz for the downlink and 50 GHz for the uplink

Artist's concept of the Inmarsat-5 satellite, courtesy of Inmarsat

- See that the industry is moving towards Q/V-band, e.g., passive component

- See its use for very high-speed broadband for forward (down) link and uplink

Space Agencies

National space agencies are also showing interest in the Q and V frequency bands. **CNES**, the French Space Agency, commissioned a study[47] into low bit-rate emergency communications. Although the results of this study imply that Q/V-band is not particularly favourable for this application, it nevertheless demonstrates the growing interest for communications in these bands.

The **European Space Agency** (**ESA**) is keen on Q&V-band developments ('technology push') as illustrated through several tenders listed in their **ARTES** work programs, e.g., ARTES 5.1 201048 and 201149 work plans. ESA clearly states its rationale within these work plans, and is paraphrased here:

The need for bandwidth in satellite communications and broadcasting is constantly increasing. "It is prospected that the capacity at Ka band will soon become, in some specific areas, crowded due to emerging applications such as broad-band internet, satellite-HDTV, live video, telemedicine, interactive gaming, video conferencing, and others" (e.g., 3DTV). Despite the recent commercial exploitation of Ka-band, preparations must be made for the next generation of broadband satellites able to satisfy this growing demand. This will require the availability of higher numbers of beams on the user side and new frequency bands such as Q/V-band, initially for the feeder link, and in a second stage for the user link.

The exploitation of the higher frequency Q/V-band will offer a substantial increase in capacity for all satellite users, public and private. ESA believe that Q/V-band will first be employed by gateways and then by individuals, similar to what happened in Ka-band.

Satisfying the demand for broadcast and broadband is the most important due to market size and revenue; other additional applications for Q/V-band are secure communication links between high altitude platforms (HAP) and low or geostationary orbit satellites; and UAVs, especially for those that fly above the clouds; inter-satellite communications / links. ESA has projects planned to address key

Q/V-band technical areas and thereby stimulate technology developments; some of these key areas are:

- An LNA (low noise amplifier) to allow Q/V-band use for feeder links

- A Local Oscillator (LO) unit

- Frequency converters, and high-frequency filters

ESA's technology push is encouraging also demonstrating the requirement for other Q/V-band equipment, in addition to TWTs, to ensure a full communications chain. ESA believes that the path for Q/V-band communications is likely to follow a similar route to that of Ka-band.

Spectrum demand from various groups (science, aircraft, military) will exacerbate the need for more spectrum; operators will have to provide a solution if they wish to see company growth. There is clear interest in the use of Q/V-band by National Space Agencies and, to varying degrees, by satellite operators.

Q/V-band is not without its challenges. As others50 have also commented, to achieve higher capacities, increased bandwidths are needed, which impacts upon the difficulty of antenna design due to the increasing ratio of (bandwidth : center frequency). This implies higher centre frequencies such as those available at Q/V-band, with associated challenges to address, such as tighter manufacturing tolerances, difficult link budget – higher RF, propagation and rain-fade losses, lower efficiency electronics, amongst others.

Potential Market For Space-qualified Q/V-Band TWTs

In their 2010 report, **Futron** identify ten separate satellite applications or services. Some have direct potential to use Q/V-bands, whereas others indirectly affect its use. For example, the infrastructure part of Internet access (gateways), is relatively easy to move (from a user viewpoint) to Q- and V-bands. This frees up Ka-band spectrum in order to serve more users. There is pressure from TV services: As Ka-band spectrum fills up, e.g., as more local TV is demanded, requiring more spot beams, or the need to serve new, under-served (or not at all served) communities means that other, and more, spectrum is needed. This is summarised in *Table 2*.

An estimate of the initial (starting point) total of Q/V-band TWTs may amount to around 90 in number. In addition, there may be pressure to use Q- and V-bands for business mobile use

Application	Transponder Equivalent		Estimated no. of Q/V band transponders (2019) (%)	Estimated no. of Q/V band transponders (2019)
	2009	2019		
Internet back haul	200	200	10	20
Direct Internet access	400	1200	2	20
DTH / DBS	1700	2850	1	30
Wireless back haul	200	400	5	20
Total:				90

Table 2. Estimated TWT figures from Futron's forecast.

(commercial mobility), military communications (who may find it attractive due to the initial inherent security afforded by lack of specialized, expensive equipment), and airborne communications. This estimated figure is similar to that for initial Ka-band use (see *Figure 1*), which shows that by 2004 there were approximately 100 Ka-band TWTs in operation.

Although the estimates in *Table 2* imply equipment requirements by 2019, the timing is difficult to determine. Ka-band history would indicate some years later, but the pace of change is accelerating. The end of the decade is likely to have some, but less than the tabulated figure, requirements. Other aspects also influence this, for example, the technology readiness and competitiveness of Q/V-band technology compared with Ka-band. If Ka-band SATCOM development is a guide to Q/V-band satcoms, then the first commercial, experimental satellite could be launched towards the end of this decade, with a full commercial service a few years later. Telesat is more proactive – it plans to launch a hybrid satellite, with a Q/V-band payload in 2016/2017.

As stated earlier, there are two major manufacturers of space qualified TWTs: **L-3Com** in the U.S. and **Thales Electron Devices** (**TED**), in France and Germany.

L-3Com is a large conglomerate of numerous companies; its subsidiary **Electron Technologies Inc**. manufacturers TWTs. To be of use, a TWT must be incorporated into a **TWTA** (TWT Amplifier) or an **MPM** (*Microwave Power Module*). There are several TWTA manufacturers, with the most relevant being **Electron Technologies** (**L-3Com**), **Thales** and **TESAT**. To realize Q/V-band SATCOMs, tubes will be needed for both the space and ground segments.

Both L-3 and TED make TWTs across all frequency bands. In the main, TED supplies TESAT with its space-qualified TWTs who then make the space-qualified TWTAs. (TESAT only supply space-qualified TWTAs.)

L-3's Ka-band TWTs do not appear to be particularly competitive in terms of performance[51],[52], having relatively low efficiency (max. 60 percent), and high mass. In their product brochure[53], L-3 claim to have tubes at frequencies covering the range 40 – 46 GHz, and MPMs covering the range 26.0 – 40.0 GHz, *i.e.*, around Q-band.

Thales Electron Devices claim to make Q-and V-band TWTs. In a Ka-band TWT brochure[54], a graph of capability indicates that they either make, or have capability for, such space-qualified tubes. A further brochure on pulsed TWTs[55] clearly claims

Company	Product	Comments
MCL www.mcl.com (UK reseller: UKRF)	Q-band TWTA[57] V-band TWTA[58]	Claim to make TWTs, but cannot find on website. Do not make space-qualified TWTAs.
dB Control (www.dbcontrol.com)	TWTAs: 1 to 40 GHz (i.e., just includes bottom end of Q-band).	Do not make space-qualified TWTAs.
TMD Technologies Ltd[59]. (www.tmd.co.uk)	TWTs[60] and TWTAs for Radar, EW, Communications, EMC RF testing, and lab. applications.	Do not make space-qualified TWTs and TWTAs. Claim to be able to make (source?) TWTs/TWTAs for space.
Comtech Xicom Technology (www.xicomtech.com)	Claim to have TWTAs at Q and V band.	Do not make space-qualified TWTs and TWTAs.

Comments:
- *MCL is a wholly owned subsidiary of Miteq[61].*

Table 3. Suppliers of Q- and V-band TWTs/TWTAs

Band	Reference	Frequency (GHz)	Output power (W)	Small-signal gain (dB)	Conversion AM/PM °/dB	Intermodulation (dBc)	Cooling
EHF	TH 4031	40.5 - 42.8	40	40	5	-29	Conduction
	TH 4034C	43.5 - 45.5	100	40	5	-29	Conduction

Table 4. Thale's two SATCOM uplink products

that TED make Q-& V-band tubes respectively at frequencies 37 – 42 GHz and 60 -65 GHz, but it is unclear whether these are space-qualified. Within their SATCOM uplinks brochure[56], Thales list two SATCOM uplink products (*see Table 4*), designated for the EHF band (30 – 300 GHz), effectively Q-band; they appear to be ground based equipment.

— **Output power (W)**
   40 100
— **Small-signal gain (dB)**
   40 40
— **Conversion AM/PM o/dB**
   5 5
— **Intermodulation Cooling (dBc)**
   -29 Conduction -29 Conduction

There is potential competition to L-3 and TED from other TWT suppliers. The few listed in *Table 3* claims to make Q-and V-band

TWTAs, some also claim to make TWTs, but none currently claim to make space-qualified TWTs/TWTAs.

There are several other TWT manufacturers who currently do not make Q/V-band TWTs. By way of illustration, **e2v Technologies** (U.K.) **plc** manufacture a range of quality TWTs[62], such as *Coupled-Cavity TWT*s for high performance multi-function radars, their market-leading *helix TWT*s for Ka-band satellite uplink, and a range of other vacuum electron devices.

Despite these and other TWT manufacturers (see *Figure 2*), the space-qualified TWT market will be difficult for others to enter (even assuming that they may wish to do so). Space tubes are harder to make, require more infrastructure (*e.g.*, clean rooms) and capability, not to mention the 'space heritage' that satellite manufacturers and operators will demand to protect their huge investments. With the current market being essentially duopolistic in nature (see *Figure 3*), a new entrant will have to demonstrate some compelling reason why it should be chosen ahead of the established players.
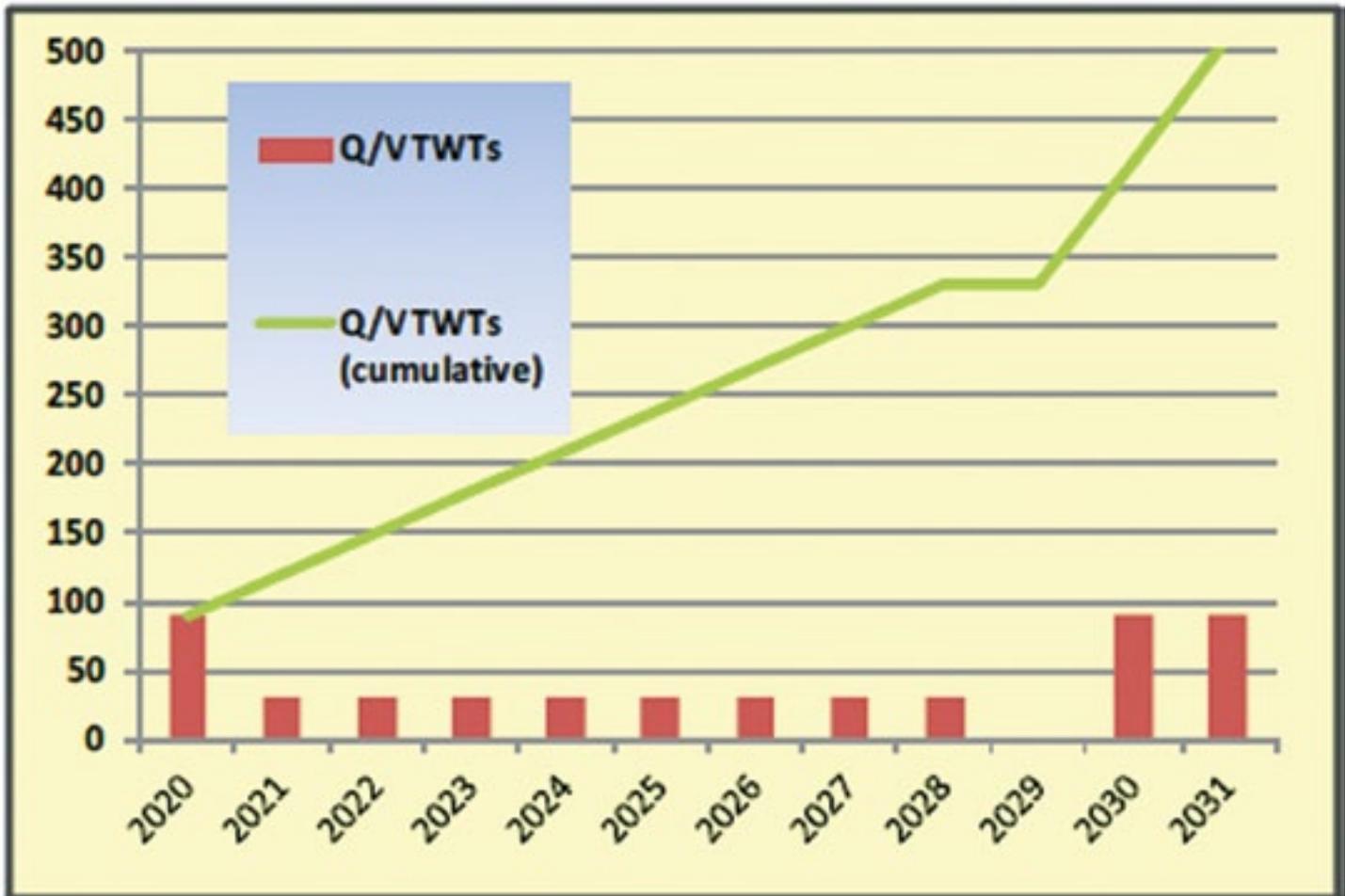
Figure 4. Estimated Q/V-band Market — TWT Numbers
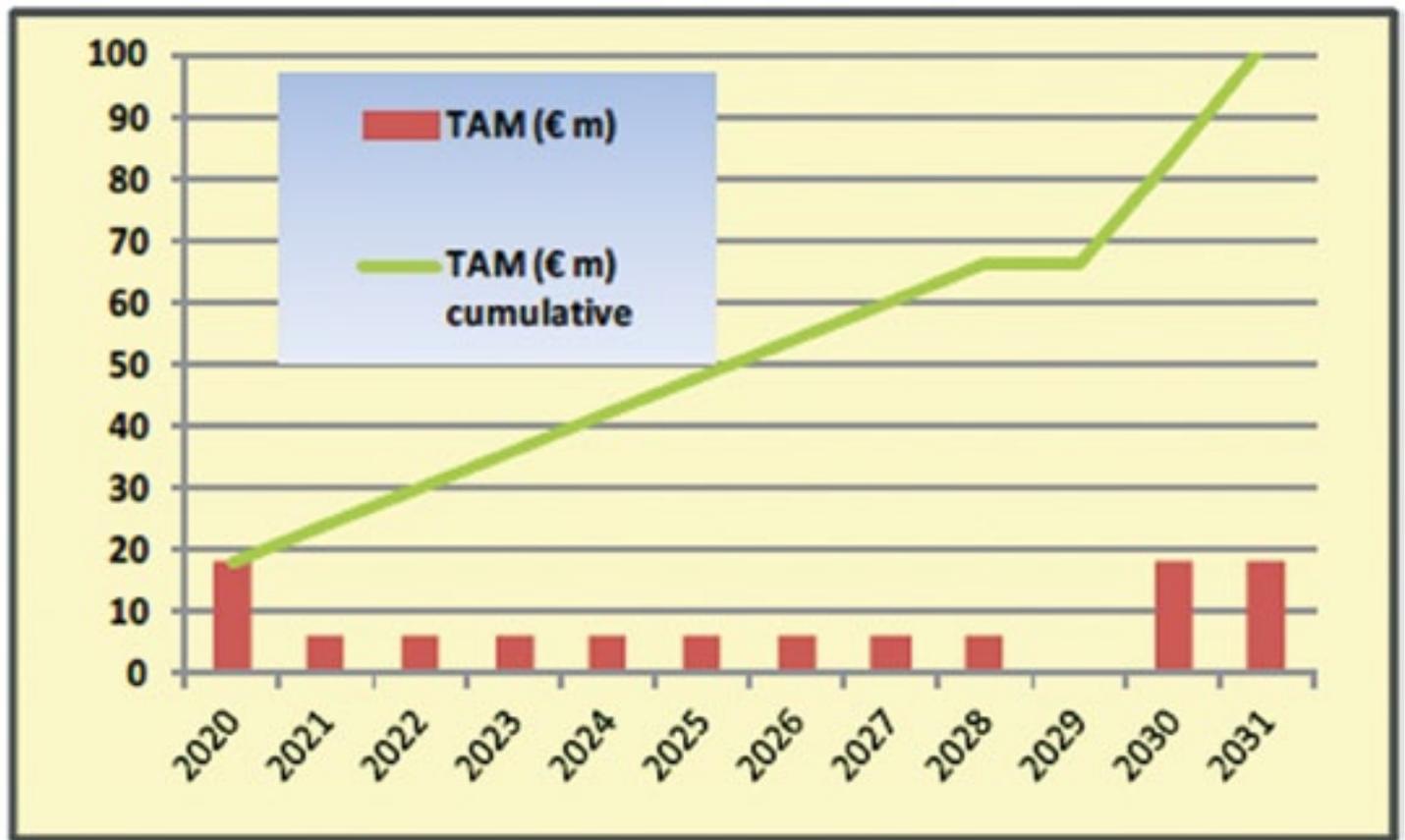
Figure 5. Estimated Q/V-band Market — Million Euros

Analysis Of The Space-qualified Q/V-Band TWT Market

Ka-band development started about 20 years ago at the start of the 1990's. Some ten years later, operators launched Ka-band transponders to secure frequency rights and to undertake experiments in advance of commercial deployment. Approximately ten years further on (2010), Ka-band is in full commercial exploitation.

