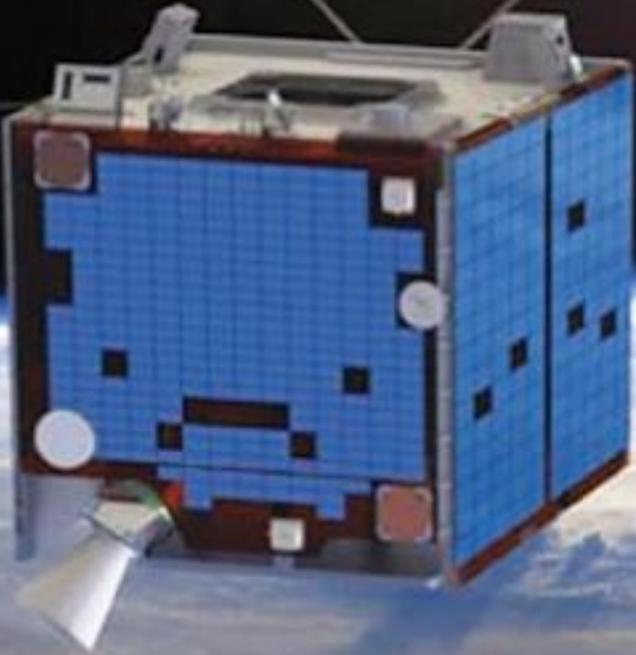


SatMagazine



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Comtech EF Data
Globecomm
Chris Forrester, Alan Gottlieb, Jos Heyman + Bert Sadtler
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and much, much more...

Payload

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A Case In Point: How to Run A Tight Ship



PACC Ship Managers Pte. Ltd. knows how to run a tight ship. They do it for their parent company, Pacific Carriers Limited (PCL), a Singapore-based company that is a leading owner and operator of dry bulk carriers and product tankers. **P.36**

Executive Spotlight: Dan Berkenstock, EVP, Skybox Imaging



Dan Berkenstock is an entrepreneur and engineer from Chicago, Illinois, with a healthy respect for the risks and rewards of doing business in space. He is also fascinated by scalab. **P.48**

Executive Spotlight: Janne Morstøl, COO, T-VIPS AS



Janne T. Morstøl is COO of T-VIPS AS, a technology company providing professional video transport solutions. She is one of the founders of the company, and manages key functions within the company. **P.88**

Focus: Progression In The World Of SATCOMs @ Sea



The maritime industry has always had a challenging time trying to keep its workforce in place. The financial reward for going to sea, often for months at a time, can be significant but the fact that seafarers are required to spend so long away from home means that many of them don't view life on the ocean waves as a job for life. — by Casper Jensen. **P.44**

Forrester's Focus: Newtec: Expanding... + Compressing



"This past year has seen the U.S. dramatically reduce its equipment buying levels, and this is the first time we have seen this in the U.S.," says Serge Van Herck, CEO at Newtec. "We have been able to grow very nicely in other parts of the world and this has stabilised and compensated those lost revenues. **P.66**

Gottlieb's Focus: Which Service Is Best?



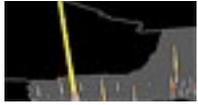
As satellite phone airtime prices have fallen and lower cost phones have been introduced, the market for satellite phones has grown substantially. With the introduction of Inmarsat's low cost IsatPhone Pro and the likely coming revival of Globalstar's duplex voice services, selecting the appropriate provider and hardware is more complicated than ever. **P.40**

Heyman's Focus: Aerosat — A Brilliant Idea Gone Wrong



In the early 1960s various ideas for dedicated application satellites were advanced including one for aeronautical communications that was being considered in the United States as well as the European nations, the latter through the European Space Research Organisation (ESRO). Unfortunately the market was not ready for this development and the proposal was cancelled. **P.82**

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Every once in a great while, a report surfaces about a communications satellite which has been partially or completely disabled as the result of a sudden knockout blow delivered by the sun. The first thing to keep in mind is that these things can happen... by Tobias Nassit. **P.32**

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Tracking Disease Outbreaks

Satellite images of nighttime lights, which normally are used to detect population centers, also can help keep tabs on diseases in developing nations, according to new research. An international research team that includes Matthew Ferrari, an assistant professor of biology at Penn State, found that the new technique accurately indicates fluctuations in population density — and thus the corresponding risk of epidemic — that can elude current methods of monitoring outbreaks.

The research, reported in the current issue of the journal *Science*, is expected to help medical professionals to synchronize vaccination strategies with increases in population density. Ferrari and his team used nighttime images of the three largest cities in the West African nation of Niger to correlate seasonal population fluctuations with the onset of measles epidemics during the country's dry season, roughly from September to May. Because many pathogens that cause epidemics flourish in areas where the population density is the greatest, satellite imagery showing brighter areas — indicating greater numbers of people — then can be used to pinpoint disease hot spots. The images, taken between 2000 and 2004 by a U.S. Department of Defense satellite, were compared to records from Niger's Ministry of Health of

weekly measles outbreaks during the same years in Maradi, Zinder, and Niger's capital, Niamey.

In many agriculturally dependent nations, such as Niger, people migrate from rural to urban areas after the growing season, explained Nita Bharti, a postdoctoral researcher at Princeton University and the first-listed author of the research paper. As people gather in cities during the dry-season months when agricultural work is unavailable, these urban centers frequently become hosts to outbreaks of crowd-dependent diseases such as measles. Because temporary and seasonal migrations are very hard to measure directly, the night lights are an important source of data for Africa and Asia, especially, where other sources of data are sometimes absent.

The team found that measles cases were most prevalent when a city's lighted area was largest and brightest. "We found

that seasonal brightness for all three cities changed similarly," Ferrari said.

"Brightness was below average for Maradi, Zinder, and Niamey during the agriculturally busy rainy season, then rose to above average as people moved to urban areas during the dry season. Measles transmission rates followed the same pattern — low in the rainy season, high in the dry season." The team members also found that the relationship between brightness and measles transmission appeared even clearer at the local level, as did the potential value of the researchers' technique in providing medical treatment.

For example, in Niamey, measles cases were recorded daily for three districts, or communes, during the 2003 to 2004 dry season. Both brightness and measles infection peaked early in the northern districts in February and March of 2004. A two-week mass-vaccination campaign

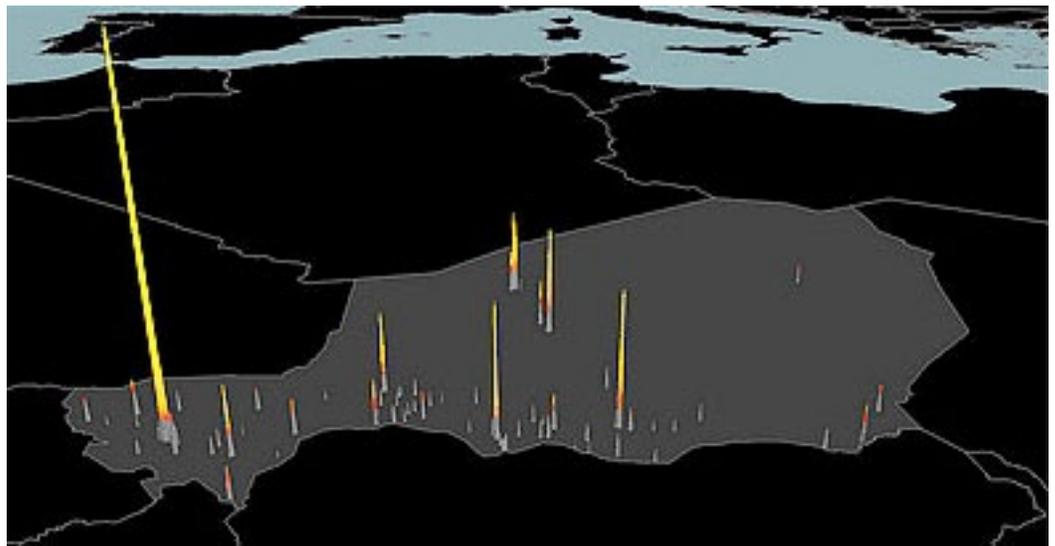
was launched in March and April of 2004, but population density, as determined by light brightness, already had started to decline in the north of the city.

"Ultimately, the goal is to use this research to design better preventative-vaccination programs and more-efficient responsive vaccination strategies when outbreaks do occur," Ferrari said.

Bharti added that the team's new method is not limited to understanding measles.

"Think about malaria or meningitis," she said. "These diseases are geographically specific, for the most part, to areas where this would be a useful technique. These are places that are not so industrialized that they always will be saturated with brightness and where there may be some level of agricultural dependence so that there are detectable labor migrations."

The researchers also are exploring the use of nighttime lights with other large-scale population-



Researchers analyzed the seasonal changes in nighttime-light brightness in Niger's largest cities. The height of the peaks represents the brightness of nighttime lights over the course of one year.

tracking methods such as the monitoring of mobile-phone usage.

"When used alone, both population-tracking methods have their shortcomings," Bharti said. "Nighttime-lights imagery is susceptible to weather conditions, while mobile-phone usage data are biased in the portion of the population it can represent." Bharti and her co-authors hope that when nighttime imagery is combined with other techniques, the measures will be complementary.

In addition, the team members hope to explore uses for nighttime satellite data outside of epidemiology, such as tracking population displacement and mass migration during a war or following a natural disaster.

"We now have a technique that allows us to observe and measure changes in population density," Bharti said. "This short-term use of nighttime-lights data could apply to a number of different situations beyond seasonal migrations and infectious diseases, such as humanitarian and disaster aid. We're excited about the potential this method has for other important global-health issues."

