

SatMagazine

A satellite with solar panels is shown in orbit above the Earth. The sun is rising over the horizon, creating a bright glow and lens flare effect. The Earth's surface shows clouds and landmasses.

**M2M Connectivity
It's All About Location
No Sky View?
Forrester + Heyman
Bragging Rights
The Failed Hire
Improving STEM**

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Published monthly by
Satnews Publishers
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 Phone: (707) 939-9306
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InfoBeam

A Successful Antenna Unfurling (Harris) Page 08

SES' Hulk..... Page 08

Dual Solutions (Yahsat) Page 08

Antenna Approvals (Thrane & Thrane) Page 10

Joining Forces (Astrium Services + Hisdesat)..... Page 10

CAPEX Impact On FSS Operators (NSR) Page 11

An Awarding Day (Inmarsat) Page 12

Playing A Big Role (Aerospace) Page 14

A Controlling Presence (GMV)..... Page 14

Wise-Up With This New Wiki (ESA) Page 15

Counterfeit Regs (HSI) Page 16

CASBAA Rallies And Resists..... Page 17

The Freeze Is On (U.S.A. F. + NGC)..... Page 18

Working The Circuits (Agilent + Comtech) Page 18

Meteosat Membership (Thales Alenia Space)..... Page 18

Oil & Gas Growth (NSR) Page 18



The Forrester Focus On SatBroadcasting™: DirecTV Planning For U-HDTV



Pay-TV giant DirecTV will adopt Ultra-HDTV, which is the 'next generation' follow-on technology from today's HDTV. DirecTV is already planning its future spectrum needs in readiness for U-HDTV. Philip Goswitz, DirecTV's Senior Vice President of Space & Communications/R&D, speaking at the Satellite event in Washington, DC, said "4,000 and 8,000-line services are great for the satellite industry and will ensure that satellite broadcasting continues to distinguish itself for image quality of service."

By Chris Forrester, Senior Contributing Editor — Page 20

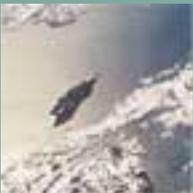
Prime: A Single Source For M2M Connectivity + Data Management



The market for M2M solutions is constantly evolving, with many factors making significant impact on enterprises that are considering the development and implementation of a new M2M solution. Market demand for M2M is moving from a purely high-end product focus, such as cars, excavators and smart meters, to virtually any type of product, such as food containers, personal navigation devices (PNDs), pets and even Barbie dolls.

By Gwenn Larsson, Chief Marketing Officer, Telenor Connexion— Page 22

Insight: It's All About Location, Location, Location...



At first glance, why would an established, or entrepreneurial, state-of-the-art space or satellite business choose to base itself on a small island in the middle of the Irish Sea, some 30 miles off the UK mainland? With a population of around 84,000, boasting the world's oldest continuous Parliament stretching back well over 1,033 years, the Isle of Man might seem an unlikely location for such a forward looking industry. However, with all due consideration to the past and long standing political and economic stability, it's to the future—or more specifically, the skies above—where a growing portion of the island's versatile economy is now firmly focused—Page 26

Insight: Two Dimensional GPS For A Three Dimensional World



The Global Positioning System—GPS—is a worldwide radio-navigation system that is formed by a constellation of 24 satellites that communicate with their respective ground stations. The Global Positioning System is mainly funded and controlled by the U.S. Department of Defense (DoD). The system was initially designed for the U.S. military. However, over the past 10 years, there has been a widespread introduction of innovative ways to introduce the GPS technology into the private sector; in fact, so many that other countries are now deploying their own none-military use GPS systems in order to fill the increasing global demand for location information on people and products.

By Patrick Bertagna, CEO, Founder + Chairman, GTX Corp. — Page 30

Uplink: No Sky View? No Big Deal...



If you're underground or in some other closed facility location that lacks a view of the sky, communication with the up-top world can sometimes be difficult or even downright impossible. A new communication solution to deal with these conditions has been created by Gilat Satcom. This solution allows users of Iridium satphones to communicate with those above ground and outside the closed facilities without having to leave their surroundings. This is a light weight, easy-to-install, and cost-effective solution for obtaining sky view when such is not available.

By Ami Schneider, Director Of The Mobile Satellite Division, Gilat Satcom — Page 32

Focus: Titan's Time



In much the same way as for most of the current space launch vehicle, the Titan launch vehicle started life as a military missile. Intended as a back up for the Atlas ISBM missile, development was started in October 1955 when the Martin Company (which in 1995 merged with Lockheed to become Lockheed Martin) was awarded a contract for the airframe design. Towards the end of its military operational life, some of the missiles were refurbished as space launchers. Also, the missile formed the basis of a family of space launch vehicles.

By *Jos Heyman, Managing Director, Tiros Space Information* — Page 34

Insight: Bragging Rights



An Australian satellite communications company was among the finalists in this year's World Teleport Awards for Excellence, proving Australia is certainly one of the regions of the world at the forefront of space technology and able to provide some of the Earth's best satellite communications. The satellite event in Washington, DC, this year drew more than 11,000 satellite communications' professionals from 70 countries. The main purpose was to learn, discuss and share the latest developments within various markets that included government, enterprise, broadcast, mobility and telecommunications.

By *Bob Gough, Senior Contributing Editor, Asia-Pacific* — Page 40

Re:Sources: The Road To The Future—The Failed Hire



Dear Bert,

You have mentioned the concept of "failed hire" in your column and during your interview on Federal News Radio. Please explain what you mean by "The cost of a failed hire."

By *Bert Sadtler, President, Boxwood Executive Search* — Page 44

Focus: We Must Work Together To Improve STEM Education



I am drawn to the word "holistically" as I start to compose this editorial on education. At its most basic, the word holistically means improving not just one part but the whole thing. Those of us in the space industry, government, education and, in fact, America, overall have this thing called STEM that needs improving; the whole thing. To the person on the street, a problem with STEM may sound a bit like a medical term, maybe a new super-virus.

By *Iain Probert, Vice President of Education for the Space Foundation* — Page 46

Advertiser Index

Advantech Wireless	Page 07	Harris Corporation	Page 05
AnaCom, Inc.	Page 33	MITEQ / MCL, Inc.	cover + Page 23
Arabsat Satellite	Page 09	Near Earth LLC.	Page 19
AVL Technologies	Page 27	Newtec CY	Page 03
CASBAA	Page 25	SatFinder	Page 43
ComtechEF Data	Page 39	Teledyne Microwave Solutions	Page 17
Cometch Xicom Technology, Inc.	Page 13	Wavestream Corporation	Page 35
GigaSat Limited	Page 11	W.B. Walton Enterprises, Inc.	Page 15

A Successful Antenna Unfurling

Two unfurlable mesh antenna reflectors developed by Harris Corporation (NYSE:HRS) were successfully deployed last month onboard the first Mobile User Objective System (MUOS) satellite built by Lockheed Martin Space Systems Company, Sunnyvale, California.

MUOS will provide military users with next-generation, narrowband tactical satellite communications with 16 times more capability than existing UHF satellites, including superior data rates and priority-based access to on-demand voice, video and data transfers. The announcement was made during the National Space Symposium that was held April 16-18 at the Broadmoor Resort in Colorado Springs, Colorado.

In total, Harris is building 10 units for the MUOS constellation, with the remaining eight units in varying stages of production. The antenna reflectors were manufactured at the company's reflector manufacturing facility in Palm Bay, Florida.

More information: <http://www.govcomm.harris.com/solutions/products/defense/muos.asp>

SES' Hulk

SES S.A. has announced that the SES-4 satellite is now fully operational and ready for service at the orbital location of 338 degrees East.

SES-4 was successfully launched from the Baikonur

Cosmodrome in Kazakhstan on board an ILS Proton Breeze M booster on February 15th, 2012. SES-4 replaces the NSS-7 satellite and provides replacement as well as incremental capacity at this well-established SES orbital slot over the Atlantic Ocean.

SES-4 is a 20-kilowatt satellite manufactured on the flight-proven Space Systems/Loral 1300 platform, with 52 C- and 72 Ku-band transponders. It has C-band beams serving the eastern hemisphere of Europe and Africa and providing full coverage of the Americas, plus a global C-band beam to support mobile and maritime customers. Four high-power, regional Ku-band beams provide service to Europe, the Middle East, and West Africa, as well as North and South America, with extensive

channel switching capability between C- and Ku-band transponders for enhanced connectivity. The satellite is designed to deliver services for 15 years or more.

Martin Halliwell, Chief Technology Officer of SES, said, "We are delighted to see the 50th spacecraft in the global SES fleet go live and congratulate the technical teams involved for the successful bringing into operation of this important addition to our fleet. SES-4 offers state-of-the-art transmission capacity to SES customers across three continents and for a wide array of applications, including video distribution with DTH power-levels, VSAT, government and maritime services."

More information: <http://www.ses.com/4628467/ses-4>



The MUOS satellite, developed for the U.S. Navy, leverages the latest commercial advances in cellular and satellite technology, while maintaining compatibility with legacy UHF systems. This is the first of five MUOS satellites scheduled for deployment. Each MUOS satellite will carry two Harris antenna reflectors—a 14m diameter unit for multiple-beam operation that significantly increases the number of users and traffic the system can support and a 5.4m diameter unit for legacy mission operations. The reflectors are secured to the satellite by precision booms that are also provided by Harris. A reflective gold mesh weave provides the reflective surface required for radio waves.



The SES-4 satellite, photo courtesy of Space Systems/Loral.

Dual Solutions With Multiple Spot Beams

Y1B, the second satellite of the United Arab Emirates' space communications program, is ready to be launched on a Proton launcher from Baikonur in Kazakhstan.

Comprising two satellites and a ground segment, the Yahsat project is a complete commercial and military satellite communications system built by Astrium and Thales Alenia Space (TAS) for the Al Yah Satellite Communications Company (Yahsat). The Yahsat system will offer innovative commercial solutions, including HDTV broadcasting, Internet trunking via satellite, corporate data networks, and Internet services for public and private users, as well as secure communications.

Astrium is responsible for the final integration of the two satellites and for delivery in orbit. Thales Alenia Space provided the payloads and is responsible for the space segment, including the launch of the satellites. Astrium Services, with its partner Thales Alenia Space,



Yahsat's Y1B satellite, photo courtesy of Astrium.

is responsible for the ground segment, which comprises a network of ground terminals, and for a management system which provides remote control of all system hardware. Astrium Services, in association with Thales Communication and Security, is also in charge of operating this system, providing ground segment maintenance and of training Emirati operators over a five-year period.

Y1B will deliver communications in Ka-band for commercial and governmental users. It will provide high-data rate Internet services for public and private users in the Middle East, Africa and South West Asia with state-of-the-art Ka-band multi spot-beam technology, achieving cost-effective bandwidth supply through 61 narrow spot beams. The governmental

mission will bring a substantial increase in the total capacity available for the UAE secure communications over the Middle East, complementing the Y1A satellite.

With a launch mass of approximately 6,000 kg and a spacecraft power of 14 kW, Y1B has a design lifetime of more than 15 years. Like Y1A, Y1B was integrated by Astrium on a Eurostar E3000 platform and tested at its Toulouse site. More than 50 Eurostar satellites have now been launched and have accumulated over 400 years of successful in-orbit operation. Both commercial and military Ka-band payloads were built with state-of-the-art Ka-band multi spot-beam technology from Thales Alenia Space. Early orbit phase operations will be conducted by Astrium from its spacecraft control center in Toulouse.

Antenna Approvals

Following a series of Type Approvals from Inmarsat, Thrane & Thrane has announced the availability of several new antenna options for its AVIATOR SwiftBroadband portfolio.

This approval will enable the satellite communications equipment manufacturer to offer increased flexibility to its worldwide customer base. The antennas, now Type Approved for use with Thrane & Thrane's AVIATOR 700D, 350 and 300 systems are:

- *AMT-700 and HGA-6000 approved for use with the AVIATOR 700D*
- *CMA-2102 and HGA-7000 approved for use with the AVIATOR 350*
- *IGA-5001 approved for use with the AVIATOR 300*

Thrane & Thrane offers a portfolio of SwiftBroadband solutions ranging from the AVIATOR 200, 300, 350 and 700, to the AVIATOR 700D, which is FANS 1/A and CPDLC compliant and also supports a range of advanced applications including cockpit voice dialling, in-flight calling and Internet browsing.

The newly approved antennas join a range of other antennas already Type Approved for use with Thrane & Thrane's SwiftBroadband solutions.



Thrane & Thrane's AVIATOR 700D

Joining Forces For Additional Flexibility

Astrium Services and Hisdesat, the Spanish government satellite service operator, have signed a framework agreement for a joint technology development project with the aim of establishing a constellation approach for the radar satellites TerraSAR-X and PAZ.

The German satellite TerraSAR-X, launched in 2007, reliably delivers high-resolution radar data for versatile applications to worldwide customers.



Artistic rendition of TerraSAR-X.

PAZ is the first Spanish radar satellite designed as a dual use (military and civilian) mission to meet operational requirements in the field of high resolution (up to 1 meter) observation. PAZ is scheduled for launch in 2013 into a polar orbit, which will be specifically optimised to improve the time to get images over key areas of interest when combining TerraSAR-X and PAZ into a constellation.

Operating these two virtually identical satellites in a constellation will afford Astrium and Hisdesat with a more flexible capacity management of their systems. The company's customers and partners will benefit from enhanced performance and service levels thanks to improved revisit time, service reliability and increased data acquisition capabilities. The constellation approach will also provide improved system redundancy and back-up for both satellites in case of maintenance phases. A wide



The PAZ satellite, artist concept.

range of time-critical and data-intensive applications will benefit from this constellation approach, such as precise monitoring and faster detection of surface movement activities:

Defence and security:

reduced lead times and a reliable, faster coverage of critical areas of interest and hot spots will facilitate improved support to operational missions worldwide

Surface movement

monitoring: engineering and mining companies will be able to efficiently monitor and manage their operations and reduce risks to workers

on the ground. Maritime surveillance: applications such as ship detection, oil pollution monitoring and sea ice observation will benefit from improved revisit times and increased data acquisition capabilities

Humanitarian organisations and crisis intervention: faster and assured access to data over the affected areas supporting the efficient coordination and management of rescue and relief activities.

