

Worldwide Satellite Magazine

July/August 2012

SatMagazine

EO + Imagery

Dual Use Of High Res Satellites

Telenor's Progress

Executive Spotlights:

Peter Mabson, exactEarth

Patrick Shay, DeLorme

Dynamism Of Satellite payTV

Challenges Of VPN Over Satellite

Barbarians At The Gates

CubeSat Advances

Satellite Backhaul For Small Cells

Jos Heyman On Proper Groundings

Publishing Operations

Silvano Payne.....Publisher + Writer
Hartley G. Lesser..... Editorial Director
Pattie Waldt Executive Editor
Jill Durfee Sales Director, Editorial Assistant
Donald McGee Production Manager
Simon PayneDevelopment Manager
Mike Antonovich... Contributing Editor, SatBroadcasting
Chris Forrester..Senior Contributing Editor, Europe
Alan GottliebContributing Editor, Maritime
Bob Gough.Senior Contributing Editor, Asia-Pacific
Richard DutchikContributing Editor
Jos HeymanContributing Editor
Jose Del RosarioContributing Editor
Dan Makinster Technical Advisor
Giles Peeters....Senior Contributing Editor, MILSATCOM
Bert Sadtler.....Contributing Editor
Jim Render..... Contributing Author

Authors

Dimitri Buchs
Chris Forrester
Rani Hellerman
Hartley Lesser
Alan Mercer
Eric Mumm
Elliot H. Pulham
Claude Rousseau
Pattie Waldt

We reserve the right to edit all submitted materials to meet our content guidelines, as well as for grammar and spelling consistency. Articles may be moved to an alternative issue to accommodate publication space requirements or removed due to space restrictions. Submission of content does not constitute acceptance of said material by SatNews Publishers. Edited materials may, or may not, be returned to author and/or company for review prior to publication. The views expressed in our various publications do not necessarily reflect the views or opinions of SatNews Publishers. All rights reserved.

All included imagery is courtesy of, and copyright to, the respective companies.

InfoBeam

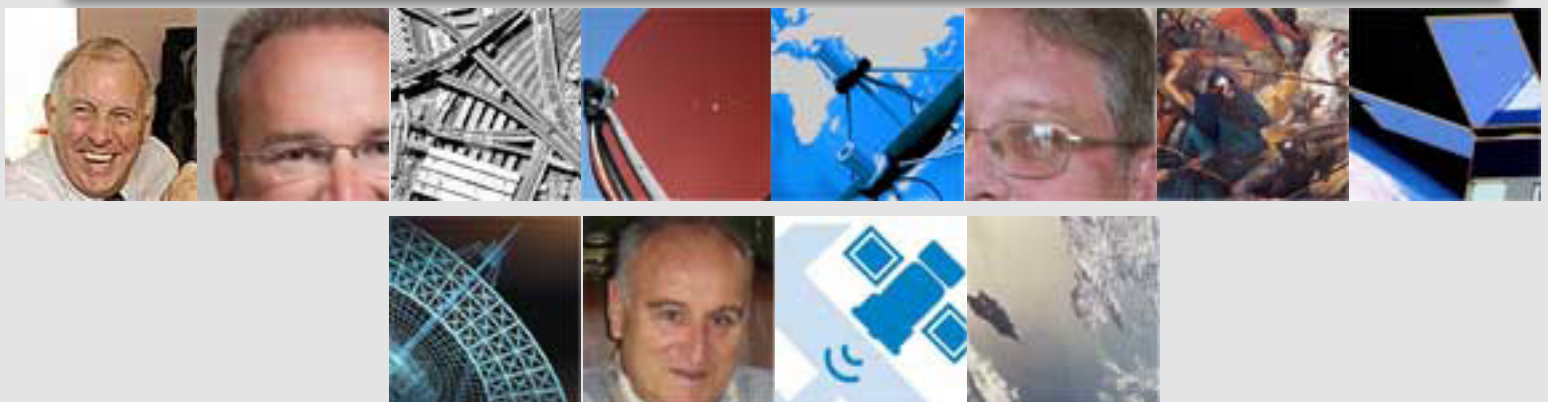
The Pegasus Push (Orbital Sciences).....	Page 06
New Business Propellant (Astrotech).....	Page 06
Most Suitable For Backhaul (Hughes).....	Page 08
Sea Connectivity Satisfaction (O3b).....	Page 08
"Magical Breakthrough" (Newtec).....	Page 08
Any One Of Three (ILS).....	Page 10
DSNG Designs (WORK Microwave).....	Page 10
Vega's Kazakhstan Mission (Astrium).....	Page 10
Second Jack-Up Contract (Imtech Marine).....	Page 12
Magnificent Seven.....	Page 12
Air Traffic Advancements (Aireon).....	Page 14
Capturing Capacity (Earthly Orbit).....	Page 17
Cheers! See You In London (COMSYS)	Page 17
Two To Go, Please (HISPASAT + Orbital).....	Page 18
Microwave Makings (COM DEV Int'l).....	Page 18

Advertiser Index

2012 International Satellite Directory.....	Page 55
Advantech Wireless.....	Page 07
Arabsat Satellite.....	Page 03
APSCC Asia-Pacific Satellite.....	Page 57
China Satellite 2012.....	Page 13
COMSYS-VSAT2012.....	Page 15
Comtech EF Data.....	Page 37
ESTEL Conference Organization.....	Page 79
Giga Communications Ltd.....	Page 27
Giga Communications Ltd.....	Page 65
Harris Corporation.....	Page 05
IBC 2012.....	Page 25
ImageSat.....	Page 19
MITEQ / MCL, Inc.....	Page 47
MTN Government Services.....	Page 09
Newtec CY.....	Page 31
NSR (Northern Sky Research).....	Page 61
Space Foundation.....	Page 49
Teledyne Microwave Solutions.....	Page 35
Wavestream Corporation.....	Page 33
W.B. Walton Enterprises, Inc.....	Page 11

Published monthly by
Satnews Publishers
800 Siesta Way
Sonoma, CA 95476 USA
Phone: (707) 939-9306
Fax: (707) 939-9235
© 2012 Satnews Publishers

Prime: Dual Use Of Very High Resolution Satellites	Page 20
<i>By Rani Hellerman, ImageSat</i>	
Forrester's Focus: Telenor's Dramatic Progress.....	Page 26
<i>By Chris Forrester, Editorial Director, Broadgate Publishing + Contributing Editor</i>	
Executive Spotlight: Patrick Shay, DeLorme	Page 30
<i>By the editors</i>	
SatBroadcasting™: Continued Dynamism Of Satellite payTV.....	Page 36
<i>By Dimitri Buchs, Euroconsult</i>	
Uplink: The Challenges Of VPN Over Satellite	Page 40
<i>By Bentley Walker Newsletter Editors</i>	
Executive Spotlight: Peter Mabson, exactEarth LLC	Page 42
<i>By the editors</i>	
Re:Sources: The Road To The Future—Signing Bonuses.....	Page 50
<i>By Bert Sadtler, Boxwood Search</i>	
Downlink: Barbarians At The Gate	Page 52
<i>By Elliot Holokauahi Pulham, Space Foundation</i>	
Insight: Powering Up—Advances In CubeSats Enable New Apps	Page 56
<i>By Erik Mumm, Honeybee Robotics Spacecraft Mechanisms Corp.</i>	
Uplink: Adjusting The Focus In HTS Mobility	Page 60
<i>By Claude Rousseau, NSR (Northern Sky Research)</i>	
Heyman's Focus: Proper Groundings In Western Australia.....	Page 62
<i>By Jos Heyman, TIROS Space Information + Contributing Editor</i>	
Brief: Satellite Backhaul For Rural Small Cells	Page 66
<i>By Erik Mumm, Honeybee Robotics Spacecraft Mechanisms Corp.</i>	
Insight: The Isle Of Man—Onward, Onward, Onward.....	Page 68
Re:Sources: A Video Pathway To Learning—STEM Flix™	Page 72
SatBroadcasting™: Live From London—The 2012 Olympics.....	Page 76
<i>By Alan Mercer, SatStream</i>	



The Pegasus Push

Orbital Sciences Corporation successfully launched the company-built Nuclear Spectroscopic Array Telescope (NuSTAR) satellite for the National Aeronautics and Space Administration (NASA) into its intended orbit.

The "Stargazer" carrier aircraft taking off from Kwajalein Atoll in the South Pacific on its 27th successful Pegasus mission. Pegasus has launched from six different sites worldwide, the first time a space launch vehicle has demonstrated such operational flexibility.

The Pegasus/NuSTAR mission originated from the U.S. Army's Reagan Test Site, Kwajalein Atoll, which is a part of the Marshall Islands in the mid-Pacific Ocean. Following a one-hour preplanned positioning flight, the Pegasus rocket was released from Orbital's L-1011 carrier aircraft at approximately 12:00 p.m. (EDT). After a 13-minute powered flight sequence, Pegasus launched



the 770 lb. NuSTAR satellite into its targeted circular orbit approximately 400 miles above the Earth.

Orbital designed, manufactured and tested

the NuSTAR satellite at its Dulles, Virginia, satellite manufacturing facility. The Pegasus rocket was assembled and tested at company facilities at Vandenberg Air Force Base, California. Today's successful launch by the Pegasus rocket was the 27th consecutive successful mission for the Pegasus program over a 15-year period and the 41st overall flight of the company's unique air-launched system since its introduction in 1990.

Mr. Ron Grabe, Orbital's Executive Vice President and General Manager of its Launch Systems Group, said "The NuSTAR program is another 'dual' mission for our launch vehicle and satellite engineering teams, building on our history of supporting successful NASA scientific programs such as AIM, GALEX, SORCE, ACRIMSAT and IBEX with our launch vehicles and satellite platforms."



The "Stargazer" carrier aircraft taking off from Kwajalein Atoll in the South Pacific on its 27th successful Pegasus mission. Pegasus has launched from six different sites worldwide, the first time a space launch vehicle has demonstrated such operational flexibility.

New Business Propellant

Astrotech Corporation has announced that its Astrotech Space Operations (ASO) subsidiary secured a \$1.1 million purchase order to supply hypergolic propellants support to a spacecraft manufacturer.

ASO will provide propellant delivery and export-related services from its headquarters in Titusville, Florida. From their HQ, as well as from Vandenberg Air Force Base in California, Astrotech Space Operations provides all support necessary for government and commercial customers to successfully process their satellite hardware for launch, including advance planning; use of unique facilities; and spacecraft checkout, encapsulation, fueling, and transport.

Additionally, ASO has demonstrated expertise in design and fabrication of spacecraft processing facilities and ground support equipment "GSE". In its 30 year history, ASO has successfully supported the processing of nearly 300 spacecraft.



Astrotech assists in preparing a satellite for launch.

Most Suitable For Backhaul

Hughes Network Systems, LLC, has successfully completed end-to-end verification of its HX System with Nokia Siemens Networks' GSM Base Station.

GSM operators can now have full confidence that the Hughes HX260 platform in combination with Nokia Siemens Networks' GSM Radio Access operating over the bandwidth optimized 'Packet Abis' interface, provides a proven and reliable satellite mobile backhaul solution.

Hughes HX260
Mesh/Star Broadband Router



According to Joerg Ambrozy, single radio access transport product manager at Nokia Siemens Networks, "The Nokia Siemens Networks Packet Abis and Hughes HX260 together provide a strong Mobile Broadband Solution for Satellite Backhaul which improves voice quality and data throughput for our customers. We are looking forward to continuing our joint efforts with Hughes to also deliver optimized 3G and 4G backhaul solutions via next-generation high throughput satellites."

Supporting cellular backhaul in either star or mesh configurations, the HX System's fast packet processing design reduces round trip latency to approximately 600 milliseconds and one-way jitter to 20 milliseconds, resulting in superior voice quality and very efficient data throughput—essential for real-time

applications. A just-in-time burst feature on the return channel ensures that data packets are transmitted at the earliest possible opportunity.

Sea Connectivity Satisfaction

Dedicated to delivering high-speed connectivity anywhere, O3b Networks has launched O3bMaritime, a first-of-its-kind broadband solution capable of providing cruise ship guests and crew with more than 100 times the average Internet access rates at sea.

Innovative cruise ship operators will be able to significantly enhance guest satisfaction through fast, affordable broadband connections. In game changing performance unmatched and unrivalled by current and future maritime offerings, O3bMaritime will deliver over 500 Mbps in aggregate bandwidth to a single vessel.

Cruise operators facing increasing competition from luxury shore based resorts no longer need to suffer the performance compromise necessitated by today's

maritime connections. Guests can surf, download, work, watch, speak and stream in the same way they do on land, unlocking new revenue opportunities for operators and reinforcing best-in-brand service in all aspects of the cruise experience.

The only offshore solution to deploy dedicated steerable beams, O3bMaritime will track a ship's course continuously, optimizing performance for the guests onboard.

In the competitive world of super and mega-yachts, only O3bMaritime can provide the range of benefits that overwhelm existing satellite based solutions today. O3b's crystal clear voice and 65ms mouth-to-ear latency provides peerless voice quality. From cruise operators to super-yachts and from guest experience to crew welfare, O3bMaritime is redefining connectivity at sea and is now less than one year from launch.

Steerable Beams Tracking your Ship



"Magical" Breakthrough

Newtec has ushered in a new era of bandwidth efficiency by breaking the magical 0.5 Gbps two-way throughput over a 72 MHz transponder on a Eutelsat satellite.

Testing was performed at Eutelsat's teleport in Rambouillet during the night in order not to disturb crucial daytime sport transmissions. A significant margin was taken in cloud cover conditions to ensure the tests were relevant for real-life high availability service.

In the two-way high speed backbone tests, Newtec combined its Bandwidth Canceler and Next Generation modems (Newtec MDM6000 series) to achieve a staggering 506 Mbps (2 x 253 Mbps).

Innovative elements were used, including Clean Channel Technology® (a Newtec technology for implementing lowest roll-off and filtering to boost throughput). New modulation and Forward Error Correction (FEC) codes were also used, which can be seen as demonstrators for evolutions in extending the DVB-S2 standard. In particular for this part of the test, a complete reworked 32 APSK 135/180 (135 over 180) modulation proved to be most optimized.

In another test, 352 Mbps was achieved in a one-way distribution set-up over the 72 MHz transponder using 64 APSK modulations and related codes, with significant margin on the Ku-band system.

Any One Of Three

International Launch Services (ILS) and Asia Satellite Telecommunications Co. Ltd. (AsiaSat) announced a contract for an ILS Proton launch service as early as 2014 from the Baikonur Cosmodrome in Kazakhstan—this will be for launching one of AsiaSat’s future satellites, AsiaSat 6, AsiaSat 8 or AsiaSat 9, a replacement satellite to be procured for AsiaSat 4.

The launch contract includes an option for AsiaSat to order one additional launch service from ILS for any of its upcoming three satellites.

DSNG Designs

WORK Microwave has debuted their new DVB-S2 Modem SK-DV.

Using DaVid technology, the device offers simultaneous transportation of data (network connection) and live broadcasting (video content) over a single satellite carrier. The DaVid technology works by aggregating multiple MPEG transport streams and IP data into a single baseband stream, called multistream, which is then inserted into a broadcast modulator.

The single carrier signal is transmitted via satellite by the modulator and then received by multiple receivers that separate and extract specific content parts based on their DVB-S2 Input Stream Identifier (ISI).

The DaVid technology configures all DVB-S2 baseband parameters independently for each stream, providing users with the flexibility to choose

the number of streams that need to be processed.

The combined modem includes several features and capabilities designed to provide users with maximum bandwidth efficiency and data throughput at all times. The DVB-S2 Modem SK-DV uses Generic Stream Encapsulation according to TS 102 606, which ensures the device is compatible with products from other providers compliant to the DVB-S2 standard and allows users to easily incorporate the modem into existing operations.

Additionally, advanced modulation up to 32APSK offers the most efficient satellite communication for dedicated links, enabling broadcasters to deliver reliable, flawless transport.

Multichannel ACM functionality (OptiACM) compensates for disturbances in the satellite link due to physical conditions—such as humidity and atmospheric precipitation—through real-time adaptation of transmission parameters according to link conditions, improving data throughput in all usage cases and under all environmental conditions.

Additionally, the DVB-S2 Modem SK-DV optimizes the amount of usable bandwidth through a traffic shaping capability that controls the volume of traffic being sent over satellite and determines minimum/maximum data rates for each content type. Traffic is differentiated into groups and prioritized with respect to a number of configurable parameters.

Built on a cross-layer system design that applies interlayer communication exchange across the protocol stack, the DVB-S2 Modem SK-DV operates at an efficient data rate of up to 160Mbps, supporting high-speed data transmission so broadcasters can deliver live high-definition video content over a satellite link—in addition to Internet file transfer.

Vega’s Kazakhstan Mission

The DZZ-HR high-resolution observation satellite is being built by Astrium for the government of the Republic of Kazakhstan.

Weighing 900 kg at launch, the DZZ-HR satellite will be launched by Arianespace’s Vega light launcher into a

Sun-synchronous orbit at an altitude of about 750 km. It will be launched from the Guiana Space Center, French Guiana, in the second quarter of 2014.

The DZZ-HR system will be independently controlled by Kazakh operators who have been trained by Astrium.

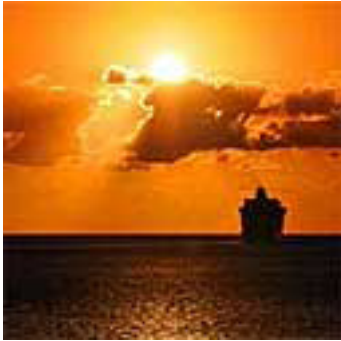
Using images acquired by the DZZ-HR satellite from the entire planet, the system will provide very-high-quality panchromatic and multispectral products for a wide range of applications, including cadastral surveys, management of natural resources, environmental monitoring and homeland surveillance.

Arianespace Chairman and CEO Jean-Yves Le Gall said: “Today, with the European launcher Vega, we can offer all customers new launch services for this type of mission. This is the third contract for Vega, after Sentinel 2 and 3, and this time we are serving an end-customer outside of Europe. We are also delighted to be working once again with Astrium Satellites, with whom we have a long-standing relationship of mutual trust.”



Second Jack-Up Contract

Imtech Marine (Radio Holland Netherlands) has been awarded an extensive contract from Jack-Up Barge for the communication and IT systems for its newbuild, self-elevating platform JB-118.



This follows a similar contract for the JB-117, which Imtech Marine successfully completed earlier this year. Additionally, Jack-Up Barge and Imtech Marine have concluded an Advanced Support Agreement for the vessels, which includes 24/7 remote Monitoring & Maintenance and covers all of the systems onboard.

The recently awarded contract for the latest barge is extensive comprising the PA intercom and alarm system, VSAT network, PABX central telephone system and the total navigation, communication and entertainment package, including IPTV and satellite television. Additionally, Imtech Marine will install VHF/UHF communications for the crane operators, a meteo and CCTV system, as well as a communications system for the helideck.

Nico van Leeuwen, Imtech Marine Netherlands Sales & Marketing Manager, says the two companies started to work together around 18 months ago on the JB-117, which was built in Batam, Indonesia. "The JB-117 was a difficult installation, very complex; our knowledge gained from this project has provided valuable input for the JB-118 and any future orders."

One aspect that makes the installation quite challenging is that the barge typically has 50 to 80 crew onboard

of different nationalities and of course, they would all like to watch their favorite TV shows on different stations.

Paul Koole, Project Manager E&I, Jack-Up Barge, said, "The JB-117 is working on a three-year contract on a wind farm in the North Sea. Jack-Up Barge recognises that this access to television and the Internet is very important for crew welfare."

Jack-Up Barge has taken out an Advanced Support Agreement for the vessels, which includes 24/7 remote Monitoring & Maintenance and covers all of the systems onboard, including VSAT, computers, navigation and communication equipment. As the barges are often working offshore for many months at a time it is vital that any problems can be sorted out remotely. This agreement also includes systems management. For instance when there are crew changes and a new crew is boarding everything is set up ready, email accounts, login passwords etc. so they don't have to worry about changing the systems themselves.

Imtech Marine has already started on the pre-engineering and the drawings for the JB-118, which is being built near Hong Kong in Shenzhen and installation work is likely to start in the third quarter. The JB-118 is expected to be delivered mid-2013.

Jack-Up Barge is one of the world's leading suppliers of Self Elevating Platforms for both the energy and heavy civil construction markets. Based in Slidrecht in the Netherlands, Jack-Up Barge supplies two types of Self Elevating Platforms, the Modular and Monohull Jack-Up.

Magnificent Seven

Seven pacific nations have come together to initiate their own satellite program to reduce dependency on Internet and IDD calls currently provided by other nations.

The provision of low cost Internet and international calls is a public service that was made a priority for all the nations involved. The seven nations include Vanuatu, Solomon Islands, Fiji, Tuvalu, Tonga, Papua New Guinea and New Caledonia.

His Excellency Thureign of Vanuatu said that the launch of the satellite is a long-term investment by all the nations involved bringing economic benefits and savings for the population but also for attracting international businesses by providing efficiencies and economies that are unacceptably high under the present supply. He said, "We are looking to elevate the standard of our people and their access to continuing education through the Internet and expanding their horizons and community"

Funding from this project has been provided from various donations, especially from China. The satellite will be launched from Russia using existing commercial launch vehicles. Pacific ComNet have commissioned the satellite from Russia-based TIME Technologic LLC who have entered a Joint-venture for this project with Peixin Investment (HK) Ltd. The life expectancy of the satellite is 50 years.



Aireon(sm)—Air Traffic Surveillance Advancements Ahead

For the first time ever, air traffic management agencies around the globe will be able to continuously track aircraft anywhere in the world.