In addition to Ferrari and Bharti, other authors of the study include Andrew Tatem of the University of Florida; Rebecca Grais of Epicentre, a non-profit research facility located in France; Ali Djibo of the Nigerian Ministry of Health; and Bryan Grenfell of Princeton University. The research was supported by the Bill and Melinda Gates Foundation.

For more information, contact Ferrari at 814-865-6080 or mferrari@psu.edu, or Barbara Kennedy, Penn State Science PIO, at 814-863-4682 or science@psu.edu.



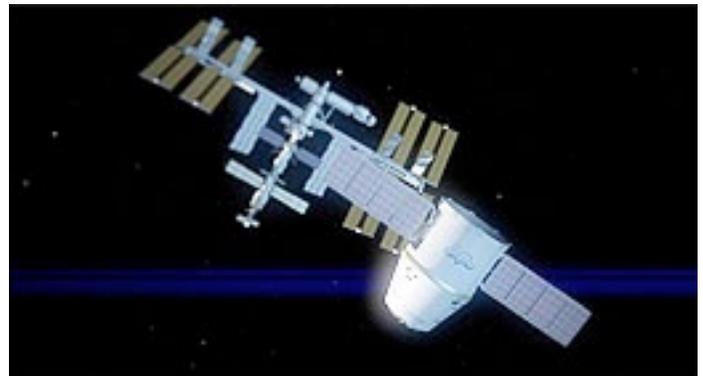
Article is courtesy of Penn State Live, the University's Official News Source

Dragon's COTS Demos

December 8, 2011, marked the one year anniversary of Dragon's first Commercial Orbital Transportation Services (COTS) demonstration flight. The flight made history as SpaceX became the only commercial company to successfully return a spacecraft from orbit. This feat had previously been accomplished only by five nations and the European Space Agency.

The Company is now preparing the Dragon spacecraft for yet another historic flight, becoming the first commercial vehicle in history to visit the International Space Station (ISS). NASA recently announced February 7, 2012, as the new target launch date for the upcoming mission. In addition, NASA officially confirmed that SpaceX will be allowed to complete the objectives of COTS 2 and COTS 3 in a single mission.

This means Dragon will perform all of the COTS 2 mission objectives which include numerous operations in the vicinity of the ISS, and will then perform the COTS 3 objectives. These include approach, berthing with the ISS, astro-



COTS 2 objectives include Dragon demonstrating safe operations in the vicinity of the ISS. The actual zone of operations is greater than shown in the illustration above. Illustration: NASA / SpaceX.

nauts opening Dragon and unloading cargo, and finally, astronauts closing the spacecraft and sending it back to Earth for recovery from the Pacific Ocean off the coast of California.

This mission marks a major milestone in American spaceflight. While SpaceX's first missions to the ISS will be to transport cargo, both Falcon 9 and Dragon were designed to ultimately transport astronauts. Every trip made to the ISS from this point forward gets the Company closer to that goal.

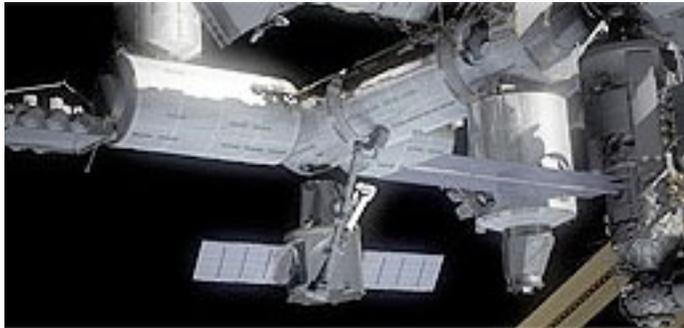
Just as Dragon's first mission to orbit and back involved a level of effort

equal to launching the first Falcon 9, preparing Dragon for two weeks of operation in space and for approach and berthing with the ISS poses new challenges. Meeting them requires a large amount of detailed planning and careful execution.

Each launch day will have just one narrow liftoff window — no more than a few minutes — in order to synchronize Dragon's flight with the orbit of the ISS. Catching up to the ISS will take from one to three days. Once there, Dragon will begin the COTS 2 demonstrations to show proper performance and



As part of the COTS 3 objectives Dragon approaches the ISS, so astronauts can reach it with the robotic arm. Illustration: NASA / SpaceX.



The astronaut operating the robot arm aboard the ISS will move Dragon into position at the berthing port where it will be locked in place. Illustration: NASA / SpaceX.

control in the vicinity of the ISS, while remaining outside the Station's safe zone.

During the entire time Dragon is in the vicinity of the ISS, station astronauts will be in direct communication with Dragon and will be able to monitor the spacecraft as well as issue spacecraft commands.

After successfully completing the COTS 2 requirements, Dragon will receive approval to begin the COTS 3 activities, gradually approaching the ISS from the radial direction (toward the Earth), while under constant observation.

Dragon will approach to within a few meters of the ISS, allowing astronauts to reach out and grapple

Dragon with the Station's robotic arm and then maneuver it carefully into place. The entire process will take a few hours.

Once in place, Station astronauts will equalize the pressure between the ISS and Dragon, open the hatches, enter the vehicle and begin unloading Dragon's cargo. After Dragon spends about a week berthed at the ISS, astronauts will reverse the process, loading Dragon with cargo for return to Earth, sealing the hatches, and un-berthing Dragon using the robotic arm.

Dragon will then depart from the ISS and return to Earth within a day or so, and the SpaceX recovery crew will meet it at splash

down in the Pacific Ocean off the coast of California.

Both the Falcon 9 launch vehicle and the Dragon spacecraft that will fly in the COTS Demo 2/3 mission have been delivered to the SpaceX launch complex in Cape Canaveral, Florida. Falcon 9's first stage, second stage, and interstage were integrated and rolled out for two separate wet dress rehearsals, in which SpaceX engineers performed the entire countdown sequence up until the moment the engines would be fired.

The Dragon COTS Demo 2/3 spacecraft and trunk have also been delivered to the launch pad and are undergoing final processing for flight.

Predictions Of The Spatial Sort

The new generation of weather and environmental satellites, GOES-15, officially became operational as GOES-West December 13, 2011. As a result, communities across the Western United States and Pacific region will begin to benefit from improved weather forecasts and environmental intelligence.

ITT Exelis Geospatial Systems, an operating division of ITT Exelis (NYSE: XLS), designed and built the imager and sounder instruments flying on board GOES-15 for the National Oceanic and Atmospheric Administration (NOAA) in cooperation with NASA's Goddard Space Flight Center, Greenbelt, Maryland. In addition to producing the familiar weather pictures on U.S. newscasts, these instruments will enable GOES-15

to provide early warnings of severe weather conditions like tornadoes, flash floods, hurricanes and hail storms.

"Providing timely access to environmental intelligence is critical to protecting lives, property and infrastructure," said Rob Mitrevski, vice president, Intelligence, Surveillance and Reconnaissance programs at ITT Exelis Geospatial Systems. "The satellite instruments built by ITT Exelis continue to be an integral part of our nation's weather forecast ability, enabling our country to see and solve some of the toughest environmental challenges."

GOES satellites provide meteorologists with nearly continuous images as well as temperature and moisture data, enabling more accurate weather forecasts. GOES data is also used for climate-weather prediction models; ocean temperature; charting ice; snow and glacier mapping; land temperature measurement; and monitoring agricultural crop conditions.

GOES-15 was launched March 4, 2010. After reaching geostationary orbit 22,300 miles above



The completed Falcon 9 COTS Demo 2/3 vehicle in the SpaceX hangar at Cape Canaveral, Florida. Photo: Mike Sheehan / SpaceX.



ITT Exelis' Advanced Baseline Imager (ABI)
More information at <http://www.exelisinc.com/solutions/Pages/GOES-R.aspx>

the U.S. and prior to being activated, the satellite underwent six months of extensive post-launch testing before being parked in on-orbit storage. ITT Exelis has been designing and building space-borne meteorological instruments for nearly 50 years and is currently working with NOAA and NASA to build GOES-R. This next-generation environmental satellite will include the most advanced meteorological imaging instrument ever built for operational weather forecasting, the Advanced Baseline Imager (ABI).

Designed and built by ITT Exelis, ABI will monitor three times the number of atmospheric conditions currently measured and will produce images that can discern objects as small as one-half a kilometer. ABI is also much faster, updating data every 30 seconds versus the current rate of 7.5 minutes. At that speed, ABI can create a full-Earth image in five minutes versus 30 minutes for the current imagers. ABI also will zoom in and track a single storm while simultaneously collecting continent-wide data and imagery. All these improvements add up to faster and more accurate forecasts, improved hazardous weather tracking and increased capability to study and monitor climate change.

Six Pack Lift Off

A launch representing France, Chile and Russia has been successful...

Arianespace Flights VS02, ST24, VA205 and VV01 are aboard as Soyuz performs its second liftoff from the new French Guiana launch facility created for this medium-lift vehicle's operations in service with Arianespace. Arianespace confirmed Soyuz' mission flexibility in operations from the Spaceport with the successful launch that placed six satellite passengers into Sun-synchronous orbit.

Departing precisely at the planned liftoff time of 11:03:08 p.m. in French Guiana, the Soyuz performed a three-hour, 26-minute flight to deploy its payload of the French Pléiades 1 and Chilean SSOT satellites for civilian and defense image gathering, along with four French ELISA micro-satellite demonstrators for defense-related electronic intelligence gathering (ELINT).