CAPEX Impact On FSS Operators

In its recently released Satellite Operator Financial Analysis (SOFA) study, NSR assessed two different metrics regarding typical CAPEX outlays for fixed satellite services (FSS) operators:

- *The first metric was the **Total CAPEX to Cash Flow from Operating Activities** ratio that gives an indication of how much of a FSS satellite operator's capital expenditures can be financed by the annual cash flow coming out of its operations. The lower the ratio, the less cash is being absorbed by capital spending and more cash remains for other activities, be they payment of dividends, deleveraging, or possible merger and acquisition activities.*
- *The **Total CAPEX to Annual Revenues** ratio was the second CAPEX related metric assessed in this study. It performs a similar function to the prior metric and shows what fraction of an FSS operator's annual revenues are used for CAPEX functions.*

NSR's statistical analysis of the Total CAPEX to Cash Flow from Operating Activities ratio from the SOFA study illustrates a clear distinction between large FSS operators and small- to mid-sized FSS operators. While the **industry average for this ratio stands at 0.79**, indicating that on average nearly 80 percent of cash flow coming from operating activities is funneled into CAPEX, the standard deviation shows that this can **easily vary as widely as under 10 percent on the low end and over 150 percent (sometimes well over) on the top end.**

This trend occurs because small- to mid-sized FSS operators will normally exhibit periods of very high capital spending when they need to plan for a replacement satellite in their fleet or look to expand their overall fleet size, but the small- to mid-sized FSS operators will then have very low CAPEX requirements in between

these satellite programs. The larger FSS operators typically have more consistent year-to-year capital expenditure requirements as they normally launch several satellite

while small- to mid-sized operators can spend anywhere from less than five percent of annual revenues on capital projects to more than 150 percent of annual revenues depending exactly

came next in terms of the Total CAPEX to Annual Revenues ratio in 2010 indicating that from this perspective they were spending fairly typical levels of on CAPEX for an FSS satellite operator. All of these companies are in slightly different places in their capital spending cycle, so there will be considerable movement in these rankings in coming years.

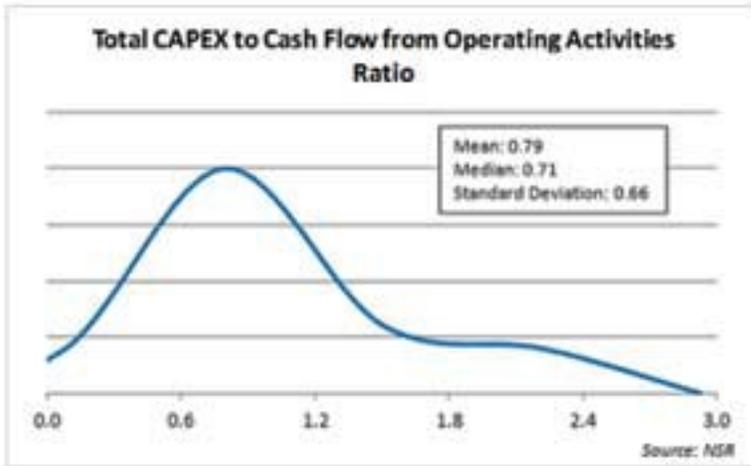
For example, SES was heading into a peak of CAPEX spending in 2010 and therefore scored the highest of the large operators. Conversely, APT Satellite actually spent more on capital investments in 2010 than it had in total revenues. This was because APT Satellite was at the crest of its capital spending cycle for its Apstar-7 and -7B satellites and actually took on debt in this year in order to fund its CAPEX program. APT Satellite's capital spending will likely decline significantly in the coming year or two, and it should then score a more typical Total CAPEX to Annual Revenues ratio.

It is a well known fact that the FSS business is very capital intensive and the high costs of building, launching and insuring satellites are both a major barrier to entry into the sector as well as the core issue at the heart of every business plan in the industry. Over a longer period of time (about 5 years), NSR's analysis shows that the

average FSS operator will spend about 35 percent to 45 percent of their annual revenues, or 50 percent to 70 percent of their operating cash, on CAPEX.

With statistically determined typical values for these ratios as well as understanding the different trends between large and small- to mid-size operators, it becomes a straight forward task to assess individual operator statements regarding their CAPEX spending projections and determine both how they stack up to their peers as well as if they are staying within industry norms.

Analysis by Patrick French, Senior Analyst, NSR Singapore. Mr. French joined NSR in September 2003 and is the lead author for NSR's annual studies Global Assessment of Satellite Demand and Broadband Satellite Markets.



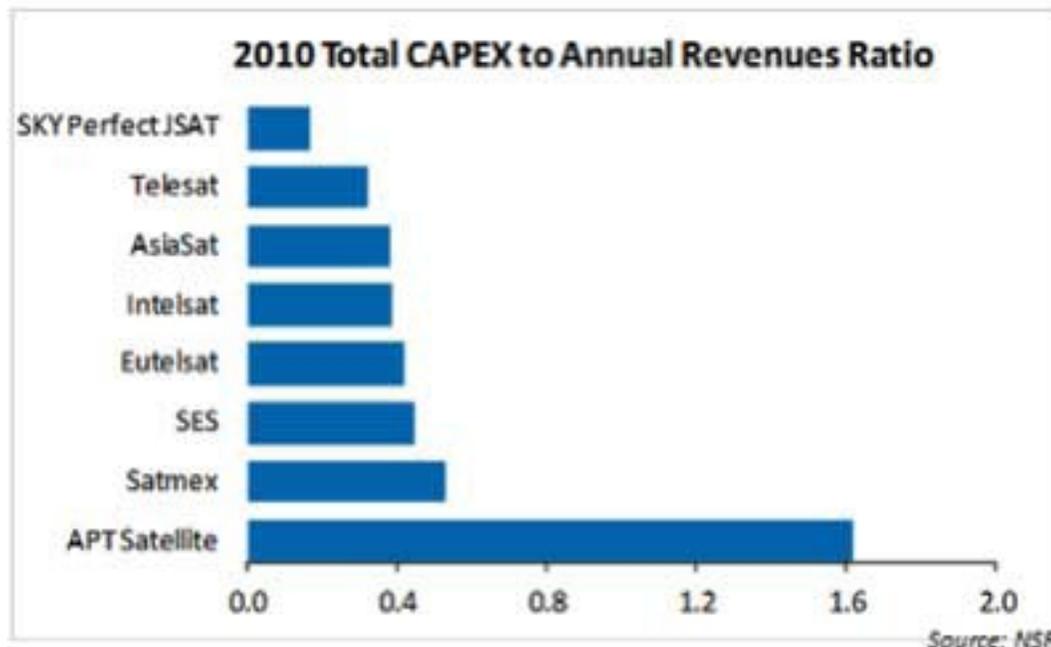
replacements or expansion programs per year; however, they, too, will see cycles in their capital spending profile with periods of lower or higher spending (just not quite as dramatic as the small- to mid-size operators).

The Total CAPEX to Annual Revenues ratio essentially illustrates the same trends as described above for the Total CAPEX to Cash Flow from Operating Activities ratio. Larger FSS operators tend to score more consistently, though with some variability, in the 0.3 to 0.5 range,

where they are in their fleet replacements/expansion cycle.

SKY Perfect JSAT appeared to be in the "trough" portion of its capital spending cycle in 2010, and this allowed it to score the lowest Total CAPEX to Annual Revenues ratio of all FSS operators for the year for which NSR had data. Assuming SKY Perfect JSAT does increase capital spending in the next several years, it will likely see a more typical score for an FSS operator of its size in this metric.

Telesat, AsiaSat, Intelsat, Eutelsat, SES and Satmex all



An Awarding Day

Inmarsat has received a major industry leadership award, being named Satellite Services Provider of the Year for the second consecutive year.

The accolade was bestowed at a special ceremony at the Digital Studio Industry Leadership Awards in Dubai. The awards were attended by many of the Middle East's leading professionals from key industries, especially the media and TV and film production companies.

"It's a great honor to receive this award for the second time," said Helene Bazzi, Inmarsat head of regional development for Europe, the Middle East and Africa. "We see it as great recognition of our efforts towards offering the best services possible to professionals and organizations in the region. Inmarsat has gone to great lengths to



develop our premium satellite services, which uses one of the most reliable satellite communications network in the world to provide global coverage for users to broadcast live news from wherever they may be."

Helene added that many organisations and individuals rely on our technology, especially in emergencies, so it needs to be the best it can be, delivering when and where it's required, which is something Inmarsat strives to achieve. In its eighth year, the Digital Studio Industry Leadership Awards recognize the efforts of individuals and companies that have contributed to the growth of the broadcast and production industry in the region.

Another Inmarsat story involves a news team from Sky News that provided compelling and award-winning coverage of the Libyan uprising has told how they relied on Inmarsat BGAN to report to audiences worldwide.

Alex Crawford, special correspondent for Sky News, her producer and two cameramen were reporting from the newly-liberated town of Zawiya when they spotted a convoy of opposition fighters heading for the capital Tripoli. Taking their BGAN unit with them, they decided to follow the group, and became the world's only news crew to capture the moment opposition forces entered Tripoli.

"We were live on air via satphone, telling the studio about the scenes of celebration we could see, but it was evident that nobody could quite believe what we were saying," said Ms. Crawford. "So we decided to rig up the BGAN and show them the pictures."

Producer Andy Marsh set up the BGAN from the back of a pickup truck, which was moving slowly through the gridlocked

streets. "We had it attached to the cigarette lighter for power, connected to a laptop, and Andy synched it up with the Inmarsat satellite," said Ms. Crawford. "He was monitoring the connection, and as we crawled forward, he moved the unit ever so slightly to maintain the link. It was a genius move."

The connection was so reliable that the team were able to broadcast live and

uninterrupted coverage for 40 minutes, as Ms Crawford answered questions from the studio in London. "As soon as they could see the pictures you could hear the penny dropping the other end quite dramatically," she said.

"The viewers of Sky News expect to see reports from the heart of the story, and so the news teams need to be ready to move at a moment's notice

and follow the story wherever it leads," said Mike Seery, Head of Media Sector Development for Inmarsat. "Mobility and speed of set-up, as well as reliability, are all essential. BGAN has delivered all of these for the Sky News reports."

Ms. Crawford, three times winner of the Royal Television Society's Journalist of the Year, has been praised for her bravery and tenacity



Sky News correspondent, Alex Crawford

to be the first broadcast journalist to enter the city. Her live reporting from Libya has been described as "heroic journalism". Earlier this year Sky News' coverage of Libya won a Royal Television Society award, with judges praising the team's "brilliant achievements in just getting to the right places at the crucial moment."

Inmarsat distribution partner GMPCS has worked with the broadcaster for many years. "Sky News has built their 24-hour rolling news operation on some pioneering use of mobile satcoms, and have been enthusiastic adopters of BGAN," said John Stoltz, Director, GMPCS. "Their commitment to technology is one of the reasons they achieve the award-winning coverage."

"This is a fantastic example of the power and flexibility of BGAN," said Mike Seery. "It demonstrates just how quick and easy it is to set up a BGAN and get a reliable connection for live video reporting. If there is news breaking from a remote part of the world, and a news crew covering it, you'll most probably find a BGAN."

Playing A Big Role With Small Satellites

Following three years of design, fabrication, and test, Aerospace delivered two CubeSats to a national security space agency, and one CubeSat to the Space and Missile Systems Center in January.



The picosat team, left to right, Geoff Maul, Petras Karuza, Jim Swenson, Jerry Fuller, Dan Rumsey, Daniel Ehrlich, Andy Chin, and Siegfried Janson. Not pictured, David Hinkley.

CubeSats, which are a specific type of small satellite, measure 10 centimeters on a side and usually weigh less than 1.3 kg. Aerospace is one of the creators of small satellite technology, and has been designing, building, and operating nanosatellites (1 to 10 kg) and even smaller picosatellites (0.1 to 1 kg) since 1999.

"We designed, fabricated, tested, and operated the 250-gram mass PicoSat 1.0 spacecraft over a decade ago, and they are still the lightest active satellites ever flown," said Siegfried Janson, a senior scientist in the Physical Sciences Laboratories. Since then, the PicoSat group at Aerospace has built six picosatellites, as well as 10 nanosatellites during the past 13 years.

The group also developed a miniature propulsion system, which was licensed last summer to a company called Austin Satellite Design. Austin Satellite Design plans to fly this system on University of Texas CubeSats in the next few years.

In general, small satellites provide a number of advantages compared with their larger counterparts, namely, they are inexpensive, they require less time to build, and they are small enough to simply "hitch a ride" on a launch vehicle.

"Small satellites can be designed, fabricated, and tested within a year, and flight opportunities, at least for CubeSats, are becoming available every few months," Janson said. In fact, sometimes it doesn't even take a year. An example of how quickly Aerospace created one of these diminutive satellites

occurred last year. "Our PicoSat group, led by David Hinkley, went from concept to flight hardware delivery within six months on the PicoSatellite Solar Cell Testbed-2 (PSSCT-2) spacecraft when a ride on the last U.S. space shuttle suddenly became available," Janson said. This small satellite measured 5" x 5" x 10" and weighed 3.6 kg. It was launched by the space shuttle Atlantis (STS-135) on July 21, 2011, and operated until its re-entry in early December. As they can be built so quickly, small satellites can be used to test new technologies and discover and fix problems earlier.

"The design, build, test, get flight data, and redesign cycle can now be as short as six months, thus accelerating space system evolution by five to ten times compared to traditional development cycles," Janson said. "This enables risk reduction on major flight programs by identifying and correcting issues with new component or subsystem technologies earlier in the development cycle."

A number of the small satellites Aerospace has built have been CubeSats because there are many opportunities to launch CubeSats. CubeSats are placed in box-like ejection tubes called Picosatellite Orbital Deployers (PODS), which are flight-qualified for different launch vehicles and can hold a variety of CubeSats.

"This is analogous to the ubiquitous overseas shipping container; shippers don't care what's inside as long as the container is within the weight limit and no hazardous materials are present," Janson said.



If this CubeSat weighed two more grams, it would be classified as a nanosatellite instead of a picosatellite. Photo by Eric Hamburg

PODS have flown on a variety of launch vehicles, including the U.S. space shuttle, Minotaur-1, Minotaur-IV, Taurus-XL, Falcon-1, Japanese M-V, Russian Dnepr, Russian Kosmos-3M, Russian/German Eurockot, Indian PSLV, and the European Vega launch vehicles.

Aerospace has developed two versions of its own POD, the Aerospace Picosatellite Orbital Deployer, or A-POD, which was used on multiple shuttle flights. The three CubeSats Aerospace delivered in January—one AeroCube 4.0 and two AeroCube 4.5s—fit in a single POD and will be launched from VAFB in August on an Atlas V launch vehicle as part of a 12-picosatellite deployment.