Aireon LLC, a planned joint venture announced by Iridium Communications Inc. (Nasdaq: IRDM), will make this transformation possible.

Aireon will deliver this revolutionary surveillance capability to Air Navigation Service Providers (ANSPs) around the world and their commercial airline customers through a planned joint venture between Iridium and NAV CANADA with support from the U.S. Federal Aviation Administration (FAA) and suppliers Harris Corporation (NYSE: HRS) and ITT Exelis (NYSE: XLS). NAV CANADA, whose participation is subject to the completion of formal agreements in the near future, intends to be Aireon's first customer.

Aireon will enable fully global and continuous space-based monitoring and control of aircraft, even over oceans and remote regions where it is not currently possible.

Aireon's service will use space-qualified Automatic Dependent Surveillance-Broadcast (ADS-B) receivers

built into each of the 66 satellites in Iridium NEXT, Iridium's second-generation satellite constellation, to deliver this transformational capability. Iridium NEXT satellites are scheduled to launch from 2015 to 2017, and will provide this capability as the new satellites are commissioned, with full service expected by 2017.

Aireon's new offering will enable commercial airline operations to be more efficient, safer and more environmentally friendly.

Today the world is divided into Flight Information Regions where ANSPs safely manage aircraft within their designated coverage areas. For example, across the heavily traveled North Atlantic, the FAA, NAV CANADA and NATS in the UK manage traffic between points in Europe and North America but need to keep aircraft widely-spaced in part because of the lack of radar visibility over oceanic airspace. Aireon will provide complete visibility to all aircraft everywhere, helping ANSPs decrease inefficiencies.

NAV CANADA is ideally suited to be a partner in Aireon since it manages the second largest air navigation service in the world by traffic volume.

In its North Atlantic operation, NAV CANADA provides air traffic management for 1,200 flights per day—the busiest oceanic airspace in the world. NAV CANADA operates one of the world's most advanced oceanic air traffic management systems, and has been a pioneer in the use of ADS-B over remote areas and now into the North Atlantic through ADS-B ground stations over Hudson Bay, the Eastern Arctic and Greenland.

"I am excited that Iridium will once again be able to use its unique global satellite network to expand connectivity beyond the limitations of ground-based systems," said Matt Desch, CEO of Iridium. "Just as we opened the world of personal communications far beyond the 10 percent of the Earth's surface that is covered by terrestrial networks, we are now extending the reach of land-based aircraft tracking systems. This is a big milestone for commercially hosted payloads and it will be a ground-breaking use of Iridium NEXT. Iridium is the only company with the capability and reach to enable this, and we are thrilled that our service will make air travel more efficient and safer. Aireon is truly revolutionary."

For Iridium, Aireon is the product of its multi-year commitment to establish an innovative use of the hosted payload capability that will be available on Iridium NEXT. The ADS-B 1090 MHz Extended Squitter (ES) receivers on every Iridium NEXT satellite will complement ground-based air navigation systems currently in use by seamlessly relaying, in near-real time, position and status information of aircraft flying over oceans, poles and remote regions to air traffic controllers on the ground.

This new capability will extend the benefits of current radar-based surveillance systems, which cover less than 10 percent of the world, to the entire planet. The Iridium NEXT constellation, a low-Earth orbiting (LEO) system of inter-linked satellites, is the only system that will be able to seamlessly provide ADS-B coverage globally.

"We have pulled together a world-class team of experts in air traffic management and communications to make this venture possible," added Don Thoma, president and CEO of Aireon and an Iridium executive vice president for more than a decade. "By bringing together

Iridium, NAV CANADA, Harris and Exelis, Aireon will represent unparalleled experience in developing and deploying advanced air traffic surveillance systems. Together, we will create a very unique and important service, and we are poised to help the aviation industry evolve to new levels of efficiency and safety."

Multinational mandates already require commercial aircraft to be fitted with ADS-B transmitters. Given that such upgrades are already underway (and required to be completed in U.S. airspace by 2020 as part of the FAA's NextGen initiative), Aireon will enable air carriers to maximize returns on billions of dollars in aircraft avionics upgrades they are already making without the need for any additional onboard equipment. They will benefit from improved climb profiles, more flexible routing, and more efficient use of airspace—saving substantial fuel and time on oceanic routes.

"NAV CANADA and other ANSPs around the world have made significant progress in our efforts to enhance flight efficiency in oceanic airspace using today's technologies and procedures; however, there are still significant limitations due to the absence of viable surveillance over most of the world's oceans," said John Crichton, president and CEO of NAV CANADA. "These limitations ultimately waste fuel and increase carbon emissions, despite the best efforts of air traffic services personnel. Aireon will enable a quantum improvement. For that reason, NAV CANADA aims to be a major user of this new ADS-B capability, starting with the busy North Atlantic airspace. Furthermore, we feel that this Iridium

innovation is so important to the future of air traffic management—with significant transformative potential—that we have decided to become a partner in this venture, subject to the completion of formal agreements."

In the U.S., the FAA has been working with Iridium and the Aireon team over the past year to evaluate the capabilities of space-based ADS-B systems.

"Because the insight and control of air traffic management through space-based ADS-B is unparalleled, the FAA will be engaged with Iridium and its Aireon partners in setting the specifications and configuration of space-based ADS-B surveillance," said Chris Metts, FAA air traffic vice president, Program Management Organization.

Aireon will deliver significant value to both public and private stakeholders in the global aviation community. Planned benefits delivered by Aireon will include:

- *Operational Cost-Savings*
- *Lower Environmental Impact*
- *Extended Operational*

Exelis has been the systems engineering provider for Aireon and has extensive experience collecting and providing air traffic information as the operator of the FAA's ground-based ADS-B system.

"Exelis has been working closely with Iridium on the development of the space-based ADS-B system applying our experience designing, deploying and operating the terrestrial ADS-B network in the U.S., which serves as the backbone of the FAA's NextGen initiative," said Mike Wilson, president of Exelis

Information Systems. "With this proposed joint venture our goal is to ensure that the space-based ADS-B service offered by Aireon seamlessly integrates with, and extends, existing ground-based services, setting a foundational building block of a globally harmonized space-based air traffic management system."

Harris Corporation has been selected as the payload provider for Aireon after an extensive, competitive process. Leveraging more than 50 years of space experience and a close relationship with the FAA, Harris will provide 81 space-qualified ADS-B receivers to fly as hosted payloads on Iridium NEXT, including in-orbit and ground spares.

"This is the most significant hosted payload program in the space industry to date," said Bill Gattle, Harris Corp. vice president of space systems. "Through our partnership with Aireon, we will leverage our deep technical expertise in space payloads and air traffic control systems to deliver extremely flexible solutions at an affordable cost."

Assuming the successful negotiation of long-term service contracts with NAV CANADA and other ANSPs, and related financing, Aireon is expected to generate approximately \$200 million in one-time hosting fees for the integration and launch of the payloads between 2014 and 2017.

Iridium also expects to receive annual data fee revenue and have a significant retained interest in Aireon, which will evolve it from being the largest shareholder today to between 40-50 percent ownership during the deployment of Iridium NEXT. The Company expects that Aireon will be accommodated on future Iridium constellations, enabling continuity of its operations well beyond 2030.

Fieldstone Partners and NEXA Capital Partners are advising and supporting Iridium in the formation of Aireon LLC. Aireon LLC, a Delaware limited liability company, will be headquartered with Iridium in McLean, Virginia.



Capturing Capacity

The Russian Satellite Communications Company (RSCC), the Russian state satellite operator, and Earthly Orbit Communications Limited, a U.K.-based satellite solution provider, jointly announced that they will grow their existing relationship, which currently includes leasing large volumes of capacity on Express AM44 (11 degrees West) and Express AM22 (53 degrees East), with a cooperation agreement for Express AM-8, to be launched in 2013.

The agreement was reached during a series of meetings at the Cabsat 2012 exhibition in Dubai a signing at CommunicAsia 2012.

Earthly Orbit provides customers with a choice

of teleports to operate using RSCC satellites and additionally with high quality link performance analysis and capacity optimisation, utilising the latest advances in satellite communication technologies, modulations and coding. This makes it possible for Earthly Orbit to provide best value and service across the globe, often reducing client costs. Earthly Orbit serves a diverse range of clients, including Teleports, Oil & Gas, Mining, Banking, Military, Maritime and Mobile users.

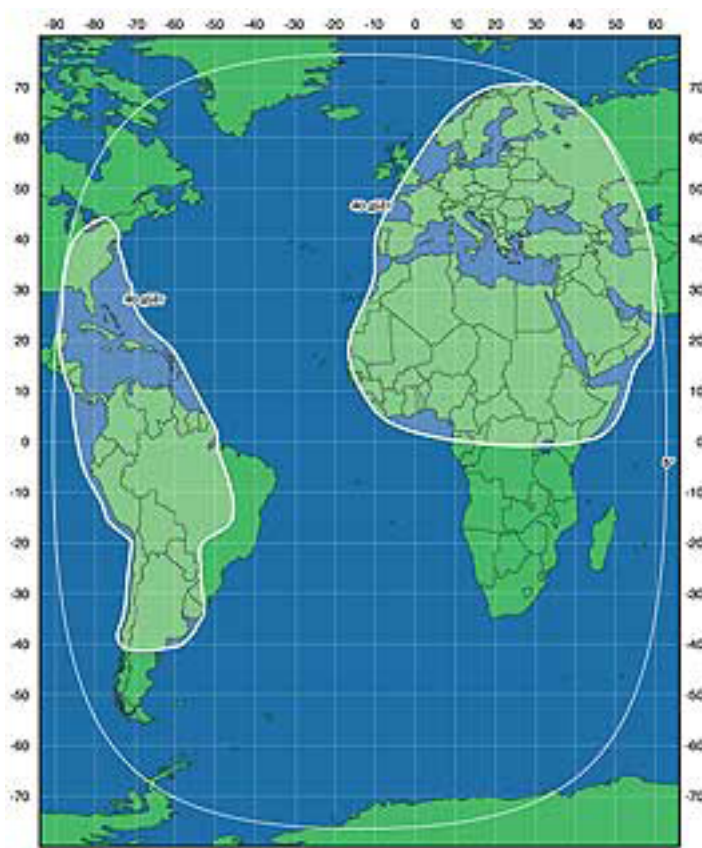
The Express-AM8 satellite is scheduled to be launched to 14 degrees West in the third quarter of 2013. The satellite will be equipped with six high-power Ku- and two C-band spot beams providing coverage of Europe, Africa, the Middle East,

North and South America. Express-AM8 is designed for high-quality video, voice and data services in both local and transatlantic networks. Earthly Orbit will initially be committing to three C- and two Ku-band transponders.

Cheers! See You In London

Learn experts' views regarding the future needs of customers and the development of new applications and platforms, all this and more (whew) at the Lancaster London Hotel from September 12-14, which means there are less than three months

global speakers and delegates from the industry because it is the only event which covers operational experiences and customer application examples from all regions of the world. Whether you need an industry update, coverage of new technologies and market developments, a chance to network with some of the most influential people in the VSAT business or just some inspiration, the COMSYS VSAT2012



Express AM-8 coverage map

to go until VSAT2012.

At this event, the leading innovators in the VSAT market will deliver their views on the future needs of customers and the development of new applications and platforms. COMSYS has negotiated special discounted rates at the Lancaster London Hotel for conference attendees, subject to availability. Please click on the photo at the top of the next column for further information.

The COMSYS VSAT Conference reports indicate it draws the highest profile

Conference will meet your requirements. Building on 13 years of success, COMSYS VSAT2012 has moved to a larger venue to satisfy the demand for additional places—the Lancaster London Hotel. On the day before the main conference COMSYS there's also a choice of one-day workshops (VSAT Market & Technology Essentials or Satellite Communications Fundamentals).

VSAT2010 and VSAT2011 conferences were sold out—book early to secure your registration.

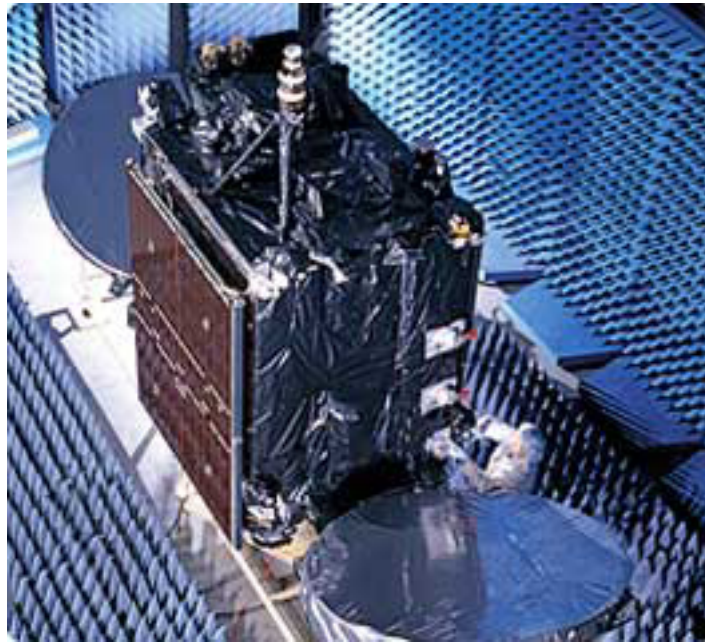
Two To Go, Please

Group HISPASAT CEO Carlos Espinós and Executive Vice President Mike Larkin of Orbital Sciences Corporation have signed a contract in Santander, Spain, for the construction of two new satellites, Amazonas 4A and Amazonas 4B.

These satellites will be located at orbital position 61 degrees West longitude to enhance the company's presence in the Americas, where HISPASAT is a leader in the dissemination of content in Spanish and Portuguese.

The Amazonas 4A and 4B satellites will allow HISPASAT to meet the growing demand for satellite capacity, mainly for satellite television platforms, in Latin America. This demand is expected to increase even more due to major sporting events taking place in Brazil in the coming years, including the World Cup 2014 and the 2016 Olympics.

These two satellites, together with the upcoming launch of the Amazon 3, are examples of HISPASAT's strong commitment to the Latin American market. Thus, HISPASAT will strengthen its position in the region,



Orbital's GEOStar communications satellite

characterized by high growth potential for both video and broadband services, and maintain a significant market share. In 2011, 49.1 percent of HISPASAT's total capacity leasing income came from the Americas.

The Amazonas 4A and 4B satellites, along with those already provided in its Plan for Growth and Expansion, will double HISPASAT's in-orbit fleet over the next four years.

Five satellites are currently in orbit and will soon be joined by the Amazonas 3, the AG1 spacecraft, followed by the two new satellites from Orbital, and the Hispasat 1F. HISPASAT's total investment will exceed one billion euros and will provide significant returns for Spanish companies in the aerospace sector.

The Amazonas 4A satellite will carry a payload of 24 Ku-band transponders with coverage of South America, from Venezuela and Colombia in the north, to Argentina and Chile in the south. Satellite performance will be 46 to 48.5 dBW throughout the South American mainland.

The launch of Amazonas 4A is scheduled for early 2014. The higher-power Amazonas 4B, whose final design will be determined later depending on market requirements, will be launched into orbit in 2015.

Both GEOStar satellites will be designed, manufactured and tested at Orbital's facility in Dulles, Virginia, in the United States. Amazonas 4A and 4B are the 34th and 35th geosynchronous-Earth orbit communications satellites ordered by Orbital customers around the world, 26 of which are in orbit with nine others (including the two new Amazonas satellites) in design, production or pre-launch preparations.

Orbital's highly successful communications satellites are based on the company's GEOStar satellite platforms, which are able to accommodate all types of commercial communications payloads and are optimized for satellite missions requiring 2.5 to 7.5 kilowatts of payload power. In most instances, GEOStar satellites can be built and delivered in 24 months or less.

Microwave Makings

COM DEV International Ltd. (TSX:CDV) has been awarded three contracts to deliver hardware for commercial and military communications satellites.

The combined value of the contracts is in excess of \$11 million. One of the contracts is initially structured as an Authorization to Proceed, and is expected to lead to a fully funded contract valued at a further \$3 million, bringing the total expected value of the three contracts to more than CA\$14 million. COM DEV will provide switches, multiplexer assemblies and other passive microwave equipment for the satellites.

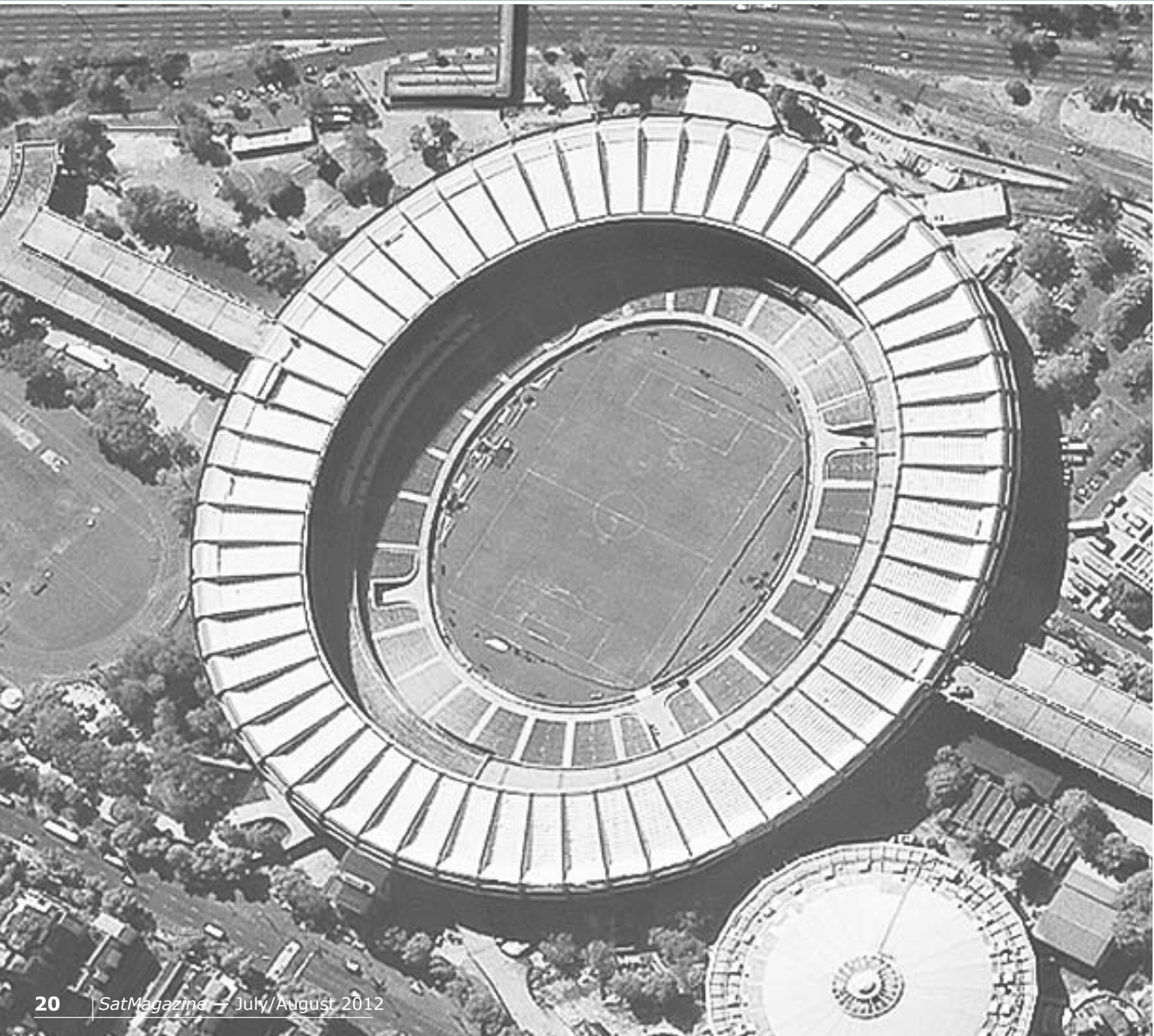


Artistic rendition of the HISPASAT Amazonas 4A/B

Dual Use Of Very High Resolution Satellites

By Rani Hellerman, Vice President, Business Development, ImageSat International Ltd.

There is no doubt that the commercial very-high-resolution satellite data business has reached a critical level of maturity. The industry has applied itself to the growing challenges of the civilian and national security applications. ImageSat International is playing a key role in this trend.



In the years since the launch of the first sub-meter resolution commercial imaging satellite in September of 1999, there have been marked improvement in the variety and competitiveness of imaging satellites. Their upgraded sensors create higher resolution imagery and they have more efficient platforms and technologically superior ground systems.

During the past decade, we have seen the power of satellite imaging harnessed by the military, then passed from the professional civilian market to the popular market, with **Google Earth** and **NASA's Visible Earth** becoming tools of the trade and for hobbyists.



EROS Imagery: A Multi-Functional Power-Tool

Prime: Imagery

In the coming years, greater sophistication in our processing capabilities will be achieved; improved interoperability of software and hardware which will result in new and even more powerful applications as well as increased sharing of processed data, providing greater value from satellites and their data.

Geospatial Information professionals play a significant role in this evolution, helping governments, private businesses and individuals to manage and protect our communities, resources and environment.

Today, military and homeland security applications still account for the majority of commercial satellite data consumption. However, a vast civilian industry has emerged. More and more applications have been developed for the civilian market, and the circle of users becomes wider.

There has also been a significant improvement in the competitiveness of international very high-resolution sensors, among them EROS A and EROS B, developed by Israel Aerospace Industries (IAI) and owned and operated by ImageSat



International. ImageSat is currently one of a few satellite imagery providers with standard, sub-meter resolution.