Interest in Q/V-band payloads has recently commenced. Assuming a similar time frame for Q/V-band as for Ka-band development, initial Q/V-band tubes may be required in advance of 2020 for satellite launches during 2020. Full commercial exploitation is then expected around 2030. Some operators, such as Telesat, are moving faster and plan to have Q/V-band capability on their satellite, due for launch in 2016/2017. Seeding the technical supply base in this way, *i.e.*, by launching a Q/V-band payload, is likely to stimulate it further to develop all the necessary components for Q/V-band communications (as it did for Ka-band).

Arguments for a shorter or longer time frame for Q/V-band are feasible: the demand for ever increasing high-speed data communications may hasten the deployment of Q/V-band; conversely, just as the Ka-band time frame was lengthened by a few years due to the dot-com bust (around 2000 to 2001), current and future, unforeseen world economic events may slow demand for Q/V-band. A 20 years time frame, therefore, does not appear unrealistic.

Earlier, the number of Q/V-band tubes by the end of this decade was calculated to be about 90 to 100. Initially, a payload is expected to comprise about 12 tubes (eight active, four spare). Using *Figure 1* as a guide to a possible Q/V-band market, the assumption is that an initial requirement will be for 90 tubes, with that dropping to a conservative 30 per annum, followed by

a conservative rise back up to 90 around 2030. These reduced figures are because Ka-band satellites are still being planned and deployed for at least the next five years, with each having a life time of approximately 15 (till 2025) to 20 (till 2030) years. It is, therefore, unlikely that there will be satellites with major (or only) Q/V-band payloads requiring significant numbers of tubes due to the coverage that will be achieved with operators' current Ka-band plans.

These assumed figures are a rough, first order guesstimate, which have been used to calculate a *Total Addressable Market* (**TAM**) over the period 2020 to 2030. Assuming a selling price of 200,000 euros per tube, a revenue stream estimate can be offered: *Figure 4* shows the number of tubes for the market and *Figure 5* shows the same information in revenue terms. The total cumulative TAM over the period is estimated as 102 million euros. The revenue figure is a straight linear calculation; it ignores, for example:

- Reducing sales price, e.g., due to improved manufacturing and competition

- Reducing manufacturing cost, e.g., due to efficiency, experience, and volume; or increasing cost due to materials becoming in short-supply (such as gold, copper, etc.)

- Inflation (net present value has not been considered).

Comments made previously show that other space applications (e.g., military satellite communications, inter-satellite communications) may, in time, also wish to use Q/V-band. It is difficult to quantify (even guess) Q/V-band requirements at this early stage – interest is just forming, especially for military satcoms.

Frequency band	Frequency range (GHz)		
	low		upper
L	1	to	2
S	2	to	4
C	4	to	8
X	8	to	12
Ku	12	to	18
K	18	to	26.5
Ka	26.5	to	40
Q	30	to	50
U	40	to	60
V	50	to	75
E	60	to	90
W	75	to	110
F	90	to	140

Waveguide frequency bands (GHz)		
low		upper
2.60	to	3.95
5.85	to	8.2
8.2	to	12.4
12.4	to	18.0
15.0	to	26.5
26.5	to	40.0
33	to	50
40	to	60
50	to	75
60	to	90
75	to	110
90	to	140

Table 5. Frequency bands and their designations.

However, this implies that more space-qualified Q/V-band tubes may be required than estimated above from, say, about 2025 onwards.

In Closing

It is clear that there is a nascent Q/V-band market – it is developing through technical studies, both theoretical and empirical (e.g., ESA's Q/V-band experiment, commercial studies), and potential market demand. Most satellite operators suggest a time line of some five to ten years; Telesat have firm commitment to launch a Q/V-band payload in 2016/17.

Significant commercial activity is unlikely before the start of the next decade and, if Q/V-band development follows a similar path to Ka-band, large-scale Q/ V-band payload deployments are probably 15 to 20 years away. From the available data, the space-qualified Q/V-band TWT market is unlikely to be large for some time to come. Further acceleration of demand for high-data rate communications, especially from rural areas and from the developing World, would help to grow the market. Other services that put pressure on Ka-band spectrum (*e.g.*, DBS) would also increase demand for more spectrum, thus potentially moving some services to Q/V-band.

Appendix A: Frequency Bands

Frequency bands are defined in several ways, with slight frequency band-edge differences. Table 5 illustrates the frequency bands and compares them with the waveguide frequency bands[63]. The diagram shows a detailed view of the K-band frequency usage[64] in the United States, allocations between 27 to 40GHz, as at 1996. Some of these applications could move to Q/V-band in the future.

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About the author

Deepak Gupta has more than 20 years of engineering and manage-
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baseband and RF electronics. He has worked on several ESA SATCOM
bids and projects, and was the ESA account manager for his employer.
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Currently, at Black Kite Ltd., Deepak operates as an independent,
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Delivering VSAT Solutions To New Markets

by Greg Quiggle, Vice President, Product Management, iDirect

I mplementing VSAT solutions for large-scale narrowband networks is a key area of growth for satellite service providers, particularly within the utility market. In the utility industry, operators need narrowband connectivity to support SCADA monitoring at remote substations. Narrowband is also essential for enabling the "smart grid" and backhauling smart meter data across thousands of rural collection points. Additionally, as utility companies evolve, they need dedicated satellite bandwidth for new, diverse applications such as Internet, video, and VoIP.

Furthermore, because these networks usually feature a large network of individual sites with remotes that are often idle, satellite service providers require a VSAT solution that is bandwidth-efficient and energy-efficient, not to mention easy to deploy, to help reduce costs. Finally, utility companies also need everything to run on the same system.

At iDirect, we have worked to help service providers deliver narrowband solutions to the utility industry, and other key emerging markets, through the development of *iDX 3.1.*

What Is iDX 3.1?

iDX 3.1 is the latest operating software release for the iDirect Intelligent Platform. With iDX 3.1, service providers can now support large-scale narrowband networks affordably.

The iDX 3.1 release comes with several important upgrades and features. One important new feature is the new *Evolution X1* remote. The X1 is a compact, low power remote that features a super efficient BUC and LNB. The X1 also comes in an indoor and outdoor version.

Similar to other Evolution remotes, the X1 features **DVB-S2/ ACM** and **TDMA**, basic routing, VLAN functionality and **QoS**. For the outdoor version, the X1 has an **IP67** weatherproof casting and can operate in a wide temperature range. The X1 outdoor also features passive cooling functionality and can be powered by either DC or a rechargeable battery.

Another important feature of the new bundle is a new licensing option for iDirect's **XLC-M** line card. With this option and an Evolution modulator card, the XLC-M can support a 16-channel narrowband inbound configuration, which makes it ideal for networks that feature one large outbound and multiple inbounds.

With the iDX 3.1 release, iDirect has also enhanced its Group Quality of Service bandwidth allocation algorithm to deliver more efficiency for large-scale networks that must switch between active, idle or dormant states. iDX 3.1 also improves on other narrowband systems in that it supports minimum availability requirements for critical and non-critical applications, balancing responsiveness with efficiency. Lastly, iDirect's web *iSite* tool makes it easier to commission satellite networks through an intuitive web-based network configuration model.
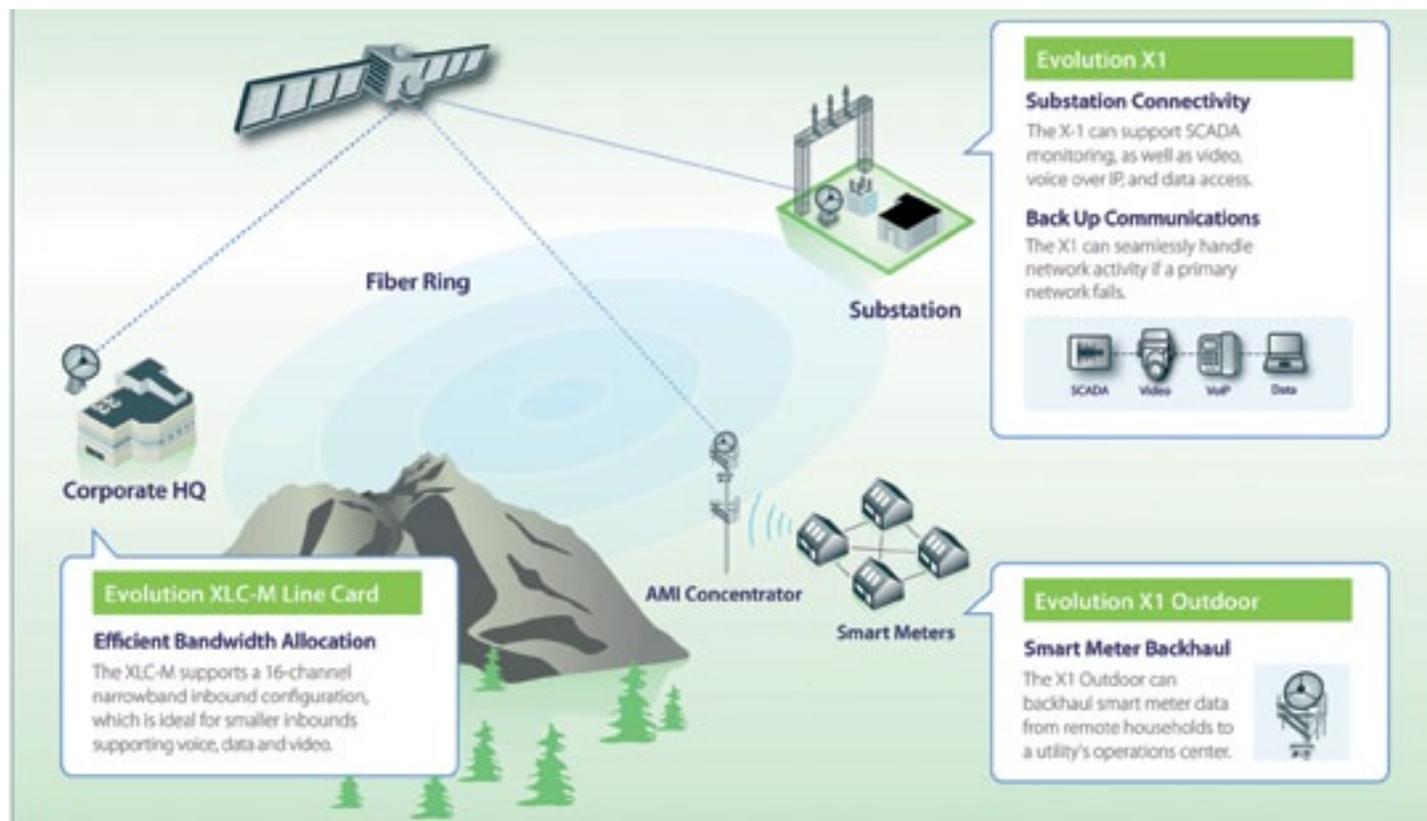
Supporting The Utility Market + Other Industries

iDX 3.1 is a breakthrough satellite solution for a wide range of applications, with the utility industry being one of the key new beneficiaries. Here are two ways that iDX 3.1 supports the utility industry.

- *Smart Meter Data Collection* – By mounting an Evolution X1 Outdoor remote and a satellite antenna on a utility pole, iDX 3.1 enables utility companies to affordably and efficiently collect and process smart meter data from thousands of remote locations through one in-route.

- *Substation Automation* – Utility substations must be equipped for a variety of applications – from SCADA monitoring to IP voice, video, and data connectivity. The X1 supports multiple service levels and meet standard SCADA response times of 600 milliseconds, while also supporting broadband data rates when needed.

In addition to the utility industry, iDX 3.1 also supports other applications including:

- *Business Continuity*: Through bandwidth efficiencies and less costly hardware, iDX 3.1 makes it much more affordable to deploy an iDirect network as a large-scale business continuity solution.

- *Retail*: iDX 3.1 makes it more cost-effective for retail organizations to support point-of- sale, digital signage and training for operations in remote destinations.

- *Distance Education*: Distance education networks are often idle, but sometimes require heavy bandwidth for video streaming and interactive learning applications, which makes them perfect for iDX 3.1.

- *Pipeline Monitoring*: iDX 3.1 supports efficient pipeline monitoring, including fiscal metering, leak detection, corrosion monitoring, level gauging and overfill protection.

As satellite communications has evolved to become a mainstream networking solution, iDirect has continuously worked toward innovation in the marketplace. With iDX 3.1, organizations can scale iDirect networks to a significantly greater number of sites, reach new levels of bandwidth efficiency, and expand field applications.

About the author

Greg Quiggle currently serves as the VP of Product Management at iDirect. Prior to joining the team, Greg served as the Executive Vice President of Marketing for Tollgrade Communications and the Vice President of Marketing for Acterna Corporation (now JDS Uniphase). In these roles, Mr. Quiggle has spent over 18 years conceptualizing and executing successful corporate-level product strategies within the communications industry.

Executive Spotlight

Errol Olivier
President + CEO
MTN Satellite Communications

Errol Olivier is a leading executive with more than 25 years experience serving the oil & gas services and telecommunications industry. He brings his vast technical, operational and sales management expertise to his role as President and CEO at MTN where he is responsible for all daily operations further elevating the quality and breadth of services the company delivers to its customers. In addition, he is focused on defining and leading the long-term strategy and vision for MTN's suite of solutions and market expansion, as well as fostering relationships with existing MTN customers.

Prior to joining MTN, Mr. Olivier served as the President and Chief Executive Officer of Broadpoint, a private equity owned satellite and cellular communications company, serving the oil industry in the Gulf of Mexico. There he was responsible for leading the company through the final integration of four companies into one branded service organization until the company was sold to Cellular One in 2010.

In addition, Mr. Olivier was the President and COO for CapRock Communications where he led the administration of the company's global sales, marketing, engineering and operations for seven foreign countries as well as three operation centers in the United States. He is credited with pioneering the first multi-tenant satellite telecommunications strategy serving the oil & gas industry in the Gulf. During his seventeen-year tenure, he led CapRock through significant operational and financial growth and achieved industry recognitions for innovation and operational excellence.

SatMagazine (SM)
First of all, congratulations on your new position as MTN's President and CEO. In this role, what strategic initiatives are you looking to implement in 2012 to continue the company's growth?

Errol Olivier
Over the past 30 years, MTN has led in innovative satellite communications and delivered many "first to market" solutions for the maritime industry and federal government. Now, as part of the MTN team I plan to continue building on the company's successful foundation in the maritime industry and diversify our offerings to meet the evolving needs of our current and future customers in the maritime industry and other markets. MTN was built on a "customer intimacy" philosophy model and that will be our focus and core to how we continue to grow.

SM
MTN currently provides services to vessels in the cruise, yacht, commercial and government industries. What are your plans to increase the company's presence across these industries during 2012?

Errol Olivier
While we have strong roots in the maritime industry, MTN is not exclusively a maritime company. Our success began in the cruise industry and, while we continue to provide bandwidth and innovative connectivity and communication solutions to cruise ships around the world, we have expanded our reach with these solutions to a variety of new industries and regions around the world on land, in the air and at sea.

SM
What changes are you seeing in the very small aperture terminal (VSAT) services market? How is MTN adjusting to these changes?

Errol Olivier
What we are seeing the most is demand. Demand on more bandwidth, demand on the solutions that leverage the bandwidth, and demand on where this bandwidth is being leveraged. People demand to be connected whether for corporate communications or to satisfy the need of their customers. No matter the audience, a reliable connection, anywhere, anytime, with a "land based" experience is becoming a priority to many.

I see this as a great opportunity for companies like MTN, but also believe we will need to shift the way we purchase and deliver managed services. Years ago we, as an industry, were speaking about 128kbps, then 512, and now we talk in megabytes. But here at MTN we are talking gigabytes and possibly terabytes in the not-so-far future. A hard pill to swallow right now, I know, but this day is coming and we aren't going to follow, we are going to lead.

SM
Both C- and Ku-Band are the primary frequencies used for maritime satellite communications—a great deal has been said lately about Ka-Band, as well. How do you think Ka-Band will impact the industry in the near future?

Errol Olivier
At the moment, there is a lot of talk around Ka-Band and people are debating which frequencies should be used. While there will definitely be a market for Ka-Band, it may not be ideal as the primary frequency for satellite communications in certain mission critical environments. The C-Band and Ku-Band offerings will continue to be a viable option for many years to come and may be used in conjunction with Ka-band in hybrid solutions. Ka-band will also bring relief to the congestion we experience with the exponential demand for bandwidth allowing us to move some non-critical traffic on to a more consumer grade service of Ka-band while preserving C-band and Ku-band satellites. This is for the customers who can't afford to put the welfare of their employees and customers and the mission critical nature of their operations at risk. A hybrid solution with Ka-band will be good for backup and overload relief.

SM
What separates MTN's product and services from other firms in the same market segments?

Errol Olivier
Our team takes a lot of pride in delivering the best solutions and service to our customers, and our mission is to deliver cost-effective solutions that exceed our customers' expectations and help them maximize their connectivity investment. We're involved in every aspect of our customers' connections—we sell them their bandwidth, install the equipment and manage the connection. Even if they work with a partner, they've been trained by our team.