The team from Aerospace is not stopping with AeroCube 4.5. Plans are already underway to build and launch two AeroCube 5.0s.

"We plan on upgrading future AeroCubes with on-orbit propulsion, improved attitude determination accuracy, and higher communications data rates," Janson said.

To read about Aerospace's role with small sats, [**check out their website.**](#)

Story by Laura Johnson, originally appeared in the Aerospace Orbiter publication.

A Controlling Presence

GMV has announced a contract with THAIKOM Plc. to provide the satellite control center for the Thaicom 6 communications satellite.

The project builds on GMV's satellite control center experience. Thaicom 6 is a Star 2 platform geostationary telecommunications spacecraft built by Orbital Sciences. Over the years, GMV has established a strong history with Orbital Sciences and supports numerous Star 2 platform spacecraft.

Theresa Beech, president of GMV USA, said, "We are pleased to bring our experience in successful communications satellite control center installation and operation around the globe to Thaicom 6 and to build our relationship with Thaicom an important spacecraft operator in Southeast Asia."

Thaicom 6 satellite's payload will offer C- and Ku-band services to the South and Southeast Asia and Southern Africa regions. The satellite will generate approximately 3.7 kilowatts of payload power and will be located at 78.5 degrees East.

Wise-Up With This New Wiki

Satellite navigation is progressing at such a breakneck speed nowadays that technical books are often already behind the times when they are published.

There is also a lot of incorrect information scattered around the Internet. To guarantee access to trustworthy and up-to-date

information on this technology, the European Space Agency (ESA) has launched Navipedia, its own wiki knowledge base covering everything to do with satellite navigation. This is ESA's first ever technical wiki opened to the public.

The initial version of Navipedia was produced with contributions from GNSS experts from GMV, contracted for the production and revision of articles, as

well as from several European universities and an internal team of ESA navigation specialists. Due to its key roles in the development of the European navigation systems, EGNOS and Galileo, GMV has cultivated a highly skilled team of experts in the most varied areas of satellite navigation. Written and reviewed by experts, the wiki now has more than 400 articles covering the fundamental



Artistic rendition of Thaicom 6.

GMV will develop and implement the satellite control center for Thaicom 6, including the satellite telemetry and telecommand system based upon GMV's product hifly®, the flight dynamics system based upon GMV's product focusSuite, as well as the ground equipment monitoring and control. Thaicom 6 is expected to launch into orbit in mid 2013.

principles of satellite navigation, how receivers operate, current and future operational systems around the globe and GNSS-related services and applications.

This new wiki is intended to serve a wide range of users from institutions and industry, to academia and the general public interested in knowing more about GNSS systems. Navipedia articles have therefore been classified into three categories: basic, medium and advanced, to satisfy target audiences ranging from highly knowledgeable GNSS specialists to the public at large. ESA is convinced Navipedia will be an excellent tool for promoting and supporting GNSS education in Europe.

This website's launch comes at just the right time, with ESA preparing to launch its next Galileo satellites, ground-based augmentation systems proliferating, all other Global Navigation Satellite Systems (GNSS) in full evolution and new applications emerging every day incorporating satellite navigation.

Counterfeit Regs Could Well Impact Global Suppliers

Stringent new counterfeit-part regulations contained in the 2012 U.S. National Defense Authorization Act (NDAA) may have broad international implications, impacting hundreds of overseas companies that have supplied billions of dollars' worth of items to

the American government.

Non-U.S.-based suppliers accounted for more than \$2 billion during the five-year period from 2007 to 2011, with the European Union (EU) and Middle Eastern companies accounting for the bulk of the American government's procurement spending.

This is according to the IHS Haystack Gold™ service from information and analytics provider IHS (NYSE: IHS).

The figure below presents a ranking of foreign countries' revenue from sales to the U.S. government. Data in the figure was derived from the IHS Haystack system that provides information on more than 100 million items in the U.S. Federal Supply Catalog and more than 40 U.S. Army, Navy, Air Force and related databases. "There's a

perception that U.S. regulations such as 2012 NDAA, Section 818. Detection and Avoidance of Counterfeit Electronic Parts, is only an issue for American companies, and that they don't impact firms in Europe, the Mideast and elsewhere," said Greg Jaknunas, senior product manager, supply chain solutions, at IHS. "However, the impact is beginning to be felt worldwide, as many international companies and global manufacturing facilities can directly participate in the defense supply chain and begin to see customer requests for counterfeit detection and avoidance measures that are flowed down through the supply chain."

Even though the regulations in 2012 NDAA are from the United States, they will become an international issue as defense contractors place requirements on their suppliers, who then place similar demands on their suppliers, and so on, Jaknunas added.

"The 2012 NDAA requirements will get pulled through the global supply chain," Jaknunas observed. "Owing to the complex nature of the supply chain, it will become an international concern. In a way, this is similar to the EU's restriction of hazardous substances (RoHS) environmental directive, which called for the elimination of six hazardous materials in electronic components and systems, most notably lead. While RoHS requirements appeared to be

European in nature, they had a ripple effect worldwide as suppliers all over the world changed their products in order to continue to do business in the key EU markets."

IHS estimates that 362 non-U.S. companies worldwide that are supplying the U.S. government could be directly impacted by the NDAA counterfeit regulations, with many more that could be indirectly affected.

Reports of counterfeit parts have soared dramatically in the last two years, presenting huge challenges for electronics manufacturing and especially the military and aerospace industry. Supply chain participants in 2011 reported 1,363 separate verified counterfeit-part incidents worldwide, a fourfold increase from 324 in 2009, according to IHS.

The bulk of these incidents were for commercial electronic components that have wide use across every major technology end market. Counterfeit parts often are often cheap substitutes or salvaged waste components that fail to meet strict military and aerospace specifications, leading to potential failures.

On December 31, 2011 the fiscal year 2012 NDAA was initiated, which adds regulations for counterfeit part detection and avoidance. Members at all tiers of the defense supply chain must put counterfeit risk mitigation procedures in place, and

IHS Figure: Revenue by Region from Suppliers to the U.S. Government for the Period From 2007 Through 2011 (in U.S. Dollars)

Region	No. of Companies Affected	Revenue Affected	% of Overall Revenue
European Union	283	\$1,023,188,872.00	50.52%
Middle East	32	\$951,248,650.00	46.97%
Asia-Pacific	38	\$35,475,070.00	1.75%
South America	2	\$9,693,771.00	0.48%
Caribbean	1	\$3,211,084.00	0.16%
Central America	1	\$2,190,856.00	0.11%
Africa	4	\$148,074.00	0.01%
Eastern Bloc	1	\$29,901.00	0.00%
Total	362	\$2,025,186,278.00	100.00%

Source: IHS [Supply] Research April 2012

certain steps must be completed within 270 days of the president's signature.

Companies based in the European Union represent the largest group of foreign suppliers to the U.S. government. During the five-year period from 2007 through 2011, the region accounted for \$1 billion in sales, or 51 percent of the total. The area, by a large margin, also had the most number of companies—283 firms. Next was the Middle East with \$951.2 million, representing 47 percent of the global total during the past five years. This revenue was generated by just 32 companies. The region, particularly Israel, is involved in extensive defense spending, to the United States. A major purchaser and user of U.S. military equipment, Israel is also involved in the joint development of military technology and regularly engages in joint military exercises involving United States.

Other regions trailed far behind, including Asia-Pacific, with the region's 38 companies accounting for just two percent of global revenue. To manage the wrenching changes wrought by the NDAA regulations, companies throughout the world must have tools that allow them to identify components at risk of counterfeits.

IHS Haystack provides critical, integrated and interpretable logistics information to the government and contractors so that processes can be automated, labor and research costs saved, and new levels of efficiency as well as return on investment realized.

IHS Haystack allows users to locate a part number, determine its manufacturer, research past award histories, conduct competitive analyses, identify alternative sources, and find parts and manufacturers qualified against military specifications.

Companies can use IHS Haystack's Qualified Products Dataset to locate the most current information on certified government manufacturer and supplier sources of qualified products, in order to stay within a trusted supply chain of authorized suppliers.

Contact **Jonathan Cassell @ IHS** for more information.

CASBAA Rallies And Resists... India's Retroactive Satellite Tax Laws

Imagine the thought of having to pay taxes retroactive to 1976!

A host of international business associations from a wide range of India's major trading partner and investment partner countries have urged the Indian government to abandon to impose sweeping retroactive taxation affecting a large number of industries. CASBAA has taken up advocacy on behalf of the international satellite industry.

Both satellite operators and their Indian customers and consumers would suffer from the planned imposition of new tax rules. In its letter to the Indian Finance Ministry, CASBAA noted, "...as far as the satellite industry is concerned—retroactivity could not be justified on the basis that the government was merely "clarifying" existing tax law.

Said CASBAA, "... certain concepts that are fundamental to satellite services (i.e., satellite, up-linking, amplification, conversion for down-linking of any signal)...were not prevalent in India in 1976 and thus, it is inconceivable to think that a concept that did not exist in 1976 was intended to have been present in the legislation."

Additional important issues may be read at this link...

The Freeze Is On

Weather has been discontinued—well, not exactly... however, the U.S. Air Force has terminated all Defense Weather Satellite System contractual activities with Northrop Grumman Aerospace Systems, all in accordance with the FY2012 National Defense Authorization Act and FY12 Consolidated Appropriations Act.

Northrop Grumman Aerospace Systems activities in support of the Suomi National Polar-orbiting Operational Environmental Satellite System Preparatory Project Satellite, however, are not subject to the termination notice.

The Defense Weather Satellite System was created out of the Executive Office of the President and was the restructure of the National Polar-orbiting Operational Environmental Satellite System program in February of 2010.

Northrop Grumman Aerospace Systems was the prime contractor for the military DWSS program and was responsible for developing the satellite, including the Visible/Infrared Imager Radiometer Suite, provided by a subcontract with Raytheon Space and Airborne Systems.

The DWSS was intended to satisfy military requirements for timely, reliable and high-quality space-based remote sensing capability for global and regional environmental observations of atmospheric, terrestrial, oceanographic, solar-geophysical and other phenomena.

Today, the Air Force Defense Meteorological Satellite Program constellation of satellites continues to provide high-quality and timely weather data to forecasters with two more satellites yet to be launched.

Working The Circuits

Agilent Technologies Inc. has announced that Comtech EF Data has selected Advanced Design System software for use in developing RF and microwave circuits for high-performance satellite communications systems.

Comtech EF Data, a subsidiary of Comtech Telecommunications Corp., designs and manufactures an assortment of satellite communications equipment that is deployed in commercial and government applications around the world. Satellite communications systems require leading-edge performance and high reliability.

ADS is a broad-ranging circuit and system design platform. It provides a comprehensive suite of simulation and analysis tools for the high-frequency designer, including parametric tuning and optimization, and a full set of yield and sensitivity analysis tools. Comtech will leverage these extensive capabilities to ensure its designs meet the performance and reliability criteria demanded by its customers.

"One of the key reasons we chose ADS was its capacity to accurately co-simulate across the DSP/RF boundary—a clear-cut advantage compared to other tools we had evaluated," said Tibi Artzi, unit manager with Comtech EF Data. "ADS's ability to handle linearization design of power amplifiers that are used in proprietary and next-generation systems will substantially increase our competitive advantage in the satellite communications marketplace. This capability, along with the other best-in-class analysis offerings (like EM analysis) that ADS integrates into one platform, made ADS the obvious choice for our needs."

"Comtech's engineers have a uniquely challenging set of tasks due to the often-proprietary nature of high-performance satellite communications systems and the high reliability that is needed for hardware design," said Joe Civello, ADS product manager for Agilent EEsof EDA. "We are delighted that Comtech trusts the capabilities of ADS and has decided to use it for design work in this particularly demanding market."

Meteosat Membership

Thales Alenia Space Deutschland GmbH, has signed a contract with Thales Alenia Space-France in the frame of the Meteosat Third Generation (MTG) weather satellites.

This contract includes the development and the validation of the operations Satellite Simulator (SATSIM), as well as the Payload Data Generator for all the satellites.



It was signed in Berlin at a ceremony attended by Klaus-Dieter Scheurle, the State secretary in the German Federal Ministry of Traffic, Construction and Urban Development. The contract is worth up to 4 million euros.

"Unconventional" Equals Oil & Gas Growth Opportunity

With virtually the entire Oil & Gas industry focused on North American Shale Gas, it is easy to forget the unconventional resource movement spans the entire globe.

Shale Gas, an unconventional resource, should be read by the satellite industry as— "Long to extract, and requires sophisticated technology which means making more money"—and can be found from the South China Sea to under the Arctic Oceans. Furthermore, the satellite industry will experience the biggest growth from unconventional resources not from North America, but from Asian and Latin American deposits.

As **NSR** projects in its **Oil and Gas via Satellite, 2nd Edition** study, North American Exploration and Production VSAT In-service Unit growth from 2011 - 2021 will be less



than 5 percent, well behind the 13 or 14 percent growth of Latin America or Asia, respectively. This lack-luster long-term growth in North America stems from a robust terrestrial infrastructure that will be installed as the Shale Gas industry transitions from the "exploration" to "production" stage.

growth from unconventional resources in Asian and Latin American markets, rather than well established markets in North America or Europe.

The Shale Gas exploration "Boom" throughout North America will transition to a production "fizzle" as existing O&G well-sites throughout the region move to long-term



Pennsylvania—a hotbed of Shale Gas activity—recently proposed legislation that would require real-time monitoring and communications at over 5,000 current and planned natural gas sites within the state. In addition, O&G industry representatives state that less than 5 percent of well-sites are covered by terrestrial infrastructure... a sure sign that satellite will play a critical role in well-site communications.

assets, which brings terrestrial network infrastructure. The remote On- and Offshore unconventional resources of the rest of the world will provide strong growth prospects for satellite service providers, and account for 34% of a \$1.1 Billion dollar industry by 2021.

Yet, Pennsylvania has one of the most aggressive rural broadband deployment plans with every town, village and city having access to broadband connectivity by 2015, and the legislation was announced at the facilities of a terrestrial network provider. Combine the two, and satellite growth becomes murky in the long-run for North America.

Analysis by Brad Grady, Analyst, USA, NSR. Mr. Grady joined NSR in 2010 and provides assistance to the Senior Analyst team on multi-client research reports and single-client consulting projects throughout NSR's coverage areas.