ImageSat was established with the vision of serving the national security and civilian markets with more direct control over the satellites' sensors and offering competitive, top-quality, high-resolution imagery.

Urban mapping is among the fastest-growing applications of EROS imagery, providing infinite value for planning, management, compliance and change detection. With the rapid expansion of metropolitan areas, it is essential to calculate their development and to plan accordingly, whether for adding

roadways, neighborhoods, infrastructure, public services or contingency plans. Among ImageSat's clients, for instance, are municipalities which use EROS data to monitor illegal construction through change detection.

Forestry is high on the photogrammetry agenda, including mapping forests for monitoring and management of growth, replanting, fire safety, regional development, wildlife and illegal logging.

ScanEx R&D Center, a private Russian company, employs both EROS A and EROS B to assist in emergency situations, mapping and monitoring illegal logging activities in large mountainous areas that would be expensive and treacherous to



Prime: Imagery

monitor by aircraft or other means. In addition, ScanEx is taking sub-meter resolution images of cities in Russia for a range of applications.

Infrastructure planning has gained momentum during the last few years and is expected to be among the leading applications in the coming decade.

Since the commencement of operation of EROS B, ImageSat has responded to the increasing demand for very high-resolution satellite images for monitoring purposes. The European Union, the United Nations, and other international alliances have set regulations for their members and their beneficiaries, to ensure fairness, human rights and worthiness of funding.

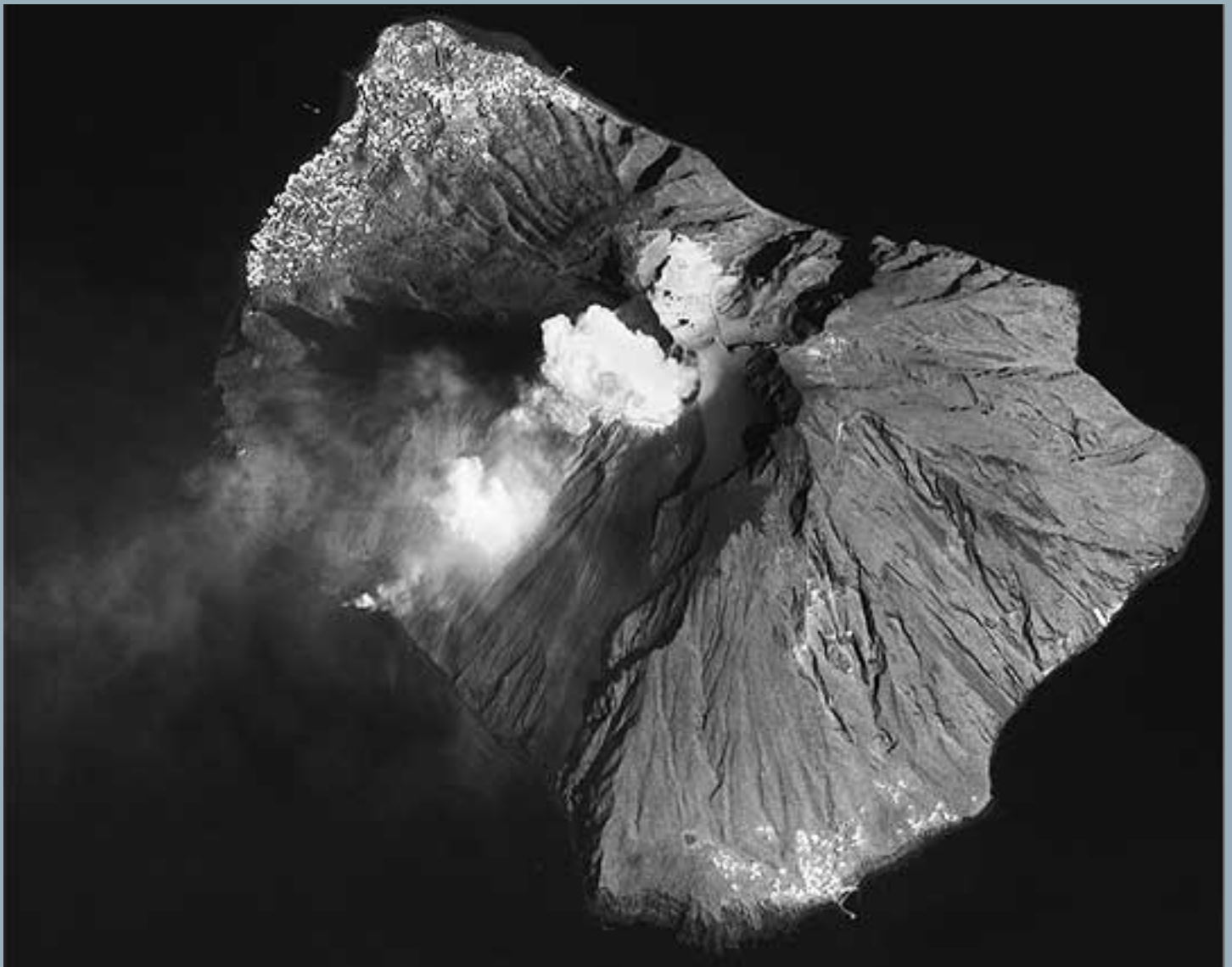
Following the devastating earthquakes around the world ImageSat and its partners have provided images and processing of high resolution optical satellite Eros B to the relevant humanitarian organizations. With the integration of findings from other satellite operators worldwide, it was possible to promptly provide a quantity of data, even in the presence of the devastation of primary logistics infrastructure (airports and roads) which have proven useful in the early hours after tragic earthquake relief coordination.

With regard to all of these applications, when things go wrong—such as natural disasters, terror attacks or other tragedies—it is helpful to have baseline imagery in order to conduct disaster assessment. Change occurs fast, especially with regard to disasters; for this reason, police forces and municipalities are sharing data with the city planners and National Guard forces to ensure that all are on the same page before disasters strike.

For these cases and others, when near real-time data collection is a must, ImageSat International provides flexible capabilities for immediate tasking and direct imagery reception on a “light” ground station that can be deployed by the customer at very short notice.

About the author

Rani Hellerman is Vice President for Business Development at ImageSat International Ltd. and has experience working with military and civilian satellite imagery data for more than 17 years.



Telenor's Dramatic Progress

*By Chris Forrester, Editorial Director,
Broadgate Publishing*



N

orway's Telenor is a telecoms giant and is making steady progress beyond its home borders. The Company has a few telco-based challenges in places as far away as, for example, India. The company delivered its latest numbers on May 8th.

Telenor's Dish Farm

However, **Telenor**'s non-telco division (carried under the umbrella **Telenor Broadcast Holdings** vehicle) now generates 7.2 percent of Telenor's overall revenues and seems to be doing very well. In total, Broadcast Holdings brings in a more than useful 915m euros in revenues (in 2011) and has, among other activities, close to 1.8m DTH payTV subscribers in the Nordic region served via the **Canal Digital** brand on DTH and cable, plus another 2.27m in Central/Eastern Europe.

Some 17m homes in total receive TV signals from the **1 degree West** slot (a spot Telenor shares with **Intelsat**). **Telenor Satellite Broadcasting (TSBc)** operates the infrastructure for Canal Digital as well as the region's public and commercial broadcasters (about 8.4m Nordic homes, 9m Central/Eastern European homes) and carries more than 700 TV channels, only a few dozen of which are in HD (and now the first 3D channels are on air). In other words, the growth potential for switching from SD to HDTV is considerable.

The Company's national TV transmission arm (**Norkring**) has a valuable contract in place to build and equip DVB-2 networks for Flemish customers (North of Belgium) plus the region around Brussels, and is looking for similar contracts elsewhere. Norkring looks after FM, AM, DAB and TV carriage throughout Norway.

Telenor's TV encryption arm, **Conax**, is in an enviable position, with some 300+ global customers (as well as its own Canal Digital payTV sister-company) with anti-piracy software and so-called 'smart cards'. Indeed, Conax's future road map, as explained by CEO *Morten Solbakken*, seems to be more than comfortable about matching its larger rivals (**NDS** and **Nagra Kudelski**) with up-to-the-minute technical solutions for its clients. This year sees the Company supplying advanced OTT support, access for 'smart' phones as well as the other bells and whistles now accepted as normal within the payTV environment. Multi-screen delivery of secured content is a major thrust for Conax and its clients, although it is looking to develop (or improve) on simpler pre-integrated solutions for some of its applications.

For example, Conax will announce a new 'partner' program at the giant IBC trade show in September. *Solbakken*, who has been in post since only September last year, has clearly hit the ground running with his team and says the 80 country spread of clients (including ultra-low ARPU customers, such as India's **Dish TV**) secures content for some 125m subscribers—and, they are growing their territorial spread. New offices are opening, including Sao Paolo, where he said Conax sees "huge growth potential" and where the Latin American market is of "key" interest.

Forrester's Focus

Conax's geographic revenue split sees some 50 percent being generated in Europe, 25 percent from Asia (mostly Dish TV), around 15 percent from "the Americas," and MENA contributing around 10 percent. Out of that mix they have some valuable contracts: KPN Netherlands (1.4m subs), Cablemas Mexico (3m), ComHem in Sweden (1.8m) and Russia's Orion Express (around 6m). Recent new contract 'wins' include Biznet Indonesia (400,000), AVG Vietnam (potentially 17m homes), Claro Ecuador (1m), and ICHD out of Dubai (potentially 10m). Five new contracts have been secured this year: KCCL India for CATV, Access Haiti for DTT, Valaiscom AG Switzerland for DTT, NHK/JSTV for a Japanese DTH service for ex-pats, and Gorod TV Russia for their cable service.

Solbakken pulled no punches in saying that Conax was confident of announcing five additional "major" deals in the next two to three months. Also, part of the overall road map is to tap into the growing opportunities for Conax in emerging markets where the digital dividend is only starting to develop.

However, Conax's EVP/Products *Tom Jahr* issued a warning to broadcasters, consolidators and the industry in general, saying that 'Smart' and 'Connected' TV services were wonderful, but they placed extra pressures on security—"Search engines, VOD, catch-up, all carry a risk".

He said the fast-changing world of television also means that clients would no longer be prepared to wait three years for a secure

Conax revenues (*Norw. Kroner)

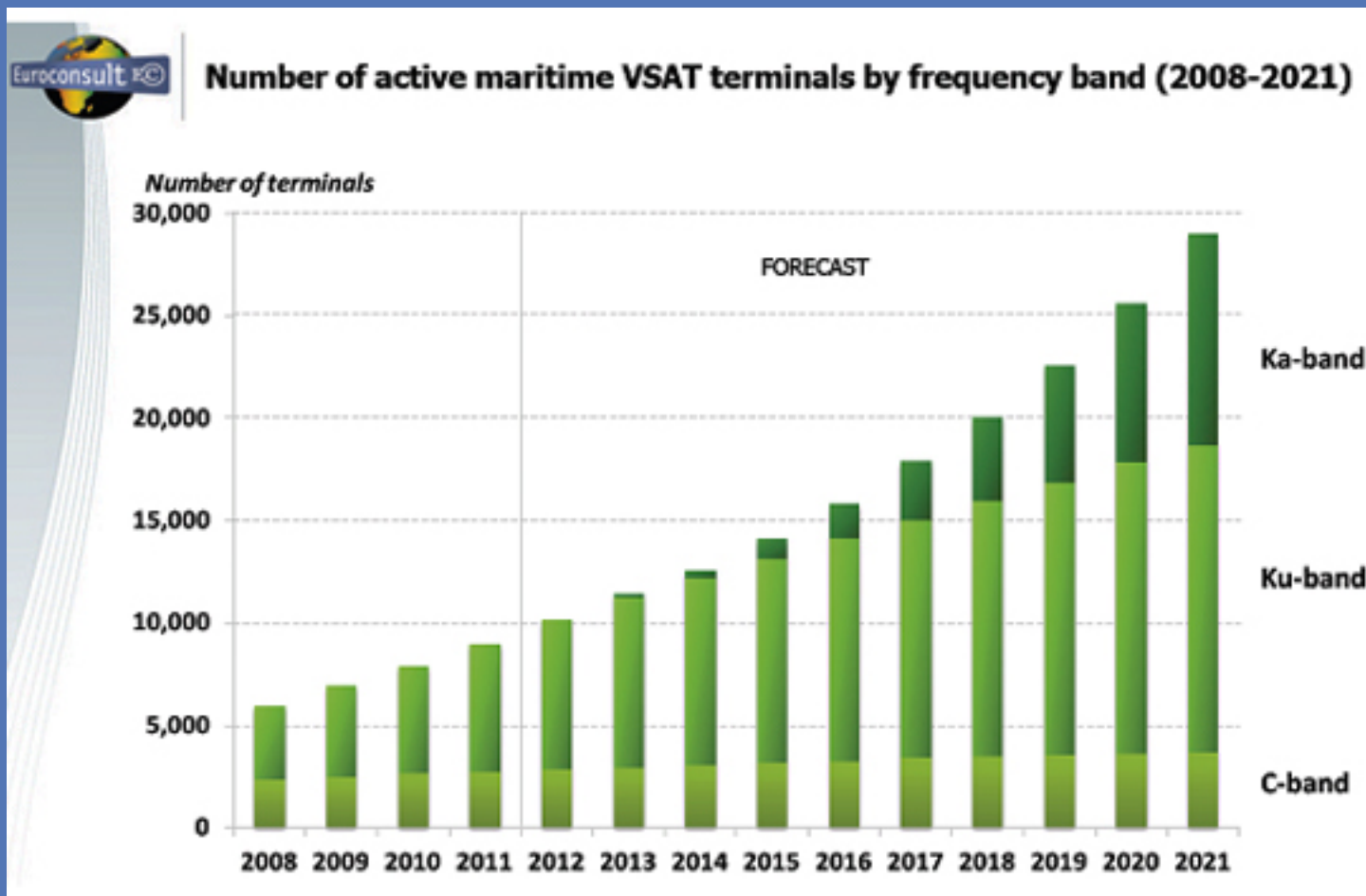
2007	467m
2008	632m
2009	547m
2010	528m
2011	557m

Data: Conax/Telenor

solution to be developed, and that Conax was working to see these sorts of problems solved in perhaps the next eight months.

News emerged during a recent press briefing that *Cato Halsaa*, TSBC's CEO, will retire next year. He will leave with a solid record of achievement, not the least of which was the re-generation of a division that, not so many years ago, was widely reported to be on the sales forecourt.

That division is now a vibrant member of the satellite operating community. He supervised the ordering of the **Thor 7** from **Space Systems/Loral**, which will take its multiple





been at that slot operating in inclined orbit for some time and it can perform a role for the next seven to eight years. This is more than enough time for either an existing satellite to be relocated to 4 degree West when replacement capacity is available, or—although nothing has been said—a new craft could be procured. However, at the top of Halsaa's list is finding customers for the 4 degree West position. Currently, it has a solid client base spread amongst top-quality names, and Halsaa is quietly confident that these will grow.

1 degree West (from both Telenor and Intelsat capacity) has carved out a terrific niche in terms of Occasional Use demand, helped by high-profile events such as last year's U.K. Royal Wedding, and events such as the upcoming Olympics (where Halsaa says TSBc has been fully booked for the opening day's activities). Sadder events such as the Oslo shooting outrage, and the trial that is now taking place, have also generated massive OU demand (profits from this coverage are being donated to Norway's Red Cross). TSBc also succeeded in winning a useful three-year contract from Germany's **WDR** (part of **ARD/ZDF** public broadcaster) for OU capacity, and where 80 percent of the capacity is fed through TSBc, with the remainder spread through suitable third party capacity suppliers, such as SES and Eutelsat.

About the author

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

spot-beams and high-throughput Ka-band to the next level to satisfy the fast-growing demand of maritime and related services with coastal and marine coverage spreading over the North Sea, Red Sea, Baltic Sea, Persian Gulf and Mediterranean.

Halsaa's team have done their homework well and have identified both existing and new VSAT services, in particular from current satisfied clients, who want extra marine and datacomms bandwidth. **Thor 5** and **6**, for example, mostly provided replacement and back-up services. **Thor 7** adds valuable new capacity to 1 degree West.

Thor 7 will expand TSBc's 11 transponder Ku-band capacity in particular for Central/Eastern Europe. **Arianespace** will launch **Thor 7**, hopefully toward the end of next year (winter 2013-2014). TSBc is also tapping into the current low premium interest rates available for Arianespace launches.

Halsaa explained that TSBc's strategy was simple enough: continue to grow, expand the datacomms market, maintain strong efficiency and customer satisfaction levels as well as add more HDTV, perhaps more 3D and, sometime in the future, see the introduction of Ultra-HDTV. Add in a growing demand from play-out and IPTV, VOD and 'Tablet TV' and there's a solid business road ahead.

TSBc is also expanding from its adjacent 4 degree West slot where it holds absolute rights to 40 frequencies. Telenor 3 has



Artistic rendition of Telenor's Thor 7 satellite

Executive Spotlight

Patrick Shay, Vice President + General Manager, DeLorme



Patrick Shay brings 25 years of experience in creating and developing new markets in the GPS and wireless marketplace. As vice president and general manager for data services at Iridium Communications Inc., Shay provided the strategic leadership necessary to grow the company's business in this market's area. Under his direction, the satellite data business became the fastest growing market segment at Iridium, experiencing 60 percent year-over-year growth and serving customers in industries such as transportation, people tracking, maritime, aviation, oil/gas and government.

Prior to Iridium, Shay held the positions of vice president at Hughes Telematics, Sirius Satellite Radio, and Rand McNally, where he created and launched innovative new services in the wireless and GPS marketplace. His career began at Motorola, where he led the global sales team for the company's GPS and telematics business. Shay is also the chair of the ProTECTS Alliance, a global industry group focused on the promotion of two-way emergency messaging and tracking solutions, with more than 65 members worldwide.

Executive Spotlight

DeLorme is a privately held, disabled veteran-owned small business based in Yarmouth, Maine, where we have our corporate offices and state-of-the-art research and development facility. It's also the home of our very successful DeLorme retail map store, as well as Eartha, the world's largest rotating and revolving globe.

SM

Please tell us more about Eartha.

Patrick Shay

Eartha is a 3-D topographical scale model of the Earth. Measuring 41.5 feet in diameter, it is listed in the Guinness Book of World Records. The giant motorized globe is housed in a three-story glass atrium, and to say it is spectacular is an understatement.

SM

What about your new satellite communication product?

Patrick Shay

DeLorme's inReach is a handheld GPS locator, personal tracker and satellite communicator, all in one. It provides:

- *Follow-Me tracking, transmitting its position coordinates every 10 minutes so that followers can see the latest location and "bread-crumbs" trail on an Internet map display*
- *Find-Me locating, allowing an authorized person to "ping" the inReach to trigger an on-demand position report*
- *SOS distress alerting with an automatic confirmation of message delivery*
- *Two-way text messaging via a Bluetooth connection with an Android or Apple smart mobile device, or a DeLorme PN-60w handheld GPS.*

Housed in a three-story glass atrium at the company's headquarters in Yarmouth, Maine, Eartha took two years to build and represents Earth as it is seen from space. Every continent is beautifully detailed, with vivid colors illustrating all levels of vegetation, major roadways and cities. Ocean depths are also completely represented.

In this photo, Eartha illuminates DeLorme headquarters in Yarmouth, Maine, USA. © Jeffrey Stevenson



SM

The last time we talked with you, a couple of years ago, you were very involved with the ProTECTS Alliance. Can you give us an update on what's happening on that front?

Patrick Shay

ProTECTS is an acronym that stands for Promotion of Two-Way Emergency Communication and Tracking Systems. It is a consortium of companies and organizations established in 2010 to foster the rapid and orderly market development for portable satellite-based location, tracking distress alerting products. Since its formation two years ago, the ProTECTS Alliance has worked closely with the SAR community to create broad-based industry standards to ensure interoperability with public safety dispatch networks, SAR systems and response procedures. Today, the ProTECTS Alliance has 65 members and functions as a subcommittee within RTCM. I still serve as its chairman.

SM

Where do you see personal tracking and messaging technology going over the next few years, and can you tell us anything about DeLorme's roadmap moving forward?

Patrick Shay


I believe we're just scratching the surface of this emerging market. The confluence of GPS positioning and mobile satellite data communication technologies presents exciting opportunities. While I cannot reveal any of our future product development plans at this time, I can only say "you ain't seen nothin' yet." So stay tuned. We are uniquely positioned to capture the intersection of mapping, GPS and satellite communications.

Our vision is to change how consumers, enterprise and government customers communicate, work and deploy through dependable, affordable two-way tracking, locating, alerting and messaging anywhere on the face of the Earth.



Continued Dynamism Of The Satellite payTV Market In 2011

By Dimitri Buchs, Consultant, Digital Broadcasting Analysis Team, Euroconsult



In the last decade, the satellite payTV industry has become global and has reached a critical size in the digital TV market. Close to 140 satellite payTV platforms are currently in operation around the world, covering more than 100 countries in the different regions of the world. The number of platforms has more than doubled since 2001. In the last couple of years, close to 30 new platforms were rolled out. Most of them operate in emerging digital markets. In the recent past, Latin America and South-East Asia have clearly been two of the most dynamic regions. An increasing number of countries have at least one active platform, the latest countries to roll out services being Myanmar (Burma) and Georgia (Europe) in 2011.