On another note, we are not just a bandwidth company; we are a telecommunications solution provider. We take what is coming through the pipe and deliver a variety of "sticky" and revenue-generating solutions for our customers and partners. MTN is not just a business-to-business solution provider but we work alongside our customers to focus on their customers which, more often than not, is a business-to-consumer model. Simply put, we deliver quality and drive our business forward based on a customer intimacy philosophy.

SM
Will we see MTN moving additional resources and products into the government/military arena?

Executive Spotlight

Errol Olivier

Our MTN Government Services (MTNGS) division is growing rapidly and is a high priority for us moving further into 2012. We are continuously looking to diversify our offerings and provide "best-in-class" solutions for this segment.

To address the unique needs of this market we have secured various certifications and compliancy such as the ISO 9001 Certification and IA MAC Compliancy. In addition we have gone to great lengths to recruit and hire some of the best professionals within the industry with the expertise and security clearance that allows us to grow.

SM

What led you to a career in the satellite industry? And why did you select MTN as the company where you wished to develop your career?

Errol Olivier

I began my career in telecommunications with Shell Oil Company when all services in the Gulf of Mexico were provided by analog microwave and two-way radio systems. These were very cumbersome networks with so many inherent problems with voice quality, interference, path fades during the foggy seasons and, more than anything, a nightmare of logistical challenges every time the drilling rigs moved to new locations. I had a vision to overcome the logistical hurdles by putting satellite systems on the rigs that could be easily realigned when the rig was repositioned at the new site. During my 20 years serving the oil and gas industry, I frequently ran into MTN and I was always impressed with how strong the company focused on satisfying the customer. MTN had the same customer service philosophy I had and, because of that, I always wanted to do something between our companies. But while those paths never aligned, I was given the opportunity to join the company and couldn't pass it up. Now I have the opportunity to be a part of the passionate team here at MTN.

SM

A current dilemma facing the satellite industry is acquiring the trained personnel necessary for various important projects. How important is a STEM curriculum for today's high school and college students? How can companies support such educational incentives?

Errol Olivier

The future is in the hands of the young students of today and a strong education is the key to preparing these students to take on this responsibility. Not a day goes by where I don't apply some principal of science, technology, engineering or math in my planning, strategy and general operations of the business. Being a father of two daughters in college, I can clearly see how the Advanced Placement (AP) classes during their high school years helped prepare them for their specialized studies. The satellite industry is full of intriguing technology and exciting career opportunities. Companies like MTN can simply send representatives to the local schools supporting STEM to give these students an idea of the technology and opportunities that lie ahead of them. Students are easily influenced during this stage of their lives and together we can promote an industry that needs the best of the best and surely we will find a following of these high caliber students.

SM

Looking back over all of your work with the various companies over the years, what projects bring a smile of satisfaction to you, and why?

Errol Olivier

I've smiled a lot with satisfaction over my career and a number to things come to mind. Being in the customer service business there is nothing more satisfying than a really happy customer. I will never forget the day one of our customers called me and said, "Errol, I really want to thank you for the quality of service you and your team has provided us in the past few months since you have taken over our account. I received a standing ovation when I walked into a meeting with my fleet managers for the improvements in our vessel communications. And at the recent holiday party I actually had a spouse come by and thank me for bringing communications to the boat so that she could talk to her husband during his 30 day shift." Now that sort of call surely puts a smile on my face. I've been here at MTN only nine months and I have witnessed, on numerous occasions, customer testimonies about how impressed they were with the responsiveness of our staff and the quality of our service. So I have plenty of times to smile.

MTN's wholly-owned and operated Holmdel, New Jersey, teleport, is a 10,000 square foot facility to support transmission needs.

What The Future Holds For The Satellite Industry

The past few years have proved challenging for many companies across diverse industries and regions around the world. Despite tough economic times, the global satellite market continued growing. According to the Satellite Industry Association (SIA) data the satellite market has experienced an average annual growth of 11.2 percent from 2005-2010. The growing demand for satellite capacity is driven by many factors, some of which include the need for faster speeds and larger bandwidths, Internet across developing and geographically challenged countries, real-time communications anywhere-anytime and remote communications for military and government. Robert Bell has more than 20 years experience in the telecommunications industry and is currently Executive Director of the World Teleport Association (WTA). Robert spoke at NewSat's Satellite Seminar held at its South Australian Teleport in late 2011 and provided some in-depth insights into the global satellite industry, presenting four predictions for the future of satellite communications. Mr. Bell believes that satellite communications is a growing global market that offers many opportunities and niches. This is a result of an ever increasing demand for high-quality bandwidth communications via satellite across a wide range of industries.

NewSat's Jabiru-1 satellite

According to Mr. Bell, the unique value of satellite technology is evident: "It has the best economics of any possible form of communication in terms of one-to-many communications, and provides the best means of establishing connections with remote areas. The latter, is an important requirement of governments, military organisations and enterprises such as mining and resources."

The WTA has been dedicated to helping the operators of teleports maintain and expand their businesses for over 25 years and Mr. Bell has witnessed many satellite companies grow at an astounding pace. "The satellite industry is a very significant niche and definitely a growth business. It's a business that has been doing nicely through some pretty turbulent times. This is because satellites are becoming more and more vital to many different industries," he said. Mr. Bell projected four distinct forecasts for the satellite industry: There will be a rising rate of commercial military integration in satellite services; There will be an increase in media and telecommunications, especially media on demand, something that is highly reliant on technology and high-speed Internet delivered via satellite; All of this will lead to a rise in demand for Ka-band, the latest satellite frequency which allows more information to be sent at any one given time; and the compression of information, which is all about getting more through the satellite circuit, will ultimately have no boundaries.

Mr. Bell predicts an increase in the use of satellites in commercial military. He believes that although defence forces heavily rely on satellites and receive good value out of them, they have not yet tapped the full potential of what the technology can offer. "I forecast that we are going to see the military become much smarter buyers of satellite technology because they will be forced to, because the capacity of this technology is literally limitless as far as we can tell. The modern military have realized that there are amazing advantages that satellite technology can provide them with; whether it's for gathering information, surveillance and intelligence from the field, or for the projection of force from remote locations.

Technology is also changing the dynamic in the way people communicate, live and work. At a time when fast communications and Internet are expected to be available anywhere, anytime, satellites can accommodate. TV, for example, is undergoing an amazing revolution. People want to watch TV and catch up with shows when it suits them. "For the satellite providers, this is a booming market. Satellites can send content anywhere, anytime, in any format, and the members of WTA are really excited about this. They are investing huge sums of money in the systems that make TV-on-the-go quickand easy. The ability to use these commercial capabilities is going to be an important development in this area," explained Bell.

Furthermore, he asserted that the new generation of Ka-band satellites will be in high demand in the future. "Ka-band technology offers higher frequency and allows more data to travel through at any one particular point. There are currently around $5 billion of Ka-band assets going into space starting in 2007 through to 2014, without counting NewSat's own Jabiru-1 satellite, which is set to launch in 2014," he said.

Future demand for this type of satellite will be highly driven by the sheer capacity of this new technology. According to Mr. Bell, so far, the Ka-band satellites being launched have more bandwidth capacity than the entire orbital arch today. "While Ka-band technology offers an unbelievable bonanza of bandwidth to customers. This is because it opens up the future possibility of hybrid services, of combining Ka- and Ku-bands for additional bandwidth, while maintaining reliability that satellite is famous for."

Moreover, Mr. Bell predicted that the compression of information sent via satellite will have no boundaries. Although one may believe that we have hit the limit in terms of how much information can be compressed and sent through satellite, and that the amount is limited to a certain number of megahertz, satellite technology will keep taking leaps towards higher modulation.

"More and more information will be able to travel through at astounding speeds in the future. Ultimately, due to managed services, a practical limit to how many bits one can cram through those hertz will cease to exist, because we are going to have hybrid services delivering so much more bandwidth, and yet maintaining reliability.

"We are already seeing smarter, much tighter integration with government and military getting ever higher value out of this business, so I think the future of satellites is exciting and full of opportunities. This is something we can be very optimistic about," concluded Mr. Bell.

The satellite industry's strength and growth through a challenging economic period demonstrates the resilience and potential for the future of satellite communications. Mr. Bell's predictions offer an encouraging insight into the future of satellite communications promising a rising rate of satellite for commercial integration, an increase in media on demand, a rise in demand for Ka-band and boundary-less compression of information. While the satellite industry accounts for only 1 percent of global telecommunications, Mr. Bell believes it is a significant niche.

Take a tour around NewSat's Perth Teleport by scanning this QR code with your smart phone.

DVB-RCS2, A Most Worthy Upgrade

by Richard R. Forberg, Vice President, Product Management, STM Group, Inc.

The industry leading DVB-RCS standard recently underwent a thorough upgrade, bringing the potential of satellite communications as a whole to a new level. The new **DVB-RCS2** standard ("**RCS2**") not only improves link efficiencies, it also rockets throughput potential up by 300 percent.

The RCS2 standard was published by the **DVB organization** in 2011 based on collaborative work by many leading industry participants. Both the specification and implementation are the result of three years of advanced development, in which **STM** was a key technology contributor, leading several research organizations under contract to the **European Space Agency** (ESA).

The base of the new RCS2 standard is, of course, DVB-RCS (Digital Video Broadcast with Return Channel via Satellite), the worldwide open standard for satellite network specifications that carriers, militaries, and businesses have come to rely on for advanced, high quality services. It uses Multi Frequency Time Division Multiple Access (TDMA) and Time Division Multiplexing (TDM) methods for two-way communications. It has been used commercially since 2001 by hundreds of companies and government agencies. The new RCS2 standard is now being deployed in Q1 of 2012, giving operators the latest satellite waveform technologies for modulation and coding, plus many other useful features.

DVB-RCS: The Foundation

To appreciate RCS2, it is necessary to understand the foundation first. The DVB-RCS standard is all about implementing very fast, efficient and reliable Internet Protocol (IP) networks using Very Small Aperture Terminals (VSATs)—or larger ones, if necessary. DVB-RCS provides excellent support for fixed, transportable, and mobile VSATs with high-throughput communications. Communications-On-The-Move (COTM) is delivered for ships, off-road vehicles, high speed trains, and aircraft with roaming across beams and countermeasures against interference. DVB-RCS works with any type of fixed, auto-pointing, electronic array, or stabilized antenna systems in any satellite band or beam configuration. DVB-RCS specifies use of the popular DVB-S2 standard for the Time Division Multiplexed (TDM) carriers in continuous mode, which can be broadcast to hundreds or thousands of remote VSATs from a central hub, gateway, or master station.

It then also specifies the advanced TDMA control logic, precise burst synchronization (down to 37 nanoseconds), modulation and coding, plus fast frequency-hopping used on TDMA carriers. Timeslots may be allocated to a given VSAT statically and/or dynamically (i.e. as bandwidth-on-demand) in any mixture determined by policies set by network operators for different applications or traffic types.

Applications requiring any combination of VoIP, video conferencing, video feeds and/or video multicasting, plus any type of data application can be served with a single VSAT. Each capacity request from the VSAT for bandwidth-on-demand may distinguish the QoS treatment required for the service.

DVB-RCS is ideal for remote operations that need huge transmit bandwidths rapidly but unpredictably. A TDMA "carrier group" can have dozens of carriers creating a massive pool of shared bandwidth for return and mesh link communications. Up to 44 MHz of shared TDMA capacity is feasible in commercial implementations today that use wide-band, multi-carrier burst demodulators, with double that coming soon. This is in contrast to most proprietary TDMA systems which are limited to < 8 MHz of shared bandwidth for TDMA access.

In the latest commercial Return Link System (RLS) burst demodulators, all 44 MHz can be digitized and processed for up to 32 concurrent bursts in a 1U rack-mounted unit for reception at the hub or a number of gateway stations providing 50 Mbps of IP throughput on TDMA carriers. This also enables high-capacity, high-performance hub/gateway systems, easily transported to the theater of operation.

Example DVB-RCS Network

Each TDM Forward Link controls one or more TDMA Carrier Groups

DVB-S2 with ACM

FWD Link #1

FWD Link #2

Etc.

Hub/Gateway

TDMA Carrier Group #1 (e.g., Return Only)

TDMA Carrier Group #2 (e.g., Mesh & Return)

TDMA Carrier Group #3 (e.g., COTM Mesh & Return)

Etc.

Mix of symbol rates, modulation & coding allowed in each Carrier Group and up to 32 carriers each

1000's of VSATs per Carrier Group are feasible
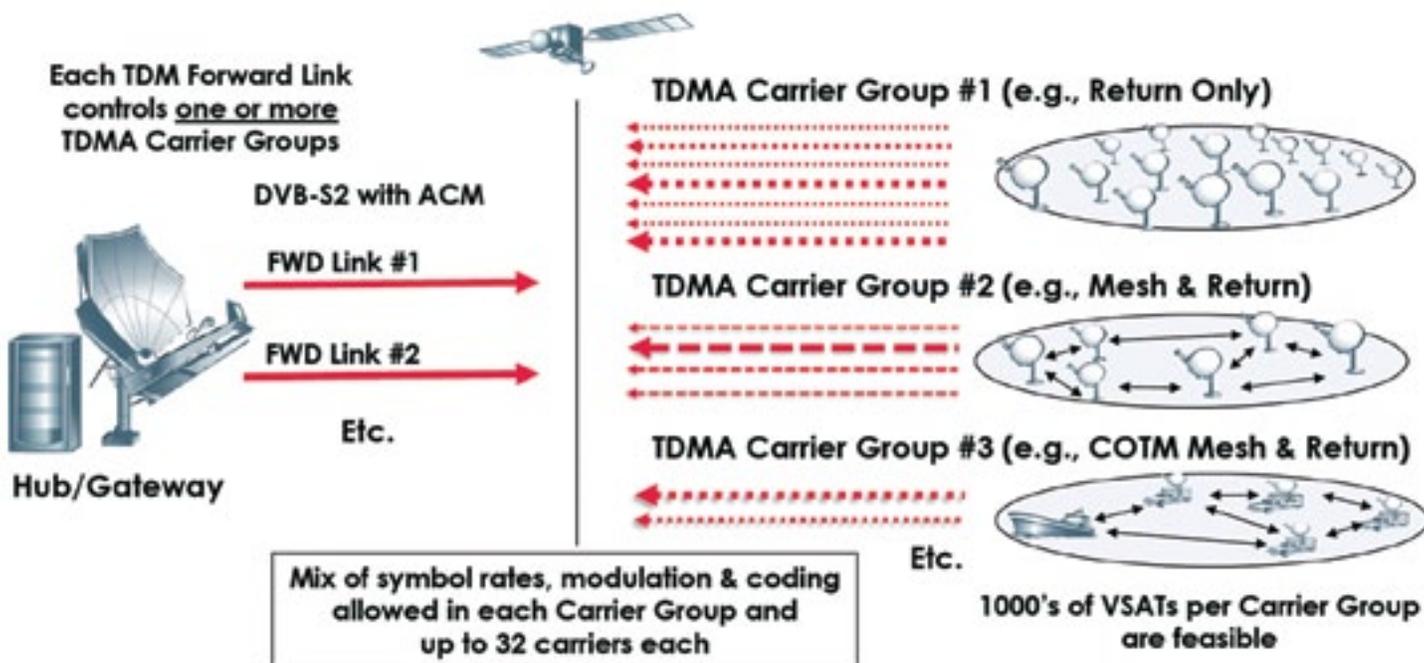
Figure 1. An Example DVB-RCS Network

Mesh networking capabilities, available in commercial DVB-RCS implementations today, over these same TDMA carrier groups, enable single-hop communications between small remote VSATs with capacity for demodulating eight (8) concurrent bursts. Mesh networking also supports bandwidth-on-demand with multiple QoS Classes on every active mesh link, if desired.

In recent years, Adaptive Coding and Modulation (ACM) on DVB-S2 carriers operating at information rates well over 100 Mbps in TDM mode has proven to be a key advantage in many networks, often doubling the TDM carrier capacity and greatly improving TDM link availability. It is DVB-RCS, however, that specifies how ACM on DVB-S2 is implemented optimally with rapid closed-loop control using the same signaling messages that handle closed-loop synchronization and capacity requests for TDMA timeslots.

In DVB-RCS, the modulation, coding, and symbol rates on TDMA bursts are also handled adaptively, in real-time, using intelligent carrier selection in the TDMA controller at the hub. This completes increased link availabilities and average information rates obtainable for two way communications, and delivers better gains than today's proprietary adaptive methods, because of the larger dynamic ranges supported. This allows VSATs to perform fast frequency hopping across a wide range of TDMA carriers, operating, say, from 500 ksps up to 8 Msps in a highly reliable manner.

Other features in the leading commercial DVB-RCS implementations at higher layers include: built-in TCP and HTTP acceleration, Network Address Translation (NAT), and header compression of IP stack protocols. These are essential for high-performance, flexible networking. Many aspects of such features are now gradually being standardized by efforts in the DVB Higher Layers for Satellite (HLS) working group, in close coordination with the RCS working group.

Transmit capacities over 12 Mbps of IP content from a low-cost VSAT are feasible in today's low-cost commercial implementations of DVB-RCS; and the receive capacities for total IP content over DVB-S2 to a single VSAT can reach 50 Mbps. Of course, throughput always depends on signal-to-noise ratios (SNR), which in turn depends on antennas, amplifiers, and many other factors including satellite characteristics and atmospheric fading, especially in higher frequency bands such as Ku- and Ka-.