Instead, service providers should primarily focus on opportunities outside North America. Not only are these deposits (and therefore activity) larger, but the deposits are found both on- and offshore, and in remote environments where terrestrial networks are unlikely to have high penetration.



Overall, satellite service providers will enjoy stronger

The Forrester Focus On SatBroadcasting™

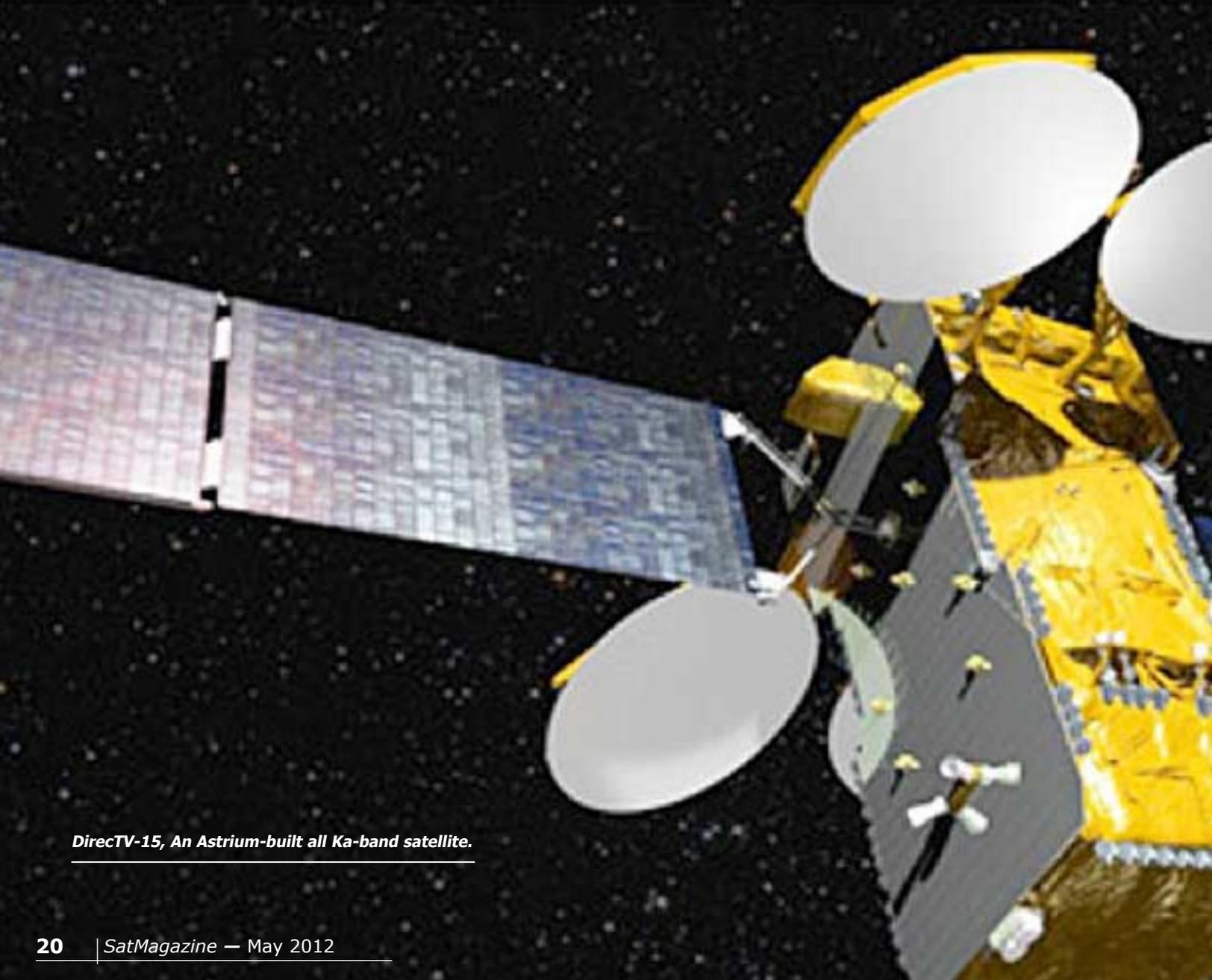
DirectTV Planning For U-HDTV

By Chris Forrester, Editorial Director, Broadgate Publishing,
+ Senior Contributing Editor for SatMagazine

Pay-TV giant DirectTV will adopt Ultra-HDTV, which is the 'next generation' follow-on technology from today's HDTV.

DirectTV is already planning its future spectrum needs in readiness for U-HDTV. Philip Goswitz, DirectTV's Senior Vice President of Space & Communications/R&D, speaking at the *satellite* event in Washington, DC, said "4,000 and 8,000-line services are great for the satellite industry and will ensure that satellite broadcasting continues to distinguish itself for image quality of service. We see this as a key strategic advantage for us. At DirectTV we see a couple of things happening. First, our subscribers are migrating away from Ku-band, and upgrading themselves to Ka-band and its HDTV services. In four or five years, our Ku-band [transmissions] could end. We are also developing the so-called Reverse Band for DBS services, and these are on our Road Map for future international services. 4000-line is exciting to us because of its image quality, and the potential for glasses-free 3D."

While Goswitz did not say when 4,000-line services would start, and it is fair to say that there's still a great deal to be done on compression and other enabling technologies in order to bring these very high-resolution images into viewers' homes, it is nevertheless clear that DirectTV wants to see its lead maintained over terrestrial TV, cable and DSL-type delivery services—Goswitz sees satellite as maintaining that technological edge.



DirectTV-15, An Astrium-built all Ka-band satellite.

Japan's planned introduction of Ultra-HDTV is scheduled for 2020, and will use Ka-band, a largely unused set of frequencies around the globe. In February the ITU's *World Radiocommunications Conference* in Geneva also agreed that Ka-band would be used as the future carrier of U-HDTV signals.

DirecTV is already transmitting very successfully in the Ka-band to its North American customers. Goswitz described his Ka-band satellites as "spectacular." Indeed, DirecTV could successfully argue that its **Spaceway** Ka-band satellites are the most profitable satellites being used anywhere (whether in Ku-, Ka- or any other band), as they are helping generate some \$20bn a year in revenues for DirecTV because of their spot-beam and 'local-into-local' HDTV services over North America.

Goswitz admits that few people even know that Ka-band is being used, such is its seamless integration into DirecTV's overall portfolio of satellite assets. "I am not even sure our own executives know! They don't know the difference between Ka- and Ku-band, and why should they?"

"But Ka-band doesn't just mean broadband. To us it means broadcasting. The truth is that, as our Ku-band transmissions end, then increasingly every dollar in revenue is attributable to Ka-band. We'll be entirely Ka-band in about five years. Currently, of our total \$27bn in annual revenues, about \$20bn comes from Ka-band," said Goswitz.

Goswitz's reference to 'Reverse Band' covers the 17 to 24 GHz bands, and these—at least as far as North America is concerned—have always included video services. New satellites operating in these 'Reverse' bands must comply with **FCC** obligations to have four degrees of orbital spacing.

Currently, DirecTV as a whole operates 12 geo-satellites, of which 11 are owned and one is leased. The fleet currently operates seven Ku-craft (three at **101 degrees West**, one at **110 degrees West**, one at **119 degrees West**, one [leased] at **95 degrees West** and a spare that has been moved from **72.5 degrees West** to **110 degrees West**).

DirecTV also has two Ka-band craft at **99 degrees West** and three at **103 degrees West**. Their future plans include contracts for two new Ka-band craft: **D-14** (Q1-2014 launch being built by **Space Systems/Loral**), and **D-15** (Q4-2014, to be built by **Astrium**) to "provide additional HD, replacement and back-up capacity," says a recent SEC filing, and expected to be used for its Latin American services.

DirecTV's Ka-band satellites were brought into the fleet with a little help from Rupert Murdoch and News Corp, achieved when News Corp bought a controlling interest in Hughes Network

DirecTV group revenues last year topped \$27bn. With 10 satellites in orbit (five in Ku-, five in Ka-). According to Goswitz, some 75 percent of the company's total revenue comes from its Ka-band capacity, or around \$20bn.

Systems (which it subsequently sold off) but retained possession of Spaceway 1 and 2. Much of the on-board 'broadband' processing and switching was abandoned in favour of DirecTV's 'local into local' HDTV services.

Spaceway 1 was launched (by **Sea Launch**) in 2005, and with a 12-year life expectancy. **Ariane** launched **Spaceway 2** in April 2006, again with a 12-year lifespan. This suggests that sometime in the next year or two DirecTV will need to order up their replacements.

One interesting comment from Goswitz concerned two-way satellite-based activity. Contrary to the thinking of many of his satellite competitors, and including EchoStar's Dish, it seems DirecTV is not in the slightest bit interested in itself providing two-way traffic links to and from consumer's homes. "Our customers are not asking [for a satellite-delivered service]," he stated. "In Latin America, it is a different story, but in the U.S. we have

yet to meet a customer who cannot get [separate] access to broadband."

He was also quite happy to agree to the importance of streaming content via any available means. "We'll stream everything we can to our subscribers. These services compliment TV. Our job is to knit these services together. But satellite is the most powerful, and efficient, method of getting TV into homes."

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. He wrote "High Above – the untold story of Astra, Europe's leading satellite company", in 2010.

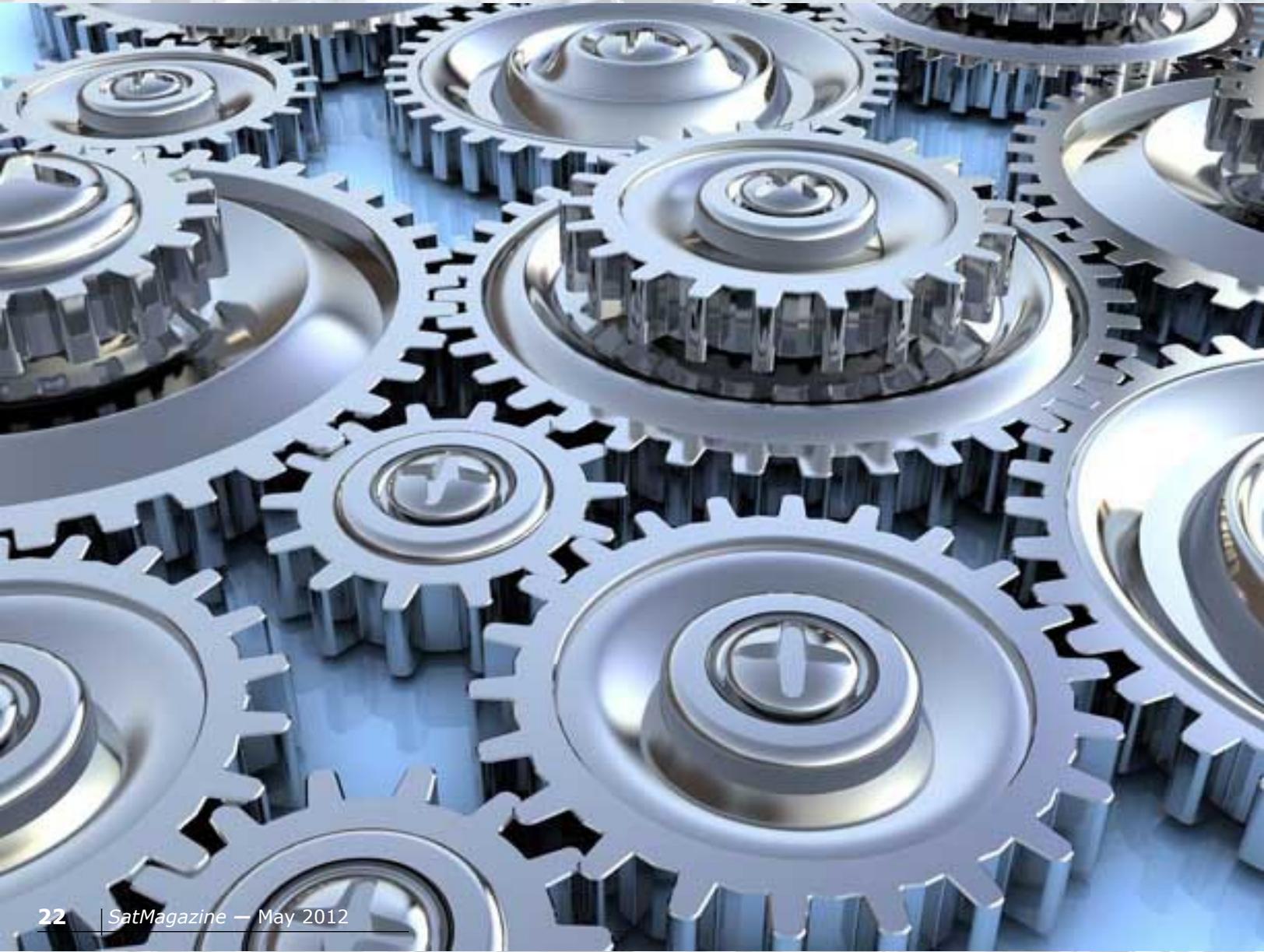


A Single Source For M2M Connectivity + Data Management

By Gwenn Larsson, Chief Marketing Officer (CMO), Telenor Connexion



The market for M2M solutions is constantly evolving, with many factors making significant impact on enterprises that are considering the development and implementation of a new M2M solution. Market demand for M2M is moving from a purely high-end product focus, such as cars, excavators and smart meters, to virtually any type of product, such as food containers, personal navigation devices (PNDs), pets and even Barbie dolls. In addition to this broadening scope, there is an increased demand for solutions that are truly universal and adhere to the numerous global standards that are currently in place and evolving. Many companies have experience with their own markets and national mobile network operators, however when they take the application to a new market, problems arise. Finally, contrary to historical usage, it has become obvious that a combination of low volume *and* high volume applications can be needed to serve just one vertical, such as the case with the automobile industry. The impact on enterprises developing and implementing M2M solutions are apparent, but problems arise when key areas for developers within the enterprise are overlooked. The three primary topics to consider when implementing M2M solutions are the openness and control of the solution, the burden of trying to implement an M2M service in-house, and the ability to scale globally.



First, it is important to ensure that open (platforms that embrace industry standards for delivering services) and controlled environments are created. This is necessary to guarantee that enterprises are in control and have a future-proof platform. A solution to this problem is to make sure that the data management platform (sometimes referred to as an **application enabling platform**) is an open and future-proof architecture, which allows customers to freely choose the most suitable combination of devices and applications to fit their needs. To break it down, the data management platform is a managed application enabling platform allowing for quick and easy deployment and operation of new M2M solutions based on a device library and generic service enablers that should be designed to telecom principles of scalability, reliability and security. Basically, it enables any device to communicate with any application. When the architecture design philosophy is open, it becomes a horizontal service architecture, shielding the complexities of the devices from the applications, and vice-versa. By ensuring that the architecture is open (not silo'd) and future-proof, enterprises can be sure that they have full control of the user experience.