In the last decade, satellite payTV subscriptions grew by at least 10 percent every year. The positive trend continued in 2011 when worldwide subscriptions increased by around 16 percent. Some of the fastest growing markets include Brazil, Russia and India. Asia has even become the leading region in terms of subscriptions ahead of North America thanks to the booming Indian market. India has one of the fastest growing satellite payTV subscriber bases. In 2011 alone, around 12 million subscribers were added by the country's six payTV platforms. Most countries observed an increase in satellite payTV subscriptions in 2011 but there were exceptions. Indeed, several countries including the Nordic countries, Spain and Australia lost satellite payTV subscribers during the course of 2011. Reasons vary depending on the country. Subscriber losses were notably explained by increasing terrestrial competition, growing free-to-air competition and the economic downturn.

Revenues have also increased consequently in the recent past. In 2011, they reached close to \$90 billion, up from \$79 billion in 2010 (*i.e.*, +14 percent). All regions experienced revenue growth in 2011, with Latin America leading the way. The growing number of value-added services (*e.g.*, HD, OTT, VoD, PPV...) offered by platforms is one of the main revenue drivers, notably in mature digital TV markets where subscription growth has been more limited in recent years.

The performance of the industry is quite exceptional, as indicators have progressed despite unfavorable global economic conditions. North America and Western Europe, which have been strongly impacted by the economic slowdown in recent years, still account for a large majority of global revenues thanks to higher-than-world-average ARPU.

The dynamism of the satellite payTV industry resulted in the broadcasting of close to 1,000 additional channels in 2011. While the historical satellite payTV

platforms continued to diversify content by adding new channels, including a large number of HD channels, the launch of new platforms in the last couple of years also drove additional channel roll-outs in emerging digital markets, where most new platforms offer services. In 2011, more than 80 percent of net new channels were distributed in emerging digital markets and about 60 percent of channels that were rolled out were HD channels.

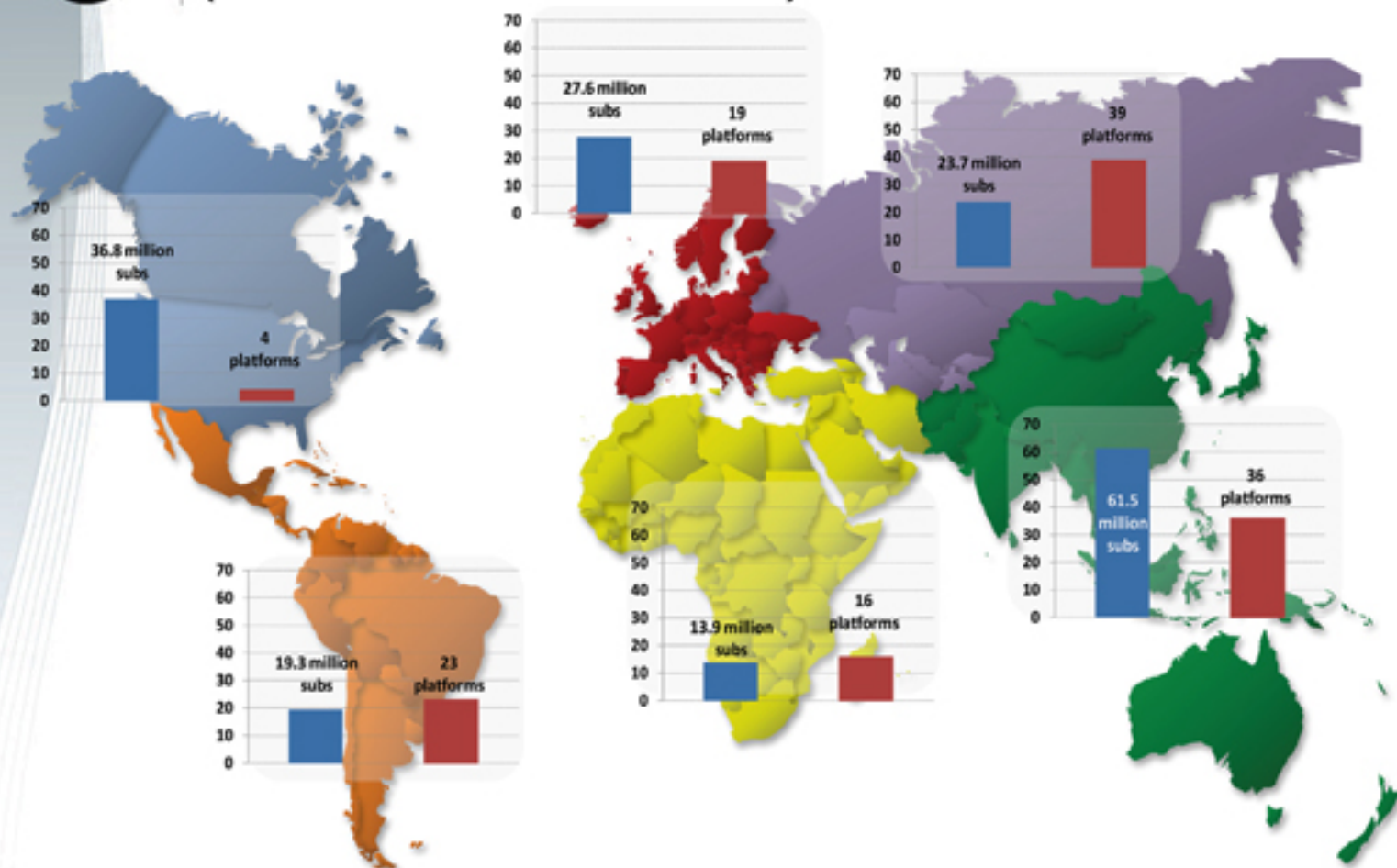
Satellite TV Growth Drivers

In the last five years, emerging digital markets have experienced a tremendous growth in the number of players, revenues and in subscriptions.

There were more than 100 satellite payTV platforms in emerging markets at the end of 2011. The number of countries with at least one satellite payTV platform keeps on growing year after year and this trend is expected to continue in coming years. Bangladesh and Pakistan could very well be two of the future



Multichannel Satellite Pay TV Platforms Worldwide (Number of subscribers as of 2011)



Satellite TV Platforms: World Survey and Prospects to 2021 © 2012 Euroconsult

countries to roll out their first platform. In Bangladesh, this would be favored by the expected launch of a national satellite, Bangabandhu-1, in 2015. Several markets have seen the introduction of two or three new platforms in the last couple of years, including Vietnam (K+, AVG and VTC Digital), Indonesia (Centrin TV, SkyNindo and Nexmedia), Bulgaria (Vivacom and Satellite BG) and Brazil (CTBC and GVT). Those markets currently represent strong growth drivers for the overall industry, while the potential, but still far from certain, opening of the Chinese market may give a new boost to the industry in the middle- to long-term.

Revenues have also increased consequently in emerging digital markets. In just five years, revenues more than tripled in these regions. In 2011 alone, revenues increased by 26 percent, with Latin America driving growth. The growing number of value-added services (e.g., HD, OTT, VoD, PPV...) offered in these regions favors revenue growth and enables platforms to better apprehend competition.

Subscriptions to satellite TV platforms in emerging digital TV markets reached 110 million in 2011, up from the 2006 total of 19 million. India has been one of the main growth drivers over the five-year period, with countries like Brazil, Mexico, Russia and even Indonesia joining forces more recently. Operating mainly in areas

with a limited development of terrestrial networks and ageing cable infrastructure, satellite payTV platforms will continue to represent a driving force for the development of digital entertainment in those markets.

Investing In Value-Added Services

Technological improvements and investments in research and development have facilitated the development of new types of video services that represent new relays of growth for satellite payTV platforms. HDTV, next-generation set-top boxes (STBs), OTT and 3D are certainly key drivers for payTV platforms for the coming years. Driven by the challenge of growing terrestrial competition (free-to-air and pay

competition) and the launch of new satellite TV competitors in many markets, platforms have been investing massively in the development of innovative and enhanced services to develop competitive advantages.

HDTV is the perfect example of the necessity for satellite TV platforms to invest in value-added services in the current competitive landscape. The HDTV market continued to rapidly increase in 2011, following four years of strong growth between 2007 and 2010. Around 90 satellite payTV platforms have already rolled out HD services. All regions of the world now offer HDTV via satellite payTV platforms. Dozens of HD channels are available in all the leading broadcasting markets around the world. A large number of smaller TV markets have also rolled out their first HD channels in the last couple of years. As a consequence, HD is becoming a mass market product that a wide number of TV households can now access.

An increasing number of platforms have rolled out or are planning to roll out OTT services (e.g., Sky Brazil, OSN, Sky Digital...). In many cases, this is a competitive move to block competition from specialized on-demand Internet streaming media providers such as Netflix and Hulu. While such services may reduce churn and increase the average revenue per subscriber in the middle term, they represent an initial investment from platforms in terms of set-top-box subsidies, programming rights, marketing campaigns and customer care, and they require dedicated partnerships and revenue-sharing schemes.

The situation is totally different for 3DTV. One of the main barriers to adoption of 3DTV is the need for consumers to buy a new screen, especially as many households have recently bought a new HDTV screen and they are reluctant to make another costly CE purchase in the short to middle term. The other main barrier is the minimal amount of content available in 3D. As was previously the case for HD, the scarcity of 3D content in the initial development phase of the format is an issue that is expected to have an impact on the initial development of the format. At the end of 2011, 16 satellite payTV platforms had launched 3D services, including Sky Digital in the United Kingdom, Foxtel in Australia and Sky Deutschland.

Adapting To Increasing Competition

Terrestrial competition (i.e., cable TV, IPTV, Digital Terrestrial TV) has increased in recent years with the rapid development of IPTV services and the digitalization of networks. On a global basis, cable TV has been less of a threat, as cable operators are still mostly broadcasting on analog networks in a large number of countries and particularly in emerging digital regions and as the digitalization of networks takes time and is very expensive.

The emergence and the success of IPTV services appears to be a major long-term challenge to satellite TV platforms due to the capabilities offered by the broadband return path in addition to the reception of TV content. Currently, the threat primarily involves the most advanced telecom and media markets, in which telecom operators invest in large DSL and fiber coverage.

Competition is also coming from online video distributors such as Apple TV, Netflix and Hulu, which offer OTT services. These services have grown in popularity in past years and could pose a growing threat to satellite payTV platforms if they continue to attract additional viewers. The market is particularly developed in North America and it is quickly expanding in Europe.

Growing competition has pushed satellite payTV platforms to put in place strategies to adapt, whether it be by offering Internet and telephone services, by offering pre-paid services, or by rolling out their own OTT services.

A growing number of satellite payTV platforms offer their subscribers the possibility to also subscribe to Internet and telephony services. This is clearly an attempt to limit churn toward IPTV service providers that usually offer triple-play or quadruple-play services to their subscribers. By offering Internet and telephony services, satellite payTV platforms can compete more directly with telecom operators.

The impact of growing competition on satellite payTV platforms is expected to differ quite significantly depending on the regions. The mature digital TV markets should be more directly impacted than the emerging digital markets.

On a global basis and despite growing competition, the satellite payTV market is expected to remain dynamic in the coming



decade, with emerging markets driving growth. In several of these markets, an emerging middle class is embracing payTV services. This trend is expected to expand to more markets in the coming decade with the continued projected growth in household formation and per capita income growth.

Global industry revenues are expected to reach close to \$150 billion in 2021, with emerging markets (i.e. Latin America, Central Europe, Russia, the Middle East, Africa and Asia) representing a growing share of revenues that will nearly double over the next 10 years to reach 44 percent by 2021. Subscriptions are also expected to grow in the coming decade. Close to 350 million households should subscribe to satellite payTV platforms worldwide by 2021, representing a 6.7 percent CAGR over the 10-year period.

About the author

Dimitri Buchs is a Consultant based in Euroconsult's Paris office, where he is part of the Digital Broadcasting analyst team which produces the Satellite TV Platforms World Survey & HDTV reports. He also contributes to other Euroconsult research reports, specifically those focused on digital broadcasting. Prior to joining Euroconsult, Dimitri participated in several consulting assignments, in particular analyzing the impact of free newspapers on pay media and mobile TV. Dimitri has a Masters of International Management and a Bachelors of Economics from the Pantheon-Sorbonne University in Paris. He joined Euroconsult in 2007.



The Challenges Of VPN Over Satellite

Republished courtesy of Bentley Walker Satellite News & Information Newsletter

A

s the cost of consumer satellite systems and bandwidth drops lower and lower Internet access becomes more wide spread and the demand for secure connections from remote worker locations to Company headquarters, or branches, is increasing.

The high latency or *round trip time (RTT)* inherent in commercial communications satellite connections has historically presented a significant obstacle to efficient **VPN** (*virtual private network*) connections over satellite.

In order for a two-way satellite service to perform properly in conjunction with traditional terrestrial networks two-way satellite networks must employ special software to deal with the extra 23,000-mile space distance of the connection. Without this software, the increased latency (the time required to traverse the space segment) means that the TCP protocol severely limits link performance.

The Internet relies on the *Transmission Control Protocol (TCP)* to ensure packet delivery without errors. TCP works by sending a certain amount of data, then waits for the receiver to send an acknowledgment of receipt. With TCP, the sender cannot transmit more data until it has received an acknowledgment.

If an acknowledgment does not arrive in a timely manner, TCP assumes the packet was lost (discarded due to a congested network) and resends it. When packets go unacknowledged, TCP also slows the send rate to reduce the perceived congestion and to minimize the need for retransmissions.

TCP/IP sessions start out sending data slowly. Speed builds as the rate of the acknowledgments verifies the network's capacity to carry more traffic. This is known as slow-start, followed by a ramp-up in speed. The speed of the connection builds until the sender detects packet loss from a lack of an acknowledgment.

Ground networks typically have round-trip latencies in the range of 35 to 100 ms. Satellite networks, due to the distance of geo-synchronous satellites above the equator, require 550ms or more. Some satellite connections have much higher RTT. The TCP protocol interprets the additional satellite RTT as network congestion. If uncorrected, this effect causes the network to send all additional packets at the slow-start rate.

Current two-way satellite networks employ a technique referred to as *TCP spoofing* to compensate for the extra time required to pass through the space segment. Special software on the satellite modem appears to terminate the TCP session, so it appears to the sender as the remote location. In reality, the satellite modem is acting as a forwarder between the originating PC or host and the remote site.

When the modem receives Internet traffic destined for a location, it immediately acknowledges receipt of the packet to the sender so more data packets will follow quickly. This way, the sender never experiences the actual higher satellite latency to the remote site because acknowledgments return to the sender at LAN speed. As a result, TCP moves out of slow-start mode quickly and builds to the highest link send speed.

IPsec VPNs not only encrypt the data portion of packets, they also encrypt the TCP packet header. Popular IPsec VPNs, therefore, defeat the modem TCP acceleration software because the modem cannot detect the TCP packet and will pass the unrecognized packet over the space link as a "raw" packet.

This situation requires that acknowledgments transit the space segment twice (over and back) and results in substantial performance degradation. The impact on performance increases as the latency rises.

There are many products in the market to overcome this issue. They use many techniques—a common approach is to convert the TCP packet to UDP before the packet is presented to the satellite modem. UDP packets do not require acknowledgments' and are, therefore, "pushed" over the satellite link at full throughput.

These solutions are generally end-to-end solutions with a hardware device or software at both ends of the connection that will unpack the received UDP packet and reconvert to TCP before passing onto the LAN.

A new form of VPN connection has recently appeared on the market—**SSL VPNs**. These new VPNs are based on the *Secure Sockets Layer (SSL)*, the protocol that safeguards the world of e-commerce; the VPN's are quickly becoming a leading option for remote access. Using HTTPS ports, the application can be recognized by the TCP spoofing software and, therefore, spoofed to full data throughput.



Executive Spotlight

Peter Mabson, President, exactEarth Ltd.



The exactEarth team is led by Peter Mabson, who brings over 27 years of experience in the space sector and product businesses. In particular, Mr. Mabson has held various executive positions within COM DEV related to the creation and development of new businesses and new business opportunities.

Since 2002, Mr. Mabson held the position of Vice President of Corporate Development within COM DEV where he was responsible for Corporate Strategic Planning and for Mergers and Acquisitions. He was appointed President of exactEarth Ltd. in 2009 with proven expertise in product design, business management, sales and marketing, and new business development.

He has written many technical papers related to satellite communications systems and has extensive experience in international business dealings having been involved in more than 20 international programs across the globe. Mr. Mabson graduated from McMaster University with Degrees in Engineering Physics and Business Management in 1981. He also served on the technology advisory board at Conestoga College in Kitchener, Ontario.

SatMagazine (SM)

Mr. Mabson, you have a great deal of experience in the space community and related products environs...would you tell us of your background?

Peter Mabson

I have worked for more than 30 years in the global space industry. During that time my career has ranged from designing satellite payload systems to creating new initiatives and businesses in the satellite industry and I have been involved with most major global players in the commercial and government space community. It has been, and continues to be, a very exciting ride because, as you can appreciate, in that time period the industry has grown tremendously and has created many of the capabilities that we now take for granted—such as satellite navigation, weather forecasting, satellite television, Earth observation and now satellite delivered Internet and personal communication. Being a part of all of that has been very exciting.

SM

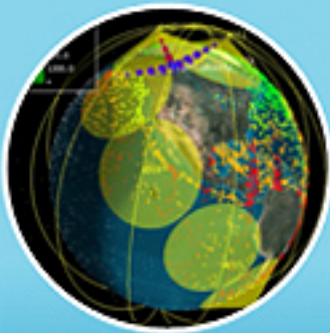
How did you decide to steer your career into the space sector?

Peter Mabson

As a boy growing up in the sixties with a bent for science and science fiction, I was immersed into the tremendous drama of putting a man on the moon and became hooked on space from that point on. Nevertheless when I graduated from University I initially worked in more conventional industries, but when a former professor of mine phoned me and told me that a new small satellite technology company had just relocated into my area I immediately went over for an interview. The company was COM DEV, which at the time only had about 50 employees, and as soon as I walked through the door I knew that I wanted to work there. As a young engineer, the prospect that I could be involved with developing a new piece of technology from conception through construction and then put it on a spacecraft and launch it into orbit and see the results was just too compelling to turn down. I went to work there and I have been hooked on the space industry ever since.

SM

What coursework do you recommend for young students today who wish to develop their own careers in the satellite and space world? How can our industry promote STEM training and encourage more interest in our industries?



Satellite Constellation

- Detects AIS Class A & B
- 3 Sats in Orbit now
- 4 Sats to Launch in 2011
- Ongoing Constellation Expansion
 - <2 hour global revisit
 - Secure downlink



Earth Stations

- Downlink signals
- Data Pre-Processing
- 6 Primary Earth Stations
- Additional stations coming in 2011
- Secure link to Data Center



Data Center

- Located in highly secure facility in Canada
- Decollides AIS signals into AIS messages for 5x
- Convert messages into industry standard formats
- Filter and forward messages to Customer



Customer Delivery

- Industry standard files (NMEA, OTH-Gold, KML, or XML)
- Only authorised users
- Available display systems
- Integration into Custom Display System
- Anomaly Detection
- Value-Added apps

End-to-End, Highly Secure and Reliable Solution delivering world class performance

Executive Spotlight

Peter Mabson

This is a very important topic. Over the years myself and a number of my colleagues have been active with local schools, colleges and universities to promote our industry and to help set up courses in relevant fields such as materials science, electronics technology and systems engineering. There is a concern that with the end of the "Space Shuttle" era that one of the visible icons of the space industry that served as a draw for young minds is now being lost and that this might result in fewer students coming into our industry. In fact the opportunities in the space industry are greater than ever—both because of the rapid growth of new services and capabilities as well as the fact that the Space Industry is facing its own "Baby Boom" retirement wave. Students who have an interest in the space industry should focus on such subjects as physics, electronics or materials science.

I would also highly recommend participation in co-op programs and seeking out work terms with space related companies—this provides invaluable exposure to the industry and will help you focus more specifically on what career interests you. Satellite companies such as exactEarth are always interested in taking on co-op students—it helps us attract the bright minds that we need to support our future growth

SM

What led you to make the move from the executive team at COM DEV into that Company's exactEarth subsidiary? How does HISDESAT enter the picture for exactEarth?

Peter Mabson

At COM DEV eight years ago I was leading the group responsible for creating and developing strategic growth initiatives. In that role, together with a couple of colleagues in my team, we first developed the satellite AIS business initiative that would ultimately become exactEarth. I was so excited by the potential of this business and the prospect of working once again with a small team to create something incredible that didn't exist before that I moved over to run the company when we formed it. I am constantly amazed at the resourcefulness and creativity of our team here at exactEarth as we have wrestled with the myriad of issues involved whenever you take on something like this—it is truly an invigorating environment.

With respect to Hisdesat, they were the ideal choice for us as an investor in terms of the capabilities and expertise they bring as an established satellite operator as well as the market strength and access they provide for us in Europe and the Spanish-speaking countries. For them the exactEarth business is synergistic with the Earth Observation business they are developing so it has worked out to be a great relationship.

SM

Can you explain the history of your company and what is the primary product of exactEarth?

Peter Mabson

As I said, exactEarth started as a strategic initiative within COM DEV looking to use new micro-satellite technology. It turned out that this technology was ideally suited to create global ship tracking capabilities that were not previously possible. Following a path of aggressive development and investment to prove the technology, COM DEV realized such a venture would require global partnerships and more focus and presence than a division of the company could provide. exactEarth was then established in 2009 and shortly after in September 2010, HISDESAT was brought on board as a joint owner. All technology was licensed to exactEarth to enable the company to operate independently helping to build partnerships, raise investments and sell the data service.

exactEarth provides an end-to-end global vessel tracking solution to its customers. Our premium product is exactAIS, providing a global capability for monitoring all AIS-equipped vessels using our own satellite constellation and global network of ground stations. In simple terms we provide our customers with the ability to track all AIS-equipped vessels anywhere around the world—and to look at their complete voyage history over the past few weeks, months or even years. This fundamental capability





enables a huge number of applications that improve maritime safety and security.