This is where the Second Generation of DVB-RCS becomes especially important.

Raising The Bar: What's New In The RCS2 Upgrade

The major advance in DVB-RCS specifications to DVB-RCS2 offers 8PSK and 16QAM modulation options, as well as the usual QPSK. It also uses a new, powerful 2D 16-state Turbo Code FEC algorithm in TDMA bursts, giving up to 2 dB more gain. Selected alternative modem specifications (e.g., for non-linear modulation) are also allowed but yield lower efficiency. VSAT log-on signaling now handles an even wider-range of diverse terminal capabilities via auto-discovery, promoting simplicity of operation in networks with diverse terminal types, including some or all using encryption.
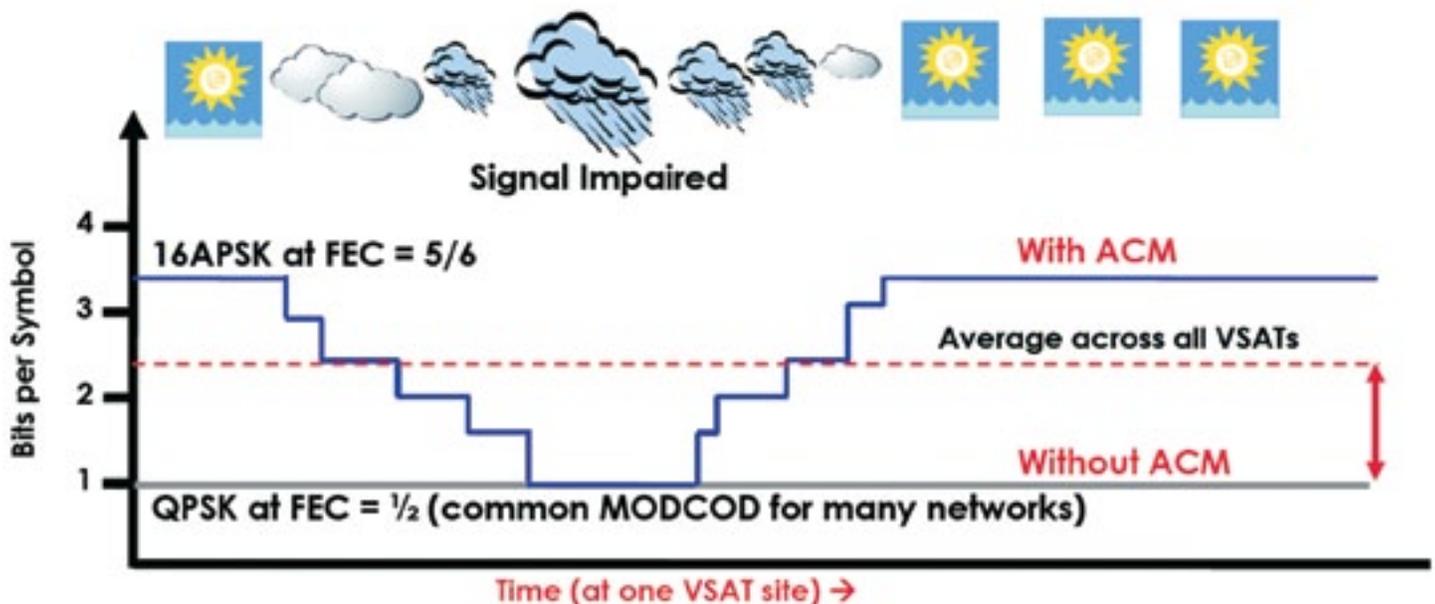
Figure 2. How ACM Works

Figure 3. An Example of an STM RCS2 Ready VSAT

Particularly important is that ACM is now also implemented on the TDMA carriers for each timeslot (i.e., "per burst"). This is done in combination with the dynamic adaptive carrier selection already in use today.

TDMA carriers, therefore, have no defined modulation and coding until a timeslot is assigned on them to a given VSAT. Even the symbol rates and the number of carriers in the TDMA carrier group may be dynamically adjusted, given the flexible superframe and frame formats in the new standard. All this gives an additional dramatic improvement in average network capacity and link availability over TDMA carriers in high-frequency networks (e.g., Ka band), without increasing antenna sizes.

With these advances, the transmit capacities from a low-cost VSAT will reach 24 Mbps of IP content in the near term, with more in the years to come.

Another benefit comes from new methods for encapsulating IP packets into TDMA bursts and on DVB-S2 carriers, which reduce layer 2 overheads to the bare minimum and eliminate MPEG overheads, while retaining flexibility for diverse Layer 3 protocols, such as IPv6 and IPv4 running concurrently over the same carriers.

A Game Changer

The upgrade to DVB-RCS2 is a game-changer in the satellite communications industry, raising the bar for efficiency and speed while remaining a trusted, open standard. With improvements across several key aspects of the DVB-RCS specifications, RCS2 will be a valuable asset across many market sectors. With several hubs already set to upgrade, it is clear that there is great interest and appreciation for the increasing performance and efficiency for networks and applications of all types.

DVB-RCS2 in Action

In the summer of 2011, STM became the first to implement the new DVB-RCS2 standard on the SatLink® platform in a demonstration attended by representatives of the European Space Agency (ESA) and the Norwegian Space Center. STM's implementation of RCS2 yields bandwidth efficiencies up to ~2.9 bps/Hz (3.33 bits/symbol) on TDMA carriers and offers excellent return link availability with ACM, as is critical for new broadband networks.

Hubs owned by NSSLGlobal, Ltd. and Global IP will be among the first to offer RCS2 services through their SatLink hubs. Chief among the motivations to upgrade were RCS2's high throughput for IP packets on the return link and the capability of having higher link availability and efficiency than ever before. The hubs are also part of each company's plans to increase their coverage area, which can be done without requiring additional transponder capacity from the satellite.

The newly upgraded RCS2 hubs will provide solutions for high-speed Internet Access, TV/Video services, VoIP, and GSM backhaul used by the maritime industry, energy sector, utility companies, and global corporations. All of these services can operate on the same VSAT with excellent QoS.

How To Lose Weight The *All Digital* Way...

by Allan Chin and Luciano Zoso, Stellamar

Programmable digital devices, led by **FPGAs**, have exploded in popularity for aerospace applications. Major advances in performance and radiation tolerance/hardness have fueled the growth. This also leads to an increase in FPGA usage in other high-reliability and system-critical applications. A recent article in the **EE Times**, *Programmable ICs: The Next Innovation Engine*, identifies and describes the most fundamental challenges to continuing the growth path of FPGAs in these applications. Challenge number one in this article is mixed signal circuit integration. Specifically, the article mentions that ADCs, DACs and power circuits will need to be integrated to drive the next wave of FPGA evolution.

Analog design, especially for space, is a highly complicated task requiring tremendous resources, both in terms of time and dollars. This is why there are a limited number of space qualified external analog components. The options are usually targeted at the most advanced speeds, and cost a pretty penny, and also represent points of failure. Most of these parts are not optimal for general sensor applications. General current and temperature "housekeeping" measurements offer all sorts of advantages during a mission. But, take for example, the absurdity of measuring your system's current temperature with a 4 channel 12 bit, 1msps ADC. This is like trying to drive the head of a pin with a sledgehammer.

Fortunately, design teams looking to integrate customized ADC functionality for system housekeeping and other functions, can now do so by utilizing the FPGA or ASIC process currently spec'd for the design, thereby eliminating most tradeoffs that occur with external parts.

An A2D Without The "A"

At **Stellamar**, All Digital ADC IP core requires no analog block design. Only a few passive components are necessary. Specialized proprietary signal processing enables analog sigma-delta ADC performance to be replicated with all digital library cells. This proprietary technology allows digital ADCs to reap all the benefits that digital design has over analog designed external parts:

- 50 percent lower power on average
- 68 percent smaller area on average
- Process technology independence
- Reduced risk and cycle time
- Digital integration and synthesis
- Easier radiation-hardened design

These simple block diagrams (*Figure 1* and *Figure 2*) represent some differences.

In the traditional analog ADC approach, the designer must select an external ADC part to use an ADC with FPGAs. The bad news is that these ADCs are usually external and large. Multiple pins are needed to connect to an FPGA. By not controlling the ADC development, designers tradeoff optimization for reduced design cycles. The vendor's solution is most likely an overdesigned part for the system costing power, size and weight. This tradeoff is suboptimal when designing for aerospace and other high reliability applications where reliability is key and costs grow exponentially.
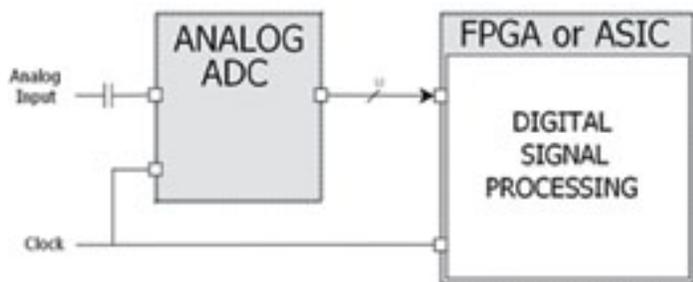
Figure 1. Analog ADC approach

With the All Digital approach, a designer does not have to use external ADCs, which can take up critical board space. The IP core is instantiated right in the FPGA and is much easier to implement through digital synthesis. The digital ADC only uses two pins and a couple discrete components, depicted in *Figure 2*. Now you have an ADC embedded in the digital fabric of your FPGA, which is properly optimized for your application, and you have also reduced board space, complexity and testing time, while increasing mean time between failures (MTBF). This approach is much easier to implement and test, which can greatly enhance your ability to meet time-to-market. (See *Figure 2*.)

For additional ADC functionality in the conventional approach, either more ADC chips would be added, or an analog multiplexer would have to be added. With the All Digital ADC solution, a designer could just add more digital ADC IP blocks to take advantage of size and power savings.

Figure 3 and *Figure 4* are typical frequency response plots for an ADC with a bandwidth of 20 kHz. The plots show an output with two different amplitudes of a 15 kHz input frequency. The first has an amplitude of 1.8 Vpp while the second is 60 dB lower, with an amplitude of 1.8 mVpp.

Performance + Applications
Current performance of this All Digital Solution is up to 14 bits of resolution and 100 kHz bandwidth. Bandwidth depends on the selected resolution. Development efforts continue to support higher performance. Current performance is suitable for a host of space applications including the following:

- Sensors—temperature, pressure, voltage, current, acceleration
- Touch screen integration
- Voice and high quality voice
- Motor control
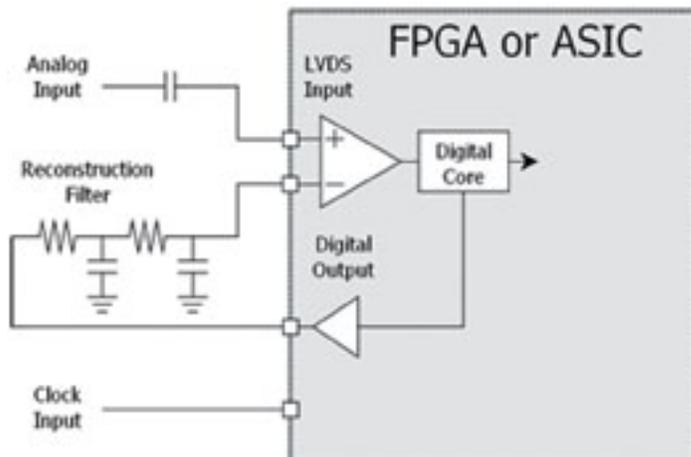
Figure 2. Stellamar All Digital ADC Interface

Implementation Example
Through FPGA partners Xilinx and Microsemi, several customers have used Digital ADC IP cores from Stellamar to provide ADC functionality in aerospace designs. Often "system health monitoring"-sensing of on board current and temperature is forgone because the addition of this capability is too expensive. Digital ADCs are perfect for this application, and allow flight units to be health monitored and debugged on the ground through matching boards. Two examples are:
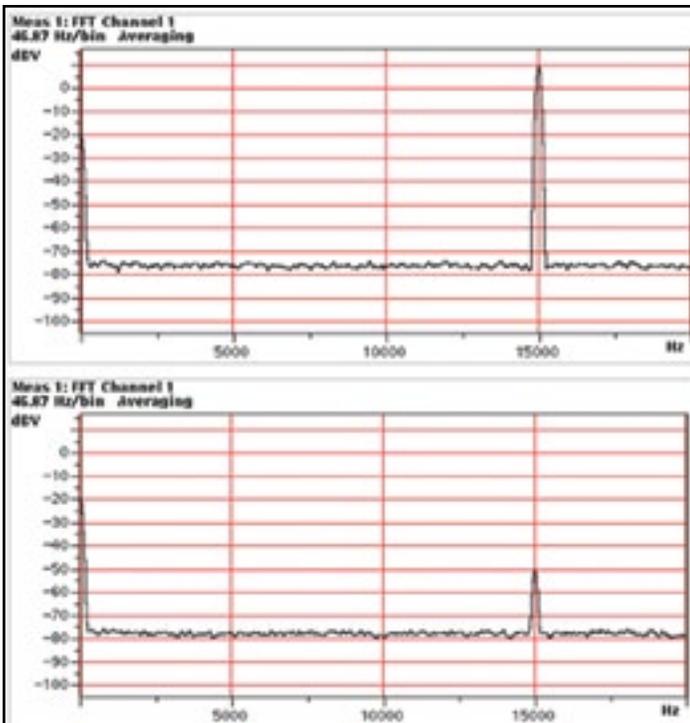
Top
Figure 3, Input frequency 15 kHz, Input Amplitude 1.8 Vpp

Bottom
Figure 4, Input frequency 16 kHz, Input Amplitude 1.8 mVpp

- SEAKR Engineering: On Board Processor Program
- Finnish Meteorological Institute: Lunar Landing Mission

Both programs found housekeeping to be an essential feature, but had not found an effective way of implementing without major tradeoffs. In each example, Stellamar helped define requirements, and delivered an IP core customized to the application including number of channels, resolution bandwidth and clock. Total design process is about two weeks. With an All Digital ADC, these teams are able to reduce board space, weight and power and increase reliability.

Radiation Hardening

Since the design of radiation-hardened ADCs is extremely difficult, expensive and lengthy (typically over two years), only few radiation-hardened ADCs are developed that target the applications requiring the highest conversion speed. The same ADCs are used as well for lower speed applications, such as voltage measurements and pressure/acceleration sensors on the system. This means that power is being wasted and system performance is not optimized. If you have a Microsemi radiation-tolerant ProASIC®3 device, or Xilinx V5 QV (for example) already on the board, why not use the remaining 1 percent of the gates to run an optimized digital core which provides an ADC as hard as the surrounding FPGA? Furthermore, Rad Hard ASICs and Structured Arrays such as Honeywell HX5000 can be used in the same way. The Digital ADC is ported to this process and due out in 2012. You have not increased the number of parts, or board space, and now you're optimized for power, and have a configurable ADC to repurpose for other applications.

Deliverables

Xilinx and Microsemi-based FPGA evaluation boards are currently available. The intellectual property (IP) retargeted to FPGAs or ASICs is available for purchase. Example performances are 11

bits of resolution over a 20 kHz bandwidth for standard resolution, and 14 bits over 500 Hz for higher resolution applications. A purchased digital ADC block can be specifically optimized just about anywhere below those thresholds. Resolution and sample rates are driven by customer requirements. Stellamar will work with the customer to deliver a customized IP database that best suits those requirements. The IP database will also allow the customer to target desired technology. With the IP database, Stellamar provides a detailed implementation guide, and offers customer support through implementation.

The Digital Solution

Satellite and space electronics designers requiring ADC integration in ASICs or FPGAs now have a simple, flexible and complete solution. With a Stellamar digital ADC, most of the common bottleneck issues caused by ADC integration are removed. The result is a Digital ADC that can be easily embedded in any FPGA, and can be reprogrammed for different performance requirements. This ADC will also be much smaller and less power hungry for low power portable applications and critical aerospace needs. In the near future, engineers will be better able to integrate and synthesize other components previously thought to only remain in the analog domain. The Digital ADC is the first step. Visit http://www.stellamar.comor or email info@stellamar.com for more information.

About the authors

Allan Chin has more than 30 years of design experience with high performance digital and mixed signal systems. Allan has made significant and recognized accomplishments in the design and engineering of sophisticated electronic systems and assemblies. His broad expertise covers many areas of IC design, including system requirement definition, chip development, mixed signal simulation, verification, prototyping and lab testing. Allan started his career at Honeywell, where he worked on flight and main engine control systems for the space shuttle. Allan also co-developed the digital video encoder chip while at Motorola/Freescale. During his career Allan has held various management positions leading design teams at Motorola/Freescale, Mentor Graphics and Honeywell. Allan has a B.S. in Electrical Engineering from Marquette University, Milwaukee, Wisconsin, and holds nine patents. Allan can be reached at allan.chin@stellamar.com.