Second, it is widely thought that it's a wise investment to launch an in-house new M2M service. Does the wheel need to be re-invented when designing a solution, or is there an existing platform that serves the connectivity needs? Enterprises must consider the investment needed in-house to launch a new M2M service. There are plenty of examples of companies that built an M2M service (the fleet management industry is a good example) on in-house protocols, and design, and later found out they could not sell their offering to any other truck manufacturers. Now most OEMs are using standards-based platforms with open APIs to ensure they are future-proof and compatible.

We've seen the consumer market expanding and demand exploding for embedded connectivity and new devices, such as connected PNDs, tablets, and connected picture frames. These emerging markets need to be targeted in order to capture high SIM volumes. M2M connectivity providers have spent years perfecting connectivity solutions and adjusting to the market to fit its needs. Does an enterprise have all of the problem solving tools in-house to develop an efficient M2M service? How do they know the approach that they are taking is correct? For example, what if it is more cost effective

for an enterprise to take a layered approach to implementing a business and life critical M2M solution that includes connectivity, and horizontal data/application management. By working with a global M2M connectivity provider, the enterprise can then develop their own application and vertical development at the highest layer, reducing time to market, guaranteeing quality of connectivity and having will have the ability to support multiple vertical applications.

Without the expertise of a M2M connectivity provider, something like this might be overlooked. Using an off-the-shelf product to deliver M2M services will almost always be more cost effective as the development is being shared across several companies and organizations. Overall, instead of developing a

Prime

solution for one specific M2M application, it is more efficient to implement new developments on open platforms with a variety of interfaces, supporting a variety of technologies. (See the diagram below.)

Lastly, being geographically limited when choosing an M2M provider inhibits the increasing demand for solutions that work globally and have the ability to adhere to global standards. Today, technology that is implemented in one part of the world could have a great impact on another. Each part of the world has different connectivity requirements and needs. The connectivity offering should support a variety of bearer services with an emphasis on GSM-based technologies due to the proliferation of the technology on a global basis. Most devices do not switch freely between technologies, cellular (GSMA or CDMA), satellite, and NFL (Zigbee, WiFi). Most European M2M service providers only build in GSMA standards into their application, and then must redo some testing, integration, development, etc. to enter the U.S. market if they want to do it with CDMA. Today, it's very rare to see WiFi integrated into an M2M device. Using a dedicated platform for M2M, customers are ensured of the highest level of reliability and flexibility for M2M offerings.

Industry leading tools for connectivity monitoring through a service portal or API, gives customers full control over multiple applications from one source. Adherence to GSMA embedded standards for M2M connectivity is also important. This ensures that the M2M solutions introduced by the enterprise are reliable, compliant to standards and future proof. Additionally, it's important that the enterprise understands the need for high or low volume data, and how to reduce costs associated with data transfer. Offerings to enterprises are generally based on the

value of the connectivity service delivered rather than a price per megabyte. By choosing a connectivity provider that is an expert in the global market, the customer will continue to maintain full control of status, location and performance of connected devices regardless of a vertical market, while enjoying the highest level of customer service awareness and responses.

In summary, a packaged solution with horizontal data and application management and a premium global connectivity is both a cost-effective, and time-saving offering for enterprises. Before consideration of development or reinvention of existing technology, it's worth a closer look.

About the author

As Chief Marketing Officer at Telenor Connexion, Gwenn Larsson, is responsible for marketing and media for the brand on a global scale. Gwenn Larsson has more than 15 years of marketing, business development and B2B sales experience. More information: <http://www.telenorconnexion.com/offering>



It's All About Location, Location, Location...

At first glance, why would an established, or entrepreneurial, state-of-the-art space or satellite business choose to base itself on a small i-land in the middle of the Irish Sea, some 30 miles off the UK mainland? With a population of around 84,000, boasting the world's oldest continuous Parliament stretching back well over 1,033 years, the Isle of Man might seem an unlikely location for such a forward looking industry. However, with all due consideration to the past and long standing political and economic stability, it's to the future—or more specifically, the skies above—where a growing portion of the island's versatile economy is now firmly focused.

Image: The Isle of Man, map center, as seen from space.)



Today, just a few short years after the **Isle of Man** started, by design, to focus on the space and satellite sector, four of the world's top 10 satellite companies are now based there. The **Space Data Association**, the **Satellite Interference Reduction Group** and the **International Institute of Space Commerce** have all been established as not-for-profit organizations in **Douglas**, the Island's capital. The jurisdiction is also now home to the newest chapter of the **Society of Satellite Professional International (SSPI)**, the largest professional association in the industry. This summer, the Island will also host the founding conference for a new Space University, focused on the development of undergraduate education in space.

In addition, recent international space industry reports note the Island's core focus is on satellite financing and innovation in space commerce. Others suggest that due to its commercial focus, via Island based companies such as **Excalibur Almaz** and **Odyssey Moon**, the Isle of Man is now the fifth nation most likely to return to the Moon.



Tina Rawlinson,
Cavendish Trust

At present, the Island's star is very much in the ascendancy, according to *Tina Rawlinson*, Director of **Cavendish Trust** (<http://www.cavendishtrust.com>), one of the Isle of Man's leading niche international trust service providers, with strong connections to the space and satellite sector. "The Isle of Man is fast becoming the jurisdiction of choice for the establishment and administration of space and satellite companies," she said. "This is an extremely space friendly environment where we also enjoy one of the highest standards of living in Europe."

Rawlinson is herself a graduate of the **International Space University** of Strasbourg and with a team dedicated to the space and satellite industry, Cavendish is now among an exclusive number of Isle of Man trust companies qualified to provide all-inclusive legal and fiduciary solutions for space related companies. These services would apply either for those considering setting up an Island based business or for existing structures.

The Company has partner status with **ManSat** (<http://www.mansat.com>), the privately run business approved by the Island's Government to handle orbital filings with the **International Telecommunications Union (ITU)** in Geneva on behalf of Isle of Man based or incorporated companies.

What makes the Isle of Man such an advantageous location for conducting space business? One reason is that the Isle of Man is recognized as a well-regulated, commercially focused jurisdiction, with a AAA rating from **Standard and Poor's** and AA+ rated by **Moody's**. Furthermore, in today's shifting global climate, the political and economic stability offered by the Isle of Man, together with its renowned dedication to the Rule of Law, are also key considerations.

Yet, fundamental to the Island's appeal, is the 'pro-space' stance of the Government, with its strong political commitment to developing space commerce. The Island has developed space-friendly legislation, which has helped create a strong base of space, aerospace and high tech industries. This is supported by a world class telecommunications infrastructure which has, in turn, encouraged the growth of excellent local telecoms support



Chris Stott, Mansat

service providers, offering state-of-the-art hosting, IT and digital media.

Significantly, the Isle of Man was also the first jurisdiction in the world to offer a zero corporate tax rate to space and satellite businesses, plus a highly competitive insurance premium tax rate for the industry.

Additionally, the Government remains committed to the development of space law and finance. A regulatory 'level launch pad', if you will, with a core concept of neutrality in all areas, allowing competing space and satellite companies to all work from the Island without too many of the complications, real or imagined, that can be found in other jurisdictions.

"The Government is very pro-space and we are proud that this stance has enabled us to build a formidable base of space, aerospace and high tech industries over the last few years. We see this trend continuing. We also have in place a world class, professional infrastructure of legal, fiduciary and service companies. Everything is here for the space sector to flourish," explained *Tim Craine*, the Isle of Man's Government's *Director of Space*.

Tim also emphasised that the Government was keen to provide financial incentives and grant aid for businesses that created new jobs on the island. Mr. Craine also stressed that the Isle of Man encouraged flexible

employment laws which made it easy for Island based companies to use contract workers—which might not necessarily be the case in other jurisdictions.

Annual growth of around 9 percent in the Island's space and satellite sector is being watched with a growing sense of achievement at ManSat, who are now handling an unprecedented number of inquiries from companies that are seeking orbital slots.

ManSat estimates that the financial advantages of flying a geostationary satellite via an Isle of Man orbital position, as opposed to one flagged in the U.S. or UK., are in excess of US\$100m over the approximate life cycle of a satellite. "When looking purely at the bottom line, that's a definite advantage the Isle of Man has to offer, in addition to its other regulatory and financial advantages. It's easy to see why some of the top commercial satellite companies are already here," said ManSat Chairman and CEO *Chris Stott*. He further pointed out that another trump card for the Island was that, as a *British Crown Dependency*, it was recognized as being British for United States Export Control and ITAR purposes. "In terms of satellite communications companies making orbital filings with the ITU, the Isle of Man is now in the top five jurisdictions in the world, ranked behind only the United Kingdom and the United States," added Mr. Stott.

Even despite current global economic uncertainty, *Tina Rawlinson* believes the Isle of Man can stay ahead of the curve, thanks to its favorable location status. "The space and satellite industry is now recognised as being an increasingly important niche market for the Island," she said. "With our advantageous tax regime, satellite companies can achieve significant savings by structuring the operations of group holding companies or subsidiaries in the Isle of Man, or by establishing R&D or manufacturing centres on the island."

The ingredients which have helped make the Isle of Man a location of choice for the sector are not simply being championed from within. A recent *U.K. Economic Policy Centre Report on U.K. Space Policy* quoted the Isle of Man as being one of the best places in the world to base a space business. Furthermore, 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",



Tim Craine, Isle of Man's Director of Space.

The Douglas Marina, Isle of Man.



stated that the Isle of Man had “developed a unique governmental approach to space, focussed on economics tied to developing private sector financial, regulatory, legal and administrative services that supported international aerospace companies.

“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>)

Futron’s CEO, Mr. *Joseph Fuller, Jr.*, said, “The Isle of Man has effectively created a market niche that advances its national economic development, provides quality employment opportunities, and attracts significant foreign investment. Their non-traditional strategy for space focuses on financial and corporate services, providing a fascinating model to foster hi-tech economic activities.”

In reference to the Futron study, ManSat’s *Chris Stott* said, “It speaks volumes that such a highly respected international consultancy firm specialising in the space sector should have produced such a positive analysis of the Isle of Man’s vibrant, diverse and rapidly growing space industry.”

Having recently returned from the satellite event in Washington DC, the tenth year the Isle of Man has sent a delegation, *Stott* and *Rawlinson* couldn’t be more bullish about the Island’s prospects in the sector.



The flag of the Isle of Man

Stott commented, “We spoke to companies from all across the world and were pleasantly surprised by the amount of awareness there was of our Island’s involvement in the satellite industry. Our message to them was clear: If you are looking for a space-friendly environment, then you really can’t afford not to consider the Isle of Man as a viable option.”

For a jurisdiction just 33 miles long and 13 miles wide, that also happens to be family friendly and enjoys low crime rates, the sky really does **not** appear to be the limit.



The capital of the Isle of Man, Douglas.

Two Dimensional GPS Solutions For A Three Dimensional World

By Patrick Bertagna, CEO, Founder + Chairman, GTX Corp.

The Global Positioning System—GPS—is a worldwide radio-navigation system that is formed by a constellation of 24 satellites that communicate with their respective ground stations. The Global Positioning System is mainly funded and controlled by the U.S. Department of Defense (DoD). The system was initially designed for the U.S. military. However, over the past 10 years, there has been a widespread introduction of innovative ways to introduce the GPS technology into the private sector; in fact, so many that other countries are now deploying their own none-military use GPS systems in order to fill the increasing global demand for location information on people and products.



A 20 billion euros project named after the Italian astronomer *Galileo* is currently being built by the **European Union (EU)** and the **European Space Agency (ESA)**. One of the goals of Galileo is to provide a high-precision positioning system upon which the European nations can rely, independent of the Russian **GLONASS**, U.S. **GPS** and Chinese **Compass** systems.

GPS works by relaying information on an exact location (latitude and longitude) and it can also track movement, bearing, altitude and speed. For example, a GPS tracking system can be used by a company to monitor the route and progress of a delivery truck. GPS can be used by parents to check on the location of their child. Monitoring high value assets in transit is yet another GPS capability.

A GPS tracking system can work in various ways. From a commercial perspective, GPS devices are generally used to record and monitor location and movement. Some systems will store the data (known as passive tracking) and some send the information to a centralized database or portal via a modem within the GPS system on a regular basis (known as real-time tracking, or 2-Way GPS.)

Recently, 2-way GPS has found its way into many different niche applications and is gaining traction as a solution for monitoring people with cognitive disorders, people who are prone to wander off, such as sufferers of dementia, Alzheimer's and autism.

I Am Lost...

"I am a victim of Alzheimer's disease and have joined the growing 35 million worldwide number of people suffering with this disease. I have my cogent moments, but as the disease progresses I find myself losing touch with the actual world. In fact, I've been told I wander—not aimlessly, but rather with a purpose—unfortunately I don't remember what that purpose was."

The above phrase is being heard around the world as the numbers of people who suffer with Alzheimer's disease is on the increase. These victims become lost, even when close to their homes. Many wander off quite regularly and are usually unable to navigate sufficiently to return to their homes. Doesn't this seem to be a perfect niche for a 2-way GPS solution?

The problem many Alzheimer victims who suffer with memory loss simply cannot remember to bring a GPS tracking device with them when they leave their home environment. Many seniors, as well as children with autism, do not welcome new technology or anything foreign becoming part of their lives.

The technology has not yet quite been miniaturized enough for a GPS unit to be implanted under the skin. The challenge, then, becomes how to place a small, non-intrusive GPS tracking device on someone all the while making certain the device will stay with them in a non-threatening way. Also needed is a method whereby the embedded technology can be protected while remaining fully functional. One answer could certainly be to

embed the GPS technology inside something one would wear—and wears all the time.

A perfect product that comes to mind to meet these challenges is a pair of shoes. Shoes are not new and certainly are not foreign or unfriendly. They have plenty of room to house small electronic components and shoes will most likely always be worn by someone on the move.

Professor *Andrew Carle*, the director of the **George Mason University's Program in Senior Housing Administration**, seems to think so when he recently said, "A GPS Shoe has the potential to be life-saving as well as a life-changing technology for those afflicted and their caregivers. Such shoes also hold the potential to save governments hundreds of millions of dollars in search





The Aetrex GPS product.

and rescue operations, as well as in health care costs for those otherwise injured.”