This was Arianespace's second mission with the Russian-built medium-lift workhorse launcher performed at the Spaceport, and it occurred less than two months after Soyuz' historic maiden flight from French Guiana on October 21.

Designated Flight VS02 in the Arianespace launcher family numbering system, tonight's mission involved four burns of Soyuz' Fregat upper stage, which enabled the six satellites to be released for operations at altitudes ranging from 610 km. to 700 km. Using a new purpose-built payload dispenser developed

for Arianespace's Soyuz missions, the deployment sequence began with the release of Pléiades 1. It was followed by the simultaneous separation of all four ELISA satellites, and the mission was completed with the deployment of SSOT, which occurred three hours, 26 minutes after liftoff.

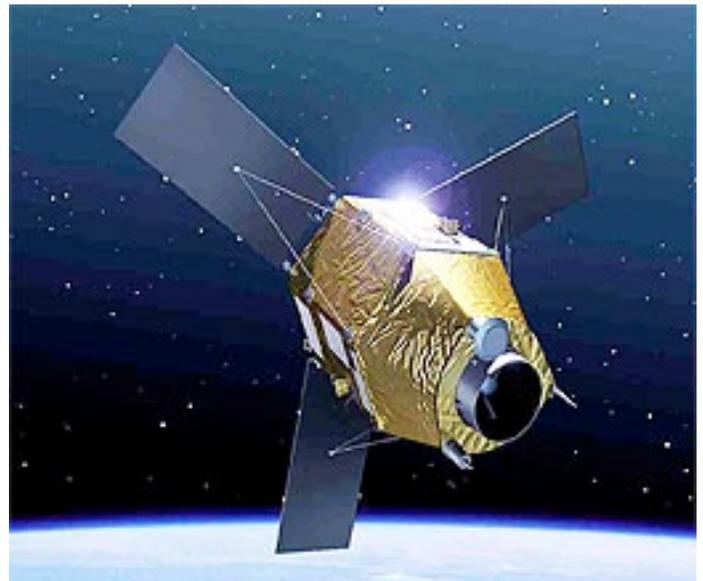
The Soyuz lift performance was an estimated 2,190 kg., which includes approximately 1,400 kg. for the Pléiades 1, ELISA and SSOT satellites, along with the weight of its payload dispenser and integration hardware. This was the 1,781st flight of the Soyuz launcher family, which ushered in the space age and continues to demonstrate its reliability and robustness in both unmanned and manned missions.

Pléiades 1 weighed in at 970 kg. at launch and will provide military and civilian users with very high resolution optical satellite imagery from a 700 km. orbit, offering 50cm. resolution imaging products at a coverage swath width of 20

km. Built by prime contractor Astrium for the French CNES space agency, Pléiades 1 is a compact, hexagonal-shaped spacecraft optimized for operational agility and image location accuracy. The Pleiades satellites offer a significant improvement in technology over previous generation satellites, based on their size, resolution, high degree of agility in orbit, and ground transmission capacity.

The four ELISA (Electronic Intelligence by Satellite) demonstrator satellites will enable French defense procurement agency DGA (Direction Générale de l'Armement) to test the space-based mapping of radar transmitters across the planet, while also determining the characteristics of these transmitters. The DGA and CNES are co-project authorities, and chose Astrium, with Thales Airborne Systems, to build the four satellites, each weighing about 120 kg., along with the user ground segment.

The Soyuz mission's four ELISA micro-satellites are part of a joint demonstrator program involving



Artistic rendition of the Pléiades 1 satellite



Vega's solid-propellant third stage is installed on top of the launcher earlier this month in French Guiana as this new lightweight vehicle is readied for its maiden flight from the Spaceport in 2012.

the French DGA defense procurement organization and the country's CNES space agency, with these spacecraft developed in a partnership of Astrium and Thales Airborne Systems. Weighing 120 kg. each, they have an operational design life of more than three years.

Chile's SSOT (Sistema satelital de Observación de la Tierra) is a dual-role military/civilian optical satellite that weighed 117 kg. at launch, and is designed for such missions as mapping, agricultural monitoring, and the management of natural resources, disasters and risks. Built by Astrium for the Chilean armed forces, SSOT is based on the same CNES-conceived spacecraft platform as the ELISA satellites.



Following this successful launch, Arianespace intends to continue its sustained launch cadence as another Soyuz mission is set for December 28 from Baikonur Cosmodrome in Kazakhstan, while preparations continue at the Spaceport in French Guiana for the new lightweight Vega's inaugural liftoff, as well as for the next heavy-lift Ariane 5 flight.

Looking ahead to Arianespace's 2012 mission activity... Operationally, Ariane 5 lofted eight large geostationary telecommunications satellites from French Guiana during the year — representing one-half of all such payloads orbited worldwide in 2011 — along with the no. 2 Automated Transfer Vehicle.

The initial Vega to be launched from French Guiana is taking shape at the Spaceport, with its solid propellant first, second and third stages now stacked on the launch pad.

Shortly, Vega's AVUM liquid-propellant upper stage will be moved to the pad and installed atop the launcher. Integration of the "upper composite," consisting of the launcher's payload and protective fairing, is planned for January, followed by final verifications of the fully integrated launcher and the countdown rehearsal.

Vega's solid-propellant third stage is installed on top of the launcher earlier this month in French Guiana as this new lightweight vehicle is readied for its maiden flight from the Spaceport in 2012.

This introductory Vega mission — designated VV01 — is anticipated

to occur in the January-February timeframe and will carry Italy's LARES laser relativity satellite, along with the ALMASat-1 spacecraft from European universities and several small cubesat platforms.

Separately, the no. 3 Automated Transfer Vehicle (ATV) for servicing of the International Space Station is scheduled for a March 9th liftoff from French Guiana on an Ariane 5. This flight's launcher has now been declared ready for the Spaceport handover to Arianespace by industrial prime contractor Astrium. It will be the 205th mission with an Ariane family vehicle, and is designated VA205 in Arianespace's numbering sequence.

The ATV's two major components — its Integrated Cargo Carrier and the Service Module — have already been mated in the S5 payload preparation building at the Spaceport, marking a major milestone in preparations for the resupply spacecraft's liftoff.

With Ariane 5, Soyuz and Vega operating side-by-side from the Spaceport, Arianespace will have a complete launcher family that supports the company's goal of being able to launch "any payload, to any orbit...anytime."

Arianespace Chairman and CEO Jean-Yves Le Gall said the company's performance in 2011 once again validated its market leadership, with the "numbers speaking for themselves."

2G's Third Launch

Six new second-generation Globalstar satellites have been successfully launched from the Baikonur Cosmodrome in Kazakhstan.

The Globalstar satellites were launched on Wednesday, December 28, 2011, at 11:09:02 p.m. local Baikonur time (5:09 p.m. UTC and 12:09 p.m. EDT) using the Soyuz-Fregat version of the Soyuz launch vehicle. There have been more than 1,780 successful launches of the Soyuz family launch vehicle.

Launch services provider Arianespace confirmed that the upper stage accurately injected the six second-generation satellites into the targeted low Earth orbit of approximately 920 km. Globalstar reports that all six satellites have been successfully acquired following separation of the Fregat Upper Stage and release from the satellite dispenser. Globalstar has initiated satellite in-orbit testing and all six spacecraft are operating normally at this time.

"It is with great pleasure that we announce the successful third launch and continued deployment of our second-generation constellation," said Tony Navarra, President of Global Operations for Globalstar, Inc. "We are now only one launch away from completing our four second-generation satellite launches and we look forward to the future services our new constellation will support. With these six new satellites now safely in orbit, we once again congratulate and applaud all of our Globalstar employees



world-wide and thank launch provider Arianespace as well as our satellite contractor Thales Alenia Space for this launch success."

Globalstar signed a contract with satellite manufacturer Thales Alenia Space in late 2006 for the design, manufacture and delivery of its second-generation constellation satellites. A total of four launches of six satellites each are being conducted by launch services provider Arianespace. The first launch was conducted in October 2010 and the second launch was completed in July of this year.

The Globalstar second-generation satellite constellation is designed to support the Company's current lineup of voice, Duplex and Simplex data products and services including its lineup of SPOT retail consumer products. The new satellites are designed to last for 15 years, twice the lifespan of Globalstar's first generation satellites.

Once the four launches

are complete and the second-generation satellites are deployed, Globalstar expects to provide the world's finest quality mobile satellite voice and fastest mobile satellite handset data services to customers in more than 120 countries. Combined with its affordable suite of consumer retail SPOT products, Globalstar expects to offer the world's most extensive lineup of high quality mobile satellite services to the broadest range of commercial and retail consumer customers around the globe.

Increased Activity

China will launch the Shenzhou-9 and Shenzhou-10 spacecraft and achieve space rendezvous and docking missions with the orbiting Tiangong-1 vehicle in 2012, a spokesman for the China National Space Administration has revealed.

Spokesman Zhang Wei made the announcement at a press conference held in Beijing for the release of a white paper titled "China's Space Activities in 2011." However, the spokesman did not unveil a detailed timetable for the launches.

China issued the white paper on the development of the space industry since 2006 and the major tasks for the next five years. The white paper was the third white paper on the country's space activities issued by the State Council Information Office, following one in 2000 and another in 2006. The Chinese government has made the space industry an important

part of the nation's overall development strategy and adhered to the exploration and utilization of outer space for peaceful purposes, the white paper said.