SM

Please explain the AIS (Automatic Identification System) and LRIT (Long-Range Identification and Tracking) mandates for maritime shipping? What are the main applications of AIS?

Peter Mabson

The AIS consists of low power automated radio transponders that are required by regulation to be fitted on all large vessels (over 70,000 currently) and that broadcast a data stream several times a minute which contains the vessel's identity, GPS position, course, speed and a range of other parameters. The original intention of this system was just to aid in collision avoidance but the system has also been used to track coastal vessel traffic and now, with satellite detection, to track vessels on a global basis. LRIT is a government-based secure system which provides identity and GPS information for a smaller number of vessels (~30,000) on a

less frequent basis but which can also be directed during crises to accelerate vessel reporting rates to as low as every 15 minutes. Therefore the AIS and LRIT systems are complementary.

Although AIS has been previously used only for collision avoidance and coastal tracking now that satellite AIS can provide this data on a global basis with rapid update a whole new range of applications are now opening up such as: improved maritime security, long range search and rescue, vessel traffic analysis, improved safety through route monitoring and "off-track" alarms, cargo movement and tracking analysis, unsafe weather alerts to targeted vessels, monitoring of sensitive marine environments, maritime pollution enforcement, Arctic vessel tracking, and many more applications that will emerge in the coming years.

SM

Over the last few years there appears to be more emphasis on tracking ship locations: What is prompting this increased activity? Are there legal issues pertaining to the requirement for tracking?

Peter Mabson

More than 90 percent of the world's trade (estimated at over \$9 trillion) occurs at sea and 70 percent of the surface of the planet is covered by oceans. As such, there has been a huge interest in ship tracking for a long time, and there has always been importance placed on the economics of shipping, the safety and the environmental impacts. Certainly the environmental concerns, or impact, have perhaps gained in importance recently as we assess man's impact on the environment. There is also a growing interest in emissions at sea at the moment.

Ship tracking is not a new concept—systems such as AIS and LRIT and high frequency radio have existed for some years now. What has changed recently over the last two years, as the satellite AIS technology has emerged, is our ability to now 'see' away from the coasts and to truly get a global picture for the first time.

Latest reported position of the 80,000+ vessels tracked by the exactAIS® system

Executive Spotlight

Satellite AIS is the new player here as it extends the range of ship tracking, the application possibilities and the quantity and quality of data. Satellite AIS is more feasible and a more low-cost solution per square mile than any alternative and is therefore the most economical solution for global vessel tracking.

With respect to your question on legal issues there is currently no regulated requirement regarding the tracking of vessels—there are however regulated reporting systems wherein a vessel is required to report as it enters certain areas or is within 96 hours of its intended port. In addition I would note that the AIS system is, by design, an open broadcast system and therefore there are not currently any legal restrictions on the use of or distribution of this data. Having said that, exactEarth has been working closely with maritime governments and agencies over the last two years to establish standards and policies for the distribution of such data. As part of our licensing with the Canadian government we have such a data policy in place and this is a very important part of our role as a good corporate citizen and we take this very seriously.

SM

What role does the United Nation's IMO (International Maritime Organization) play? Where does the IMO obtain its regulatory power?

Peter Mabson

The IMO is a UN organization made up 170 member states that debates and establishes Maritime Policy recommendations which are then enforced by the member states. The IMO created the AIS system and debates and recommends regulatory policy for its use.

SM

Please tell us about your Company's satellite constellation and ground stations.

Peter Mabson

The purpose of our overall satellite and ground infrastructure is to meet the needs of our customers in four areas that they care about: (i) *How complete is the data?* (the "Detection" issue), (ii) *How often is it updated?* (the "Refresh rate" issue), (iii) *How quickly do I get it after the satellite has received it?* (the "Latency" issue) and (iv) *Will it always be available* (the "Reliability" issue).

Our system has been designed to meet their needs and expectations in these critical areas—our goal is track all of the roughly 80,000 vessels currently equipped with class A AIS transponders every day, to update their locations on an hourly basis globally and to provide these hourly updates with an average latency of no more than 30 minutes to our customers worldwide.

This is really an astounding new capability for the global maritime community when you think that by comparison radar and optical satellites would currently take around 20 days to map the whole globe. In order to achieve this capability, we deploy small satellites in Low Earth Orbit, and equip them so that they can look at very large areas of the ocean at once. Advances in micro-electronics have allowed these smaller microsatellites (less than 100kg) to achieve these high performance capabilities at a relatively low cost to orbit.

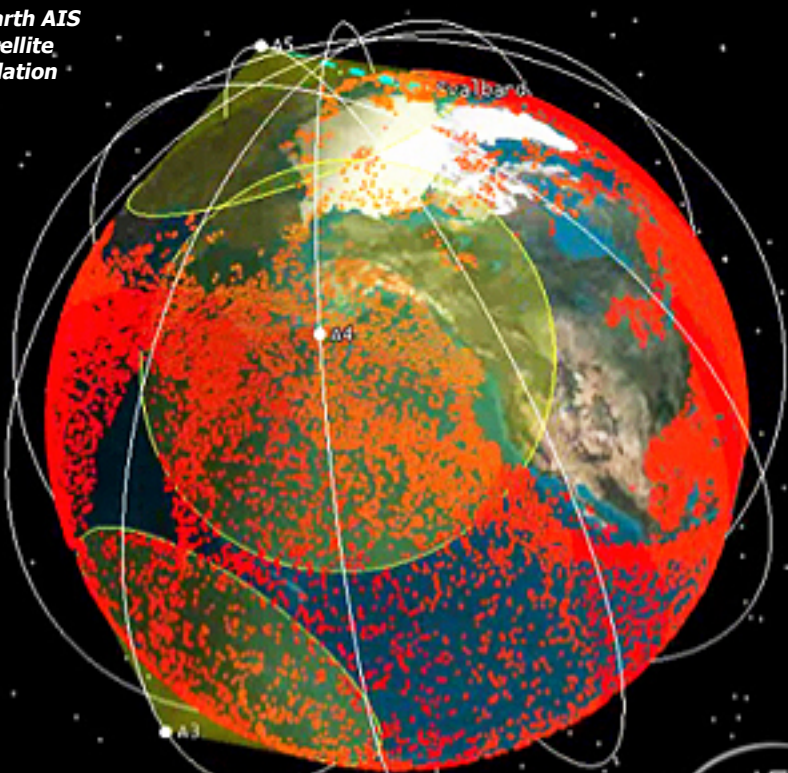
Our system is designed to meet these performance levels and has called for us to deploy a constellation of eight satellites together with a ground network of eight Earth stations and two data processing centers. We are currently at the halfway point now in this operational deployment and expect to have the full system completed by the end of next year. The Refresh rate

is set by the number of satellites and their orbits, the Latency is set by the number and location of the earth stations but the real key to a high performance satellite AIS system lies in the detection technology and this is where exactEarth has a distinct advantage.

The detection problem in satellite AIS occurs because the AIS satellites in orbit see very large areas of the ocean at once—up to 5000km in diameter—and therefore can be receiving the AIS transmissions from several thousand vessels in the same time period. The situation is analogous to being on the catwalk above a large dining hall and hearing all of the conversations at once and needing to be able to understand all of them.

It's not a simple job and what differentiates exactEarth here is our patented de-collision technology that separates out the individual conversations from all that 'noise' quickly and accurately and allows us to detect up to four times as many vessels in a single satellite pass compared to competing technologies. That is a very big deal

**exactEarth AIS
LEO satellite
constellation**



Plus, we have full control of a complete end-to-end operational supply chain from source to customer comprising satellites, ground stations, and a data processing centre in Toronto with Internet-based delivery of data. The whole system operates 24/7 and is designed to be rugged, reliable and secure with failsafe measures built-in, this deals with our customers' requirement for high reliability.

SM

How is data processed and delivered? Do certain people have access to certain types of data?

Peter Mabson

We have the ability to receive and decode all AIS messages on the ground (GBP) which is an important point to make. The alternative approach is to do initial processing on-board the satellite before downlinking to the ground station. We do have the ability to do this On-Board Processing (OBP) also but our preference is always to download the entire 'spectrum' of data captured in Space.

The reason for this is that it means we always have an entire archive of everything that the Satellite captured and it allows us to throw more 'horse power' for the processing on the ground in our Data Processing Centres than would ever be possible on the satellite. Not only that but it also allows for continuous improvements to be made to our algorithms and process flows over time so we can re-visit previously captured data and improve our detection performance, something that could never be achieved in space.

Data are received by one of our Ground Stations and then transferred to our Data Processing Centre in Toronto. Here the data are very rapidly filtered for customers requiring a 'live feed' of data, and is also archived in our database. The AIS messages can be filtered by any attribute as well as by geography. We then translate the messages into standard formats, segment by Area of Interest (AOI), time, etc. and then send to a customer directly either live

through a proxy, or using Secure FTP. Every customer can choose what data they wish to receive and for which AOI.

We know it is hugely important for our customers to be able to quickly and easily consume our data into their own systems and importantly to fuse our data with other sources to make decisions. We therefore supply our data in a range of industry standard formats. Increasingly, as its use widens, we are seeing a demand now for data in more generic geospatial formats and we are working to support these, and to provide data as web map services for even quicker assimilation into target systems. We are

Executive Spotlight

committed to Open standards such as OGC Web Map Services, KML, XML etc. to facilitate this.

There are also many applications where our AIS data is combined with other data sets to produce an application—for example combining current weather data with vessel location/type in order to identify vessels that may be heading into dangerous conditions. exactEarth does not actually integrate data ourselves; we leave this to our partners or customers, but we are seeing increasing use of our data fused with Radar imaging, Weather and Ocean characteristic data, and also other local sources of Vessel Information to create a myriad of new applications.

We are also now beginning to offer secure web services for machine-to-machine communication where we respond automatically to 'requests' for data. These data can then be transmitted as WMS or through a Data API which we publish to our customers. We offer a global service, a restricted area service, or even a service restricted to certain vessels.

SM

What are the greatest challenges to shipping traffic today? Where is more attention needed in the future?

Peter Mabson

Well I have already mentioned the applications of our data to improve vessel safety from a route-monitoring and search and rescue point of view. Another current challenge is certainly piracy—here our AIS data is being used proactively to help manage the routing of vessels through high risk areas as part of the international community's war on piracy.

Another challenge lies in logistics. Ninety percent of the Worlds' trade takes place across the Oceans. An ability to track shipments fully from source to destination would aid in planning, increase efficiencies, and back on the environmental theme help reduce emissions. Also being able to monitor vessels more completely would allow Port Logistics/Management applications to manage the schedules so that a ships speed was controlled so that they arrive in port on time, saving fuel by not travelling too fast and/or wasting fuel and time sitting at port if they arrive early.

Another important topic is weather-related vessel damage or groundings. Currently more than ten thousand containers are lost during ocean voyages each year, which entail not only an economic loss but even more importantly become a hazard to shipping in their own right. In addition, early identification of ships in distress could prevent environmental disasters. For example, exactAIS allows for correlation of hydrographic and meteorological data to plan better ship routing to avoid dangerous weather and sea conditions. By comparing ship movement data with weather data, it is also possible to proactively identify ships that may be in potential danger.

In terms of future issues we would expect a focus on environmental issues and specifically on the areas of vessel engine emissions and vessel pollution of the maritime environment. It is estimated that 10 percent of the Earth's carbon footprint can be attributed to shipping, and although in this high profile area standards and metrics exist for most things, they have yet to be set for the Maritime Domain. Perhaps one of the reasons has been an inability to monitor and measure. Satellite AIS, with

its ability to measure course and speed over the entire voyage, brings an important new data capability with respect to this issue. Satellite AIS, when combined with other sensor technologies, is also expected to be important in detection and prosecution of illegal dumping of pollutants from vessels.

Another important future topic is the management of global fish stocks and the combatting of illegal fishing. On this important issue Europe has already decided to place AIS on every fishing vessel and other nations are expected to follow suit. There is growing recognition that fish stocks must be managed on a global basis and that illegal uncontrolled fishing cannot be allowed to continue. Global AIS tracking of fishing vessels represents a proven low-cost approach to start tackling this issue.

SM

Looking back upon your career, what are the projects you have been responsible for that have brought you a great deal of satisfaction?

Peter Mabson

Although I was pleased to be involved in the early days of satellite communications and satellite—delivered television I have to say that what we are doing here at exactEarth is very exciting and satisfying. It harkens me back to the beginning of my career in the space business—here, once again, we have a small team that is creating something truly breathtaking and making a difference in the world. The first time at exactEarth that we had customers call to tell us that they had used our data to catch a polluter, or to help rescue a vessel, or when they call you so excited as they realize the possibilities of what your data is going to enable them to do—well I have to tell you *that* is a really cool feeling.

I think that it was *John Masefield* who said "All I ask is a tall ship and a star to steer her by"—so at exactEarth, I guess we're giving the stars a bit of help.



The Road To The Future—Signing Bonuses

By Bert Sadtler, President, Boxwood Executive Search + Contributing Editor

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 is 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. Boxwood also provides a consulting solution for the analysis and improvement of the employer's current recruitment process. If you would care to submit a recruitment, hiring, or retention question for Bert to answer, please email your question to BertSadtler@BoxwoodSearch.com.

Dear Bert,

We are in the process of recruiting a mid-level manager. The issue of offering a signing bonus has come up. What has been your experience regarding a signing bonus?

Jim Q.
COO
Government Contractor

Dear Jim,

Thank you for your straightforward question. I wish the answer was as simple as your question.

Before offering an opinion on a signing bonus, we need to take a few steps back in order to determine if a signing bonus would be appropriate. Consider the following:

- If your recruitment process has reached the point of a signing bonus, it should be fair to assume that you have launched a recruitment campaign, screened candidates, interviewed selected candidates, identified candidates who are both a technical as well as a cultural fit, have developed/discussed an action plan and are working with several finalist

candidates. At this point, you are focused on the candidate who is regarded as the top choice and you are determining what it will take for the candidate to accept your offer. At the same time, if you are unsuccessful with your top choice, you have one or two more finalists who you could hire.

- Do you understand the candidate's current total compensation? Once you do, you have a better understanding of what it will take to make an offer that is superior to the candidate's current compensation and you will be positioned for a discussion around "total compensation". Compensation comes in multiple forms which can include: 401K, Paid Holidays, Paid Vacation, Stock, Stock Options, Equity, Medical Benefits, Company Car, Car Allowance, Salary, Performance Bonus, Sales Commission, Profit Sharing Bonus, Annual Company Bonus, Unlimited Sick Leave and Continuing Education Reimbursement.
- Reaching the point of transparency and trust with a candidate is critical in order to develop chemistry. If you have been open and earned

the candidate's trust, it should be easy to obtain the candidate's total compensation. Once you have understood their total compensation, you are prepared to construct an offer that the candidate would find attractive and compelling.

- Does your company's compensation plan have the flexibility to include a signing bonus? Not all employers can include the words "signing bonus" in an offer. If you can't, be open with the candidate and say that company policy prohibits offering a signing bonus but here is how we could address the "total compensation picture" once you have developed an attractive offer.



- Do you know what the candidate is looking for? If your discussions have been open, you have heard the candidate tell you why they want to work for your company and what motivates them. Your offer should include “levers” that motivate your candidate to accomplish your challenges. If it is performance based, compensation will play a bigger role. If it is mission based, “making a difference” will play a bigger role. In most cases, it is one or the other. Have you incorporated the right one into the offer you are preparing?
- Is the candidate seeking an offer solely based upon financial aspects or are there non-financial incentives that would be attractive to the candidate? Examples might include: Specific title, working on a project that is especially exciting to the candidate, fast track for career advancement, etc.
- Are you recruiting a passive candidate or a candidate who is in employment transition? A passive candidate is not looking to make a job change because they have a good one already. However, they can make the best candidates because they are more likely to ask great interview questions and will not over-promise their capabilities since they don’t have to. They take a more thorough approach to the interview process and as a result, generally are a better fit. The passive candidate will be more selective and more likely to negotiate an offer. They are generally less of a hiring risk. It may be necessary to include a signing bonus with them. The candidate in transition is in a different situation and may not request or require a signing bonus.

- Once you determine that you want to offer a signing bonus, it should be specific and meaningful to the candidate as a result of your knowing them through several interview meetings. Examples might include:
- Cover part of the candidate’s moving/relocation expenses?
- Offset an anticipated earnings bonus from the candidate’s current employer?
- Increase the total compensation offer to exceed the candidate’s current compensation?
- Provide a one time lump sum to cover a projected several month ramp-up of commission earnings?
- Offer a lump sum payment instead of increasing the candidate’s base salary?

The signing bonus should be used as the final step in gaining the candidate’s acceptance. At this point, your discussion of an offer with a candidate should be verbal and not written. The written offer should be delivered to the candidate only when the candidate has agreed verbally.

Jim, in summary, good recruiting is a process that includes specific steps in a specific order. The goal is less about “making a hire” and more about acquiring the right talent who can deliver long-term value and will enjoy working for your company. I have seen signing bonuses work well under the right circumstances and used as an effective means to gain a candidate’s commitment.

I hope you have found this to be helpful.

Sincerely,

Bert Sadtler

About Boxwood Search

There is an ongoing battle for senior level talent. A great hire can make a long term positive impact and a failed hire can prove to be very expensive. How does a company recruit and hire the right talent? It is more than just networking within the community of friends and business associates. It requires focusing on results through a process oriented approach. Boxwood Search is committed to reaching a successful outcome with recruitment methods that have repeatedly proven to deliver very qualified senior talent.

Candidates are screened against key criteria, technical fit and cultural fit analyzed, interviews conducted, references contacted and hiring recommendations then presented. Upon making the offer, Boxwood Search is the employer’s advocate and an active participant in communicating with the candidate until offer acceptance has been secured. Results are guaranteed.



Barbarians At The Gates

By Elliot Holokauahi Pulham, CEO, Space Foundation

Growing up in a ranch family, I heard plenty of cowboy wisdom about “closing the gates after the horses have all run off.” So, I naturally tend to think about U.S. “protection” of space technologies in similar terms.



Charles de Steuben's Bataille de Poitiers, en octobre 732, painted between 1834 and 1837

Imagine a fenced-in pasture where our space technologies are grazing. The front gate is labeled "Exports"... however, the gate is slammed shut and is guarded by throngs of taunting, saber rattling guards.

control findings announced by Ambassador *Greg Schulte* during the *28th National Space Symposium* were hardly surprising, but the fact that the Ambassador is finally in the position to talk about them is major progress.



However, if you look closely, another gate, labeled "Universities," is standing wide open. Our grazing technologies meander in and out of this gate, mingling with students, researchers, scientists and others from virtually every nation on the planet.

I think the visual is very apt, and there's a lot of instructive fun you can have with it.

One of the first things a really wise, old cowboy would say is that we never used to have to worry about the corral in the first place. Heck, we were so busy driving our space programs across the range at high speed nobody could keep up with us. By the time they figured out where the herd was, we had all moved on. The herd was moving fast, and growing all the time.

Not exactly where the U.S. space program is today.

The reason these images pop into my head is that it appears, at long last, that the U.S. is ready to replace the throngs of guards at the ITAR entrance with a more reasonable gatekeeping system—we hope. The "1248" export

Good people in the Congress, administration and industry are all trying to prop that gate open a bit, so that reasonable commerce can once again commence.



This is nothing more than enlightened self-interest, as export controls have seriously injured the U.S. space industrial base, while creating global market opportunities for other nations. The American government, simply, is finally recognizing the increased costs and reduced purchasing power that comes along with a constrained domestic industrial base.

As the country works through the enabling legislation and the processes by which space exports are controlled, it will be kicking the export gates open a bit. How much? As wide as possible, I hope. We need to adjust the Export gate in full consideration of just how far open the Universities' gate stands. It does no good to constrain commerce in space technologies that are already freely flowing through the open portals of academia.

As many of the "gate guards" in this area foot-stomp and bombast their concerns about China, it is appropriate to examine our internal inconsistencies. While the exports gate remains closed to China—indeed many gatekeepers continue to pile more and more anti-China locks upon the entrance—the academic gates happily flap open, wider and wider.

According to the Council of Graduate Schools, a half million applications for the autumn 2012 term have been sent to U.S. graduate schools by foreign students.

Applications from China rose 20 percent in 2010, another 21 percent in 2011, and jumped another 18 percent this year. China is the single largest country of origin for international graduate students coming to study and perform university research in the United States, and the fastest growing.

By most counts there are 723,277 foreign students enrolled in American universities, of which some 157,558—or 22 percent—are Chinese. While the number of Chinese students that we are educating at the graduate level is increasing at about 20 percent per year (per the above data), at the undergraduate level, Chinese enrollment in U.S. colleges increased about 43 percent last year.

It is instructive to look at some of our more technically focused schools. The University of Virginia has seen its international enrollment increase 44 percent, with China being the single largest nation of origin. The University of Southern California is a perennial favorite of non-U.S. students, with nearly 9,000 enrolled. The Ohio State University, with more than 10,000

graduate students, has opened a gateway office in Shanghai in order to keep up with applications from China, which have increased 29 percent.

These are not bad things.

International students spent about \$21 billion in the U.S. on tuition, fees and living expenses last year. Given the decreases in funding for U.S. higher education, at both the federal and state levels, international students paying disproportionately higher non-resident tuition are helping to prop up a higher education system that has been the victim of benign neglect from elected and appointed officials. Until America, as a nation, is ready to make education a priority again, our colleges and universities must find ways to keep their doors open and international scholars are forming an increasingly important part of that calculus.