By melding satellite and cellular technology seamlessly into consumer friendly products, an entire new level of functional oversight, security and peace of mind is being introduced to a wide variety of audiences and special needs. Enter the **Aetrex Navistor GPS Footwear System**, powered by GTX Corp.

While wanderers may relieve themselves of virtually every material thing they own in pursuit of their “journey,” they rarely—if ever—surrender their shoes. **Geo Fencing** on the GTX portal will alert to any breach of the preset monitored area to the caregiver long before the person being observed has gone far. With this in-a-minute information, the wanderer can be located and safely returned to their care givers.

As wanderers are not typically habitués, providing them with their privacy and personal sovereignty is a unique quality singularly found in this tracking solution. The GPS Shoe delivers the user with a real-time and cost effective (approximately \$1 per day) technical solution which compliments responsible caretaking.

There’s more to this shoe, as well. It’s not just seniors who get lost—perhaps 2-way GPS can be used in additional ways.

Already, shipments and other assets of significant value can be tracked with GPS monitoring systems to ensure items are delivered when and where they are expected. Travelers can use GPS technology to map their trips so that family and friends can locate them for safety reasons. Travelers also can toss a tiny tracker into their luggage to help protect their valuables from loss or theft. Did you know that more than eight million suitcases are lost or stolen every year?

Runners and power walkers use GPS Tracking Devices to note where they have been, how fast they are going, and also for safety reason. Loved ones can log in to check on a runner’s status in real time. Boaters and jet skiers use the GPS Tracking System to keep tabs on their boats—insurance companies are requiring GPS devices for personal safety on many policies. Bicyclists and motorcyclists use the GPS Tracking Products to track bicycles and motorcycles as a means of viewing speed, distance, and detailed maps of their travels, as well as to protect their vehicles from being stolen. Dog and horse owners use GPS Tracking Devices because they need to know where their pets are and this is also a means whereby they can be located should they make it out of the yard to experience a neighborhood adventure.

Clearly, most GPS hardware and software solutions are maps that are populated by graphical markers presented on web accessible devices. However, there are even more applications that can use personal GPS monitoring currently being introduced to the market; social networking, proximity marketing, business networking, remote telemedicine and games of skill and chance are all new avenues where GPS monitoring is becoming ubiquitous and starting to meld seamlessly into everyday life styles.

History would have us looking at GPS as a new and improved compass, but clearly the value of 2-way GPS personal location services has yet to be fully realized. The jury is still out on how far this technology will take us, but clearly, it’s already far beyond use as only a navigation tool.

About the author

Mr. Bertagna is the Chairman, President, CEO and founder of GTX Corp and co-inventor of the patented GPS Footwear technology (US Patent No. 6,788,200). His career spans 27+ years in building companies in both technology and consumer branded products. Patrick started his career importing apparel from Europe and later went on to design and manufacture a line of clothing, accessories and footwear in over 20 countries, with sales exceeding \$27 million, selling to U.S. retailers from JC Penny’s to Neiman Marcus. In 1993 Mr. Bertagna transitioned into the world of software technology and founded Barcode World, Inc. a supply chain management application company, enabling the accurate tracking of consumer products from design to retail distribution. Within four years the company had over 450 premier branded accounts with a staff of 40 plus in the U.S., Eastern Europe and India. After selling his company Mr. Bertagna then combined his two past careers (consumer products and tracking technology) and founded GTX Corp in 2002. Mr. Bertagna was born in the South of France and is fluent in French and Spanish; has formed alliances with Fortune 500 companies such as IBM, AT&T, Sports Authority, Federated Stores, Netscape and GE; and has been a keynote speaker at numerous industry trade shows and conferences.

For additional information: <http://www.gtxcorp.com/>



No Sky View? No Big Deal...

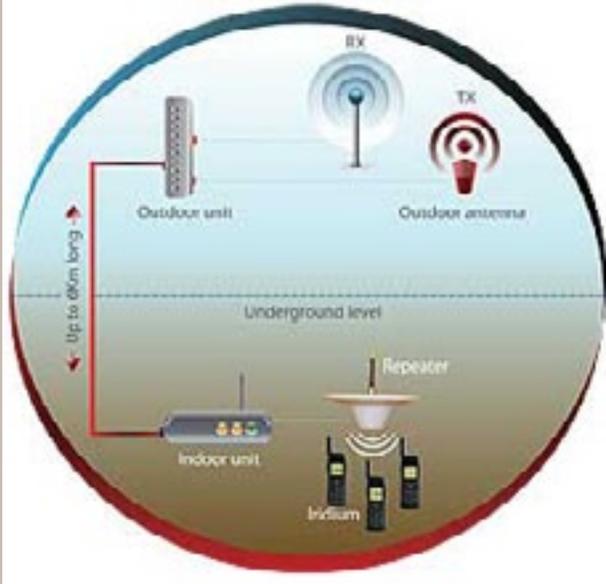
By Ami Schneider, Director of the Mobile Satellite Division, Gilat Satcom

If you're underground or in some other closed facility location that lacks a view of the sky, communication with the up-top world can sometimes be difficult or even downright impossible. A new communication solution to deal with these conditions has been created by Gilat Satcom. This solution allows users of Iridium satphones to communicate with those above ground and outside the closed facilities without having to leave their surroundings. This is a light weight, easy-to-install, and cost-effective solution for obtaining sky view when such is not available.

Named for suricates who, upon coming out of their burrow, immediately post a sentinel on high ground to watch over them, Gilat Satcom's *Suricate PRO*[™] posts an antenna with sky view to maintain communications with the satellite(s) orbiting overhead. Just as the suricates on the ground rely upon their sentinel to maintain vigilant watch and communications, Suricate PRO provides Iridium satphone users with constant and reliable communications even when they do not possess that all-important sky view.

The Solution

Suricate PRO provides coverage extension for Iridium satphones without sky view using wireless capabilities that extend the signal up to 6 kilometers, even underground. Similar to the posting of the sentinel to provide communication to the suricate clan, a



Suricate PRO outdoor antenna is placed on the surface of the mine or other facility where it has sky view. In constant contact with the satellite, the antenna is connected to an outdoor unit that takes signals received from the satellite and transfers them to a fiber optic cable which is run into the mine or secure facility. The fiber cable plugs into an indoor unit which takes the signal from the cable and puts it into the air within the facility at satphone radio frequencies.

Iridium satphones pick up the clear signal within the facility as if they have sky view. If it is necessary to extend the signal, repeaters can be mounted in the facility to provide coverage throughout providing all the mobility necessary for the Iridium satphone users. (See the Suricate PRO schematic in the left column.)

Suricate PRO comes in a small plug-and-play kit that can be set up quickly. Once setup, the system enables one or several Iridium satphone users to make simultaneous phone calls, send text messages and receive pages as they normally would. Computers and data networks can be connected to satphones in the normal manner to enable Internet access and other types of data communications between the remote facility and anywhere else in the world.

With Suricate PRO, Iridium satphone users lacking sky view can enjoy the entire menu of satphone services with complete mobility. Easy to setup and operate, Suricate PRO provides the rapid and reliable communications of an ever-present sentinel.



Titan's Time

By Jos Heyman,
Managing Director of Tiros Space Information

In much the same way as for most of the current space launch vehicle, the Titan launch vehicle started life as a military missile. Intended as a back up for the Atlas ISBM missile, development was started in October 1955 when the Martin Company (which in 1995 merged with Lockheed to become Lockheed Martin) was awarded a contract for the airframe design. Towards the end of its military operational life, some of the missiles were refurbished as space launchers. Also, the missile formed the basis of a family of space launch vehicles.



A Titan 4 launch.

Titan As A Missile

In total, 163 Titan I missiles were built of which 62 were built as research and development vehicles identified as:

- **Lot A:** Six built—simplified first stage, dummy second stage and limited range
- **Lot B:** Seven built—complete first and second stages with reduced second stage engine duration, open and closed loop radio guidance
- **Lot C:** Six built—complete first and second stages with reduced second stage engine duration, radio guidance, separable scale model re-entry vehicle
- **Lot G:** 10 built—complete two stage missiles, closed loop radio guidance, separable re-entry vehicle, range up to 4000 nautical miles (nm)
- **Lot J (also AJ):** 22 built—complete missile capable of flights up to 5000 nm, later missiles to carry operable re-entry vehicle and warhead without reactive materials
- **Lot V:** Four built—same as lot J with the exception of instrumentation and range safety equipment to be used for tests at Vandenberg
- **Lot M:** Seven built—same as lot J, but equipped with an inertial guidance system as a test bed for the Titan II guidance system

In addition 101 operational missiles were built as part of the SM lot.

The Titan missile consisted of two stages, with the first stage being powered by two **Aerojet LR-87-AJ-3** engines that provided a thrust of 1,333,752 N, and the second stage being powered by an Aerojet **LR91-AJ-3** engine providing 355,869 N thrust. The **Titan I** had a total length of 28.04m.

A total of 54 operational Titan I's were deployed at **Lowry AFB** (2 complexes), **Mountain Home AFB**, **Beale AFB**, **Larson AFB** and **Ellsworth AFB**. Each complex had nine missiles in three structures, each structure with three missiles each.

There was a test facility at **Vandenberg** while there were also test flights from **Cape Canaveral**. The first flight of a Titan I missile occurred on February 6, 1959, and 68 tests launches were conducted from Cape Canaveral as well as Vandenberg. Five of these launches have been identified as failures. The final launch was on March 5, 1965.

Although it was, at one stage, proposed to mate the Titan I with a **Vanguard** rocket as upper stages for lunar orbital and surface landing mission, the Titan I was not used for space launches.



Titan missile launch

Titan II, Missiles Used As Space Launchers

Although the **Titan II** was originally developed as a missile, it also had two careers as a space launch vehicle. In total, 141 of the missiles were built, of which 33 were for research and development purposes (identified as **Lot N**), while 108 operational missiles were built. A total of 54 operational Titan IIs were deployed in silos at **Davis Monthan AFB**, **McConnell AFB** and **Little Rock AFB**. Each site has 18 silos. There were also three silos at Vandenberg for test firings.

As a missile, the first launch occurred on March 16, 1962, and 81 flights were conducted until June 27, 1976. Of these flights, seven were considered as failures.

The first stage was powered by two **Aerojet LR87-AJ-7** engines with a thrust of 1,912,365 N, while the second stage carried an **Aerojet LR-91-AJ-7** that produced 444,835 N thrust.

Between April 8, 1964, and November 11, 1966, the Titan II was also used as the launch vehicle for 12 flights in the **Gemini** program. As the launch vehicle in this program, the vehicle was known as **Titan IIGLV** and was capable of placing a 3810kg payload into low orbit. A total of 15 Titan IIGLV vehicles were built.

On September 5, 1988, the first surplus and refurbished Titan II missiles were used for a space launch. A total of 56 missiles were available for refurbishment, although only 14 missiles were refurbished, some of them using parts from several missiles. Only 13 were actually flown.

These refurbished missiles are sometimes referred to as **Titan 2**, **Titan 2G**, **Titan 23G** or **Titan 2(23)G**, while some of the launches carried an additional propulsion stage to place the satellite into a higher orbit. The refurbished launchers were capable of placing 2170kg payloads into low orbit.

Titan III, Dedicated Space Launchers

In 1962, the **Titan IIIA** (there was no Titan III, as such) was selected by the U.S. Air Force as its standard launch vehicle for military payloads. It differed from the Titan II by using a more powerful first and second stage as well as the addition of the Transtage as a third stage.

The first stage engines were two **Aerojet LR87-AJ-11** engines that provided a thrust of 2,339,852 N, whereas the second stage was fitted an **Aerojet LR91-AJ-11** with a thrust of 453,730N. The Transtage (or third stage) was powered by two **Aerojet AJ-10-138** engines, providing 71,199 N thrust.

The vehicle had a length of up to 48.76m, depending on the size of the payload carried, and was capable of placing a payload of 2810kg into a low orbit. It was used between September 1, 1964, and May 6, 1965, for four flights, of which one failed.

A further development was the **Titan IIIB** which used the **Agna D** upper stage instead of the Transtage. This combination is sometimes referred to as **Titan III Agna D**, while in the early 1970s designations such as **Titan 3(23)**, **Titan 3(24)**, **Titan 3(33)**, **Titan 3(34)** and **Titan 34B** were also used.

The launch vehicle had a length of up to 48.76m, depending on the size of the payload carried, and could place a payload of 3630 kg into a low orbit. The first flight was on July 29, 1966, and the 68th and last flight was on February 12, 1987. Of these, four failed.

The **Titan IIIBAS2** was a mid-1960 proposal for a **Titan IIIB** with two strap-ons, a **Centaur D/E** third stage, and a **Burner 2** fourth stage. It was to be used for deep space missions but development of this vehicle did not occur.

The next version was the **Titan IIIC** which was basically similar to the Titan IIIA but with the addition of two **United Technologies 1205** solid fuelled boosters to the first stage. These provided a thrust of 5,849,620 N each. The boosters had a length of 25.90m and a diameter of 3.05m while the launch vehicle's total length was 35.05m, depending on the payload carried.

Initially proposed to be used with the **X-20 Dyna Soar**, this configuration was capable of placing a payload of 13,150kg into low orbit. It was used between June 18, 1965, and March 6, 1982. Of the 36 flights, two failed. During the 1970s, the launch vehicle was also referred to as **Titan 3(23)C**. The vehicle had a length of up to 48.76m, depending on the size of the payload carried.

The **Titan IIIC7** was a 1965 proposal that would have used a lengthened Transtage third stage as well as upgraded solid boosters with a length of 34.10m. The version was not further developed.

The **Titan IIID** was similar to the Titan IIIC but with the deletion of the Transtage upper stage. It is, however, believed that some Titan IIID vehicles were used with an additional **Agna D** upper stage. In this configuration, the vehicle was capable of placing 12,300kg into a low orbit. It had a length of up to 48.76m, depending on the size of the payload carried. The vehicle was used 24 times between June 15, 1971, and August 28, 1985. Of these, one was a failure.

The **Titan IIIE** was built specifically for **NASA** as a launch vehicle for its deep space missions. The first two stages were identical to the Titan IIIC. On top of this was a third stage consisting of a **Centaur D1T** upper stage. This stage developed a thrust of 133,375 N. For the two **Helios** missions in 1974 and 1976, a further stage was added that was propelled by a **Thiokol TE-M-364-4** solid fuelled motor.