Luciano Zoso is an accomplished engineer and inventor with over thirty years of experience in digital signal processing. He has successfully applied his expertise in the areas of voice band modems, sigma-delta converters, multi-standard digital video encoders and decoders, stereo encoders, and GPS receivers as well as sensors. His experience ranges from system-level design and simulation to full implementation. Luciano started his career as a researcher at CSELT, research center of the Italian phone company in Torino, Italy. There he developed advanced data communication systems and pioneered a design methodology for high order sigma-delta converters. After his work at CSELT, Luciano moved to the R&D department of Hayes Microcomputer Products in Atlanta. He then worked with Allan at Motorola/Freescale, where he was responsible for system design of VLSI chips for audio/video and communications applications. There Luciano co-developed the digital video encoder chip with Allan. Luciano is also responsible for the Echo Canceller currently used in landline and satellite communications, and he also created the GPS receiver currently used in cell phones. Luciano has a Dr. Ing Degree in electronics engineering from Politecnico di Torino in Italy. He holds eleven patents in signal processing. Email Luciano at luciano.zoso@stellamar.com.

The Road To The Future — Chemistry Vs. Technical Skills

by Bert Sadtler, President, Boxwood Executive Search

These are extremely challenging times for employers who need to acquire top level talent as well as for those seeking a career change. Today, companies' economics compel them to re-assess their talent needs in order to remain competitive and drive growth. The satellite communications industry remains ripe with new opportunities. Employers are challenged with making a "great hire." For the candidate, finding an opportunity can sometimes be a rather difficult proposition. To assist with career searches, we asked Bert Sadtler of Boxwood Executive Search to respond to readers' questions regarding the processes of recruitment and hiring as well as how Companies can retain crucially-needed talent. Boxwood is located in the Washington DC region and has success in senior level recruitment in satellite communications, government contracting, and within the intelligence community. If you would care to submit a recruitment, hiring, or retention question specific to our satellite communications and related industries for Bert to answer, please email your question to BertSadtler@BoxwoodSearch.com.

This issue's inquiry...

Dear Bert,
With the acquisition of talent focused on skills and on the expertise of specific subject matter, how much weight do you place on technical skills versus chemistry when recruiting for critical needs?

Thank you,

Craig M
Chief Operating Officer
Prime Contractor, Government Sector

Dear Craig,

There is an important balance between technical fit and cultural fit. Obviously, the person you are going to hire needs to have both. The market place today is full of changes and daily challenges. Being able to technically adapt is important. Being a good cultural fit means the new hire has a much higher probability of successfully embracing changes and challenges as a productive contributor.

In the December 24, 2011, issue of the *Wall Street Journal*, questions asked during an interview with **Google** were published.

They included:

1) Using only a four-minute hourglass and a seven-minute hourglass, measure exactly nine minutes—without the process taking longer than nine minutes.

2) A book has N pages, numbered the usual way, from 1 to N. The total number of digits in the page numbers is 1,095. How many pages does the book have?

3) A man pushed his car to a hotel and lost his fortune. What happened?"
These are good examples of technical interview questions. More traditional ones might focus on demonstrated experience in a specific field. Technical questions help to determine if the candidate has the skills and or background to meet the challenges and handle anticipated technical changes.

In some cases, technical questions determine that a candidate is more of a generalist or an "athlete" then an expert. Technical "athletes" are well suited to embrace change and can adopt accordingly.

While the technical fit is important, I regard cultural fit or chemistry as being more critical to the outcome of a successful hire.

By defining a successful recruitment by the long-term contribution made by an employee who enjoys their work, we have to focus beyond simply the date they are hired.

Interviewing for chemistry or cultural fit is hard to test. It requires an investment of time by the hiring manager. It requires several meetings for there to be an opportunity to develop a bond. It is based more on a feeling and a rapport between the candidate and hiring manager.

The candidate is being hired because the hiring manager has a problem or challenge that needs to be addressed. The hiring manager is likely to hire the candidate who has developed the best chemistry. It may or may not be the candidate who is the best technical fit.

As the new hire works with their hiring manager, changes and challenges will arise. By having good chemistry and cultural fit, the two are well on their way to successfully working through issues together.

I hope you have found this helpful and good luck on your efforts to look for strong chemistry during your interviewing efforts.

Sincerely,
Bert Sadtler

Dr. Walter Scott
CTO + Founder

Exec. V.P.,
DigitalGlobe

From 1986 through 1992, Dr. Scott held a number of technical, program and department management positions at the Lawrence Livermore National Laboratory, including serving as the assistant associate director of the Physics Department. Prior to this, Dr. Scott served as president of Scott Consulting, a Unix systems and applications consulting firm. Dr. Scott holds a Bachelor of Arts in Applied Mathematics, magna cum laude, from Harvard College and a Doctorate and Master of Science in Computer Science from the University of California, Berkeley.

Thanks for taking the time to talk with us, Mr. Scott. From founding and running your own Unix systems and consulting firm, to working in various technical, program, and department management positions at Lawrence Livermore National Laboratory, why did you decide to found DigitalGlobe?

Dr. Walter Scott
The Cold War ended, and it was clear that the world was going to change. One of the important technologies during the Cold War had been satellite imaging, which had provided a level of global transparency that enabled decisions to be made based on facts and not fears. Some would argue that was a big contributor to why the Cold War stayed Cold, and not Hot. I remember thinking— why can't these technologies be applied to a broader group of users, particularly with the emerging Geographic Information Systems (GIS) industry, declining computing costs, and the intro- duction of the Internet? So DigitalGlobe was born in 1992 as WorldView Imaging Corporation. Twenty years later, that vision is a reality.

SM
You are also the CTO for your Company, as such you are exposed to a number of new technologies that deal with Earth Observation and other imagery environments. Can you tell us about any new and innovative products we can look forward to in 2012?

Dr. Walter Scott
We're continuing to build the WorldView-3 satellite, due to launch in 2014. That satellite will be capable of resolutions as good as roughly 12 inches, and will offer even more capacity and revisit than DigitalGlobe's current constellation, which last year was already respon- sible for collecting over 80 percent of the half-meter-class satellite imagery commercially available worldwide. As to 2012, well, I can say it will be an interesting year, but we're not quite ready to announce anything yet.

SM
What services does DigitalGlobe provide, both to the commercial and to the government market segments? Do you see a merging of technologies for both segments?

Dr. Walter Scott
DigitalGlobe adheres to the needs of several commercial industries and government agencies, such as

defense and intelligence, federal and local governments, insur- ance, navigation and telecom. Our imagery, monitoring services, and elevation series products allow us to identify the world's natural resources, monitor pipelines and facilities, manage mountain planning, protect homelands and borders, and respond to emergencies and natural disasters. DigitalGlobe's constellation of satellites allows corporations to rebuild and plan investments in multi-million dollar infrastructure developments.

More specifically into our imagery products, our Basic and Standard Satellite Imagery, provides photogrammetric processing, three-dimensional feature extraction, and high-reso- lution images to identify features and detect changes from recent global imagery. DigitalGlobe's Stereo Imagery is ideal for Digital

Elevation Model generation, 3D visualization, and feature extraction. WorldView-2 is the only commercial satellite that provides high resolution 8-band multispectral imagery, which enables complete coverage of the visual spectrum.

Additionally, DigitalGlobe's Global Basemap delivers baseline context to better understand and analyze specific geographies of interest. Our Precision Aerial is the industry's first, high-quality collection of 30 cm natural color and 60 cm color infrared imagery. And lastly, our Advanced Ortho Series provides the best quality orthos available in a faster and easier method.

DigitalGlobe's monitoring and analysis products, including FirstLook, the Diplomatic Facilities Support Package and FirstWatch, provide pre- and post-event imagery of world disasters for quick emergency planning and damage assessment with web-based access. The experts in our Analysis Center provide the context and insight into our satellite images to effectively plan possible courses of action.

Our elevation products, including the WorldView Elevation Suite and the Advanced Elevation Series, allow us to develop elevation datasets of rural areas and Digital Surface Models for land management and engineering.

Depending on the need of the commercial or government sectors, our products offer several benefits to both markets and the technologies we employ can be used equally and efficiently in both segments. The information we provide is shareable with warfighters, coalition partners, first responders and relief workers, who collectively represent the very nature of much of our nation's security interests at home and abroad. This information can also be shared in the commercial space, adding value for both segments.

SM

With the proposed cuts in the national defense budget, how will such impact the commercial, and the military/government, imagery projects? And how will this impact our national security as well as the security of our allies? What makes imagery such a crucial environment to protect from such cuts?

Dr. Walter Scott
We are confident that our technology will continue to play a significant role in the nation's defense strategy to rebuild readiness in de-emphasized areas and to retain force structure. We realize there is always risk with the proposed budget cuts, but I am confident that investments in intelligence and surveillance in space will not be overlooked. With WorldView-1 and WorldView-2 already on orbit and WorldView-3 on schedule, we believe an objective analysis of our performance will also recognize the extraordinary value we deliver to taxpayers. As our nation is pulling back on our physical presence in hot stops abroad, our virtual presence of satellites becomes more

Artistic rendition of DigitalGlobe's upcoming WorldView-3 satellite.

critical to keep our nation safe, and ensure that we are not surprised when events unfold.

DigitalGlobe has 5x times the capacity of our nearest U.S.-based competitor. Our superior performance should give our customers a high level of trust and confidence that we offer as a strong value proposition. We provide critical information for warfighters, coalition partners, first responders and relief workers, and our cutting-edge capabilities cost the government far less money than to acquire, operate, maintain and replenish the assets themselves.

SM

How can DigitalGlobe, and the industry in general, protect this critical technology from being slashed by those who see this more as a positive political maneuver for their voting base, rather than one established on clear thought based upon national need?

Dr. Walter Scott
Our most powerful tool is to educate voters on the importance of intelligence, surveillance and reconnaissance in space. Compared to other programs, the EnhancedView contract is highly cost effective and delivers great value to taxpayers. It gives the U.S. Government access to nine satellites over the life of the program at a fraction of the cost it would take for the government to build, deploy and manage the same number themselves. Commercial satellite imagery is no longer optional, it is critical to ongoing mission success. DigitalGlobe's constellation of satellites allows U.S. Government analysts, military personnel and first responders to see anywhere on earth with or without a physical presence on the ground.

SM

Upcoming is WorldView 3, DigitalGlobe's next EO satellite that is currently under construction. Would you afford us some insight into this satellite's benefits? What does the launch schedule look like as of this writing?

Dr. Walter Scott
WorldView-3 will expand DigitalGlobe's constellation to four remote-sensing satellites that have all been supported by Ball Aerospace. Ball Aerospace is providing WorldView-3 with the BCP 5000 for stronger power, stability, data storage and transmission capability.

WorldView-3 is on schedule to launch mid-2014, capable of capturing 8-band multispectral high-resolution imagery and panchromatic band. The new satellite will strongly resemble WorldView-2 in terms of performance characteristics. However, as noted above, it will be capable of higher resolution and offer greater capacity, revisit, and timeliness.

SM

Would you please tell us about the Company's recently launched Diplomatic Facilities Support Package.

Dr. Walter Scott
DigitalGlobe's Diplomatic Facilities Support Package was launched to provide fast, web-based access to high-resolution imagery and feature information of specific cities, updated every six months. Developed by DigitalGlobe in collaboration with CACI, the package assists with the evacuation of citizens and other people by providing current information needed to identify intermediate staging bases. It enables collaboration via virtual whiteboards and incorporates tools for multiple users to view, edit and share critical information.

Significant benefits of the Diplomatic Facilities Support Package include: more effective planning for courses of action, the ability to identify high-risk areas and monitor the nature and

extent of activities, and manage resources. Our one-stop source for geospatial and information needs provides an up-to-date representation of geography and features, such as recent development, construction or change.

CACI's Freedom Web provides secure account privileges for fast and protected access from any desktop or mobile device while the DigitalGlobe constellation of satellites ensures consistent updates of important areas around the globe.

SM
Over the next five years or so, where do you believe the EO and imagery business will trend? And DigitalGlobe in particular?

Dr. Walter Scott
Over the next five years and beyond, I believe there are a few key trends that will impact how we design and deliver our solutions. First, with the growing amount of data in our industry, it will no longer be practical to ship imagery around and keep copies locally. Transportation and local copies become expensive with the need for more storage, power, cooling and data center real estate. Eventually, we'll need to move to centrally-served data, avoiding the process of transporting and managing the raw data.

Second, mobile computing will become a valuable tool by allowing the server to do most of the heavy-lifting instead of the mobile devices themselves. Mobile computing will allow the data, as well as any available software updates, to be deployed and stored centrally in the cloud. Such changes will reduce the cost of managing software updates and data availability and the time it takes to implement them.

For DigitalGlobe in particular, I see a trend in the continuous need for images to be delivered at a faster rate with more accuracy. As the Earth changes at a rapid pace, a more current, complete and accurate global model for the industry will be necessary. Therefore, a new model is needed that is aligned with, and enables the shift to, a centralized, hosted system.

SM
Is DigitalGlobe involved in any of the work to offset satellite interference problems? If so, please explain.

Dr. Walter Scott
We've been active over the years in working to minimize satellite interference. Fortunately, our satellites only transmit on a tight beam to our ground stations, and then only when they are in view; so unlike geostationary broadcast satellites, we already are much less likely to interfere.

SM
A growing area of concern within our industry is locating candidates for open positions that possess the technical competence and training necessary for crucial projects. How can our industry improve both STEM training in high schools and colleges and entice the next generation of students into careers in SATCOM?

Dr. Walter Scott
I think it's important for parents and professors of high school and higher education students to push careers in STEM-related fields for those students who have the potential to succeed. It's also important for high schools to develop programs related to science, technology, engineering and math in order for interested students to advance early in their careers.

More specifically, with Geographic Information Systems (GIS) being added to the curriculum of hundreds of university programs over the past decade, the job market has become richer with individuals skilled in GIS and related technologies. Geotechnology is another area that continues to experience growth as we find new uses for the technology and products that are developed.

By fostering an interest in these subjects at an early age and building a strong base of educated citizens, we're more likely to have a larger pool of qualified candidates to choose from in the SATCOM industry.

SM
Given your tenure in the industry, what projects have you supervised that bring you a true sense of satisfaction?

Dr. Walter Scott
Enabling portals such as Google—and later Bing along with many others—to make satellite imagery available to everyone with a web browser was a big step toward realizing the vision that started DigitalGlobe 20 years ago. There are over a billion people whose lives have been touched by—and improved by—satellite imagery, and DigitalGlobe was the first to make it available, through Google. That's immensely satisfying.
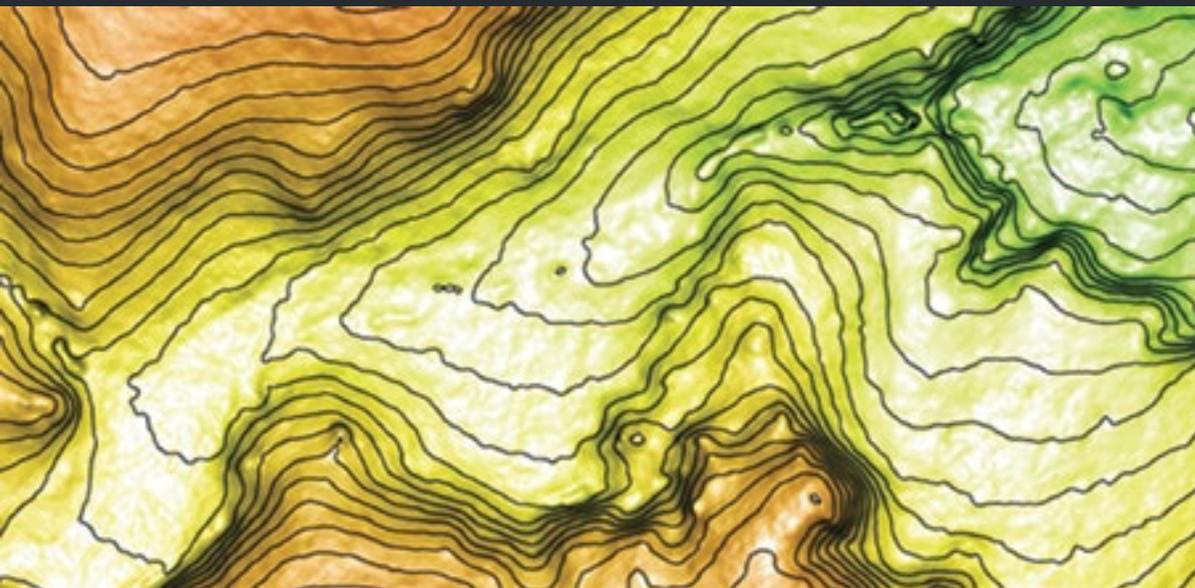
Example from DigitalGlobe's WorldView Elevation Suite, whose accurate evelation models are the key building blocks for successful exploration, engineering, land management and simlution.

Concentrating On Coverage For Africa

by Eyal Copitt, Senior Vice President — Africa, Spacecom

O Only a matter of weeks later, on January 25, 2012, AMOS-5 entered commercial operations with all systems go. Located at the 17 degrees E orbital position, it is a powerful platform offering a pan-African C-band beam alongside three Ku-band regional beams. The satellite's fixed pan-African C-band beam and three steerable Ku-band beams cover Africa with connectivity to Europe and the Middle East and support multiple transponders in both C-band and Ku-band. Thus AMOS-5 is an attractive source of capacity for a variety of African and African-related businesses, including telcos, cellular operators, teleports, enterprises, broadcasters, governments and others.