Over the past few years, China has ranked among the world's leading countries in certain major areas of space technology, it said, adding that in the next five years, there will be new opportunities for the country's space industry. At the same time, China will work together with the international community to maintain a peaceful and clean outer space environment and endeavor to promote world peace and development,

the document said.

Major tasks listed in the white paper for the next five years include a space transportation system, Earth satellites, human spaceflights and deep-space exploration. China also plans to launch space laboratories, a manned spaceship and space freighters, and will start research on the preliminary plan for a human landing on the moon, the document said. As an important part of deep-space exploration, the country's lunar probe projects follow the idea of "three steps" — orbiting, landing and returning.

In next five years, the country plans to



Artistic impression of China's Shenzhou-5 satellite

launch orbiters for lunar soft landing, roving and surveying to implement the second stage of lunar exploration.

Welcome To The Year Of The Dragon

by Elliot Holokauahi Pulham, CEO, Space Foundation



Aloha from Colorado Springs, the home of the Space Foundation, and welcome to 2012 —which will either be the most auspicious year ever, or the end of life as we know it, depending upon whether you ascribe to the Chinese calendar or the Mayan one. In fairness to the Maya, they never predicted the end times; rather they stopped counting at 2012, perhaps because they foresaw declining ISQs in our times and decided “why bother?” Of course, by now we have survived the Rapture, which was to have taken place twice during 2011. So, how bad can 2012 be, really?

The answer, of course, is up to us. If we dwell on all the things that could make it bad — ITAR, the injured U.S. space industrial base, a clueless and arrogant White House, etc. — we could certainly pity ourselves into a funk of black hole proportions. If we choose, instead, to remain outside the pity pot event horizon and carpe some diem, there’s no telling what a good year 2012 might be.



I'm mindful that our view depends upon our perspective. A lot of our partners in the global space community would likely characterize 2011 as a lousy and forgettable year — and with good reason. But other of our partners managed record results in 2011 and, thus, would have a different perspective. For the Space Foundation itself, 2011 was a banner year — not without its challenges, but a historic year of progress nonetheless. (Starting this month in *Space Watch*, we're running excerpts from our soon-to-be-published annual report.)

Certainly, we're sensitive to the difficulties that many in the space community face. NASA has bet the farm on commercial orbital transportation systems, yet the COTS lynchpin could pop right out of the machine if competing interests both inside and outside the agency divert crucial funding. Key propulsion companies, relied upon by both NASA and the U.S. Air Force, cut people and facilities to the bone in 2011, and any further uncertainty about government procurements could push the United States into a hole that would take decades to crawl out of.

Still, we're frequently reminded that positive change can come when you least expect it, usually driven by people who believe. This past Nov. 30, delivering keynote remarks at the Space States Summit, I made an impassioned case for the development of a two-stage-to-orbit vehicle as both a disruptive breakthrough in space transportation and a means for driving a new generation of technology and innovation that could inspire, enable and (literally) propel humanity. Less than three weeks later, space enthusiast and serial innovator Paul Allen announced plans to do exactly that, in collaboration with legendary aerospace designer Burt Rutan and maverick space transportation company SpaceX.

Allen and Rutan have been down this path before, with the Microsoft billionaire bankrolling the X-Prize winning Spaceship One effort, which in turn has spun off Sir Richard Branson's Virgin Galactic suborbital space tourism enterprise. All of which serves to remind us that there is, indeed, a great deal of exciting space stuff going on around the world, and that 2012 is going to be a great year for some, if not all.

Going back to COTS, it's worth keeping an eye on United Launch Alliance and its partner companies this year, as ULA continues to make great strides in getting the Atlas 5 certified as human-rated for space travel. Three of NASA's four Commercial Crew Development suppliers are counting on ULA to do the heavy lifting for their commercial crew systems, and, I believe, ULA will not disappoint. Taking a very different approach, 2012 should be the year that SpaceX makes history (yet again) when its Dragon capsule becomes the first commercial vehicle to dock with the International Space Station (ISS). The company plans a demonstration



flight and two resupply flights in 2012. Look for SpaceX to also make some big breakthroughs with the human-rated version of Dragon.

Speaking of Dragons, January 23 kicks off the Year of the Dragon on the Chinese calendar. Dragon years are believed to be the most auspicious, according to Chinese tradition, and I believe we're going to see some auspicious developments in China's space program in the next 12 months. China carried out an impressive 17 orbital launches in 2011, including both the Tiangong-1 space station/docking testbed and the Shenzhou 8 spacecraft. The impressive automated docking maneuvers following those launches paves the way for the China Manned Space Engineering Organization to conduct its next set of missions in 2012, and I believe that China will leapfrog its own schedule and launch a Taikonaut crew to Taingong-1 — becoming only the third nation to independently establish a crewed space station in orbit.

Not all that's worth watching in 2012 will involve human space flight. The Mars Exploration Laboratory "Curiosity" is presently hurtling through space, en route to an August rendezvous with the Red Planet. Despite MEL's picture-perfect launch and flawless trajectory toward our nearest planetary neighbor, we need to remember just how difficult this mission is. While the U.S. has enjoyed great success in recent years with Mars Reconnaissance Orbiter and the Spirit and Opportunity rovers, the recent, failed Phobos/Grunt mission serves as a sobering reminder that missions to Mars are frequently spacecraft killers. And "Curiosity," of course, is probably most famous as the thing that killed the cat. With its wildly imaginative "Skyhook" landing system, the MEL mission is a bold gambit . . . just the kind of derring-do that we like to see in our space programs. One thing's for sure: this mission will have us glued to our seats come August.

One group that will not want to be glued to its seats will be the passengers and crew aboard Space Ship Two when Virgin Galactic makes its historic first passenger flight to the edge of space. Although Virgin Galactic has been very careful to measure its progress in test and safety milestones rather than revenue seat miles, there's ample reason to believe that 2012 could mark the historic commencement of the Age of Personal Space Flight. And, of course, Sir Richard Branson's jaunty grin will factor in the occasion.

And that's not all.

2012 will undoubtedly bring us more stunning imagery from the Hubble Space Telescope, and more astounding discoveries of "M-Class" planets from the Kepler Space Telescope. The Pan-Starrs array atop Haleakala will reveal

more space debris than we ever imagined in the geostationary belt. Heretofore unknown Near Earth Objects will be discovered.

The U. S. Air Force AEHF-1 satellite will become operational and ULA will launch at least nine spacecraft for the national security space community. ESA will conduct the maiden launch of its Vega launch vehicle.

JAXA will launch its Kounotori 4 spacecraft on an autonomous docking resupply mission to the ISS, while Hayabusa 2 is being prepared for Japan's second asteroid encounter and sample return mission. The India Space Research Organization (ISRO) will conduct the first test launch of its three-stage GSLV MkIII launch vehicle.

And, let's not forget, J.J. Abrams' new Star Trek sequel begins filming this month.

Yes, it's true that there is so much more that we could and should be doing in space. Election year politics are going to be ugly, and federal space programs are going to suffer because of it. The ITAR dragon will defy efforts to slay it, and U.S. space companies will continue to cry for their freedom to compete in world markets.

But The View from Here is that the Year of the Dragon will be an auspicious one indeed in space. For all of us who love the milieu, the endeavor to advance space activities will be a battle worth joining, and fun to be part of — to inspire, enable and propel humanity.

Let's give it all we've got.