Foreign students also must, to succeed, learn something about American culture and society while they are here. They expose our own young people to the cultures and societies of the world. This peaceful development of friendships without borders has long been a prominent feature of secondary education, and is, perhaps, the most effective antibody our society has to inoculate us against the perils of sensational, isolationist political ranting. (Back, full circle, to those "barbarians at the gate.") In fact, no less an iconic institution than the U.S. Air Force Academy fully understands the benefits of engaging internationally through student programs: included in this year's graduating class are 50 cadets representing some 36 partner nations.

The problem isn't with this robust international engagement at the university level. The problem is with export control policies that ignore it, and instead place onerous gatekeeping burdens upon industry.

The problem isn't with colleges, universities or other organizations that are willing to engage in constructive, informal, unofficial relationships with other nations. It is

with elected or appointed government that is not willing to do this.

As another famous cowboy once said, "The enemy is within the gates. It is with our own luxury, our own folly...that we have to contend." (Marcus Tullius Cicero*)

The View From Here is that the 1248 report (mandated by Section 1248 of the *National Defense Authorization Act for 2010*) and subsequent proposed legislation finally put us in the position to get our space technology gatekeeping right. Removing space technologies from the munitions list is a good first step.

Subsequent steps must recognize and protect only those technologies that really need protecting, while encouraging industry to trade freely wherever academia and non-U.S. industry are already free to do so.

**Although best known as one of Rome's greatest orators, Cicero came from the Equestrian class, which provided horses and cavalrymen to the Roman army.*

About the author


Named chief executive officer of the Space Foundation in 2001, Elliot Pulham leads a premier team of space and education professionals providing services to educators and students, government officials, news media and the space industry around the world. He is widely quoted by national, international, and trade media in their coverage of space activities and space-related issues. Before joining the Space Foundation, he was senior manager of public relations, employee communication and advertising for all space programs of Boeing, serving as spokesperson at the Kennedy Space Center for the Magellan, Galileo and Ulysses interplanetary missions, among others. He is a recipient of the coveted Silver Anvil Award from the Public Relations Society of America—the profession's highest honor. In 2003, the Rotary National Awards for Space Achievement Foundation presented him with the coveted Space Communicator Award, an honor he shares with the late legendary CBS News Anchor Walter Cronkite and former CNN News Anchor Miles O'Brien. Pulham is chairman of the Hawaii Aerospace Advisory Committee, a former Air Force Civic Leader and advisor to the Chief of Staff and Secretary of the Air Force and a recipient of the U.S. Air Force Distinguished Public Service Medal.



Cut that wire

Powering Up—Advances In CubeSats Enable New Apps

by Erik Mumm, Vice President + Director, Flight Systems,
Honeybee Robotics Spacecraft Mechanisms Corporation



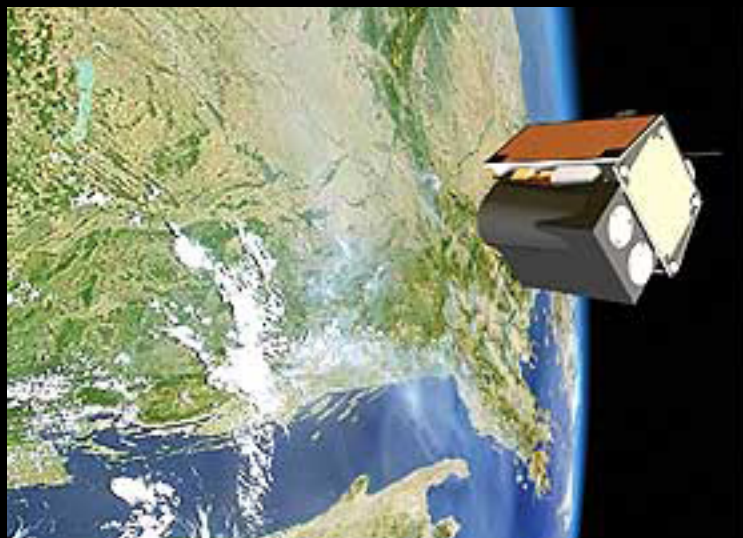
Everything old is new again in the satellite market. For the bulk of the space age—from the 1960s through the mid-1990s—satellite systems grew in size and complexity, built to handle increasingly challenging missions. As more powerful launch options became available, satellite size continued to increase in step. However, over the last decade, the industry is experiencing a resurgence of small satellite technology, with a focus on nanosatellites such as CubeSats. In some ways, this is a return to form for the industry: The first American satellite in orbit, Explorer 1, weighed in at just under 14 kilograms. This time, interest in small satellites is driven not by a lack of launch options but by improving technology that enables satellite developers to create low-cost platforms without sacrificing capabilities.

Background image: Comtech AeroAstro's small satellite platform contains a solar array deployment mechanism designed by Honeybee Robotics. Image courtesy of ComTech AeroAstro.

As part of this renaissance, the satellite industry has two independent (and often complementary) tracks to develop smallsats, defined as satellites with a wet weight of under 180kg. On the governmental and military side, small satellites provide a low-cost platform that can quickly test new technologies in the area of Intelligence, Surveillance & Reconnaissance (ISR), situational awareness and space-based science missions. On the lower end of the cost spectrum, academic and even consumer-level satellites benefit from the standardization and commercialization of the CubeSat platform, which greatly reduces complexity of satellite development. From Honeybee's perspective, missions from the former represent a more compelling opportunity for developing and deploying cutting-edge technology—for the latter group, volume of interest will be generated that will further reduce barriers to entry and the subsequent leads to new launch options. In both cases, miniaturization of electronics and flight hardware must—and will—continue advancing to provide capabilities once available only to large satellites.

Standardization Drives Innovation

In 2000, researchers at Stanford and California Polytechnic created the first CubeSat specifications. This was a 10-page document that standardized the form factors that are now common today: 10 centimeters per side, no more than one kilogram per unit; units could be stacked to form 2U and 3U rectangular birds. California



For "boots on the ground" engaged on today's mobile battlefronts, DARPA is planning on becoming a true ISR and imagery asset to help save lives and expedite missions. The agency is developing recon sats that can be quickly launched all the while remaining within tight budgetary restrictions.

Polytechnic is also the originator of the now-standard CubeSat deployer, the Poly Picosatellite Orbital Deployer (P-POD), which has

enabled standardization across launch vehicles and greater access to secondary payload opportunities. In 2004, the school hosted the first CubeSat Developers' Workshop to find ways to reduce CubeSat costs and development time, to increase the launch volume to improve access.

All this standardization has led to the birth of a new concept: The satellite as a commodity. Just as PCs underwent a revolution in the 1980s, toward smaller, cheaper, and more capable units, CubeSats on the extreme end of the spectrum are now reaching the level of mass-produced commodities with plug-and-play interoperability between systems. In fact, students and even hobbyists can now purchase commercial CubeSat kits that provide all the basic satellite framework for as little as \$7,500. The PhoneSat project, led by NASA Ames Research Center, has developed a CubeSat based on a cell phone processor for just \$3,500, which is scheduled to launch in Q3 2012. Of course, it's worth remembering that though costs are falling, buying access to low Earth orbit (LEO) is still expensive, outweighing the cost of these cheap satellites by two orders of magnitude. As secondary payloads, costs to access space are relatively low, and since 2003, some 50 CubeSats have reached space as auxiliary payloads.

Small Platform, Big Performance

The more advanced action in smallsats and CubeSats today remains with the military and government-sponsored research. Whereas a student-led CubeSat mission may provide a level of valuable data as it educates young scientists, governments are pushing the envelope of big-concept missions in small packages. These missions, for applications in situational awareness, ISR, space science and space-based Earth science, require more capabilities. This is where the shift toward small satellites is becoming quite interesting.

In the United States, NASA and the military are viewing smallsats as ideal platforms for developing new technologies and offering an order of magnitude increase in operational responsiveness. These mission capability demonstrations, such as the Edison Program led by NASA Ames and DARPA's SeeMe Program, are designed to advance state-of-the-art capabilities small spacecraft to show how they can perform more capable or less costly missions than larger spacecraft, or add entirely new capabilities: formation flying, robotics, payload recovery, close proximity operations, advanced power systems, micro-propulsion, orbital debris removal, miniaturized remote

sensors, and new deployable apertures. These missions are also prime candidates to innovate and flight validate new subsystems that could be incorporated into future spacecraft.

On a more strategic level, smallsats are relatively quick to build and launch, providing operational responsiveness and persistence for the military, such as mission-specific communications links or data acquisition. This persistent, global coverage is a focus for the military around ISR applications. For some applications, smallsat technology is ready and able to fulfill mission objectives. But in many cases, technology currently under development will be required to enable a new generation of highly capable, low-cost satellites.

Technology Development For Added Capabilities

Based on the Company's experience developing satellite technology, there are three areas in which technology improvements will significantly advance the capabilities of smallsats: Power, maneuverability, and communication.

- *Power: Every satellite faces power constraints—many smallsats must work with an austere power budget that limits their functionality. For example, most CubeSats are limited to only 5 watts of orbit average power. Smallsats fare somewhat better as they have more surface area and generally deploy solar arrays, but they are still constrained. Even in an era of low-power electronics, imaging equipment and communication antennae, this low limit can be the function-limiting step in designing a smallsat. New deployable solar array systems and miniaturized solar array drive assemblies (SADAs) are a natural step to significantly improve the power budget, and thus capabilities, of even relatively low-cost smallsats.*
- *Maneuverability: Most CubeSats are designed for a limited operational lifespan of just a few weeks or months because they are unable to maintain altitude in LEO. While this has the unintended benefit of keeping LEO less cluttered, the short operational window places limits on the capabilities small platforms can provide. Miniature micro-thruster technology would open new capabilities beyond station keeping, including synchronizing CubeSats for distributed capabilities and enabling on-orbit rendezvous. Currently, a number of*



CubeSat SADA cross-section view



CubeSat solar array drive assembly

approaches based on chemical and electric propulsion are under development. Of equal importance to spacecraft maneuverability is attitude control, or pointing. Imaging payloads in particular require attitude determination and control systems that can provide high agility and stable line-of-sight pointing. There is a growing need for higher agility in small satellites that current approaches, torque rods and reaction wheels, cannot provide. The small satellite attitude control market is ripe for innovation.

- *Communications: Smallsats are compelling to military and scientists in large part because new technology may enable them to communicate and coordinate with a network of satellites on-orbit. Such distributed architectures reduce demands placed on each satellite, which can function as a specialized node in a larger system, reducing complexity of each individual satellite and improving the resilience of the larger cluster. Multiple military and government-sponsored research programs are pursuing on-orbit communications technology, both standards and hardware systems.*

A Bright Future

The "bigger-is-better" mindset has shifted in recent years, and the future is looking bright for small satellite technology. Commoditization of CubeSats is opening a new frontier for relatively inexpensive access to space for students and researchers around the world. The military currently sees smallsats and CubeSats not as mere toys, but as valuable experimental platforms and operationally responsive systems. These two trends complement one another: As miniaturized technologies mature, the successful approaches will provide capabilities within a standardized framework, similar to the way PC components have evolved to a plug-and-play mentality.

New technologies will be required to realize the potential of these small platforms. The coming years will be an exciting time to see what big capabilities can be fit into small packages. Advances in miniaturized technology and a continued push for interoperability standards will enable mission planners to focus less on the bus and supporting systems, and instead focus on what they will do with a new constellation of capabilities.

About the author

Erik Mumm is Vice President and Director of Flight Systems at Honeybee Robotics Spacecraft Mechanisms Corporation, where he is responsible for program management, business development, flight mechanism and systems design, controls and software development, and flight operations support. He has over ten years experience in electro-mechanical systems design, development, and test for NASA and Military programs. In tandem with the Chief Engineer, Mr. Mumm ensures Honeybee's technical standards are followed and continuously improved upon. He served as technical lead on the robotic Sample Manipulation System for NASA's Mars Science Laboratory. He holds B.S. and M.S. degrees in Mechanical Engineering from the University of Nebraska.



Honeybee's Endeavors

Honeybee Robotics Spacecraft Mechanisms Corporation is a developer of specialty robotics and electromechanical systems. The company develops subsystems and mechanisms for government and commercial spacecraft, with extensive experience in deployment and positioning systems, planetary sample acquisition, power and signal transfer, end effectors, and attitude control. Two of the company's current projects are aimed at extending functionality of smallsats.

CubeSat Solar Array Drive Assemblies

Earlier this year, Honeybee Robotics developed the world's thinnest solar array drive assembly (SADA), designed to increase orbit average power and enable high performance applications in Earth imaging, space science and situational awareness. Measuring just 6.5 mm—thinner than the world's thinnest smartphone—the CubeSat SADA provides +/- 180 degrees of low power single-axis tracking. As integrated with the MMA Design High Watts per Kilogram (HaWK) solar array system, the tracked system provides orbit average power (OAP) of 22 watts, and peak power of 36 watts on a 3U CubeSats, compared to just 5 watts for existing systems.

Tiny Operationally Responsive CMGs (TORCs)

Controlling spacecraft attitude with limited mass, volume, and power resources is an essential component of smallsat design for applications acquiring data, downlinking, and solar orientation. Honeybee Robotics is developing a new miniature class of control moment gyroscopes designed for smallsats, which produces higher torque and uses less power than similarly sized attitude control systems based on reaction wheels.



TORCs enable high-agility slew maneuvers with unprecedented acceleration. For example, an individual TORC module can accelerate a 24-kg satellite at 3 deg/second²—an order of magnitude better than reaction wheels, and using a fraction of the power and volume.

Adjusting The Focus In HTS Mobility

By Claude Rousseau, Senior Analyst, NSR France

Intelsat's latest announcement of a new **High Throughput Satellite (HTS)** platform (**EPIC**) for, among others, mobility services is a sure sign that the focus on higher capacity has taken hold of the mobile satellite market. What does this mean for the industry and customers, and how will other operators, such as Inmarsat, react?



The introduction of the **EPIC** platform by **Intelsat** is a signal that FSS operators are more and more convinced that the mobility market is ripe for broadband solutions at a cheaper cost per bit. But **HTS** capacity, which has been mostly aimed at broadband consumer markets, is not necessarily designed to be a hit in all markets, even in the mobility segment.

As noted in the recently released **Mobile Satellite Services 8th Edition** report, **NSR** sees a developing trend in defining HTS for the mobility segment by taking a more in-depth look at region-by-region traffic to fine-tune the coverage where users are most likely to be found. In targeting specific maritime and aeronautical corridors with **Intelsat-29e**, in particular, the EPIC platform refines the thinking that Inmarsat introduced in the mobility market with **Global Xpress** by picking coverage over high-travel routes. For example, the North Atlantic corridor coverage of IS-29e is a key area for aeronautical connectivity going forward, and Intelsat could easily convince both **Panasonic** and **Row44** (for example) to use it for their long-haul passenger airline customers.

Furthermore, with the first Ku-band HTS payload aimed at mobility, Intelsat will offer backward compatibility at a higher throughput. This is not the case for **Inmarsat**, which has planned a comprehensive (and perhaps costly) migration path from L- and Ku-band to its Ka-band HTS. Inmarsat's fifth generation network coverage will bear a striking resemblance to its fourth generation network, with HTS capacity covering the globe, and aimed at as many current Inmarsat subscribers as possible.

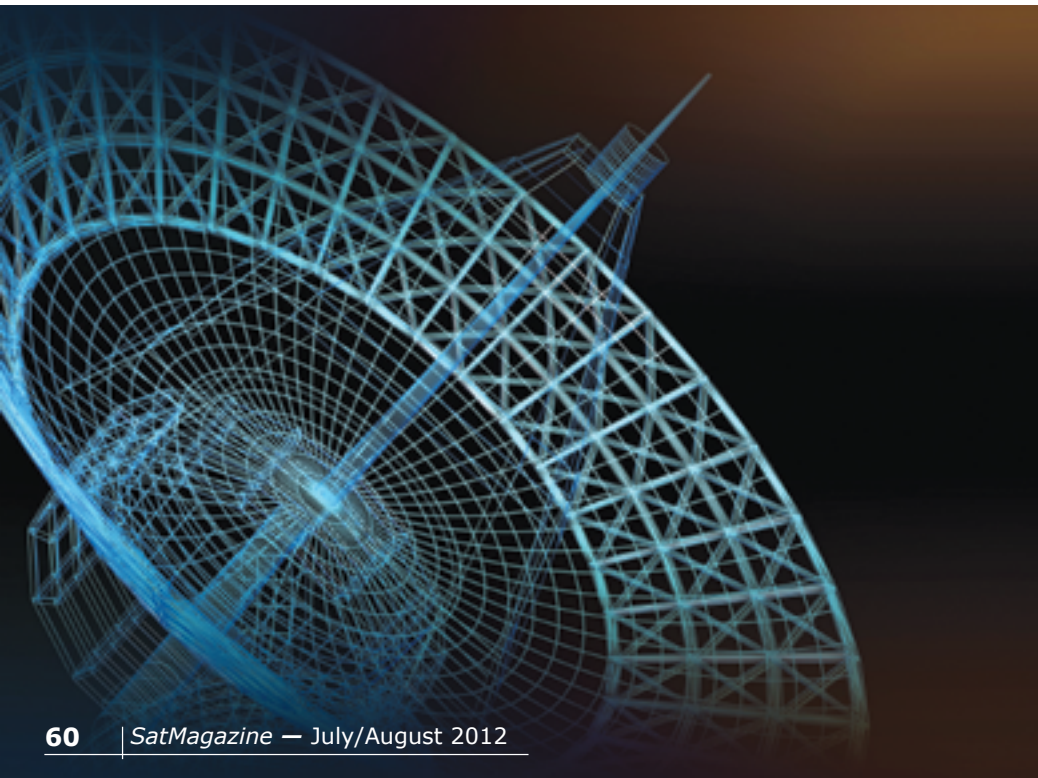
With a few thousand Ku-band customers, Inmarsat has a far broader scope and reach with its next fleet but also more "ground" to cover to reach and attract its current user base to high-capacity services. Thus, its marketing efforts will likely be more intense—the fact that Inmarsat will be operational before Intelsat's HTS platform gives them a leg up.

However, NSR also believes that users, especially in the more traditional maritime market, will initially prefer to stay with what they have (L- or Ku-band) rather than switch to a new and unproven technology, even if it still sees a transition taking place later in the decade as some HTS applications become more successful.

As for other operators such as **Eutelsat**, **Viasat** and **Telenor** that offer mobility within their HTS offering, they will be somewhat impacted by the Intelsat announcement, but to a lesser extent as their core focus is not currently on mobile users, and even then, it is aimed at specific applications and markets such as *satellite newsgathering (SNG)* for Eutelsat, maritime and oil and gas for Telenor, and continental air travel for **Viasat**.

The Bottom Line

The mobile satellite market will experience more competition in the high capacity business, with more operators selling HTS bandwidth across a range of frequencies. However, most operators with an HTS mobility solution will continue to fine tune their coverage to target high traffic areas and to transition customers to higher capacity services.





About NSR

NSR provides insightful satellite industry Market Research and Consulting Services to clients around the world. Founded in 2000, NSR specializes in analysis of growth opportunities across four core satellite industry sectors: Satellite Communications, Broadcast & Digital Media, Hybrid & Emerging Applications and Commercial Space. NSR's expert consultants are located globally and possess over 100 years of combined industry experience and the Company focuses on all analytical aspects of each sector, including business, market, financial, and technical issues, thereby enabling clients to clearly understand the current and future state of any opportunity. NSR clients range from start-ups to market leaders in various sectors of the telecommunications industry. The common theme across our clientele is the requirement for unbiased, actionable analysis that provides

each client with the intelligence it cannot find elsewhere. For further information, access NSR's website ***at this link***.

About the author

Mr. Rousseau has more than 20 years of experience in the space sector in various roles, including business and program management, consulting, research, administration and communications. Mr. Rousseau started his career in Ottawa, Canada as Special Assistant for space and science in the Office of the Minister of Industry, Science and Technology of Canada. He then joined the Canadian Space Agency in 1992 in Montreal, Canada where he was Assistant to the President, then successively Analyst for Industrial and Regional Development, Administrator for the RADARSAT program and Manager for Strategic Planning in the Long Term Space Plan Task Force.

In 1999, Mr. Rousseau became Manager, Professional Development Programs and Forum Activities at the International Space University (ISU) in Strasbourg, France. Mr. Rousseau then co-founded Futuraspace, an international space consulting company specialized in space business and management located in California and France. While at Futuraspace, Mr. Rousseau serves as regional and applications expert on satellite communications for NSR and directs both multi-client research reports and consulting projects. He is a key element of NSR's presence in the European, Middle-East and Africa market.