Indeed, AMOS-5 represents an important element of the company's vision as it moves forward to become a multi-regional satellite operator.

Africa is an exciting market for Spacecom for a number of reasons. Already in 2006, our board of directors decided that Africa's communications market was evolving and growing, making strategic sense for the company to begin working on providing satellite coverage for the continent. We also decided that with the data communications markets growing almost daily, as well as projected growth in the broadcast market, it was worth making this satellite different from our first satellites with more transponders and with the most-required C-band in Africa.

AMOS-5's 14x72 MHz and 4x36 MHz C-band transponders combined with 18x72 MHz Ku transponders enable it to be a prime carrier of African traffic in the years to come in both broadcast and data services. With a life-span of some 15 years, the satellite is offering customers a wide range of satellite services, including:

- Direct-to-home (DTH) broadcasting
- VSAT communications and broadband Internet
- Telephony services
- Data trunking
- Cellular backhaul
- Video distribution and more

One of Spacecom's major goals for Africa is to make sure that its satellite represents the ideal solution to cater to the needs of this market. With that in mind, one of AMOS-5's key differentiators is that it is one of the first satellites designed specifically to serve Africa, rather than be moved from one area to another. This decision enabled us to build it from bottom to top so that not only does it have the highest power (EIRP) enabling advanced data and broadcast services, it also was planned from the design phase to provide the optimal coverage over Africa. AMOS-5's elevation angle and extended power enables a one-hop from anywhere to everywhere else in Africa, with connectivity to Europe and the Middle East.

For instance, AMOS-5's pan-African C-band beam has two peaks—one over Kenya in East Africa with a second placed over West Africa. The C-band covers all of Africa from East to West and from North to South, as well as having easy and strong connections to the Middle East and Europe—as far as Northern Europe. This makes it a powerful and strong solution for a plethora of data and broadcast applications.

With our French Speaking Africa (Ku-1) beam, we cover the Francophone belt of Africa. In the East the beam reaches Madagascar and the Reunion Islands while in the West peak coverage is over the French speaking regions of that area. As well, we designed AMOS-5 Ku-beams to have connectivity throughout Europe and the Middle

East. This way, all of our clients on Ku-1 who are based outside of Africa can connect between their centers of operations.

AMOS-5's Ku-2 beam is focused on Southern Africa. Again, we have provided connections to the Middle East and to Europe to make communications easier between regions. The beam is strong over all of SADC from Democratic Republic of Congo to Namibia, Zimbabwe and over South Africa. As this regions' economies grow, so will the services offered on AMOS-5.

The third Ku beam is Ku-3 or the Central African beam. This beam reaches West Africa, with a beam peak over Nigeria the most populated country in Africa. the coverage includes the maritime areas making it especially attractive in the coastal region where extensive oil and gas production occurs. In East Africa, we have a peak over the economically growing areas of Kenya and bring coverage over the coastal areas from the Tropic of Capricorn (23 S) up through Northern Somalia, as well. Ku-3 covers Ethiopia and Southern Sudan, too. All together, the beam provides power throughout the center of the continent with excellent connectivity to the Middle East and Europe.

AMOS-5's Ku-beams provide true triple benefits of meeting our clients needs: a high-power satellite, with wide coverage, and designed specifically for Africa.

One question we are constantly asked is Spacecom's reaction to the commercial launch of several submarine cables for Africa that are bringing a bandwidth, or backbone, connectivity surge.

We actually believe that more fiber is good for our business in Africa. As fiber expands in Africa, business and consumers will realize that new services, especially with broadband Internet, benefit them and will seek out the best operators. This is especially true regarding Africa's burgeoning upper-middle class who are using more and more mobile telephony alongside new applications, all the time. This will bring more business to AMOS-5 and the satellite sector. Despite fibers expansion in urban and coastal areas, rural and outlying areas inland as well as large cities sitting far from the coasts, will not find fiber cost-effective. Rather, we posit, they will find that satellite services are economically competitive having both fast time to market and easy deployment. Thus, as customers in these regions want more content, more applications and more services they will turn to telecom and broadcast operators who use satellites.

Viewing Africa's increasing media and data needs, we are positive that we have made the right decision. Africa, with its growing population, ability to capture more infrastructure investments including modernization of communications platforms and overall attractiveness for business, is an important element of our business strategy. And finally, on a corporate level, AMOS-5 takes us further towards our vision of becoming a multi-regional satellite perator. from anywhere to everywhere else in Africa, with connectivity to Europe and the Middle East.

Shaping Vision, Creating Reality

CommunicAsia and BroadcastAsia, the most established infocomm technology (ICT) and media communications event of its kind in Asia, is poised to return with a large showing. Both shows have seen more than 85 percent of their exhibition space acquired by exhibitors—and there's still three months to go before the event—held from June 19th to the 22nd, 2012, at the prestigious Marina Bay Sands and award-winning Suntec Singapore respectively.
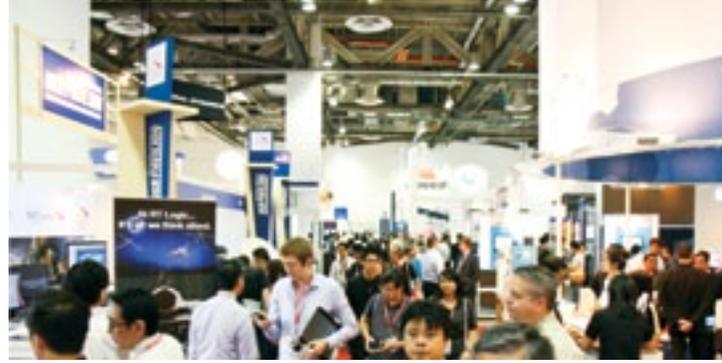
CommunicAsia2012 and BroadcastAsia2012 will highlight pertinent industry developments and address emerging trends as well as provide enhanced networking opportunities for industry professionals from around the world. EnterpriseIT, held in conjunction with CommunicAsia, will showcase innovative applications and end-to-end solutions across the entire value chain and transform the way companies operate and communicate internally and beyond. Once again, the event will present Asia's largest contingent of satellite companies assembled at any single event.

"CommunicAsia and BroadcastAsia today are the only truly international shows in Asia where business professionals across a range of industries come together in one city for one week. Strong support and endorsement from over 20 leading trade associations including **Asia-Pacific Broadcasting Union** (**ABU**), **Asia-Pacific Satellite Communications Council** (**APSCC**), **Asia-Pacific Telecommunity** (**APT**), **Singapore Infocomm Technology Federation** (**SiTF**) and others, helps to strengthen our mix of industry-leading exhibitors and visitors from across the globe," said Mr. *Victor Wong*, Project Director of Communications Events, **Singapore Exhibition Services** (**SES**). "We are proud to provide an efficacious launch pad for our exhibitors to showcase the latest and best that technology has to offer. This exclusive platform continues to play a pivotal part in driving the conversation for development within the industry."

Following the success of last year's event, which attracted a total of more than 53,000 professional attendees from more than 100 countries, attendees to this year's shows can look forward to a myriad of the newest technologies, products and solutions from 2,000 multinational and small and medium companies. Visitors can avail of opportunities to listen to industry luminaries, network with business leaders and government officials and forge business partnerships.

CommunicAsia2012 will feature breakthrough developments in NextGen Networks and satellite technology, as well as a sneak peek into the latest market-ready devices and mobile apps and solutions and dynamic industry deals set to alter ICT in Asia and beyond. Leading returning exhibitors include **Falcon Interactive**, **FiberHome**, **Globecast**, **Inmarsat**, **Intelsat**, **Irdeto**, **Netop Technology**, **PCCW Global**, **Prysmian**, **Rosenberger**, **ST Electronics**, **Tektronix** and **Tata Communications**;

new participants include **Anritsu**, **Aver Information**, **Hitachi Critical Facilities Protection** and **Novelsat**.

This year's show will provide more exhibition space and hospitality suite options for exhibitors and there will be more than 20 international group pavilions, all set to feature cutting-edge products, technologies and solutions, presenting the most relevant and current solutions for businesses and enterprises across the value chain.

Setting the stage for global industry leaders to share their knowledge, the CommunicAsia2012 Summit will offer distinctly titled forums and workshops that address the most compelling issues and challenges for the ICT industry with the spotlight on mobile-driven trends this year. Extended sessions dedicated to mobile-focused topics encompassing m-Commerce, Mobile VAS, and Mobile Security issues will be added to the conference, alongside the latest tracks on Mobile Payments, Mobile Health, Customer Experience Management (CEM), and OTT Business Models.

Integrating Technologies, Experiencing Content

BroadcastAsia continues to move beyond broadcasting to highlight the convergence of technologies and solutions relevant to the fast-changing media landscape.

BroadcastAsia2012 will showcase a global array of the latest technologies, applications, equipment and solutions in Film, Audio and TV with a spotlight on Multi Streaming Technologies, Hybrid Broadcast Broadband TV (HbbTV), Playout Services, Pro-Audio Technology, Over The Top (OTT) Technology, Cloud Broadcasting and Digital Radio. Returning exhibitors at the show include **ATG**, **Blackmagic**, **Evertz**, **EVS**, **Gospell**, **Grass Valley**, **Harmonic**, **Harris,** **Miranda**, **Salzbrenner Stagetec**, **Sennheiser**, **Snell**, **Tektronix**, **VSN** and more. The exhibition welcomes

some new exhibitors—**Envivio**, **Hitachi Kokusai Linear**, **Ideal Systems**, **Nippon Electronics**, **NTT Electrics**, **Pliat** and **Toshiba,** among others, and locally-based companies **Alphatron**, **AV Lite**, **Broadcast Professional**, **Cathay Photo**, **H Warta**, **Lemo**, and more. Visitors can look forward to nine international group pavilions and a larger **Cinematography/Film/Production Zone** on the show floors.

Backed by an international panel of speakers and industry veterans, the BroadcastAsia2012 International Conference and Creative Content Production Conferences return this year with a behind-the-scenes look at the latest technologies and techniques panning out in the market. With the growing momentum behind Smart TVs, Cloud Broadcasting, Multi-platform and OTT delivery and the challenges of managing an effective PayTV model as well as digital asset management, the BroadcastAsia2012 International Conference will offer more sessions to address the latest needs and technologies in the broadcasting industry.

In its third successful installment, the Creative Content Production Conference will return with two days of conference sessions and an add-on day of workshops this year. The conference will comprise a mix of topical issues, case studies and hands-on sessions to address the evolving challenges faced by production professionals from new media and visual effects to editing and IP rights. For show updates, please visit ...

LinkedIn:
CommunicAsia and BroadcastAsia

A Jump-Off To A Brighter Year

by Randa Relich Milliron, CEO + Co-Founder, Interorbital Systems

Interorbital Systems (IOS) of Mojave, California, entered 2012 armed with the notification of its selection for a NASA SBIR Phase I award supporting the continued development of the company's NEPTUNE modular rocket system. The NEPTUNE family of rockets is based on a single common building block: a stand-alone rocket that can be bundled in varying numbers with other identical modules—Common Propulsion Modules or CPMs—to meet any mission requirement.

Designed to radically reduce spacelaunch vehicle construction and operational costs, the **NEPTUNE** rocket series harkens back to a concept from the 1970s that was never brought to complete operational fruition: the **OTRAG** modular rocket system. *Lutz Kayser*, founder of OTRAG, the world's first commercial rocket company and creator of the modular rocket concept, commented, through *Parabolic Arc*, about **Interorbital**'s selection by **NASA**, "This is a big step toward the innovative Common Propulsion Module introduction to commercial and cost optimized space transport. In view of the budgetary pressure to save money NASA's move is highly commendable. A factor of 10 (ten) in-orbital transport cost is finally on the horizon and is getting interesting for private investors."

Since the introduction of its **TubeSat Personal Satellite Kit** in late 2009, Interorbital's rocket development program has been exclusively funded through its own commercial sales operations.

Testing + Infrastructure Updates

Roderick Milliron, IOS President/CoFounder/CTO shared updates on the modular rocket ground- and flight-test program. "We've built and installed a new test stand for our satellite module kick-engine field trials at one of our Mojave Air and Space Port test sites; constructed and tested the new rocket controller hardware and software; and completed test tankage, plumbing, and electrical improvements for our upcoming engine tests. Our first suborbital test flight will follow soon—when all ground testing is completed."

copyright Bryan Versteeg

www.interorbital.com
www.synergymoon.org
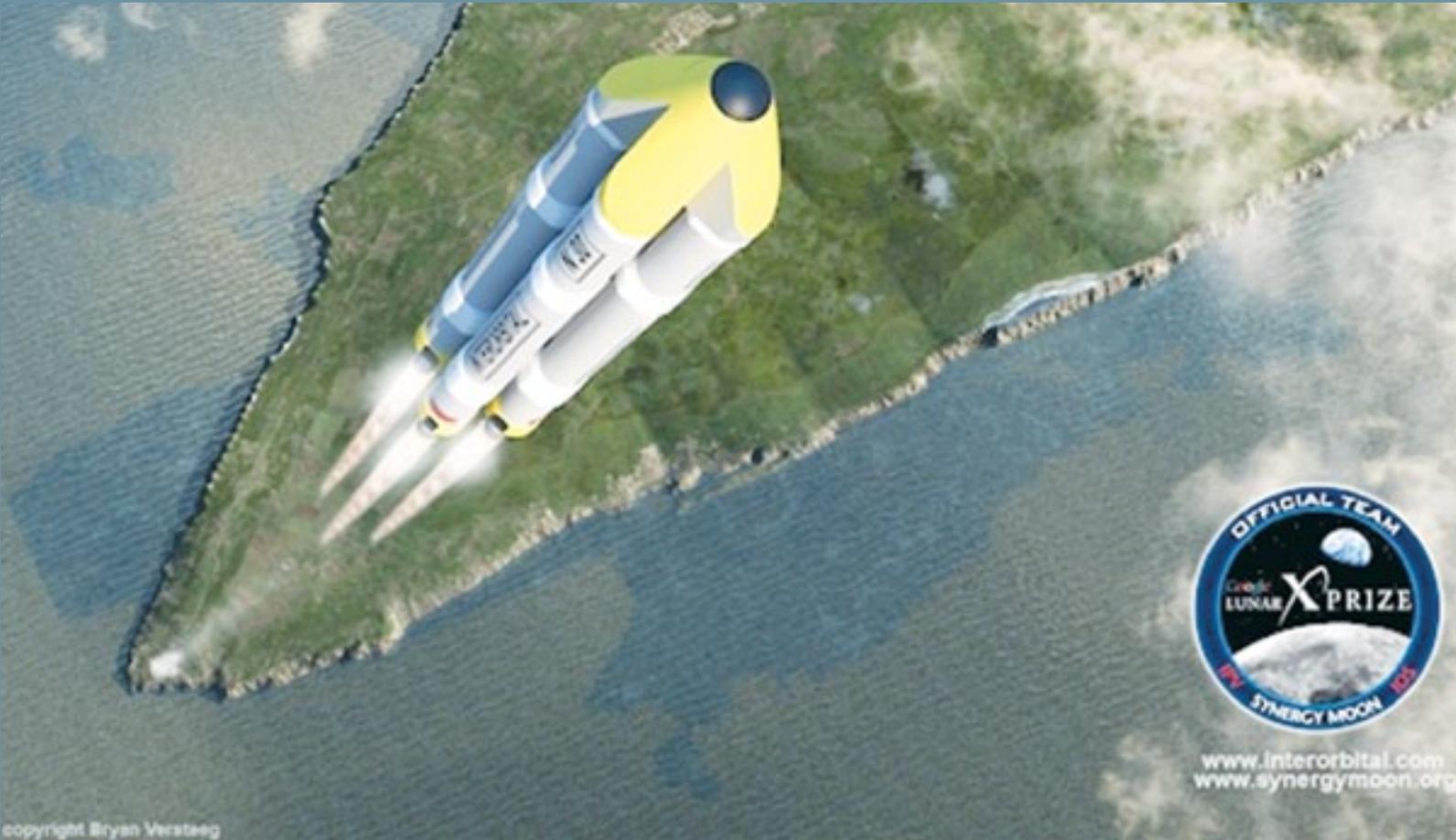
Partnerships Rocket Jumper Olav Zipser's High-Altitude Record Attempt: Spacesuit by Zvezda; Rocket by Interorbital!

German SkyDiver/FreeFlyer Olav Zipser will ride a specially modified rocket to 131,000 ft., then dive back to Earth in an attempt to break Joe Kittinger's 102,800 ft. high-altitude jump record.

Olav will forego the previous balloon-lift method used by the current record-holder, and, instead, will jump from an Interorbital Systems' **SR 145** rocket. The launcher will propel Olav to an altitude of over 40 kilometers (about 25 miles)—higher than any manned balloon can possibly go—where he will eject from the launch vehicle and FreeFly back towards Earth. Zipser explained, "This initial record attempt will be the first of a whole program of increasingly higher dives, culminating with a FreeFly reentry from above the Karman line (100km), from a real space altitude. This is not a stunt. This is a research mission."