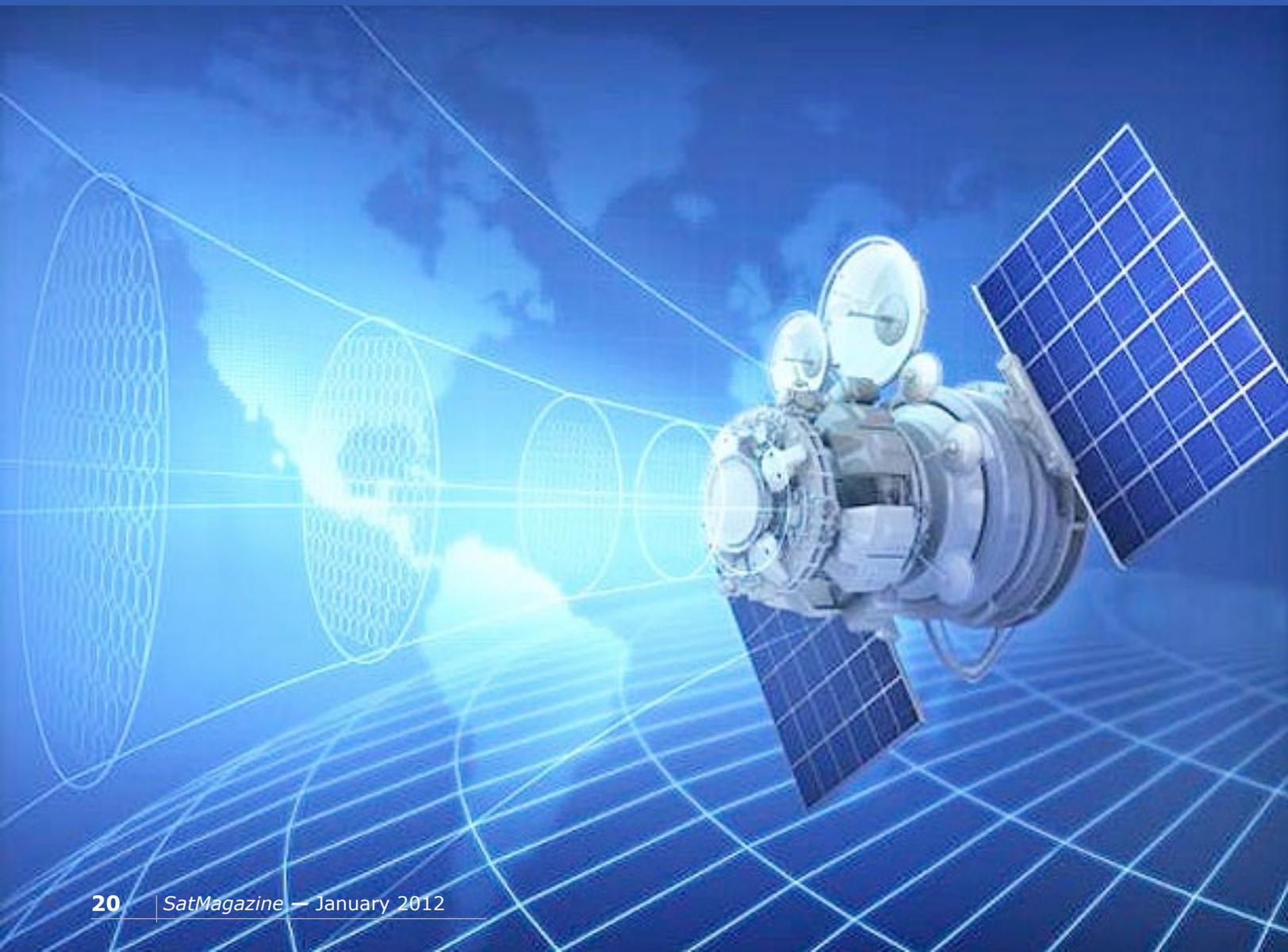
Elliot Holokauahi Pulham



Bridged Point-to-Multipoint

by Mark Dale, V.P. Product Management, Comtech EF Data

Satellite networks are often designed to support connectivity for Internet Protocol (IP) data traffic. In many networks (particularly government networks), data traffic is encrypted prior to arriving at the satellite communications element of the network. In encrypted IP-based networks, it is often highly desirable to have the satellite network transparently bridge traffic (i.e., operate at “Layer 2” in the OSI model, rather than Layer 3 or higher). This eliminates the requirement to support routing protocols and other Layer 3 functions in the satellite communication equipment on the “black” side of the encryptor, which in turn greatly simplifies the configuration and operation of the overall network.



In many IP-based satellite networks, a point-to-multipoint, or “hub-spoke” network architecture is also desired. However, standard Layer 2 Ethernet switches or other networking products operating at Layer 2 do not support hub-spoke networks. Hence without special processing, the requirement for Layer 2 connectivity in the satellite network conflicts with the requirement for a point-to-multipoint network architecture.

Comtech EF Data’s bridged point-to-multipoint implementation provides a solution to this problem, and enables Layer 2 bridged connectivity in a point-to-multipoint network.

Point-to-Multipoint Network Architecture

In a hub-spoke architecture, distributed remote terminals communicate to a central hub location. “Point-to-multipoint” is another term that is used to describe this architecture.

Figure 1, shown on the next page, shows a hub-spoke architecture connecting a number of secure Government networks using SLM-5650A Satellite Modems. In this network, data traffic from the hub to the remotes is time division multiplexed (TDM) into a common Forward Link (FL). All remote terminals receive the FL. Remote-to-hub traffic is transmitted by individual Return Links (RLs) from each remote.

In networks where multiple remotes need to connect to a common hub, a network architecture using a shared FL is often preferred because satellite bandwidth can be utilized more efficiently than an alternative architecture using multiple point-to-point connections to each remote. This is particularly true when the network is IP-based, with time varying data rates to the remote users. Key reasons for this efficiency advantage include:

- a. **Broadcast (Multicast) Traffic:**
Broadcast packets destined to all remotes are transmitted only once in the shared FL. An alternative architecture using multiple point-to-point links would need to transmit the broadcast packets in each link.
- b. **Statistical Multiplexing:**
Shared FL capacity is utilized by the remote terminals that are active at a given time (i.e. capacity is not dedicated to idle terminals, nor is excess capacity dedicated to low data rate terminals). If data rates of the remotes vary over time, the ability to share the FL capacity provides both higher peak throughput and higher average throughputs to the remotes.

Layer 2 connectivity is enabled by the “BPM Network” function shown in Figure 1. This function enables the satellite network to appear as a bridged LAN from the perspective of the Government

networks on the red-side of the encryptors (as shown in the bottom part of Figure 1, next page).

The BPM network function is implemented by a combination of packet processing in the SLM-5650A, and configuration in external managed switches. Details are provided in Section 0.

Bridged Point-to-Multipoint Implementation

A block diagram showing the key elements of the BPM solution at the hub is shown in Figure 2.

Due to the split-path topology at the hub, the traffic in the forward and return link directions is processed by different SLM-5650A or SLM-5650AD (demod only) devices. In the forward link direction, all traffic is transmitted by the hub TDM modulator (a SLM-5650A acting as a shared modulator). In the return link direction, packets received via single carrier per channel (SCPC) return links are processed by hub demods (SLM-5650ADs operating as receive-only devices).

Both the hub TDM modulator and the demods are configured with Network Processor modules, which have 4-port Ethernet switch interfaces (2 of the 4 ports of the Network Processor module are shown in Figure 2). The external hub Ethernet switch supporting data traffic is shown as two separate switches, the “Hub LAN Switch”, and the “Hub Demod Switch”. It is important to note that this is a functional concept only. The physical implementation of this switch could be accomplished in at least one of three ways¹:

- a. Two separate switches, as illustrated in Figure 2.
- b. One physical switch, partitioned into two logical switches using port isolation (many commercially available managed switches have this capability).
- c. Hub LAN switch implemented as a single external switch, with the functionality of the hub-demod switch implemented by means of daisy-chaining the LAN ports of the hub demod units together (i.e. connecting the P1 port of one hub demod to P2 of the next hub demod). This has the advantage of reducing the required hub equipment.

In the forward link direction, packets received from the hub data network ingress to the TDM modulator on a LAN port (P1), are forwarded to the satellite WAN port, encapsulated, optionally encrypted, and then transmitted to the satellite. No packets need ever be forwarded from the hub TDM modulator to the hub demods (hub demods are receive-only from the satellite direction). Hence, a filter rule is put in place to block any data traffic input to the hub TDM port connected to the hub LAN switch

Satellite Signal Spectra

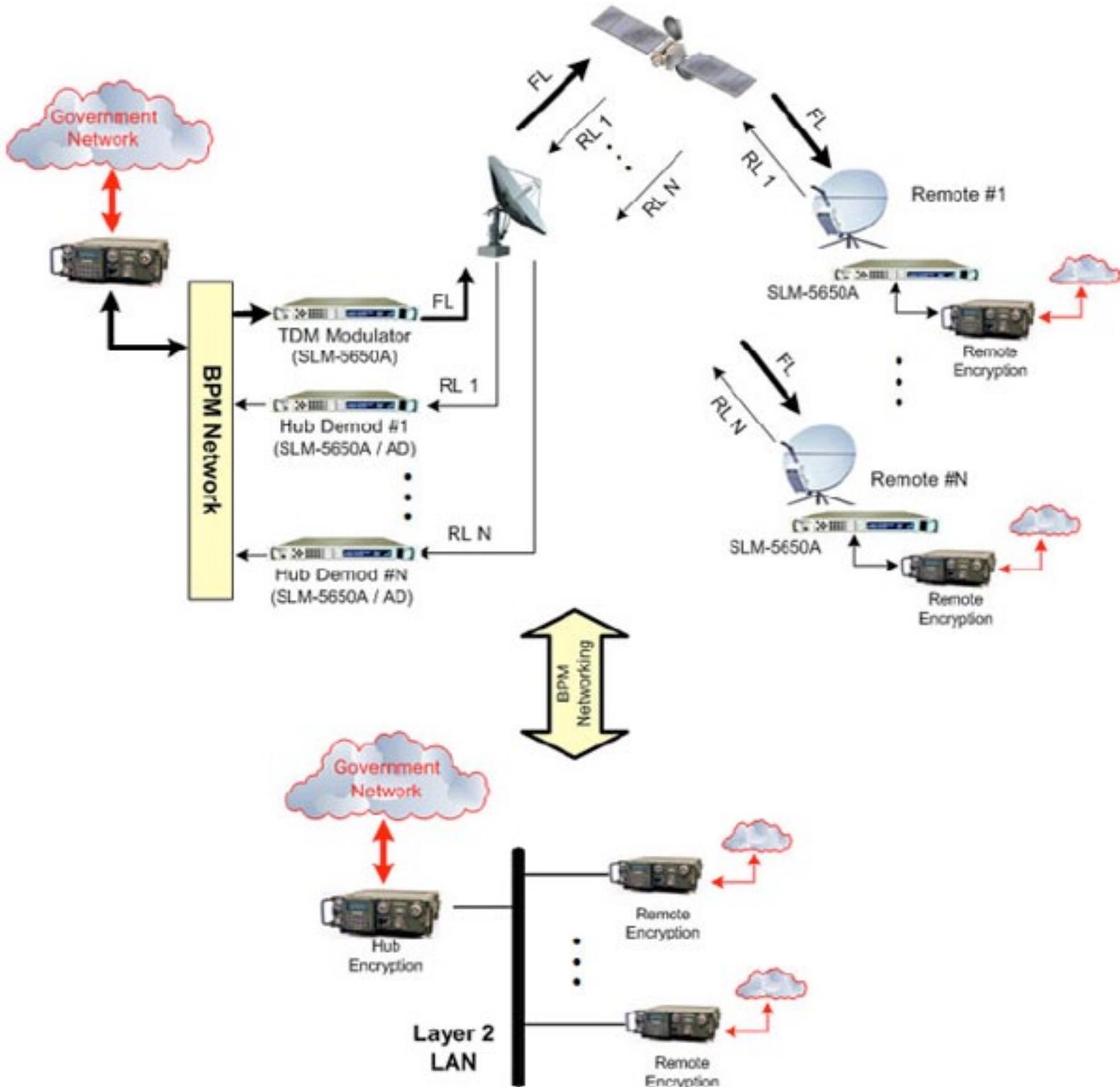
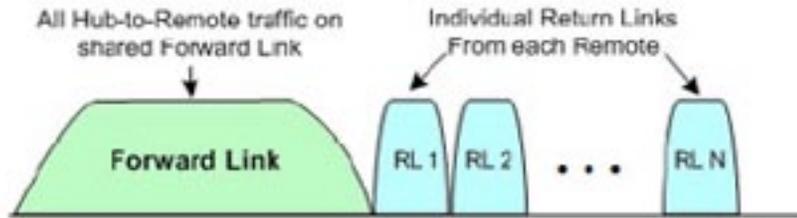