Type	Stage 0	Stage 1	Stage 2	Stage 3
Titan I	---	2 Aerojet LR87-AJ-3	1 Aerojet LR91-AJ-3	---
Titan II	---	2 Aerojet LR87-AJ-7	1 Aerojet LR91-AJ-7	---
Titan IIGLV	---	2 Aerojet LR87-AJ-7	1 Aerojet LR91-AJ-7	---
Titan 2	---	2 Aerojet LR87-AJ-7	1 Aerojet LR91-AJ-7	---
Titan IIIA		2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	2 Aerojet AJ-10-138
Titan IIIB		2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	1 Bell LR810BA-9
Titan IIIBAS2	2 Algor 2	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	2 Pratt & Whitney RL-10A-3-3 + 1 Thiokol Star 37
Titan IIIC	2 United Tech 1205	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	2 Aerojet AJ-10-138
Titan IIIC7	2 United Tech 1207	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	2 Aerojet AJ-10-138
Titan IIID	2 United Tech 1205	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	---
Titan IIIE	2 United Tech 1205	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	2 Pratt & Whitney RL-10A-3-3A
Titan IIIL	---	2 Aerojet LR87-AJ-7	1 Aerojet LR91-AJ-7	2 Pratt & Whitney RL-10A-1 or -3
Titan IIL2	2 United Tech 1207	2 Aerojet LR87-AJ-7	1 Aerojet LR91-AJ-7	2 Pratt & Whitney RL-10A-1 or -3
Titan IIIL4	4 United Tech 1207	2 Aerojet LR87-AJ-7	1 Aerojet LR91-AJ-7	2 Pratt & Whitney RL-10A-1 or -3
Titan IIIL6	6 United Tech 1207	2 Aerojet LR87-AJ-7	1 Aerojet LR91-AJ-7	2 Pratt & Whitney RL-10A-1 or -3
Titan IIIM	2 United Tech 1207	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	---
Titan 34D	2 United Tech 1206	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	IUS or TOS
Commercial Titan 3	2 United Tech 1206	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	Transtage, IUS, PAM-D or TOS
Titan 401A	2 United Tech 1207	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	2 Pratt & Whitney RL-10A-3A
Titan 401B	2 Hercules SRMU	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	2 Pratt & Whitney RL-10A-3A
Titan 402A	2 United Tech 1207	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	IUS
Titan 402B	2 Hercules SRMU	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	IUS
Titan 403A	2 United Tech 1207	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	---
Titan 403B	2 Hercules SRMU	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	---
Titan 404A	2 United Tech 1207	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	---
Titan 404B	2 Hercules SRMU	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	---
Titan 405A	2 United Tech 1207	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	---
Titan 405B	2 Hercules SRMU	2 Aerojet LR87-AJ-11	1 Aerojet LR91-AJ-11	---

Titan configurations

Focus

The length of the four stage launch vehicle was up to 48.76m, depending on the payload it carried, and it had a capability to place payload of up to 15,400kg into orbit.

Seven flights were conducted between February 11, 1974, and September 5, 1977, of which one failed.

The **Titan III** was a mid-1960s proposal for a launcher to place heavy payloads into low orbit. Its principal feature was a larger diameter first stage to accommodate four engines rather than just two engines. A version with two strap-ons, **Titan III L2** and a version with four strap-ons, to be known as **Titan III L4** were also considered, as was a **Titan III L6** with six strap-ons, which, at one stage, was considered as a first stage booster for the **Space Shuttle**. None of the versions proceeded beyond the early design stage as there were no perceived payloads that required these launch vehicles.

A **Titan IIIM** vehicle, which was to have larger solid fuelled boosters, was intended to be used in conjunction with the **Manned Orbital Laboratory (MOL)** program. It was cancelled in 1969, by which time only the first and second stages had undergone static tests. The launch vehicle was to have had a length of approximately 39m and a capability to place a 9100kg payload into low orbit.

A further development of the Titan III family of launchers, was the **Titan 34D**, which used 27.60m long strap-ons as well as the first and second stages of the Titan IIIC launch vehicle, combined with the **Boeing** developed **Inertial Upper Stage (IUS)** which was propelled by a **United Technologies Orbus-21** solid fuelled motor of 173,500 N thrust and a **United Technologies Orbus-6E** solid fuelled motor with a thrust of 74,340 N, or a **Martin Marietta Transfer Orbit Stage (TOS)** with a solid rocket motor of 187,107 N. This was topped with an **IUS-2** as the fourth stage. Some flights also included the Transtage of the Titan IIIC.

The length of this combination was 48.76m, depending on the size of the payload carried. Being capable of placing payloads of 14,515kg into low orbit, the first flight was on October 30, 1982. The 13th and last flight was on September 4, 1989. One of these was a failure.

In the early 1990s, **Martin Marietta** identified four launch vehicles as **Commercial Titan 3**. The flights were between January 1, 1990 and September 25, 1992. It was an upgraded version of the **Titan 34D** intended to be fitted with a **Transtage, IUS, PAM-D2** (fitted with a **Thiokol Star 63F** motor of 107,200 N) or the **Martin Marietta Transfer Orbit Stage (TOS)** upper stage. The length of this combination was 48.76m, depending on the size of the payload carried. It was capable of placing 14,500kg into a low orbit.

Titan 4

The **Titan 4** series of launch vehicles was procured by the U.S. Air Force and came in various versions. The length of the launch vehicle was up to 62.80m, depending on the configuration and the payload carried. The payload fairings varied from 17.10m to 26.2m in length and were up to 4.2 m in diameter.

The **Titan 401A** version combined the first two stages of the Titan vehicle with boosters with a **Centaur T** upper stage. It also had two **United Technology 1207** strap-on boosters which produced a thrust of 7,117,725 N each. Payloads up to 21,830kg could be placed into low orbit. The Titan 401A flew for the first time on February 7, 1994, and nine flights were conducted, of which one failed. The last flight was on August 12, 1998.

The **Titan 401B** was similar to the 401A except that it was fitted with two **Hercules SRMU** strap-ons, producing a thrust of 7,562,000 N each. The Titan 401B was used for the first time on October 15, 1997, and seven were launched, the last one on September 9, 2003.

The **Titan 402A** version used the **Boeing IUS** as the upper stage as well as two **United Technology 1207** strap-on boosters and was launched from Cape Canaveral to put 17,700kg into a low- Earth orbit. The first flight was on June 14, 1989, and three were completed, with the last one on December 22, 1994.

The first **Titan 402B**, which was fitted with two **Hercules SRMU** strap-ons, was launched on February 24, 1997, and five been launched, with the last one occurring on February 14, 2004.

Titan 403 was a Titan 4 with no upper stage (**NUS**) launched from Vandenberg AFB. It had a 20.10m payload fairing and was able to put a 14,685kg into a low orbit.

Five **Titan 403A** flights were undertaken between March 8, 1991, and October 24, 1997.

Two **Titan 403B** flights were conducted, with the first one on August 17, 2000. The 'A' and 'B' letters referred to the type of the strap-on boosters, which were the same as for the Titan 401A and Titan 401B, respectively.

The **Titan 404** was a configuration with no upper stage to be launched from Vandenberg. The payload fairing size and orbital parameters remain secret. Payload capacity was 13,600kg into low orbit. Similar to the previous versions, the 'A' or 'B' indicated the strap-ons used.

Three **Titan 404As** were launched between November 28, 1992, and December 20, 1996, and three **Titan 404Bs** were launched between May 22, 1992, and October 19, 2005, this latter date being the last flight ever for the Titan 4. However, two Titan 4 series launch vehicles that were never flown are intended for museum display.

The **Titan 405** was similar to the Titan 403 but was launched from Cape Canaveral. Two **Titan 405A** flights were conducted on June 8, 1990, and July 3, 1996. No Titan **405B**'s were ever flown.

Type	First flight	launches	failed
Titan I	6 February 1959	63 (*)	5
Titan II	16 March 1962	74 (*)	7
Titan IIGLV	8 April 1964	111	10
Titan 2	5 September 1988	12	1
Titan IIIA	1 September 1964	3	1
Titan IIIB	29 July 1966	64	4
Titan IIIC	18 June 1965	34	2
Titan IIID	15 June 1971	23	1
Titan IIIE	11 February 1974	6	1
Titan 34D	30 October 1982	13	2
Comm Titan 3	1 January 1990	4	0
Titan 401A	7 February 1994	8	1
Titan 401B	15 October 1997	7	0
Titan 402A	14 June 1989	3	0
Titan 402B	24 February 1997	5	0
Titan 403A	8 March 1991	4	1
Titan 403B	17 August 2000	2	0
Titan 404A	28 November 1992	3	0
Titan 404B	22 May 1999	3	0
Titan 405A	8 June 1990	2	0

Titan flights (*=suborbital)

Titan V

The **Titan 5** was a development proposal with an improved first stage using a **Pratt & Whitney** engine with a thrust of 445,728 N. No other details are known, as the development of this vehicle was never completed.

Titan Military Designations

As a missile, the Titan was designated as **SM-68**, **HGM-25** and **LGM-25**. In addition to the military missile designations, the Titan launch vehicles also received military designations in the **LV/SLV** and **SB** series. These designations probably refer to the first stage only. The following table lists the known designations and the cross references to the launch vehicle types, however, there remain discrepancies in this list. It is probable that these designations were only used for flights carrying military satellites.

About the author

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

Designation	Type
SLV-4	Titan IIGLV
SLV-5	Titan III
SLV-5A	Titan IIIA
SLV-5B	Titan IIIB
SLV-5C	Titan IIIC
SLV-5D	Titan IIID
SLV-5E	Titan IIIE
SB-4A	Titan IIGLV
SB-5A	Titan IV
SB-5B	Titan IVB
SB-6A	Titan 34D

Titan military designations



Insight

Bragging Rights

By Bob Gough, Senior Contributing Editor, Asia—Pacific

A

n Australian satellite communications company was among the finalists in this year's World Teleport Awards for Excellence, proving Australia is certainly one of the regions of the world at the forefront of space technology and is able to provide some of the Earth's best satellite communications.



Australian Teleports

The World Teleport Association's **Awards for Excellence** are presented each year to organizations and individuals in the teleport industry whose achievements have been deemed exceptional by the international trade association and its awards committees, which is comprised of industry members from across the globe.

Australia was once again recognized for housing some of the best teleports in the world, with satellite communications specialist **NewSat** named as a top three finalist in the **Independent Teleport of the Year** category for its teleports that are located in **Adelaide** and **Perth**. Not bad when you consider this selection was determined from a field of more than 1,000 global teleports, and for a country mostly renowned for digging and bludgeoning minerals from the ground.

NewSat's CEO, *Adrian Ballintine*, was quick to recognize the importance of making it into the top three. "It's a significant achievement for NewSat to be named as a top three independent teleport operator because it means that we are recognised by the industry and our customers as providing extraordinary service levels. Considering there are over a thousand teleports in the world, it speaks volumes to be named in the top three, especially for the people who run our teleports, as well as for the way we maintain our teleports."

Robert Bell, Executive Director of the World Teleport Association, commented on NewSat's top three Finalist nomination. "The WTA is dedicated to acknowledging the outstanding achievements of teleports throughout the world. It is evident NewSat is regarded by its peers and customers as one of the best teleports in the world. This is the second time NewSat has made Finalist which is an outstanding achievement for any company, especially a company from Australia which is geographically, a long way from the hub of space technology innovation".

Mission Critical Communications Advantages

While it is no surprise that the Americas, Europe and Asia are well-known for innovation in space technology, many are still surprised to learn that Australia provides some of the best satellite communications in the world. In fact, when it comes to Australia, it may be surprising to learn that the country has a number of key advantages in the delivery of mission critical communications.

With its low rainfall and mild temperatures, Australia is ideal for satellite communications. It is also geologically stable with no major earthquakes. The country's remoteness ensures minimal frequency interference, just as its geographical location enables it to achieve optimal look-angles into the Middle East and Africa providing better coverage.

Australia is politically stable and, as an allied country to the U.S., Australia holds "friendly nation status"—the country also shares a border with the USA across the Pacific Ocean. While a very big border, it provides direct cable access to the USA via the Southern Cross cable.



NewSat's Adelaide teleport

Finally, South Australia houses highly secure and government accredited teleports. This means Australia is able to meet the stringent security requirements needed to support the transmission of vital and sensitive information for government clients around the world.

The great potential of Australian satellite communications has not gone unnoticed by the Australian government. During the Washington, DC, event, the Australian Ambassador to the United States, The Honorable *Kim Beazley* hosted an evening to promote the achievements of Australian satellite communications companies, not only in Australia, but worldwide. Mr. *Beazley* recognized the advantages of Australian teleports and innovative satellites. He noted that, traditionally, the Americas, Europe, Asia and Russia have been renowned for innovation in space technology. However, Australian companies are making waves in the industry, as the attributes of Australian satellite communications are being discovered.

The evening at the Australian Ambassador's residence provided four Australian companies (**NewSat**, **EM Solutions**, **ASC** and **Clearbox Systems**) with an outstanding opportunity to enhance their profile in the U.S. For a company such as NewSat, this event meant that it was able to talk at length about its alliance with the U.S. government. "It's great for NewSat to be recognised for its contribution to the satellite industry on the biggest stage in the world," said Mr. Ballintine.

For those surprised to find Australia among the key satellite innovators, the evening proved that the Australian satellite communications industry has entered the global arena. With many high-ranking U.S. government officials and industry heads in attendance, the reception provided another strong indication that the U.S. shares Mr. *Beazley's* enthusiasm for Australian satellite communications.

A First Signing

Another major Australian event also occurred when NewSat finalized an agreement with **Arianespace** for the launch service of **Jabiru-1**, Australia's first, next-generation, geostationary satellite. In a signing ceremony on the 14th of March, the Chairman and CEO of Arianespace, *Jean-Yves Le Gall*, expressed his enthusiasm for the project and his appreciation to NewSat for selecting Arianespace.



Jabiru-1 satellite + beam footprint

"We are delighted to have been chosen by NewSat to launch their first satellite. Arianespace is particularly proud of this opportunity to serve Australian's first independent satellite operator, particularly one like NewSat who has a strong history of providing enterprise-class satellite communications from its two award-winning teleports. For us, this latest contract provides further recognition of the outstanding quality and competitiveness of our launch services." Mr. *Le Gall* said.