Olav will wear a specially modified suit constructed by Russian spacesuit manufacturer **Zvezda**. The company will provide a customized Orlan spacesuit for the FreeFly mission. Data from Olav's jumps will be applied to the continuing development of an emergency orbital reentry spacesuit for high-altitude and orbital rescue operations.

Zipser is competing for the record against Red Bull's *Felix Baumgartner* and French adventurer *Michel Fournier* who are both conducting balloon jumps. Olav will be the first to jump from a rocket. He commented, "The goal of the FreeFly Astronaut Project is to improve the odds of survival for mankind's first space pioneers. Our program will help to create the capability to safely descend from the edge of space in case of emergency." Zipser has signed on for five launches with Interorbital. For more about Olav's FreeFly Project:

http://www.youtube.com/watch?v=yOzg7vpsgn4

*Olva Zipser being fit for, and testing, the Zvezda spacesuit.*

New Commercial Venture Brewing
Interorbital Systems is currently finalizing agreements with the George Washington University (Washington DC), structuring a new commercial venture that will offer advanced forms of satellite and spacecraft propulsion and control. Interorbital

*Olav Zipser selected IOS' rocket for his world-record skydiving attempt.*

IOS' TubeSat Kit, shown with sample ejection cylinder.

Systems and the university will join forces to offer advanced satellite systems, propulsion components, and launch services for their new company's unique high-end line of maneuverable spacecraft. Applications include on-orbit satellite repair and refueling, orbital capture and debris removal, and constellation/swarm reconfiguration.

New Product

Developed as a complement to Interorbital's' wildly successful TubeSat Personal Satellite Kit, which sells with a launch included at a special academic price, the new IOS **CubeSat Kit** was developed to satisfy those who require a cubic form-factor satellite. It uses the same proven electronics developed for the TubeSat, but has more solar cells and is offered in the 1kg and 1.33kg mass
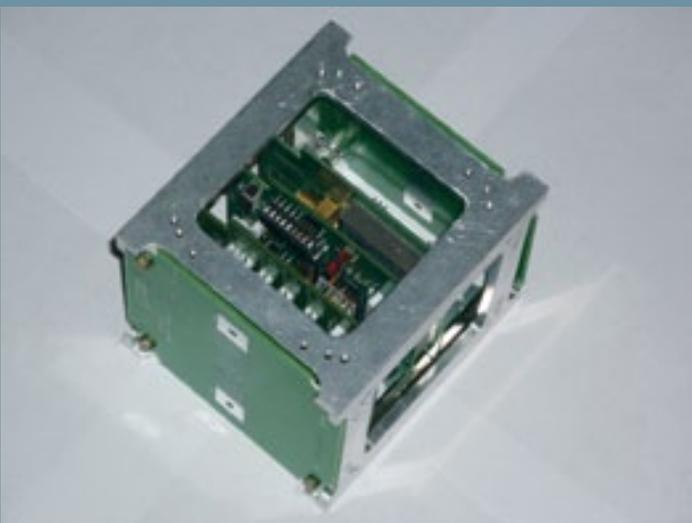
IOS' CubeSat Kit

standards. The CubeSat Personal Satellite Kit uses 60, rather than the TubeSat's 48 solar cells, and it employs an **Arduino** Mini microcontroller, rather than the TubeSat's NetMedia Basic X. Interorbital offers CubeSat Kit-and-Launch packages at special academic prices. Contact IOS for further information at **www. interorbital.com**.

Interorbital Competes

Google Lunar X PRIZE

Work with **GLXP Team SYNERGY MOON** continues toward the finalization of launch vehicle specifications. The development of the 36-module **NEPTUNE 36** (**N36**) rocket is on-going and is based on progress with the CPM test vehicle. SYNERGY MOON's European components are constructing the rovers and lander for the mission.

NASA NanoSat Challenge

Interorbital Systems has announced that it will compete for NASA's $2 million **NanoSat Challenge**, using its NEPTUNE launch vehicle. The first two NEPTUNE launches, to be conducted from the ocean off the coast of California, will carry more than 30 picosats, listed below. These first two missions are projected to take place in the third quarter of 2012, and will serve as IOS' back-to-back competition flights for the prize.

Co-Manifested Payloads On
NEPTUNE Orbital Missions I and II

CubeSats

- *UC Irvine, UCISAT1*
- *Google Lunar X PRIZE (GLXP) Team EuroLuna, Romit 1 (2U from Denmark)*
- *FPT University, Vietnam, F-1 CubeSat*
- *Nanyang Technological University, Singapore*
- *King Abdullah University of Science and Technology (KAUST), Saudi Arabia/US (2 IOS CubeSat Kits)*
- *Google Lunar X PRIZE Team PLAN B (Canada)*
- *NASA Independent Verification and Validation Facility (NASA IV & V Facility, West Virginia) (1 IOS CubeSat)*
- *Institute of Space Technology, Islamabad, Pakistan; ICUBE-1*

TubeSats (constructed from Interorbital Systems TubeSat Kits)

- *Morehead State University (Kentucky Space), plus 2 payloads on suborbital test flights*
- *InterAmerican University of Puerto Rico*
- *University of Sydney (Australia) INSPIRE Program (2)*
- *Aslan Academy (Private LA High School)*
- *Project Calliope (Space Music Project)*
- *Universidad de Puerto Rico / Marcelino Canino Canino Middle School (Micrometeoroid Impact Study)*
- *GLXP Team SYNERGY MOON: Space-Qualifying Rover Team Astronomska Udruga Vidulini's (AUV) Comms*
- *GLXP Team Part-Time Scientists / Fluid & Reason Software (2)*
- *Naval Postgraduate School (3) (Ad hoc orbital communication nodes) plus 2 payloads on suborbital test flights*
- *Defense Science and Technology Lab (DSTL, UK)*
- *Austrian arts and Earth observation program from mur.at with MURSAT*

- United States Military Academy at West Point (2)
- Brazilian Space Institute/108 5th-7th Grade Students, Ubatuba, Sao Paulo, Brazil
- Mexican Satellite Project: ULISES / Soccer Opera from Space
- TriVector Services, Huntsville: TRACsat – TriVector Radiation and Attitude Control Satellite
- AKQA (All Known Questions Answered) Advertising, San Francisco
- La Despensa (The Pantry) Advertising Agency/Iniciativas en Idiomas (Madrid, Spain)
- Earth to Sky's Project: The Golden iPod—Voyager Updated! Bishop, California (2)
- KAUST Saudi Arabia/US,1 TubeSat plus 1 payload on suborbital test flight
- Institute of Advanced Media Arts and Sciences/The Science Project, Inc., Japan (7)
- NASA IV & V Facility, West Virginia, (2 TubeSats)
- Galaxy Global, 1 TubeSat, donated to NASA Educational Program
- Universidad de Chile
- University of Sao Paulo, Brazil (2

Twenty-eight additional projects with committed payloads are in various phases of arranging funding. These include academic, arts, private-sector, military, and corporate groups from the U.S., Peru, Mexico, Singapore, Chile, India, Hungary, Germany, Pakistan, New Zealand, the Dominican Republic, Holland, South Africa, and France. The list of those seeking passage on a dedicated launch grows daily.

About the author
Randa Relich Milliron, Interorbital Systems' Co-Founder, is also the corporation's Chief Executive Officer. Her professional experience spans the space industry, the television and film industries, and academia. She served as a Television News Director and Producer at AFN Berlin. For over a decade, Ms. Milliron has taught television production, communication, and science courses at colleges in Europe and America, and is currently on faculty with the University of Phoenix. Randa holds a BA in Psychology and an MA in African Languages from Duquesne University, with additional studies in Chemistry at Cal Poly Pomona. An award-winning television director/producer, Randa is in charge of all Interorbital Systems marketing and public relations. In an engineering capacity, she also specializes in the development and use of high-temperature composite materials.
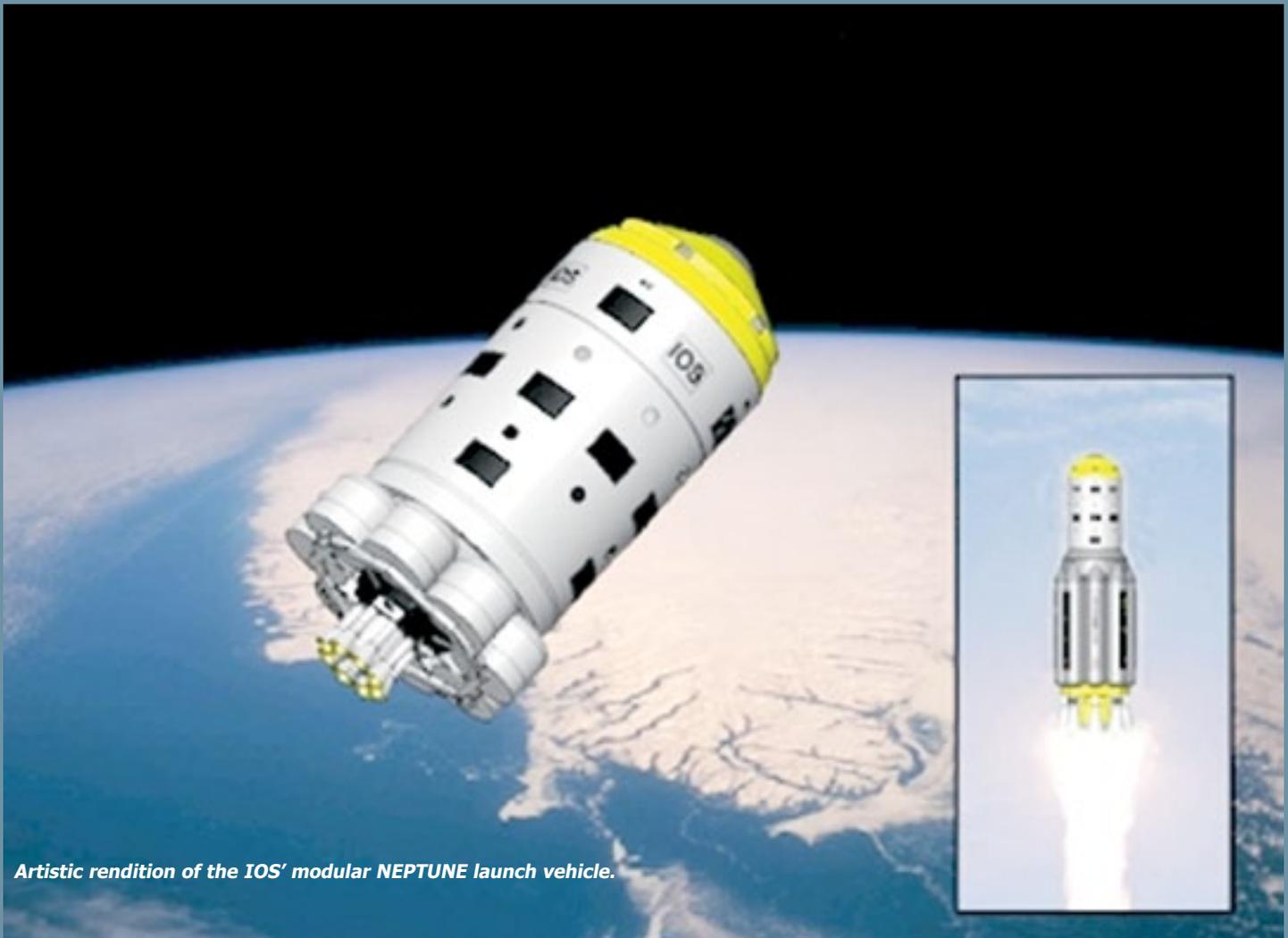
Artistic rendition of the IOS' modular NEPTUNE launch vehicle.

The STEM Of Success

by Janet Stevens, Vice President, Marketing + Communications, Space Foundation

Part of the Space Foundation's mission is; enabling humanity by intellectually preparing the next generation for the challenges that lie ahead. Its education programs, which use space themes and principles to help educators explain complex topics and inspire students to learn, are applicable to grades preK-20, and address the entire curriculum with emphasis on science, technology, engineering and mathematics (STEM)

Programs Reach Students, Teachers + Communities
The **Space Foundation**'s education programs are explained in detail at www.SpaceFoundation.org under the Education tab. The major components are:

- *Space Foundation Discovery Institute* (**SFDI**): The Space Foundation's education headquarters in Colorado Springs house classrooms, a **Mars Yard**, a **NASA Educator Resource Center** and the **AGI Space Missions Simulator,** a laboratory comprising computers and software donated by Analytical Graphics, Inc.

- *Space Across the Curriculum*: week-long intensive graduate-level courses for PreK-12 educators that provide space-related STEM content that is instantly transferable to the classroom

- *New Horizons*: community-centered science enrichment programs that include student programs, teacher work-shops, field trips, town-hall meetings and astronaut and space professional visits

- *STARS* (*Science, Technology and Academic Readiness for Space)*: hands-on student science enrichment programs created for schools based on specific academic needs

- *Teacher Liaisons*: advocates for space-related education who receive Space Foundation training and resources to further integrate space into their classrooms

- *Audience with an Astronaut Programs*: presentations by astronauts that show students first-hand what it takes to become a space explorer

- *Tours of Space Exhibits*: tours of space exhibits for secondary students at conferences, museums and trade shows

- *Career Awareness and Workforce Development Programs*: education, outreach and networking activities for under-graduate students, college graduates and transitioning military who are looking for careers in the space industry

- *National Science Standards Lesson Bank*: free down-loadable PreK-12 national science standards-based lessons

- *Jack Swigert Aerospace Academy* (**JSAA**): an aero-space-focused public middle school created in conjunc-tion with Colorado Springs School District 11 that drives *science, technology, engineering, art and mathematics* (**STEAM**) proficiency through a space-related curriculum, access to SFDI laboratories and involvement with Space Foundation programs

Space Across The Curriculum Courses
Each summer, the Space Foundation offers Space Across the Curriculum professional development courses for teachers at SFDI and, on a contract basis, to subscribing school districts. Course participants can earn continuing education credits, grad-uate credits or work toward master's degrees in related disci-plines at Colorado State University-Pueblo, Regis University or the College of Education at the University of Colorado at Colorado Springs. Public, private and homeschool teachers from around the globe are welcome.

The modest fee charged for each course is often paid through school or school district professional development fees. In addi-tion, general and targeted scholarships are available—and busi-nesses can sponsor courses or scholarships.

2012 Space Across The Curriculum Schedule

Space Foundation Discovery Institute, Colorado Springs, Colorado

June 11-15
Biological + Physical Research: Long-Term Space Travel
Life science teaching concepts based on the effects of microgravity on the human body and the dangers of space exploration. Activities include experiencing astro-naut disorientation in a Barany chair, an underwater pool simulation and a trip to the top of Pikes Peak.

June 11-15
Earth Systems Science: Our Earth Revealed
Lessons that cover the Earth's complex geological history, including erosion, natural disasters and global climate, supplemented by a field trip to the Garden of the Gods and surrounding areas.

June 18-22
Meteorology and Space Weather
Instruction on how to incorporate meteorology into the classroom, including hands-on activities and a trip to the National Oceanic and Atmospheric Administration.

July 9-13
Lunar/Mars Exploration and Base Construction
Project-based teaching concepts focused on establishing and maintaining a human presence on the Moon or Mars. Activities address growing food, creating oxygen and building an actual model of a Lunar or Mars base.

July 16-20
Astronomy Principles for the Classroom: Kinesthetic Astronomy
Exciting methods for bringing the universe into the classroom through kinesthetic astronomy, a hands-on approach to teaching astronomical concepts through kinesthetic movement.
Colorado State University - Pueblo

June 25-29
Rocketry
Instruction on how to build and launch a variety of rockets including how to use rocketry to teach a multitude of standards across various subjects.

For more information or to register, go to ***www.SpaceFoundation. org/education*** or contact the Space Foundation at ***Educational@SpaceFoundation.org*** +1.719.955.3241.

The Space Foundation has launched a new website at http://www.spacefoundation.org. This new site provides an easy-to-navigate, comprehensive view of how the Space Foundation advances space-related endeavors to inspire, enable and propel humanity.

Features include:

• Comprehensive, easy-to-find information on Space Foundation programs and initiatives

• More than 2,400 pages of upcoming events, news briefs, press releases, the Space Watch e-newsletter, white papers, news from Space Foundation partners and more

• Colorful photo galleries and videos

• Lots of downloadable program overviews and fact sheets

• A wide array of free resources for teachers and students

• Enhanced Space Foundation Indexes that provide daily updates on space industry market performance

• Features that allow browsers to share, bookmark, connect to links, access social media sites and provide their feedback

• Stunning and colorful design that includes continually updated images of the sun from Images from NASA's Solar Dynamics Observatory (SDO)

• Clear information on how to find and contact the Space Foundation

The new site was developed entirely in-house by the Space Foundation Marketing team. Web Developers/Designers Luciana Mendes and Christopher Stevens are the lead architects, supported by Marketing Director Nancy Reed and Marketing Project Manager Julie Howell. The website is powered by an open-source content management platform called - that supports millions of websites. The Space Foundation site will be continually updated with additional features and information.