Figure 1: Point-to-Multipoint Satellite Network Provides Layer 2 Connectivity for Secure Government Networks

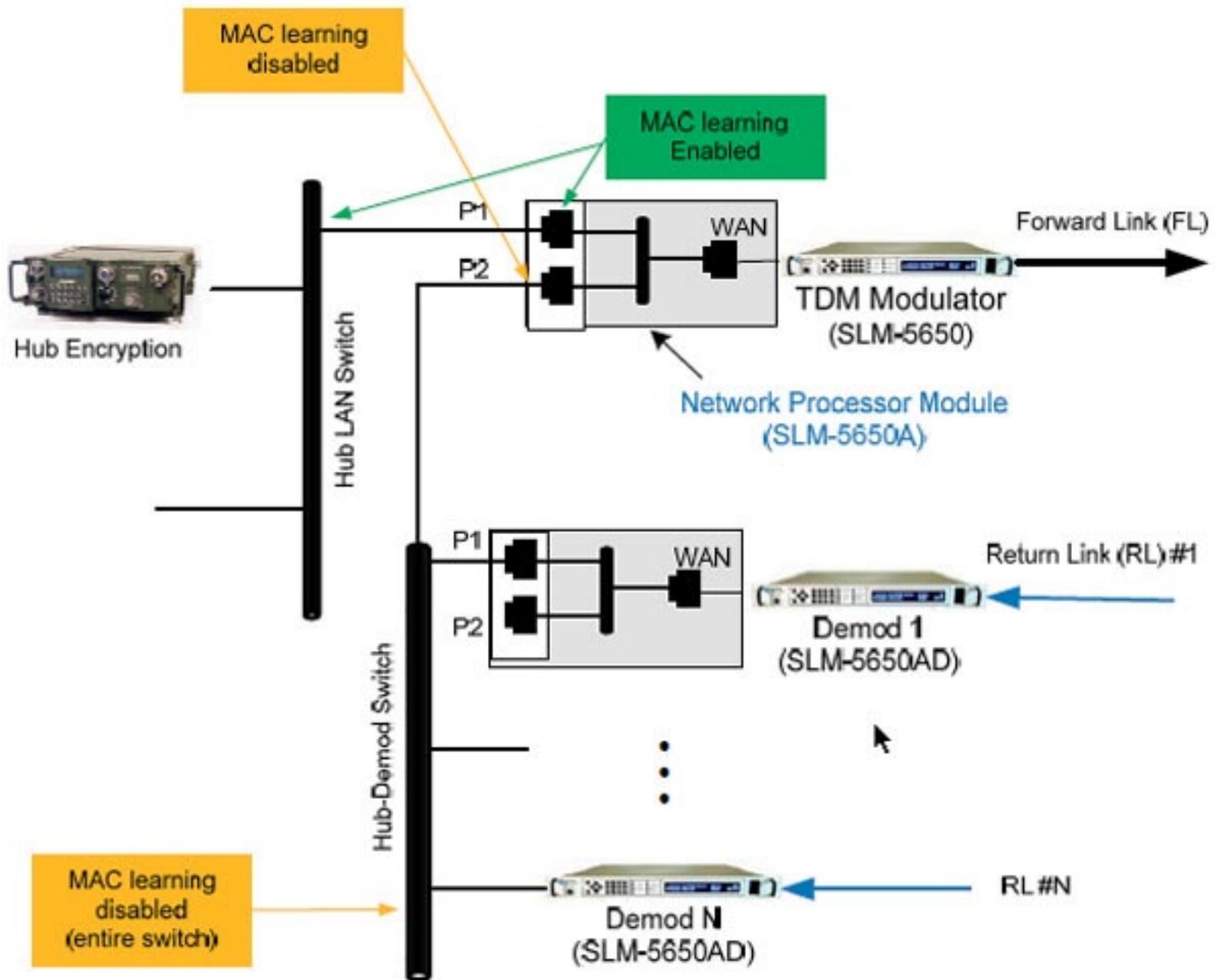


Figure 2: Bridged Point-to-Multipoint Block Diagram

(P1) being output from the port connected to the hub demod switch (P2).

For return link packets arriving via SCPC channels, care must be taken to avoid potential issues associated with the split path topology inherent in the point-to-multipoint system architecture. Two issues need to be addressed:

1. MAC address learning in the hub switches and modem switch ports.
2. MAC address filtering to avoid unwanted packet transmission and/or reception.

MAC Learning In The Hub Switches

Typically, a Layer 2 switch learns the MAC-to-port association (MAC learning) during operation. However, in managed switches, MAC Learning can optionally be disabled on a per port basis. Disabling MAC learning is necessary in two places:

- LAN port of the hub TDM modulator Network Processor that is connected to the hub demod switch (port P2).
- External hub demod switch ports that are connected to each of the hub demods (all ports).

Disabling MAC learning on these ports avoids confusion in the hub layer 2 switches². In the return link direction, disabling MAC learning on the hub demod switch ports causes all return link packets to be broadcast to all ports on the switch, including the port connected to the LAN port of the hub TDM modulator (P2). This serves to aggregate all of the return link traffic from the remotes sites into hub TDM modulator port P2.

The hub TDM modulator P1 port and WAN port are configured with MAC learning on. The hub TDM modulator P2 port is configured with MAC learning off. In addition, a feature of the TDM modulator switch called port association is enabled. This feature allows the source MAC addresses from the TDM modulator P2 port to populate the MAC learning table for the TDM modulator WAN port.

As a result, when a return link packet arrives at the TDM modulator port P2, based upon the learned MAC address, the packet is sent to the correct LAN or WAN destination. That is, the packet is sent to the hub TDM modulator P1 port if it came from a remote and is destined for a device on the hub network. If the packet came from a remote and is destined to another remote network, the packet is sent to the hub TDM WAN port for transmission to the forward link WAN TDM carrier.

Shared Outbound MAC Filtering At The Remote Modems

The hub TDM modulator will broadcast hub to remote and remote to remote packets as appropriate on the forward link. Because the outbound TDM carrier is shared across all remotes, every remote receives a copy of each packet. For large shared forward links, the amount of data traffic can sometimes exceed the ability of the subsequent Layer 3 devices at the remote to process, and hence a filtering rule to extract only packets destined for a given remote is optionally implemented.

All unicast Ethernet data packets destined for a given remote terminal will have an Ethernet Destination Address (DA) of the router or encryption device connected to the remote modem. MAC filtering allows only unicast packets with a DA matching this device, plus all multicast (broadcast)

packets to be forwarded. The unicast DA filter address is an operator configurable parameter

Conclusion

Bridged point-to-multipoint enables a satellite operator to implement a point-to-multipoint network that transparently bridges Ethernet traffic. This feature enables the operator to combine the bandwidth efficiency benefits of a point-to-multipoint network topology, with the simplicity of a bridged satellite network.

References

¹ *Note that if there is only one device (e.g. the hub encryption device) connected to the Hub LAN switch, then this switch element is unnecessary, and the hub encryption device would connect directly to P1 of the TDM modulator. Use of the daisy-chaining mechanism of implementing the hub demod switch function could then eliminate the need for any external hub switch equipment.*

² *For example, consider the case where a given Remote with Source Address = "A", sends a packet to a device on the Hub network. If MAC Learning where enabled on port "P2" shown the Figure, then the MAC-to-port association would map MAC Address "A" to port P2. If a packet generated at the Hub destined for Remote Address A arrived at port P1, the switch would send this packet to port P2, rather than the intended satellite WAN port. By disabling MAC learning on P2, the packet is transmitted as desired to the satellite WAN port.*

About the author

Mark Dale is Vice President of Product Management for Comtech EF Data in Tempe Arizona, where he works to define satellite communication products for Government applications. He has worked in the satellite industry for many years, and has contributed to the systems engineering, design, and implementation of several satellite communication products and systems.

Prior to joining Comtech EF Data, he worked at Lucent Technologies, Broadcom, and Viasat. He has an o degree from the Georgia Institute of Technology, and a Ph.D. in Electrical Engineering from the University of Southern California.



Rapid Response To Libyan O&G Comms Requirements

By Katy Harrison, Marketing + PR Manager, Hermes Datacommunications, Ltd.