The innovative Jabiru-1 satellite is currently being built in the United States by **Lockheed Martin Commercial Space Systems**. The large satellite will be fitted with 50 Ka-band transponders, which will deliver high-powered capacity through a range of multi-spot, regional and steerable beams. Jabiru-1 will meet the growing demands from government and enterprise sectors across the Middle East, Asia and Africa.

Australian Among The World's Best

There is no doubt that the space world has developed a keen interest in Australian companies and what they have to offer. Australian companies are complementing the rest of the world in the deployment of satellites and bringing innovation to the global satellite communications industry.

While Australian companies have not traditionally been renowned for their innovation in space technology, this is certainly changing. The latest events in Washington, DC, have demonstrated Australia is, indeed, a country at the forefront of space innovation and technology.



The Road To The Future—The Failed Hire

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 remains ripe with new opportunities. Employers are challenged with making a "great hire." For the candidate, finding an opportunity can sometimes be a rather difficult proposition.

To assist with career searches, we asked Bert Sadtler of Boxwood Executive Search to respond to readers' questions regarding the processes of recruitment and hiring as well as how Companies can retain crucially-needed talent. Boxwood is located in the Washington, DC, region and has success in senior level recruitment in satellite communications, government contracting, and within the intelligence community. 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,

You have mentioned the concept of "failed hire" in your column and during your interview on Federal News Radio. Please explain what you mean by "The cost of a failed hire."

Peter C
COO
Government Contractor

Dear Peter,

One definition of the cost of a failed hire comes from a researched approach. Brad and Geoff Smart, authors of *Topgrading*, interviewed 52 organizations and asked them to calculate bad hires. They determined that the cost of a mis-hire for an employee making \$100,000 was \$1.5 million or 15X.

While 15X might seem extraordinary, let's explore the definition of a failed hire, some causes of a failed hire and factors when considering the cost of a failed hire.

What is the timeline that defines a Failed Hire?

In today's workplace, it is common for professionals to change their employment every couple of years. Having a new hire change employment after two or three years would not be regarded as a failed hire. However, changing employment within 6-12 months would be. What are some of the causes of a "failed hire?"



- Whenever there is a change of leadership, there is also a change in culture. Cultural changes can lead to change in employment. Examples include: acquisition, new manager of the employee, new Senior Executive leader, and change in corporate direction.
- Once critical talent has been hired, an employer needs to implement a long-term, on-boarding program and retention plan. Competitors are aware of the recent acquisition of talent. New employees are susceptible to second guessing their decision and can be receptive to accepting a "better option" during the first six months of new employment.

- A failed hire can occur when the expectations of the new employee and the employer don't match. Employers want results. Sometimes early results have to be measured by the completion of tasks and not solely by securing revenue. For example, securing new business in the government-contracting arena can frequently take companies one to two years. The best means to measure success is to establish a timeline with steps along the way that will eventually lead to revenue and then measure against the accomplishment of the steps.
- As part of issues with expectations, failed hires can be caused by inflexible compensation plans. If a new hire is expected to deliver revenue in new market areas, time needs to be given in order to develop the opportunities. One option would be to create a short term compensation plan measured against the development of new opportunities, and then implement a long-term compensation plan based on revenue.
- A failed hire can occur because the new employee did not solve the employer's problem. Companies acquire talent because the talent can solve a "problem." It is critical to define the "problem" prior to starting the recruitment and then to make sure the candidate is capable of solving the problem and has a plan before the candidate is hired.

A failed hire can be the result of recruiting short-cuts. Examples would include:

- Too few candidates resulting in the hiring of "the only one-available candidate" versus recruiting several highly qualified candidates.
- Calling references before investing the time to get to know the candidate first.
- Not spending time during the interview process to develop chemistry and then jumping right into an offer.



What are some factors to consider when determining the cost of a failed hire? For employers who have experienced a failed hire, the costs are easy to measure. Factors can include:

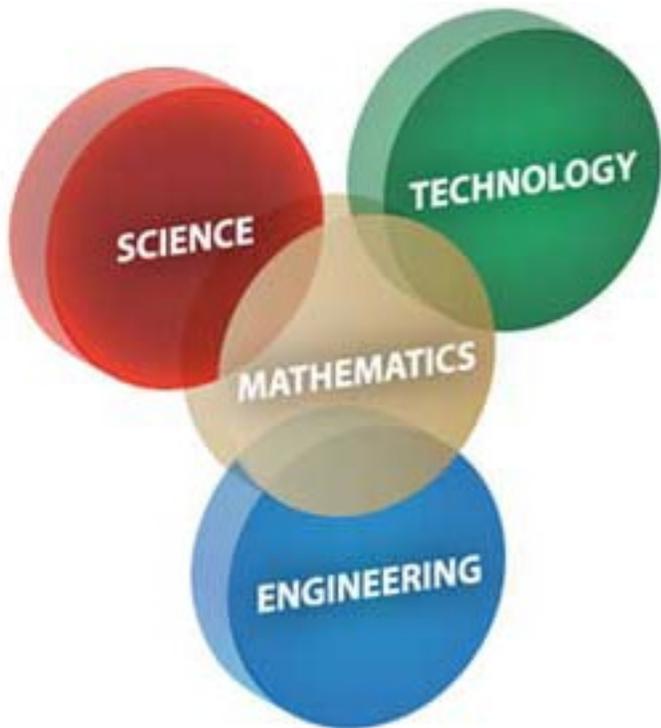
- The cost associated with the employer's reputation in the business community as a less-than-ideal place to work.
- The cost associated with the loss of current and potential opportunities when new talent leaves.
- The cost associated with the lost leadership momentum for direct and indirect reports when a new manager leaves.
- The cost associated with having recruited the new talent and the additional cost of having to launch a recruiting "replacement campaign".
- The cost of negative feelings by the departed employee as a member of the workforce with a competing employer.

A failed hire is the last thing that an employer or an employee wants to occur. The employer and employee share the responsibility of avoiding this. Employers should clearly define the "problem" they need a new employee to solve, and work toward hiring and retaining someone who can accomplish this. The employee has the responsibility of understanding what the "problem" is and delivering an agreed to solution.

I hope you have found this to be helpful.

Sincerely,
Bert Sadtler





There seems to be no noticeable hue and cry in the media about it; bar a few exceptions, notably Dr. *Neil deGrasse Tyson*, the bestselling author, director of **Hayden Planetarium** and host of **COSMOS**, as well as **Bill Nye the Science Guy®**, CEO of **The Planetary Society**. Despite the lack of public knowledge and concern about it, though, this **STEM** problem could well prove to be the undoing of decades of U.S. leadership in research, discoveries, exploration and of America sitting in the commander's seat—being the envy of the world when it comes to education, innovation and space.

To what does this term STEM refer? Simply the *science, technology, engineering and mathematics* disciplines. But you realized that, didn't you?

Is STEM really a big deal? Well, if you are betting your economic future, your advances in medicine, discoveries of new technologies, being able to keep an eye in the sky on Earth for pending human disasters ranging from the spread of disease (there's that virus again), to weather monitoring, then, yes, it is a big deal.

These are but a few of countless advantages made possible by a society knowledgeable in STEM. Without STEM, and an immediate emphasis and respect placed on it in our schools from Pre-K through 12th grade, community colleges, undergraduate, graduate and doctoral institutions, America **WILL** lose the lead in the type of advances, discoveries and explorations for which it was so revered in the second half of the 20th century. Perhaps worst of all, generations of U.S. citizens will graduate from their formal education illiterate in these disciplines, not even able to appreciate the importance of them. These very same folks will be casting votes in future elections, with some also voting in their roles as lawmakers in Washington, D.C., thus institutionalizing and further exacerbating the problem.

Real Life Illustration

I recently interviewed an impressive young man. Right away, I was pleased to learn that he is a top high school student. He is interested in robotics, has a love for sports and not only excels in, but also has a real enthusiasm for his engineering classes.

At the time of our meeting, he was actively researching which university to attend in the autumn. But wait; despite his aptitude for engineering, coupled with an interest in robotics, he was not researching these institutions' undergraduate STEM programs. I wanted to find out why...

I'd like you to meet *Kai*. *Kai* has a weighted GPA of 4.24, and SAT scores of 740 in math and 710 in reading. He is taking more than a handful of advanced placement classes and is enrolled in the fourth year of the honors engineering program, *Project Lead the Way® (PLW)*. *Kai* has already received two dean's scholarships and two chancellor's scholarships to higher education institutions. In fact, **Fordham University** is so keen to lure *Kai* to its campus, that the University is flying him to New York for a weekend to recruit him.

New York University could also be a potential port of call, along with interest from overseas institutions such as **King's College London** and the universities of **Manchester** and **Westminster**, all in the U.K. *Kai* is obviously a desirable academic candidate, particularly with his high SAT scores and natural talent and abilities in engineering and mathematics. He has the option to pick and choose both his university and his course of study. Despite his STEM academic background, however, he is not interested in continuing a course of study in one of these disciplines at university. Why?

Kai's View

Kai has very much enjoyed his experience with PLW, and was particularly complimentary about his teacher who runs the program. He did lament the fact, though, that his school was only recently able to offer a robotics club. He wondered that if he had an opportunity to join a robotics program early on and been exposed to more supplemental information about possible careers in the STEM fields (with up-to-date information about salary and benefits), maybe study in those fields might seem more appealing. *Kai* thought that exposure to STEM-related companies through summer internships, perhaps for a week or so even as early as his sophomore or junior years, may also have helped sway his decision to study a STEM field instead of what he is considering now, which is business and marketing. In fact, he was very appreciative that the father of one of his friends (who is an executive for **Lockheed Martin**) came to a number of PLW sessions to talk about careers related to space and STEM. *Kai* stressed that out of a group of 10 close friends in his cohort in PLW, three of them were considering studying one of the STEM fields at university. In *Kai's* opinion, their decision was due mainly to parental influence.

My Own View

The missed opportunity of not exposing *Kai* and his friends to more of what STEM disciplines have to offer in his earliest years of high school has culminated in the loss of a promising young scholar, engineer, scientist or mathematician. I am not so delusional as to think that every student with a GPA of 3.5 or higher should go to university to study a STEM discipline. But have we not failed in some significant way if those high-achieving students with an obvious natural ability and interest in STEM are somehow lost through the cracks?

Often when these students don't pursue STEM studies, teachers get the blame because it is perceived that they have not done their jobs correctly. But in this case at least—and I would submit that it is more often the case than not—the cause is much less obvious. I would argue that we should not blame educators, but come alongside them instead.

One way to meet this challenge is to support these capable STEM teachers' efforts to stimulate and encourage their students by getting the latest tools, training, and information into the proper hands at the earliest possible stages. To equip schools with easily accessible, state-of-the-art engineering and robotics

labs can allow students hands-on exposure and could thus engender lifelong excitement and enthusiasm. This, combined with the assurance that their interest can translate into direct and personal vocational benefits, may just be the winning combination needed to help drive the best and brightest students on a STEM-related trajectory.

Admittedly, *Kai* is the only person interviewed for this editorial and so not by any stretch of the imagination is this statistically representative. I would bet, though, that over the past years, many of us have met any number of talented young people similar to *Kai*. PLW and similar programs and initiatives are doing fantastic work and are justifiably supported by many corporate members and partnering organizations of the Space Foundation. To be sure, they ARE reaching out to students to get them enthused about STEM. But there is clearly more that needs to be done.

Steps Being Taken

Thanks to a recent grant from **The Boeing Company**, the **Space Foundation** has created a two-day educator professional development workshop to seed robotics programs in Colorado Springs so that after completing the training, 12 teachers will start robotics clubs at their respective schools. Participants receive two full NXT base kits, an educator resource add-on kit, Bluetooth and activity mats for their school to start these clubs.

Had *Kai's* high school teacher had such an opportunity to attend one of these workshops and add this to the school's PLW offering when Kai first entered high school, perhaps things may have turned out differently for this promising young man and his friends.

And what if the school counselors had a copy of **The Space Report**, the annual definitive overview of major global space developments? This valuable tool should be accessible to educators and students, especially at the university level, to provide a portrait of the space industry, particularly in terms of professional opportunities and outlooks. Its research and data is so accurate and reliable that it is used and quoted by elected officials in both state capitols and Washington, D.C. In the hands of *Kai's* teachers and advisors, and if available to him and his friends, they would have been able to see how robust, diverse and fulfilling space-related careers can be.

A Call To Further Action

Of course, no student should be left behind, but this is not to say that EVERYONE should attend university. This illusion is simply wrong. If a young person has demonstrated an aptitude and interest to go on to higher education, then as much encouragement and provision should be made so that becomes a reality. Those students who make the grade for university entrance without requiring remedial work to enable this entrance, should most definitely be supported at any cost. It is these students with drive, dedication and ability that companies, organizations and civil space agencies should concentrate on resources to encourage pursuit of STEM higher learning.

I would like to conclude with these four action items for the Space Foundation and its corporate members and partnering organizations:

- We must get robotics into as many of the nation's high schools as possible; inclusive of all neighborhoods, socioeconomic situations and average GPA of the student bodies. By doing so, teachers will have the tools to inspire, enable and propel every student to ensure that no budding engineer, scientist or even future voter is left behind.
- We must get the annual publication *The Space Report* into every high school, every academic and public library around the nation, as well as into every research institution. The value of a degree in one of the STEM disciplines will be proved, the value of a career in space clearly articulated and the undeniable benefits of space to an individual's livelihood and that of the United States as a nation made plain to see.
- We must ensure that every high school has the opportunity to work together with high tech companies and space corporations to seriously consider exploring the concept of week-long career experience sessions for those students who have the potential (as a result of their grades and interests) to be accepted into a higher education institution to study a STEM field. And I am including schools located in rural areas of the country here as well.
- And finally, once we have together encouraged these students and they have selected a STEM major and entered university, we must nurture and mentor them through our support of National Space Grant activities, which should include at a minimum, the offer of internships, and opportunities to attend the annual National Space Symposium through the Space Foundation's undergrad/grad career day program.

In and of themselves, these steps may not solve the full problem; but they are a start. I will be addressing other segments of the STEM education crisis in upcoming articles. Until then, this is my view from here...

About the author

As vice president of education for the Space Foundation, Iain Probert leads the Space Foundation's education team and manages its resources to accomplish the Space Foundation's education and workforce development, mission and goals. Prior to joining the Space Foundation, Probert was an executive for the Boy Scouts of America and its affiliate Learning for Life organization. He earned a Bachelor of Science degree in electronic and computer engineering from Thames University, U.K., and a Master of Business Administration from the International Space University, Strasbourg, France.