*Don't forget—the **28th National Space Symposium** is upcoming from **April 16th through the 19th** at the **Brioadmoor Hotel** in Colorado Springs Colorado. In fact, you can visit the Space Foundation's NSS website to learn all about this amazing symposium...*

http://www.nationalspacesymposium.org

Executive Spotlight

Steve Beaumont
President
EMEAA—SkyWare Global

Mr. Beaumont is the President of EMEAA (Europe, Middle East, Africa and Asia) of SkyWare Global. Steve has over 25 years experience as an energetic, focused executive in technology, media, telecommunications, consumer goods and manufacturing, and has worked with some of the world's most distinguished companies, including the UK's BBC, ITV, BBSat, Spain's Telefonica, Globecast, Gillette, and Parker Pen. Steve has most recently worked for EMC UK, where he served as an Executive-in-Residence focused on turnarounds and business development.

Prior to this, Mr. Beaumont served in CEO and Managing Director roles for companies in the video-over-the-Internet space where he was heavily involved with sales, marketing, operations and business development. Early in his career, Steve served as General Manager for Gillette Corporation, running the worldwide brand as Group Marketing Director, and eventually becoming Managing Director for all of Gillette's stationery product groups for Africa, Eastern Europe, Middle East and India. In these management roles, Steve was not only responsible for direct sales and the management of distribution partners, he also oversaw research and development, and manufacturing operations.

Steve Beaumont
A fascinating question; in reality I have always worked in the communications industry. I started my industrial career in the writing instrument industry—itself a form of communication. Here I was fortunate enough to build my career through finance serving as Finance Director for Parker Pen, moving into running the UK plant (employing 1200 people at the time), into marketing and then completing this phase of my career running Eastern Europe, Africa, the Middle East and India.

The second phase of my progression was also in the communications arena—video over the Internet—for Narrowstep, Inc, which was later successfully merged with Kit Digital. At the time this was an embryonic technology—pre-YouTube. Having proven the technology we set about gaining customers and in the first year of my tenure we were able to take a fledgling company from almost zero sales to an annual run rate of $15m.

Following a couple of other roles, the opportunity to join Skyware Global arose. I felt that the Satcom sector offered another communications dimension, albeit one that was new to me. Having now worked in the industry for a number of years, I have to say it is a fascinating arena. Helping businesses to provide communication solutions—whatever their industry—is incredibly rewarding. I am convinced that good communications is at the very heart of success and education.

SM
How did you decide that Skyware Global was where you wished to develop your career?

Steve Beaumont
Skyware Global combines engineering excellence with a truly global presence. Our ability to attract the best engineers in the business and use their skills in the design and manufacture of first class antenna and electronic solutions is a unique proposition. Skyware Global is an end-to-end provider of satellite solutions, and that is very appealing, not only to our global customer base, but also to me as an individual—I like to be able to see an end product. The fact that we own and operate manufacturing facilities and are not merely sourcing product is a great advantage. It results in us being able to compete at different levels within the satellite 'food chain'.

In addition to customer specific solutions—designed in-house alongside our customers engineering teams—we also produce standard products for both the DTH (Direct-to-Home) and VSAT (Very Small Aperture Terminal) markets.

In short, Skyware Global was a natural choice for me in that it manufactures to exacting standards, is home to arguably the best design engineers in the business, and offers opportunities to people like me to make a significant difference to the overall business.

98cm Ka-band Elliptical Antenna

SM
As the President—EMEAA, can you tell us about your duties in this newly created role?

Steve Beaumont
Our penetration across the globe varies by market. In the USA we are strong in the DTH and Broadband arenas. In the UK we are very focused on the DTH arena, and throughout the rest of my region we are significant players in the VSAT market. The beauty of the creation of our new strategic business unit covering Europe, Middle East, Africa and Asia is that the region now has a champion—someone who wants to drive growth and deliver high-quality customer service, whether that is to the providers of DTH services, VSAT or via systems integrators. Over the years we have built up a strong network of reputable, professional distributors across this region and one of the roles for me and my team is develop these relationships further and to expand into countries where we might be less well represented. So, driving sales is the most important role.

Secondly, I am now responsible for our manufacturing facility in the U.K.—a plant that has a strong reputation for both volume production and quality. It is my intention to build on this reputation and extend not only current production volumes but also introduce new products. While I am not at liberty to go into detail at this stage, I am able to confirm that we have a new product launch from our UK manufacturing plant starting in July this year.

Ultimately, my role is about delivering customer and shareholder value. Customer value comes in a multitude of deliverables—quality, on-time delivery, value added (design, engineering excellence), innovation, the services offered and price. If we can achieve the right blend of the above then the shareholder value is assured.

SM
What do you see as Skyware Global's competitive advantages?

Steve Beaumont
Engineering, both electronic and antenna; product offering; manufacturing; my colleagues' commitment; product quality; and a global presence all combine to create Skyware Global's unique proposition. We know how to manufacture in high-volume and therefore competitively. Having a strong, reliable and professional distributor base for markets where we do not have a company presence is also important. There is an old adage that I am sure all of your readers will recognize—'people buy from people'—and this principle, alongside the fact that sales in our industry are generally a process rather than an event, makes it very important that we devote time to our customers and build strong business relationships with them; this we do and do well. Product range combined with consistently high standards of quality is a must. A famous entrepreneur (George S Parker, 1888) once said: 'Make something better and people will buy it'. This remains true today in any industry and it is certainly a standard that we operate to in Skyware Global

I mentioned earlier our engineering capability. We have extensive research and development facilities in Scotland, England and Germany. I almost hate to think how many combined years of service our engineering teams have in the industry but I know it is significant. These groups provide innovative solutions to help meet the requirements of our customer base as well as design new generic products. Doing sales calls with any member of this group is a real pleasure.

SM
What changes do you foresee for the company?

69cm Ka-band Elliptical Antenna

Steve Beaumont
Change is essential. Not just for Skyware Global but for any business. It's why we have senior managers—their role is arguably to design and effect change. Yes, it's great to have a winning formula, but if you stay too long in the same position the competition will adopt and adapt your formula and 'steal' your market share. Change has to be thoughtful, in-line with a strategy and work toward goals, as well as being implemented at a speed that your organization can cope with.

Skyware Global will evolve as it has done over the past four years, it will innovate, it will invest and it will continue to be successful as a result. We have just undergone a significant change in structure—the setting up of two distinct strategic business units. In each region, we have to play to our particular strengths, consolidate our respective positions and then push forward.

For the EMEAA region, we are in the process of defining our strategic goals, enforcing the strong customer relationships we have and defining how we can improve our service to these customers through improved service offering, new products and geographic reach. This inevitably will bring about some changes and will deliver on the expectation of customer and shareholder value.

SM
What changes are you planning with your teams to better accomplish your product plans?

Steve Beaumont
We started this interview discussing communication. Communication is the single most important element of education. It is how, after all, that we learn. My approach in terms of the teams I work with is to communicate openly. Allow open discussions, encourage input and create an atmosphere whereby individuals can perform. Each person has a specific task to accomplish and together we can accomplish far more than on our own. Sometimes it is easier to adopt the blinkered approach —just head in a direction ignoring the impact a direction has on others, not appreciating the ramifications one set of actions has on another. While sometimes this can be a necessary path to take, generally it creates chaos.

The need for communication is not just an internal demand. True customer service requires us, as a company, to listen to our customers and suppliers. To truly hear what they are saying—or in some cases what they are *not* saying—will help us develop the right strategic solutions in a timely and valued way.

SM
How do you keep a check on overextending your's and your company's services, i.e., being all things to all needs?

Insight

Steve Beaumont
Good question! I guess the short answer is 'with difficulty'. It is very easy, especially in front of a customer, to want to say yes. This is where a good strategic business plan is of the essence. I don't mean that we have to blindly follow a plan without recourse to reality, but knowing which direction you drive a company is essential, if you are going to get there.

Knowing what you are good at is also an essential part of staying on track. We have carved out the markets we wish to operate in and those are the ones we are focused on. If opportunities arise, as they do, that are outside our core competence, we review them within the management team and decide if it is beneficial to both our customer and shareholder's value proposition.

Even where we see a value, the next action is to evaluate the proposal on an opportunity/costs basis. Will the new demand prevent other projects being delivered-on in a timely manner? Are we able to adequately resource the new demand? Is the investment worthwhile? What happens if we do not accept the new opportunity?

It is this justification process that keeps all of us in check.

SM
Do you plan to keep selling components?

Steve Beaumont
We will continue to support our core product range. We have a clear warranty provision and spares policy. Our distributor base maintains good inventory holding of the core items in order to support local demand.

SM
The Company had been concentrating its efforts to the commercial arena. However, last June, Skyware Global entered into the tactical satellite market. Could you explain the reasoning behind this decision and how such is aiding the Company's efforts? And, given the broadening scope of the Company's efforts, what sort of customer is Skyware Global targeting now? Could you explain the reasoning behind this decision…

Steve Beaumont
It's not only the tactical and military markets that we are expanding into—but also those with broadly similar needs, including homeland security, first responders and commercial broadcasters. While these markets have not traditionally been 'core' to Skyware Global, we couldn't ignore what we were witnessing: increased demand in spite of decreasing budgets. We viewed these sectors as a niche in which we could exploit our core strengths, namely in-house design and manufacturing capabilities and our market-leading expertise in Ka-band.

SM
… and how such is aiding the Company's efforts?

Steve Beaumont
While the specific markets are relatively new to us, we believe a) that our core values and processes are transferrable, and b) that there is a marked opportunity to exploit our skills in the aforementioned sectors. We're investigating organic growth, potential partnerships and acquisitions and the development of completely new products—not to mention re-engineered and re-packaged versions of existing, commercial products.

SM
And, given the broadening scope of the Company's efforts, what sort of customer is Skyware Global targeting now…

Steve Beaumont
Skyware Global is targeting those in the industry that seek a high-tech, lower-cost terminal provider. A good number of our existing customers also have an interest in such adjacent markets so it is not a complete standing start. We are also going through an intensive period of relationship building—specifically with military contractors, system integrators, satellite operators and modem suppliers—to better understand how we can best service these markets. It's an ongoing process, but one that is so far proving profitable.

SM
From your first Channel Master antenna in 1949, to being the world's only complete ODU provider on three continents, what is your game plan for maintaining your product leadership?

Steve Beaumont
Innovation, quality and an ability to consistently remove costs from our manufacturing processes to retain our competitive edge. We are looking at some value-added services around the supply of our products but ultimately we come back to the ability to 'make something better'.

We can only achieve this consistent leadership through our ongoing investment in our engineering resource and manufacturing capability. It's strange that a few years ago the trend was to 'get out of manufacturing'. I strongly believe now that being able to manufacture as close to your market place as is economically feasible is a strong advantage.

I have made several customer visits this year and being able to offer local production, secure in the knowledge that the product will be manufactured to high-quality standards, has, and is, helping us win new customers.

SM
How do you see the current EU financial challenges as affecting both your Company's efforts in this region of the world, as well as the SATCOM industry in general?

Steve Beaumont

Clearly, the economic conditions are difficult. However, we can demonstrate sales growth through 2011 and are working hard to deliver growth again in 2012. We can point to customers that have struggled: most, that fortunately have survived and a small number that have not. The number of projects that are becoming visible is not diminishing. In fact throughout the broader European arena we have seen an increase. Satellites are still being launched, governments want to be re-elected and have a need to demonstrate activity and the expansion of, particularly, broadband services to the more remote areas. Customers based in Europe are working around the globe just as we are.

If there is going to be a negative to this industry I suspect it will be a few years out as initial investment projects become caught in the multitude of cost-cutting—non essential investment programs.

SM

Given the previous questions, how do you currently locate the candidates necessary for the increasing number of engineering positions at Skyware Global?

Steve Beaumont

So far we have been fortunate in that we have access to seats of learning specializing in RF engineering. I acknowledge that it is difficult to find the right blend of professional engineering skills alongside a commercial understanding. We are also fortunate to have several PhD recipients, strong leadership in our engineering functions, and great engineers across all of the relevant sectors.

SM

When discussing employment issues, we note that Skyware Global received an award as Employer of the Year. Congratulations and could you tell us about this award and its significance?

Steve Beaumont

Skyware Global was been named Employer of the Year by the Disabled American Veterans and Auxiliary of North Carolina. The prestigious award recognises the company's peerless record in hiring both veterans and disabled veterans in line with its mantra:

'Talent has no boundaries: Workforce diversity includes workers with disabilities'.

Over the past year, Skyware Global has distinguished itself to become the number one ranked employer of veterans in the state. Of the 175 employees hired this fiscal year, 12 percent were military veterans and of that 50 percent were disabled veterans. Over 10 percent of its total employees are disabled veterans – a statistic that was particularly noted by the judging panel.

SM

Looking back over your career, Mr. Beaumont, would you reflect and tell us about the projects that have brought you the most satisfaction?

Steve Beaumont

This is truly a difficult question to answer. There are many memorable occasions all attracting satisfaction; introducing a limited edition writing instrument with a marketing programme whereby we asked hundreds of global celebrities to autograph a special book which was subsequently auctioned for UNICEF generating $100,000 for that organisation being one. Launching a complete product range in India for the first time and generating over $6m in sales in the first year is another.

It will sound minor to most but going on a sales call and achieving an order is always a buzz. Taking one of our customers at Skyware Global and doubling sales from $5m to $10m in one year is up there with the best.

SkyWare Global receiving the Employer Of The Year Award. Pictured: John Carpenter (second right), and Truett Underhill (right), plus representatives from North Carolina Employment Commission!

Building Transceivers + A New Division

The Company has a new Ka-band transceiver production line and testing facility in Cabuyao, Philippines.

The test system was commissioned, designed, and built entirely in-house by the company's RF Electronics group. The production line consists of seven independent test systems; each tester combines state-of-the-art test equipment with hardware and software custom designed by Skyware Global engineers to maximize testing throughput and ensure product quality.

Test data from each station is automatically stored to a local database and simultaneously streamed off-site to a remote redundant database located in Skyware Global's facility in the U.K. This approach guarantees data integrity, maximizes up-time and facilitates real-time yield monitoring and statistical process control. Traceability of individual transceiver sub-modules (i.e. filters, printed circuit boards and base castings) is built into the test data handling system, allowing sub-module test results for a given finished product to be immediately recalled.

David C. McCourt, Chairman of Skyware Global, said, "This cutting-edge facility reinforces our position as the world's leading Ka-band terminal supplier by ensuring high-quality and excellent value for both current and future Ka-band products."

David Geen, Vice President, Tactical Ground Systems, Skyware Global, added, "In anticipation of our new Ka-band platforms having advanced functionality such as switchable polarization, band-switching and increased M&C capability, these high levels of testing and traceability allow Skyware Global to provide exceptional quality, reliability and performance to all our customers."

Initial production is focused on Skyware Global's latest high-volume Cielo platform, a fully integrated Ka-band VSAT transceiver that offers a unique combination of performance, cost and flexibility to Ka-band system operators worldwide.

The test systems were transported by sea to the Philippines in October of 2011 and successfully commissioned in the last week of 2011. Mass production is scheduled to start in Q1 2012 with a testing capability of more than 2,500 transceivers per month.

And, as we learned in the interview with Steve Beaumont, the Company has recently established the Tactical Ground Systems (TGS) division to enter the tactical satellite market. This division will exploit the company's existing in-house antenna and RF electronics design capabilities—as well as its high-quality, high-volume production and low-cost credentials—to offer affordable solutions for fixed, motorized and mobile tactical terminals for Defense, Homeland Security, Intelligence, First Responder, Emergency Services and other government and stringent commercial applications.

The TGS Group is rolling out a portfolio of products focusing on turnkey solutions for vehicle mounted, FlyAway and ManPack platforms in sizes ranging from 45cm to 2.4m and operating at C-, X-, Ku- and Ka- frequency bands.

David C. McCourt said, "Skyware Global's long-term objective is to exploit our in-house antenna and RF electronics design capabilities to offer a truly holistic, integrated design approach which, in conjunction with our low-cost manufacturing and production methods, is unique in this industry. In a world of decreasing budgets and increasing demand, we intend to offer a portfolio of affordable solutions to the tactical community. We see this market as being underserved and, given the financial climate, believe we are well positioned to take advantage of this opportunity with our high-tech, low-cost credentials. Our expanding research and development department and the recent opening of a facility in Washington DC demonstrate our commitment to the industry."

Heading up the new division will be the newly appointed Dr. David Geen who will be the Vice President of Tactical Ground Systems alongside Mr. McCourt. Dr. Geen has more than 15 years experience in the design of communication systems for both terrestrial and satellite operations and has spent the past nine years managing the company's development of VSAT, broadband and DTH antenna terminals.

Dr. Geen said, "By establishing the TGS division, we have the vehicle to deliver affordable innovation in what has traditionally been a high-cost market. We are already developing unique technologies in reflector deployment and transceiver electronics at Ka-band that will provide game-changing differentiators to our customers. Our proven track record in offering deeply integrated solutions, including third-party modems, will also appeal to the tactical market. With the drive to provide enhanced communications across the tactical edge, our intention is to offer significantly improved volume breaks to facilitate the rollout of communications equipment to more users."

Skyware Global has also appointed Ian Felkner as Senior Product Engineer for the TGS group. Mr. Felkner has more than 12 years of experience in the defense/aerospace industry, comprising specialism in flight hardware and avionics, armored military amphibious assault vehicles, secure tactical military communications products and experimental UAV vehicles. He will work out of the company's new engineering facility in Washington DC and will report directly to Dr. Geen.