One of the most challenging projects the Company has faced in recent months was during the civil uprising in Libya for the oil & gas patch. With the demise of Colonel Gadaffi on October 20th, 2011, Hermes Datacommunications worked feverishly to renew operations in the country and recently announced the Libyan oil fields are now fully operational. Subsequent to that announcement, Hermes installed two new VSAT systems for companies working in the oil and gas sector, providing communication links from clients' offices based in Tripoli to their headquarters in Europe via the Hermes teleport in the United Kingdom. In November, Hermes won a contract from a major oilfield services company to provide a multi-site 4mbps C-band SkyWire cloud to provide connectivity for their headquarters in Tripoli, enabling the client to re-establish office connections. Glynn Wagg, Country Manager Libya, said, "The contract was signed and the system was installed by the engineering team from Tripoli just five days later. I believe the client chose Hermes not only because of our proven track record in delivering reliable, efficient and cost effective comms solutions but also because we are now fully operational in Libya and we are able to respond quickly to customers VSAT requirements."

Hermes Datacomms has an established presence within the Libyan capital, Tripoli, trading continuously and has been operating in Libya since 2005 supplying VSAT communication needs onshore and offshore, in city and remote locations. Shaun Young, Regional Director of Asia Pacific and Libya, said, "During the unrest, we continued to provide full service and maintenance support. Hermes Datacomms uses technology that has proven to be reliable in Libya and our network designs are built with redundancy and no single point of failure. This design ensured our customers were able to continue to transmit data and retain voice connectivity."

Hermes' approach to service and support aims to maximize the reliability of the client's system and to deal quickly and efficiently with any problems — remote access and management are built-in, and SLA and break-fix expectations are clear from the outset. Once a service goes live, it is monitored remotely, 24/7/365, by Hermes regional Network Operation Centers.



Hermes Datacomm monitoring equipment

Glynn Wagg continued, "One of our clients in Libya relied on the state communication system for their comms solutions from their rigs in the Libyan desert to their headquarters in Europe. As the unrest grew, the state system became less and less viable and eventually went down. Our clients

asked us to set up a satellite dish at very short notice. We took the kit out the next day and set the dish up, providing Internet from the U.K. as well as international telephony. The client was able to continue with its normal operations without having to rely on the state communications.

"We have continued to support our clients throughout the disturbances, from our support teams, out of the U.K. and Tripoli. Recently, we have been assisting our current and new customers to rebuild their communication systems. Our ex-patriot staff has started to return to Tripoli with the task of inspecting our infrastructure and meeting with the new government and ministers to ensure that we comply with the NTC vision."

Saleh ben Saleh, Administrative Director, Libya, who has remained in Tripoli during the civil uprising, said, "We have provided service to customers in Libya including BP and Petro-Canada. New business has been seriously affected as foreigners are still overcoming the hurdles of coming back to the country. The main immigration office was bombed and Libya is in the process of



Kevin Thorley, CEO Middle East, and Nigel Green, Head of Security

re-building the infrastructure. Companies are keen to get back into the country due to the importance of the Libyan market with respect of the oil and gas industry.

"Tripoli is probably about 90 percent safe now, although you can still hear a few rounds being fired into the air. We still have problems along the border, which makes travelling difficult. Recently, a small war broke out in Zawiya, a small town between the Tunisian border and Tripoli. Many of the oil and gas companies are re-establishing operations at the head offices and branches in the safer cities, but drilling sites within the Libyan Desert are still too dangerous. [As of this writing] We are waiting for the new Prime Minister, Abdurrahim El Keib, to form the new transitional government who can address the safety issues of rebel forces. Until then, it is not safe and oil and gas companies are not sending personnel out into the desert. We expect it will be three or four months before it will be safe.

"The majority of oil and gas company offices were interfered with during the past few months and equipment and links will have to be re-connected. We have several customers in Libya who continued to use our service. The Libyan situation affected their business dramatically. Hermes office in Tripoli has not been damaged, stock and systems are ready for business and our satellite links are ready immediately."

The International Energy Agency recently wrote, "Efforts to restore oil production in Libya are progressing faster than anticipated". According to their latest Oil Market Report, restoration of oil production in Libya is on a far faster track than initially anticipated. Crude oil supplies rose from an average of 75 thousand barrels per day (kb/d)

in September to around 350 kb/d in October, and 500 kb/d in early November.

"We see plenty of potential within the oil and gas sector in Libya. There is still a lot of uncertainty within the country and our most difficult challenge is the safety of our engineering team and the risk of equipment being confiscated. The local infrastructure will take some time to re-build but Hermes is positive about its future in Libya as we are in a position where we are providing full service with an established office, 24/7 local engineering support and in country stock."

Libya is just one example of the often turbulent environments we operate in. Hermes Datacomms has a strong regional presence in Russia and Central Asia, Asia Pacific, the USA, Europe, Africa and the Middle East, with business in Afghanistan and Iraq.

Operating in the Middle East for more than 10 years, Hermes' Dubai office was established in 2008 to answer the growing demand within the region and to enable Hermes to provide its regional customers with more in-depth, direct and extensive support.

Kevin Thorley, CEO Middle East, said, "We expanded our Middle East office with a dedicated team of engineers and a 24/7 help desk. From an office of just two persons in 2008, we have now grown to 22. We see tremendous growth in Iraq and across the region for the next five to 10 years."

Hermes Datacomms Middle East recently announced they received their trading license for Iraq. The Iraq branch has been approved by the Republic of Iraq Ministry of Trade. By obtaining this license, Hermes Datacomms further secures its position as one of the 'big five' international VSAT service providers in Iraq.

Thorley explained, "We see huge growth currently taking place in Iraq and predict that this will continue steadily, if not exceedingly for the next five to 10 years. Our mission is to ensure that we are not only effectively established within the region, but also that we are continuously developing and strengthening our own offering to cater for the demands ahead."

Thorley expands "Oil and gas companies are not just looking for a VSAT provider; they are looking for a company that offers an integrated solution. We are now working with partners to make sure we deliver turnkey projects that would involve fibre and last mile access, in addition to VSAT services, fixed, mobile and microwave services. Our approach is to manage and control all aspects of the network, end-to-end, including licensing and logistics at both ends of the satellite link."

Nigel Green has recently been appointed Head of Security and Operations in the Middle East. Nigel's background makes him the perfect candidate for this role, having previously worked for the Middle East private Security Company Olive group

and a military background serving in Iraq and Afghanistan. Nigel is responsible for the security of all Hermes personnel within the Middle East. He implements audits on security companies, organizes accommodation and methods of transport, and liaises with client security companies. Green explains, "More and more expats are visiting sites in Erbil, North Iraq, down to Umm Qasr in Southern Iraq and there is a need for command and control for those personnel visiting these areas. Planning a visit in advance is essential. Pre-visit briefings take place to ensure the security team is aware of what is happening in the area, intelligence reviews are carried out to identify any recent incidents or threats and safe accommodation is arranged in the area, normally at the US Military Base, although that has come under rocket attacks in the past."

Green continues, "When personnel are out on the ground, pre-deployment briefings are held to train personnel on what to do in the event of a road side bomb or small arms attack. We provide B6 armored vehicles and the personnel are accompanied by security companies, which cost around \$4,400 per day, to ensure that all possible actions have been taken to keep personnel safe." Green

says "It is about mitigating against threats of attack and being confident that all personnel can operate as safely as possible within these regions".

For more information, please contact Katy Harrison, Marketing and PR Manager, katy.h@hermes.uk.com or contact +44 1743 23555 or visit www.hermes.uk.com

About Hermes Datacomms Ltd

Hermes Datacommunications Ltd specializes in providing Wide Area Communications to the upstream oil and gas industry worldwide. With over 20 years experience, service in 54 countries, representing 92 percent of the world's oil and gas reserves. Hermes Datacomms provides satellite and fibre links to some of the most remote and challenging locations, both onshore and offshore. Solutions are tailored specifically to the oil and gas industry and include international connections, managed networks and oilfield infrastructure. Hermes Datacomms is listed in The Sunday Times Tech Track 100 2011 as one of Britain's 100 private tech companies with the fastest-growing sales over the last three years.



Dish setup in Libya

Hermes Case Study 1

Client – BP

Location: Rumailah, Iraq

Date and duration: 2010-ongoing

Background

BP was starting operations and required WAN connectivity at short notice to meet their operational requirements. BP came to Hermes to design and manage a fully meshed, dedicated bandwidth network over 21 sites.

Project

The project consisted of 21 sites across Rumailah including: Life support camps, de-gassing stations and rigs. The network required Internet, data and voice capabilities over a fully meshed VSAT network.

Solutions/Services

Developed a solution to provide BP with a VSAT network to meet their Internet and data requirements.

Agreed strict SLA's to ensure maximum uptime of the VSAT link.

24/7 network monitoring and point of contact for any network queries or requests.

Inclusion of Out-of-Band management to allow for remote diagnosis and remote repair (if feasible) of the network.

Assigned an account manager to provide advice and support as and when required.

Monthly reports showing link usage and recommendations whilst providing information on priority fault tickets.

Arranged logistics for equipment and personnel.

Trained and mentored local BP staff on the use of VSAT equipment including installation and repairs to reduce additional costs.

Hermes Case Study 2

Client – Baker Hughes

Location: Libyan Desert

Date and duration: 2010-ongoing

Background

Baker Hughes required a VSAT communication solution at short notice for their seismic and drilling crews in the Libyan Desert. The chosen network delivers Internet, voice and data capabilities in a remote location.

Solution

Developed a solution to provide Baker Hughes with a cost effective VSAT network to meet their voice, internet and data requirements.