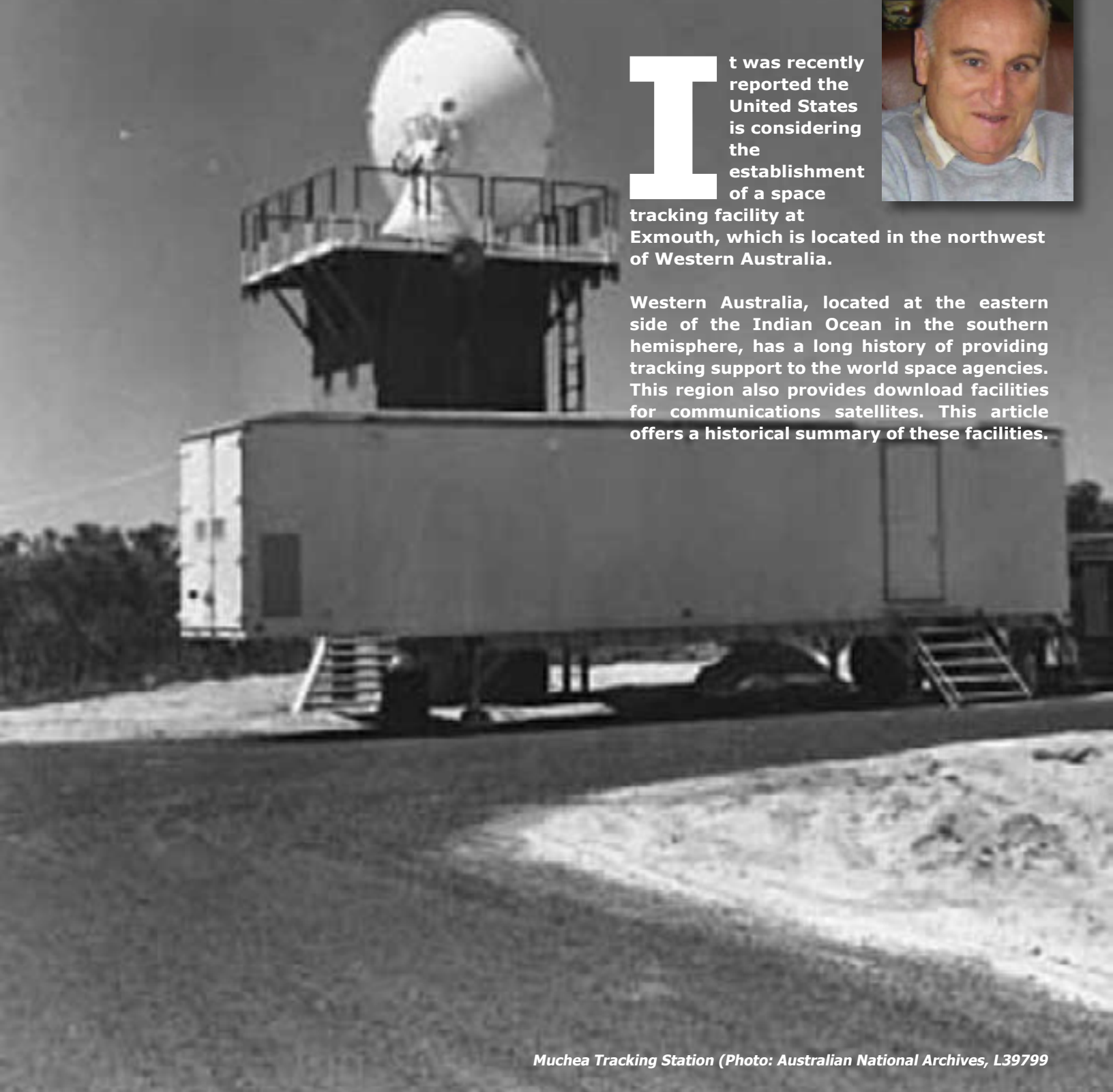
Proper Groundings In Western Australia

By Jos Heyman, Director, TIROS Space Information



It was recently reported the United States is considering the establishment of a space tracking facility at Exmouth, which is located in the northwest of Western Australia.

Western Australia, located at the eastern side of the Indian Ocean in the southern hemisphere, has a long history of providing tracking support to the world space agencies. This region also provides download facilities for communications satellites. This article offers a historical summary of these facilities.



Mucnea Tracking Station (Photo: Australian National Archives, L39799)

During the **Mercury** program, the United States used a tracking facility near *Muchea*. Opened in 1961, Muchea was one of the 17 tracking stations positioned around the globe, of which two were in Australia. Apart from receiving telemetry data, Muchea also served as a command facility during the missions. The facilities were housed in trailers and included an S-band radar instrument. Data was sent to Washington by means of teletype equipment and radio. The Muchea site was closed after the completion of the Mercury programme in 1963.

To replace the Muchea facility, a new tracking station was established at *Carnarvon*. This facility, about 11km outside of the town in the *Brown's Ranges*, was opened in 1963 and was initially operational for the **Gemini** program and later for the **Apollo** and **Skylab** programs.



Carnarvon tracking facility (Photo: author's collection)

In the **NASA** network, Carnarvon was important as it was the first tracking station that could contact the spacecraft after its orbit insertion. The principal antenna was a 9m diameter parabolic antenna while, for some time, a **Cassegrain** horn antenna was in use. NASA ceased operations in 1975 but Australia's **Overseas Telecommunication Commission** continued to use the facility to support **Intelsat** and **European Space Agency** spaceflight operations—the facility was finally closed in 1984. In 1997, the facility was re-opened as a tourist attraction.



Equipment at Yarragadee (Photo: NASA)

In 1979, the **National Aeronautics and Space Administration (NASA)**, established the **Yarragadee Mobile Laser (Moblas)** tracking facility at the *Yatharagga* property near *Dongara*. Its initial purpose was to provide tracking of the **Space Shuttle**, but after the establishment of its space based tracking network, NASA transferred the Yarragadee facility to the Australian government for use in the Australian and International geodetic framework. The facility remains in use today.



USC and Moblas sites (Google Earth)

Adjacent to the Yarragadee facility is a tracking facility operated by **Universal Space Corporation**, a subsidiary of the **Swedish Space Corporation**. Established in 1999, the facility has two independent antennas with capabilities for *Telemetry Tracking & Command (TT&C)* and data downlink services. It supports multiple frequency bands including S-, X-and Ku-Band. The site is also occasionally used as a backup to ESA's **New Norcia** tracking station.



New Norcia Tracking Station (Photo: Jos Heyman)

Established in 2002, the **European Space Agency's** deep space tracking station in **New Norcia** is a crucial link in the solar system exploration missions undertaken by that agency. The station is equipped with a 35m parabolic reflector dish antenna.

The dish's pedestal has a beam waveguide system, cooled S- and X-band **Low Noise Amplifiers (LNA)** and 20kW S- and X-band transmitters. Its equipment can be extended for use in the Ka-band. The New Norcia facility is unmanned most of the time, with control being provided remotely from the **Perth International Telecommunications Centre (PITC)** facility in **Gnangara**. During critical stages, however, a crew may be placed at the New Norcia site itself.



PITC Gnangara (Photo: author's collection)

Owned by **Telstra**, the PITC facility at Gnangara is used for the receipt of international communications as well as in support of various scientific space missions, such as those by the European Space Agency and Japan's **JAXA** space agency. The facility has, among others, a 15m diameter antenna with reception in S- and X-band and transmission in S-band as well as an antenna for the **Global Positioning System—Tracking and Data Facility**. The site's original owner was the government owned **Overseas Telecommunications Commission (OTC)**, and the site began operations in November 1986.



DSD Kojarena (Photo: Australian Dept of Defence)

The **Australian Defence Signals Directorate (DSD)** operates a military receiving station at **Kojarena**, near **Geraldton**. It provides signals intelligence for Australian Government bodies, as well as the United States, the United Kingdom, Canada and New Zealand. It is believed the station is part of the worldwide **Echelon** system.



Optus – Lockridge (Photo: Jos Heyman)

Optus operates a facility at **Lockridge**, in the **Perth** metropolitan area, to support international and some domestic satellite services. It is manned 24 hours a day in recognition of its key role as a Tracking, Telemetry & Control facility and has 21 antennas.



NewSat – Bayswater (Photo: Jos Heyman)

About the author

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



Finally, **NewSat**, a new communications satellite operator, has a ground facility in *Bayswater*, another suburb in the *Perth* metropolitan region.

Satellite Backhaul For Rural Small Cells

*By Dimitris Mavrakis + Julian Bright,
Senior Analysts—Networks, Informa*

Mobile operators around the world are witnessing a surge in data traffic as smartphone use increases, devices become more affordable and network capacity expands. One way in which they are responding to this data explosion is by adopting new, small-cell architectures that can better target underserved areas in developed markets, and extend services into previously unconnected remote and rural areas.



The technology developed for femtocells, the compact home base stations which have already been extensively deployed in many markets as a consumer offering, is now being adapted as a small-cell solution for outdoor metropolitan and rural deployments; an approach which is attracting keen interest from operators and vendors alike.

In a global survey carried out on behalf of iDirect by Informa Telecoms & Media, the use of small cells as a means of providing wireless or mobile access in rural and underserved areas attracted widespread support, with almost half (47 percent) of respondents favoring small cells in preference to 2G or 3G macrocells.

Out of over 330 senior industry professionals who completed the survey, almost 50 percent (156) were from operators, with the rest comprising system integrators, hardware and software vendors. The survey results were backed up by means of interviews with selected mobile operators in order to obtain their views first-hand. Both the survey and the follow-up research encompassed operators from developed and developing markets.

A key challenge when servicing these new small cells will be the provision of backhaul. Fixed-line backhaul options, such as copper or fiber, are almost certain to prove impractical, inflexible or too costly for use in conjunction with small cells outside highly-developed areas, and the alternatives—such as microwave or satellite, both of which are widely deployed in backhaul networks—are under consideration.

Satellite technology has already proved highly adaptable for mobile backhaul purposes. Modern TDMA-based systems can rapidly deliver the highly-cost-effective, carrier-class, two-way all-IP connectivity with shared bandwidth that is ideally suited to small-cell environments.

When coupled with satellite backhaul, the small-cell approach generated a highly positive response from the survey group, with over 55 percent expressing an interest in evaluating a solution that combines the two technologies. Both existing users of satellite backhaul and companies without previous experience of the technology responded affirmatively.

Economic modeling carried out by Informa shows that, when used in conjunction with small cells, the business case for satellite backhaul is strongly favorable. Payback can be achieved in as little as two years, and total cost of ownership (TCO) is highly competitive due to significantly reduced capex relative to competing solutions, and opex in line with similar network deployments.

In the white paper, which you can download from iDirect, Informa evaluates the market potential for satellite backhaul when used in conjunction with small cells and shares the key findings from the survey along with feedback from the operator interviews. Additionally, small-cell technologies and their applications are summarized and the performance advantages of satellite backhaul are considered. Finally, the white paper outlines the key cost benefits of a small cell solution in more detail, based on economic modeling, and presents the findings in the form of a case study.

To download this **iDirect**-sponsored white paper, visit the following link:

<http://idirect.net/Applications/Cellular-Backhaul/Informa-White-Paper.aspx>

About the authors of this brief and the white paper

Dimitris Mavrakis is a principal analyst in Informa Telecoms & Media's Networks team. He covers a range of topics including next-generation networks, IMS, LTE, WiMAX, OFDM, core networks, network APIs and identifying emerging strategies for the mobile business. Dimitris is also actively involved in Informa's consulting business and has led several projects on behalf of Tier-1 operators and key vendors. Dimitris holds a PhD in Mobile Communications and an MSc in Satellite Communications from the University of Surrey.

Julian Bright is a senior analyst in Informa Telecoms & Media's Networks team. He covers a range of wireless broadband technologies including WCDMA/HSPA, LTE, mobile WiMAX and Wi-Fi, and associated technology areas including fixed-mobile convergence, next-generation IP core networks and IMS technologies and strategies. Julian has almost 20 years' experience as a commentator and analyst in the telecoms arena. Prior to that, he spent eight years with a major telecoms company working mainly on projects for BT.



The Isle of Man—Onward, Onward, Onward

The previous two articles on the Isle of Man space industry—Location, Location, Location and Development, Development, Development have explained why the Isle of Man has become a centre of excellence for the operation of orbital filing companies and space related industries and how the Island's space industry has developed significantly from its small beginnings in 2001.

*Image...
The Isle of Man,
as imaged from space.*

In May 2012, a report published by the *Institute of Directors (IOD)* in London entitled, '*Space: Britain's New Infrastructure Frontier*', focused on the unique growth of the **Isle of Man's** space and satellite industry. In a stand-alone section entitled '*The Isle of Man's Mighty Space Sector*', the report stated, "In the new space economy, you can be small and succeed. You don't need astronauts to be in the space business."

"The Isle of Man shows how quickly a powerful niche can be built by a very small player," the report outlined, identifying the initial driver behind the island's outstanding success in the sector as being its ability to establish itself as a commercial and neutral base for orbital slots. Thereafter, with a gentle nudge from industry, the Isle of Man Government was "shrewd enough to see the advantages of declaring zero corporation tax for companies engaged in space related activities. Together with business-friendly legislation, generous grant-aid and a robust telecoms infrastructure, the island has become a magnet for the space and satellite sector."

Incredibly, this has all happened over a period of just a little more than 10 years.

The report's unveiling at the IOD's London headquarters was attended by a delegation from the Isle of Man, including *Tim Craine*, the Government's *Director of Economic Development*, who is also a trustee of the **International Institute of Space Commerce**.

"It is highly significant that the island has received the recognition and praise for its space sector from a prestigious body such as the IOD and is further evidence of the strength of the sector and significant interest that the island's space industry attracts," said Mr. *Craine*.

"The Isle of Man is an excellent example of a small economy with a thriving space sector, with more than 30 companies handling the financing, insuring, leasing and legal ramifications of global space assets."

Among a number of other third-party independent accolades, the Island was also recognized as a favorable location in

a February 2011 Report by the U.S. market research firm, **Futron**, which highlighted the Isle of Man's cutting edge satellite financing. The study, entitled "*Innovative Strategies for Space Competitiveness*" stated that "the Isle of Man's unique approach to space activity allows it to punch above its weight in terms of global visibility in the space industry. [We] imagine other nations and jurisdictions will look to the Isle to replicate its success," the Report added. (<http://www.futron.com/resources.xml><http://www.mansat.com>)

Even some of the island's closest competitors have been prone to casting admiring glances at the Isle of Man's achievements. In the February 2012 *Oxford Economics Report* for the Government of Guernsey—a similar offshore U.K. Crown Dependency—focused, in part, on the strengths of the Isle of Man's space industry.

Recognizing the island's "specialism" in space commerce and that the Isle of Man Government was actively promoting the island as a centre of space excellence, the report stated, "At present, the space commerce industry's profile on the Isle of Man is significant, with numerous global firms present and the Google Lunar X Prize being hosted in 2010. Economically, the industry provides significant high-value added activity on the island. Wider benefits, in terms of attracting visitors and potential future investors via the Lunar X prize (and potential future events) will help to build the island's competitiveness and attract global publicity."

Commenting on the Oxford Economics Report, Mr. *Craine* said, "We make no bones about our enthusiasm for promoting the island as a centre for excellence in space commerce, but it's always nice when a competing jurisdiction highlights the Isle of Man's strengths in space."

As the saying goes, 'Good news travels fast' and, while most pertinent to the space industry, the Isle of Man is living proof that there is truth behind that saying.



The advantages available in the IOM and the subsequent burgeoning space industry has created an entire secondary space related industry on the tiny crown dependency in the Irish Sea.

In terms of the island's space sector breakdown, 45 percent is focused on orbital filing, with an identical percentage dedicated to the procurement, finance and insurance of space assets. The remaining 15 percent is split between manufacturing, "new space" and not for profit organizations

While space manufacturing may account for a small slice of the overall sector, it is not insignificant. For example, **CVI Technical Optics** have made all the optics for this August's **NASA's Mars Science Lab** mission. Since December 2011, the island has been able to boast one highly advanced satellite in its own slot—**ViaSat 1** registered at **115 degrees West**—which covers all of North America and Hawaii.

Among a number of Isle of Man headquartered *Not for Profit Organizations* (NPO's aka NGO's) is the **Space Data Association (SDA)**, the international alliance of satellite operators that

supports the controlled, reliable and efficient sharing of data critical to the safety and integrity of the space environment.

The SDA, which was established by Isle of Man based companies such as **Inmarsat**, **Intelsat** and **SES**, has recently been awarded the *Space Risk Management Award* by the organizers of the *World Space Risk Forum 2012* for its outstanding cooperative efforts to reduce the risk of satellite operations.

The Isle of Man even has its own thriving satellite campus, which is part of the **International Space University** in Strasbourg. In the past 25 years, 3,500 students have graduated from the campus, of whom more than 100 are now working on the island.

"We've all worked hard to make the Isle of Man a great jurisdiction for the global space industry. We've all worked hard to ensure that the Isle of Man 'speaks space'," said *Chris Stott*, one

of the world's leading space entrepreneurs who is also Chairman and CEO of **ManSat**, an organization described in the IOD report as the Isle of Man's home-grown space champion. ManSat is



"Isle of Man" engraved by J.Bingley, published in *Thomas Moule's English Counties ... 1837* (dated 1833). The original is a steel engraved county map with original hand coloring.

Government approved and manages the satellite filing process in partnership with the Island's Communications Commission on behalf of island-based companies all the orbital filing slots that go before the **International Telecommunications Union (ITU)** in Geneva.

As for the island's meteoric rise in space commerce, there might even be a degree of inevitability attached to it. Clearly, the Isle of Man has a talent for adapting to the industries of tomorrow. In the past, the island's economy has moved seamlessly from farming to banking and financial supervision, from the film industry to e-commerce and e-gaming. And now, it has planted its flag firmly in the space sector.

Furthermore, given the island's well established network of support services, in key areas such as legal, corporate and fiduciary, it's easy to see that there has been a ready-made supply of companies capable of handling financing, procuring, insuring, leasing and administration services for space assets.

"We often say that any companies in the space industry can't really afford not to look at the Isle of Man and all that it has to offer," said *Tina Rawlinson*, Director of **Cavendish Trust**, one of the island's leading trust and corporate service companies that works closely with the satellite sector.

"Going forward, we are confident that the Isle of Man will be able to expand further and consolidate its position as a global leader in space commerce, especially given the extensive network of specialist service support companies on the island together with our world class telecoms infrastructure," she said.

On or off-island there is no shortage of space related events and activities where the island plays a significant role. The third **European Space Tourism Conference** has just been held in London which featured the unveiling of the cislunar capabilities of **Excalibur Almaz**, the international commercial space transportation company based in the Isle of Man.

The island continues to offer strong support for space education. This month the Isle of Man hosts the **Space Habitation** conference aimed at creating a new global undergraduate international space school based on the Island.

In a world gone mad, the jurisdiction has proven itself to be a safe regulatory and financial home for the space industry. With the continued growth in satellite communications and the Isle of Man's noted strengths and ever increasing experience in global satellite procurement, finance and insurance, there is every sign that the island's space sector will continue to flourish.

"As the industry continues to grow, the Island will continue to be here. We have political, regulatory, and financial stability, coupled with the Rule of Law and a true understanding and welcoming of the space industry. Space is a priority for our economy," said Cavendish Trust's *Tina Rawlinson*.

While the future for the Isle of Man space sector looks assured, this may well include closer collaboration with neighboring U.K. Intriguingly, the U.K.'s **Economic Policy Centre** in **Space Report 2010** entitled '*Space: Britain's New Frontier*' said that the Isle of Man had carried out a conspicuously successful policy of exploiting its favorable corporate operational environment and that the U.K. itself should use its flexible links with the Isle of Man to encourage more space businesses to come to the British Isles.

The report suggested that the U.K. and the IOM should be viewed as a special-purpose confederation, whose uniquely flexible in-and-out relationship with the European Union allowed companies and technologies to operate within the EU when advantageous, and outside of the EU, when not.

"British space policy should not seek to hinder this attraction to space businesses. Rather, it should copy the IOM's policies to the extent they are able to aid companies to relocate operations strategically on the IOM," the Report recommended.

It's a view with which the Manx Government would concur. "For the U.K., there is plenty of scope for further co-operation close to home," said Craine.

Boasting the world's longest continuous running Parliament, the Isle of Man has a rich history but, according to ManSat's *Chris Stott*, the Island also has a wealth of reasons to look to the future. "A jurisdiction that is 1,033 years old didn't get this way by accident. We always take the long term view. We are always looking to the future with the focus on education, regulation and jurisdictional neutrality to all comers," he said.

"Space is the future of the human race. We are only just starting to understand its value and utility to the world. Commercial services from space drive the entire world's communications backbone and information super-highways and yet this is still only the beginning. The Island is not here to judge the risk of future markets, but rather to ensure a level regulatory playing field, a level launch pad, to enable success for companies working in space markets at any level," added *Stott*.

Clearly, the Isle of Man is a jurisdiction that does not see space as the final frontier.

Editor's Note:

The article's introductory image of the Isle of Man was taken from the International Space Station by Col. Ron Garan

For additional information, access these links...

<http://www.spaceisle.com>

<http://www.wheretheyoucan.im>

http://www.cavendishtrust.com/space_and_satellite



A Video Pathway To Learning—STEM Flix

STEM Flix™ is a new, interactive video series provided by the Northrop Grumman Foundation and Science Bob that's all about having fun with STEM—that is, **SCIENCE TECHNOLOGY ENGINEERING and MATHEMATICS**.

STEM makes nearly everything we enjoy in our daily lives possible—from the circuits that make computer tablets work, to the materials used to make snowboards that allow for cool tricks to be completed. What about some of things many would like to accomplish one day, such as travel through time?! Well, while you might not be able to end up back in the land of the dinosaurs just yet, the technology to make such possible may be far closer than many realize, all thanks to STEM!

STEM Involvement

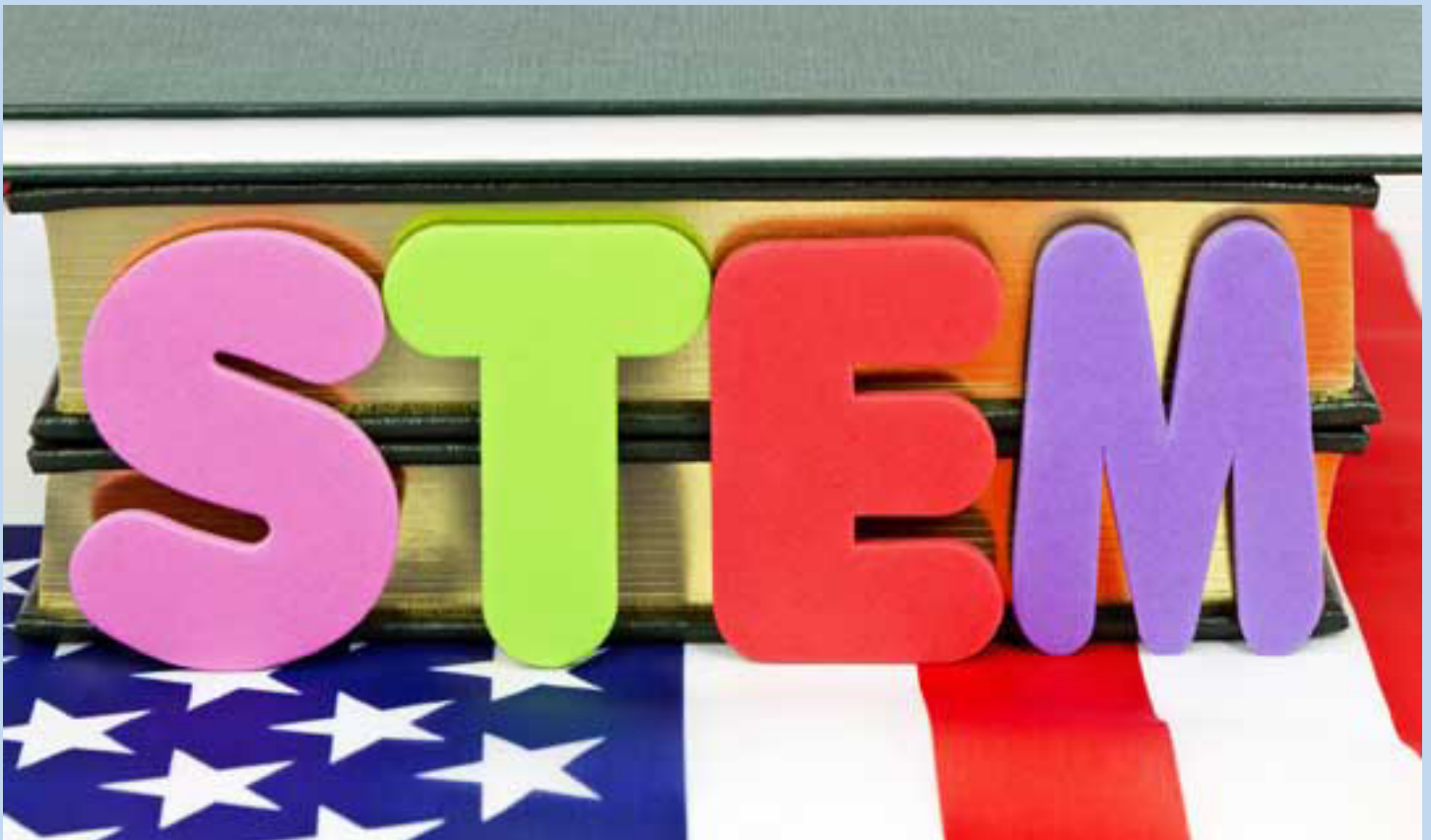
Northrop Grumman Foundation presents **STEM Flix™** because science, technology, engineering and mathematics make so many things possible. The Foundation is a charitable giving arm of a company that makes everything from robots to

satellites, allows people to communicate with each other, helps to explore new horizons, protect citizens, and much, much more.

STEM is all about being creative and coming up with new ideas that test the limits—such as the aforementioned travel through time! Or, deriving workable solutions, such as those that help the environment. Mostly, it's about constantly looking for new ways to help keep up with changing needs. That's called innovation.

The Northrop Grumman Foundation has made it their mission to create and support programs such STEM Flix™ that get teachers and students excited about STEM. This results in a future that is never short of great ideas by tomorrow's scientists, technologists, engineers and mathematicians!

The Foundation provides unique educational experiences related to science, technology, engineering and mathematics



(STEM) for students and teachers—a top priority. The Foundation supports diverse and sustainable national-level programs that enhance the education experience for students and provide teachers with the training and tools they need to be successful in the classroom.

There are two primary methods of helping with the costs of this worthwhile endeavor:

- The **Northrop Grumman Foundation Matching Gifts For Education** program is an avenue that allows employees to double their contributions to qualified educational institutions
- Through grants, the Foundation provides funding to national-level STEM programming

To see what STEM Flix is all about, [select this link](#) to view a four minute video...

For Your Youngsters...

Courtesy of Northrop Grumman, here are some fun facts that help to generate student interest in enjoying the STEM Flix video programs...

Science

*Did you know...*Science refers to gaining knowledge through observation and experimentation? That means it's because of science that we know so much about animals, the oceans, the planets, even understanding where dust comes from. And the more we learn through science, the better we can understand the world we live in and how to make it better.

Technology

*Did you know...*Technology is the application of scientific knowledge for practical purposes? In other words, technology solves problems and creates new and easier ways of doing things, or the opportunity to do things we've never been able to do before! How exciting is that?! Think about these advancements in technology and what they might have been in their time, and how they influence our lives today

Advancements in technology have, thankfully, occurred throughout our history. It has allowed us to grow and evolve as a society. Technology helps save lives through medicine, makes communication easier thanks to cell phones, and is what will one day, take us to planets we've never been to before. If you like to create, solve problems and think you have the next great big idea, perhaps a career in the field of technology is for you?

There are lots of different types of jobs in the field of technology—you could be a Software Developer and construct, test and maintain software, or a Website Developer and design websites. *Steve Jobs* and *Steve Wozniak* are famous technicians who co-founded **Apple Computer**. *Bill Gates* and *Mark Zuckerberg* are two world-famous computer programmers—Bill Gates is one of the joint founders of **Microsoft**, and Mark Zuckerberg is one of the co-founders of **Facebook**!

Engineering

*Did you know...*Engineering is the application of science to designing things whether they're buildings, machines or anything that's manufactured or man-made? Ingenuity is usually involved, which means being clever, resourceful, creative and inventive. Engineering has so many different branches, with the most common being Civil Engineer, Mechanical Engineer, Industrial Engineer and Electrical Engineer. Engineers have really cool jobs like working on the International Space Station and creating 3D special effects in movies.

Mathematics

Decimals have a point...and so does studying math!!

Did you know... that it is believed that Ancient Egyptians used complex mathematics such as algebra, arithmetic, and geometry as far back as 3000 BC? Math has been around forever, and we wouldn't be where we are today without it! If no one thought math was cool, you wouldn't be able to sit in your favorite bean bag chair playing your favorite console or computer game...

Speaking of video games, did you know that video game designers use math every day? That's right, game designers need to have a good grasp of game theory—complex math that involves everything from trigonometry to physics!

*Did you know...*that you'll need all the math skills you can get if you want to be bigger than Facebook, and more popular than Google? To be a part of the latest generation of social media platforms, gadgets and apps, computer scientists use mathematics to create and develop the next big IDEA! These 'smarties' use math skills—such as the theoretical study of algorithms—to understand computing systems and develop hardware and software to create their products.

Did you know... that you can do all these things too? Whether it's coming up with the newest video game, creating the next box office hit, or developing the next great app, it all starts with a little math.

What's Happening Now?

Young people nationwide will get a fun-filled and entertaining lesson in STEM when they head to the theaters and online this summer, thanks to the STEM Flix video series featuring popular television show guest and school teacher "Science Bob" Pflugfelder.

Airing in select theaters across the country between June 8th and September 7th, and [with its own dedicated website](#), STEM Flix is a four-part video series designed to show young people how fun STEM can be, while also teaching them how the disciplines of science, technology, engineering and mathematics are responsible for so many of the electronics, games, products and experiences people enjoy every day.

Sandra Evers-Marly, president, Northrop Grumman Foundation, said, "Many young people today don't realize how many of the things they take for granted every day are made possible because of the work of a scientist, engineer or mathematician. STEM Flix™ is our way of helping students, their parents and teachers get excited about STEM so that our future is never short of great ideas developed by tomorrow's engineers and scientists."

Re:Sources

The STEM Flix series kicked off June 8th with an introduction to STEM and a first look at how fun science can be through a simple, yet colorful experiment known as the “Elephant’s Toothpaste.” The experiment creates an exothermic reaction when a few common household ingredients such as dish soap, yeast and water combine with oxygen. Each of the remaining video episodes will focus on a specific area of science and technology with outrageous demonstrations, graphics and experiments according to the following schedule:

- “Having Fun with STEM!” — June 8-July 5
- “Micro-Electronics: It’s a Small (But Powerful) World!” — July 6-July 26
- “From Bike Helmets to Flying Cars — Composite Materials Make All Things Possible!” — July 27-August 16
- “Grab Your Telescope and Travel Through Time!” — August 17-September 7

The videos will appear during the on-screen movie trailers and announcements that air before this summer’s G, PG and PG-13 rated feature films at the following theaters:

- Shore 8 — Huntington, New York
- Del Amo 18 with IMAX — Torrance, California
- Irving Cinemas 10 — Irving, Texas
- Fairfax 10 and Fairfax 14 — Fairfax, Virginia
- RGL1258 Movies at Wekiva 8 — Altamonte Springs, Florida
- Cinemark Egyptian 24 — Hanover, Maryland
- RGL1043 Mira Mesa 18 with IMAX — San Diego, California

Produced by **PGFilm Entertainment**, the video series will also be featured online at the aforementioned dedicated website so young people and their parents nationwide can learn about STEM. In addition to the movie theater shorts, the site will feature expanded versions of the videos, home versions of the experiments, fun facts about STEM, behind-the-scenes photos from the filming of the STEM Flix series, and more, to help young people get better acquainted with STEM.

Science Bob Who?

With help from Boston science teacher and frequent TV guest, *Science Bob*, topics can be learned through videos that include experiments that can be completed at home, as well as some crazy demonstrations that show just how STEM works.

“*Science Bob*” Pflugfelder joins the Northrop Grumman Foundation’s STEM Flix™ program—an in-theater PSA campaign—as part of the Foundation’s efforts to promote STEM education by reaching students and their parents with the message that science and math are fun—and that anyone can do it!

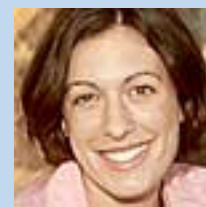
Science Bob is an award winning teacher that has shared his love for all things scientific with thousands of students. From working as a tutor on movie sets, to teaching elementary students outside of Boston, Bob knows what it takes to get students excited about science and technology. In addition to teaching in a classroom, Science Bob has shared his science wizardry with a national audience on “*Jimmy Kimmel Live!*,” “*The Dr. Oz Show*,” and “*Live With Regis & Kelly*.” His experiments have also been featured in *Popular Science Magazine*, **Disney’s Family Fun**

Magazine, and *People Magazine*. [Check out his website](#) for access to great science experiments and activities.

The Technical Expertise Behind STEM Flix

Blake Bullock, Business Development and Science Advocacy, Northrop Grumman Corporation

Blake Bullock is a campaign lead for Northrop Grumman. In this role, she is responsible for supporting scientific and technical advocacy for astronomy and astrophysics. Prior to her current assignment, Ms. Bullock served as Risk Manager and Systems Engineer for the **James Webb Space Telescope Program** at Northrop Grumman. Ms. Bullock served as a *Presidential Management Fellow* at the National Aeronautics and Space Administration (**NASA**) and in the Pentagon for the **Office of the Secretary of Defense, Strategic and Space Programs**. Prior to this, she lived and worked in New Mexico as a science journalist and Mass Media Fellow of the **American Association for the Advancement of Science**. She holds a Master’s degree in Astronomy from **Wesleyan University** and a Bachelor’s degree in Astrophysics from the **University of California, Berkeley**. She is a member of *Women in Aerospace*, the *Association for Women in Science*, and the *American Astronomical Society*.



Kelley Ristau, Manufacturing Engineer, Space Vehicle Structures & Antennas, Northrop Grumman Corporation

Kelley Ristau currently reviews spacecraft structure and antenna designs to ensure they can be built; identify tooling and processing needed to successfully build the spacecraft hardware; and help identify and implement solutions to challenges that arise during the manufacturing process. Since a young age, Ms. Ristau has been fascinated with space—what is out there, and how to get there. Growing up, her favorite subjects in school were math and physical science. Ms. Ristau graduated from the **University of California, San Diego** in 2005 with a Bachelor of Science degree in Aerospace Engineering, and since then has worked for Northrop Grumman Aerospace Systems at their Space Park facility in Redondo Beach, California. In her several years at Aerospace Systems, Ms. Ristau has worked in a number of roles, including Civil Space Business Development, Tooling Design, Materials & Processes Engineering, and Manufacturing Engineering. Ms. Ristau really enjoys hands-on materials research and development, as well as the satisfaction of seeing paper designs come to life as tangible spacecraft structures and antennas in the manufacturing area. She is proud that three of the satellites she has helped build are already on orbit around Earth. Ms. Ristau continues to take courses related to material science with the hope that advances in material technology will remove some of the restrictions that currently limit spacecraft capabilities and missions. In her non-working time, Ms. Ristau enjoys gardening, cooking, traveling, learning about sustainability, and participating in figure skating as both a skater and a judge.



Aaron K. Oki, Technical Fellow and HBT Technical Champion, Northrop Grumman Corporation

Aaron K. Oki was born in Honolulu, Hawaii. He received the Bachelor of Science in Electrical Engineering in 1983 from the **University of Hawaii** and the Master of Science in Electrical Engineering in 1985 from the **University of California, Berkeley**. Since joining Northrop Grumman as a member of technical staff in 1985, he has been working on the development, production, and insertion of advanced *Gallium Arsenide (GaAs)*, *Indium Phosphide (InP)*, *Antimonide (Sb)*, *Gallium Nitride (GaN)*, and *Wafer Level Packaging (WLP)* technologies into mission-critical U.S. government military and space systems. He is a *Northrop Grumman Technical Fellow*, *Institute of Electrical and Electronics Engineers (IEEE) Fellow* in the Northrop Grumman Microelectronics organization. He has been awarded 18 U.S. patents and has co-authored more than 250 technical publications on solid-state technology.



and enable multi-sector growth. Mr. Orlowski chairs the Corporate Engineering Council. Mr. Orlowski joined Northrop Grumman in 1999 as a senior systems engineer. Since then, he has held a number of increasingly responsible positions, including program manager for various **C4ISR** programs in Baltimore, Maryland and head of the Systems Engineering department at the former Shipbuilding sector in Newport News, Virginia. Prior to joining NGC, Mr. Orlowski worked closely with the Navy's ship acquisition community in Arlington, Virginia, as a naval architect, systems engineer and project manager. Mr. Orlowski received his bachelor's degree in ocean engineering and a master's degree in systems engineering from **Virginia Tech** in Blacksburg, Virginia. He completed the *Darden School of Business Executive Program* at the **University of Virginia**. He is the company representative on the **Aerospace Industries Association's Engineering Management Committee**. He serves as a member of the *TechAmerica Supplier Assurance Task Force*, as well as on the *Corporate Advisory Board of the International Council on Systems Engineering (INCOS)*.

Christian T. Orlowski, Corporate Director, Engineering, Northrop Grumman Corporation

Chris Orlowski is Corporate Director for Engineering and provides leadership for corporate activities associated with engineering and technology. Mr. Orlowski has the responsibility for ensuring that engineering capabilities are utilized to the maximum extent possible and are aligned to satisfy current and future customer demands across the enterprise. Additional responsibilities include identification and development of state-of-the-art capabilities, best practices and technologies that ensure successful program execution



Live From London—The 2012 Olympics

By Alan Mercer, Operations Director, SatStream

The 2012 London Olympics are nearly upon us and broadcasters from across the globe are getting ready to descend on London to capture that all important coverage live from the action. With the Olympics playing host to 216 nations, taking part in a total of 300 events, that will be no mean feat! Alan Mercer, Operations Director, SatStream, explores the critical elements of ensuring a successful Olympics broadcast.



Capturing the Feed

One of the biggest challenges at the Olympics will be acquiring the various feeds, especially as there are nine different venues within the Olympic park, a further 13 venues across London, and 10 across the United Kingdom.

Broadcasters are likely to be stretched to the limit, taking feeds from many of the sports to ensure their coverage is as all-encompassing as possible, enabling them to cater to sports fans from as wide a variety of disciplines as possible. With so much to capture, London will, no doubt, be scattered with numerous SNG and OB trucks pulling in feeds and sending them across the globe.

For major broadcasters, this will not be a huge concern, as they have enough trucks and resources to handle coverage depth. The challenge will be for smaller broadcasters who either do not possess SNG or OB trucks, or simply don't have enough on hand to complete their coverage.

Finding connectivity in an already packed city will not be easy for those broadcasters. This is especially true for satellite broadcasters who need uplink and downlink facilities in order to send and receive feeds quickly and effectively.



Smaller-scale broadcast players will need to use 'light' and highly portable solutions. Fortunately, new technology has revolutionized equipment footprints in recent years. There are any number of portable Flyaway and SNG terminals available, which will go far in helping with the downlink and uplink. However, it will still be a question of setting up close to the action, which may be difficult, at best.

Fighting For Space

The question of space is an important one—even with portable equipment, camping out somewhere may not always be possible. A "Starbucks Solution" may work for someone with just a laptop for desktop editing, but even then connectivity may be an issue as the WiFi networks will certainly be overloaded during the Olympics.

As an example, it's expected that there will be an extra 500,000 visitors* to London during the Olympics and Paralympics, most of whom will be using all forms of Internet access to view news feeds, send images, send and receive emails, check out venue details on the Internet, and so on. Just watch those bit-rates fall!

When it comes to satellite uplinks, lugging an SNG system, no matter how portable, into Starbucks simply won't work. Broadcasters will be looking for dedicated space in the city, which often comes at a premium at the best of times—rental prices for most locations will be hiked considerably during the Games.

Not only that, portable SNG systems are still larger than your average laptop. In many cases, users may need to be moved on a daily basis, yet finding adequate space with parking in London is often a whole new challenge in the best of times, so broadcasters may be forced to carry heavy equipment through the streets of London before the action starts at the beginning of the day!

Adding Value

For most broadcasters, adding voice and graphics as well as editing packages to conform to broadcast quotas and so on will be key requirements. Such necessities may be a huge issue for broadcasters without specific studio or production space booked locally.

Inserts of these reports may well need to be live, as viewers at home will want to keep as up-to-date as possible with the action as it happens. "Live" will certainly be much more challenging and will make the need for an appropriate location all the more crucial in addition to, of course, connectivity requirements.

Here, quality of service considerations are paramount—100 percent reliability needs to be the order of the day. If commentary or voice-over is to be added, then the space needs to be extremely well-thought out, both in technical and environmental terms. This is not something that can be achieved in the local coffee shop, or even realistically in any old office space or hotel lobby. A lack of infrastructure and poor acoustics will inevitably lead to frustration and disappointment, for both the broadcaster and the viewer.

Another key trend in the world of broadcast currently is multi-platform content delivery—consumers are becoming accustomed to viewing a whole range of content on numerous devices. The London Olympics may well be the first venue of its kind to reach out to such a vast array of connected devices, from

large, flat-screen TVs to the smallest of smartphones. What better example of an event where multi-platform truly fits a purpose?

Sporting fans across the globe will be watching the action and poring over the results, night and day, depending upon the viewer's timezone. Many will be going about their daily routine, but will desire to keep up with the action. It may be a case of logging onto an Internet feed during their lunch break, or watching on their mobile phones on their way to or from work.

As a consequence, making Olympic coverage available for multiplatform delivery will add a whole extra angle for broadcasters and mean that not only will they need space and connectivity, but also the wherewithal to repurpose and encode content for delivery to any number of devices and platforms, worldwide.

The Winning Solution

Broadcasting the Olympics will come with its challenges, more so for those broadcasters without a fixed production space within which to handle the hundreds of hours of local feeds and to customise, package, and deliver to the host broadcasters back home. There are plenty of improvised solutions available with their associated risks. We believe broadcasters will welcome the use of a convenient, broadcast-standards facility, which is not priced 'per 15 minutes'.

SatStream is a specialist satellite webcasting facility based in central London. It is a purpose-built facility, designed to enable broadcasters and rights owners to ensure their coverage is managed exactly as it should be: In the right place, at the

right time, to the right people. The facility enables multiplatform delivery and ensures broadcasters a large amount of available bandwidth for delivering video content. It also enables satellite downlink from a large array of satellites, both in SD and HD.

As *Craig Moehl*, CEO, SatStream, said, "We are extremely excited about the upcoming Olympics. SatStream is a convenient broadcast-standards facility, which has great connectivity, both via satellite and IP, and yet is affordable to smaller broadcasters. We welcome the opportunity to help make Olympic broadcasting smooth and seamless, ensuring the feeds are available to viewers at the right time and on any device."

With this kind of facility available, and with space in the capital already being booked up for July 2012...**why wait?**

About the author

Alan Mercer is a professional with more than 30 years experience in the broadcast industry. He is Operations Director at SatStream, Europe's largest bespoke broadcast-standards facility specifically designed for content acquisition from Satellite and broadcast by Streaming via the internet. As well as this, Alan runs his own media consultancy, GBF Media. He has specialised knowledge and experience in the technical and commercial aspects of distribution for broadcasters, including IP delivery across cable and Internet, as well as through conventional means (satellite, cable and terrestrial).