Provided a mobile VSAT solution operating on a private TDMA network, based on the iNetVu platform.

The solution offers flexibility. Once the equipment is installed, it can be moved around anywhere, providing connectivity and communications, in minutes, in remote and challenging locations. It is simple to install and allows delivery of reliable, high speed voice and internet service. With a press of a single button, the system is deployed within two minutes and is ready to provide network and voice connectivity within four minutes.

The iNetVu antenna is mounted onto Baker Hughes lorries and taken to the location for their seismic and drilling operations in the Libyan Desert.

Service

24/7 network monitoring and point of contact for any network queries or requests.

Inclusion of Out-of-Band management to allow for remote diagnosis and remote repair (if feasible) of the network.

For fault reporting, the customer can contact our Service Desk and speak to a trained engineer.

Assigned an account manager to provide advice and support as and when required.

Monthly reports showing link usage and recommendations whilst providing information on priority fault tickets.

Insight

Solar Weather Effects On Satellites

by Peter Brown, Freelance Author, + Tobias Nassif, V.P., Operations and Engineering, Intelsat

Every once in a great while, a report surfaces about a communications satellite which has been partially or completely disabled as the result of a sudden knockout blow delivered by the sun. The first thing to keep in mind is that these things can happen. The second thing to keep in mind is that they happen very rarely.

Out of the hundreds of satellites successfully launched over the past five decades, a mere handful has succumbed to any form of so-called "solar weather," which satellites are designed and built to withstand. The study of solar weather is ongoing, and operators are constantly monitoring the sun's activities and improving their ability to respond to the impact of solar events. Satellite operators tend to focus on four elements of solar weather that can affect satellite communications: solar wind, coronal holes, coronal mass ejections (CMEs) and solar flares.





The solar wind is constant but varies in intensity, while the other three solar phenomena come and go. The goal in terms of space infrastructure has been to identify and effectively counter the sun's link to so-called single-event upsets (SEUs) that happen whenever the performance of one or more spacecraft components abruptly changes without warning.

SEUs are not likely to be caused by the solar wind itself, which is relatively low in energy and seldom penetrates the outer layers or protective "skin" of a spacecraft. Instead, more disruptive are the solar flares, CMEs and coronal holes, whose powerful reach often extends beyond Mars' orbit.

When solar storms erupt, they can bombard a satellite with highly charged particles and increase the amount of charging on spacecraft surfaces. When CMEs occur in the sun's corona or outer atmosphere, a huge amount of plasma and magnetic energy is emitted. The huge and quite visible explosions on the sun are known as solar flares — the most extreme form of solar storms. They discharge large amounts of radiation and highly charged clouds of protons, in particular. X-ray observations provide an important early warning for astronauts in orbit, while slower-moving CMEs often trail behind, subject to the sun's magnetic field.

CMEs follow a curving path as they leave the sun. Because of this, the CME may not actually impact satellites at all. When a CME impacts the Earth, the Earth's magnetic field compresses on one side and stretches

out on the other. This can result in dazzling auroral (is this a word?) displays over the poles, for example. Fortunately, most CMEs last only three days or less.

Insight

Thankfully, the sun is fairly predictable in this regard, and sunspot activity takes place on 11-year cycles, with the maximum or most intense stage lasting about two years and the least intense stage lasting about five years.

Since 2006, we have experienced the least active period of major solar weather events in recent history. In other words, the sun has been very quiet lately.

Coping with electrostatic discharges from the sun that can potentially disrupt satellite services are part of the everyday reality of the satellite world. Losing solar power is not a serious concern, whereas losing total control and command of a satellite as the result of solar weather is the most severe effect.

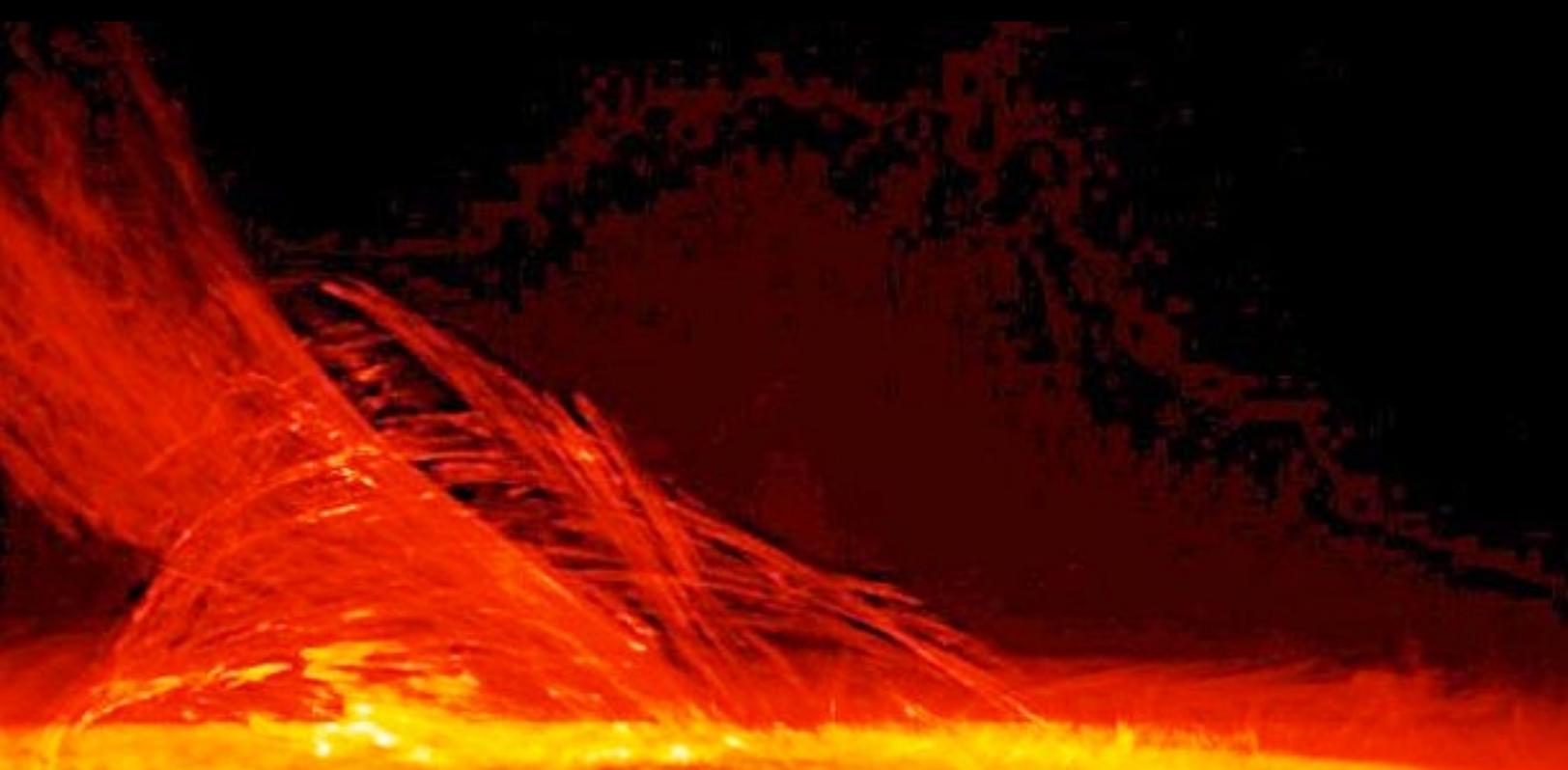
Solar panels on satellites are the most affected components, and normal erosion rates for solar panels are usually 0.3 percent to 1 percent per year. A solar storm can reduce solar panel performance by 3 percent to 5 percent in a day, but since this phenomenon is well understood, spacecraft manufacturers increase the tolerances by design and attach larger-than-needed solar panels to satellites to allow for losses during the anticipated solar storms.

The body of a communications satellite, which contains vital control and communication components, uses special materials, as well as active and passive measures, to be highly resilient.

A Faraday cage protects the satellite's internal equipment from external electrical charges. High-energy particles discharged by the sun rapidly lose strength as they pass through the multiple layers of a spacecraft's body or bus. There, they encounter a series of specially designed circuit dividers, individual compartments and other unique structural elements that act as barriers.

The disruptive nature of solar weather impacts far more than satellite operations and adversely affects terrestrial power and communications grids. For these and other reasons, a considerable amount of manpower and money has been devoted to monitoring the sun's activity, and more research into solar phenomena in general is planned in the future. Among other things, one benefit has been a steady improvement in our ability to rapidly detect and track these solar events using powerful observation and detection systems both on the ground and in space.

NASA, the U.S. National Oceanic and Atmospheric Administration and the U.S. Department of Defense oversee much of this activity. In addition to NASA's twin Solar Terrestrial Relations Observatory (STEREO) spacecraft, the Air Force Research Laboratory has launched the Communication/Navigation Outage Forecasting System (C/NOFS) satellite to forecast the presence of ionospheric irregularities caused by the sun that adversely impact communication and navigation



systems. Space- and ground-based measurements have been taken to help determine how the plasma irregularities affect the propagation of electromagnetic waves, among other things.

Satellites depend upon the sun, and satellite operators have steadily improved tools and techniques which allow them to ensure the operational integrity of all satellites in the face of all forms of solar weather. That weather changes over time, while satellite performance and design continues to improve. Thanks to proper planning, design and execution, the survival rate of satellites is quite remarkable.

About the authors

Peter Brown is a freelance writer who has covered evolving satellite technology applications and the global satellite industry for more than two decades. This article is derived from a white paper written for Intelsat.

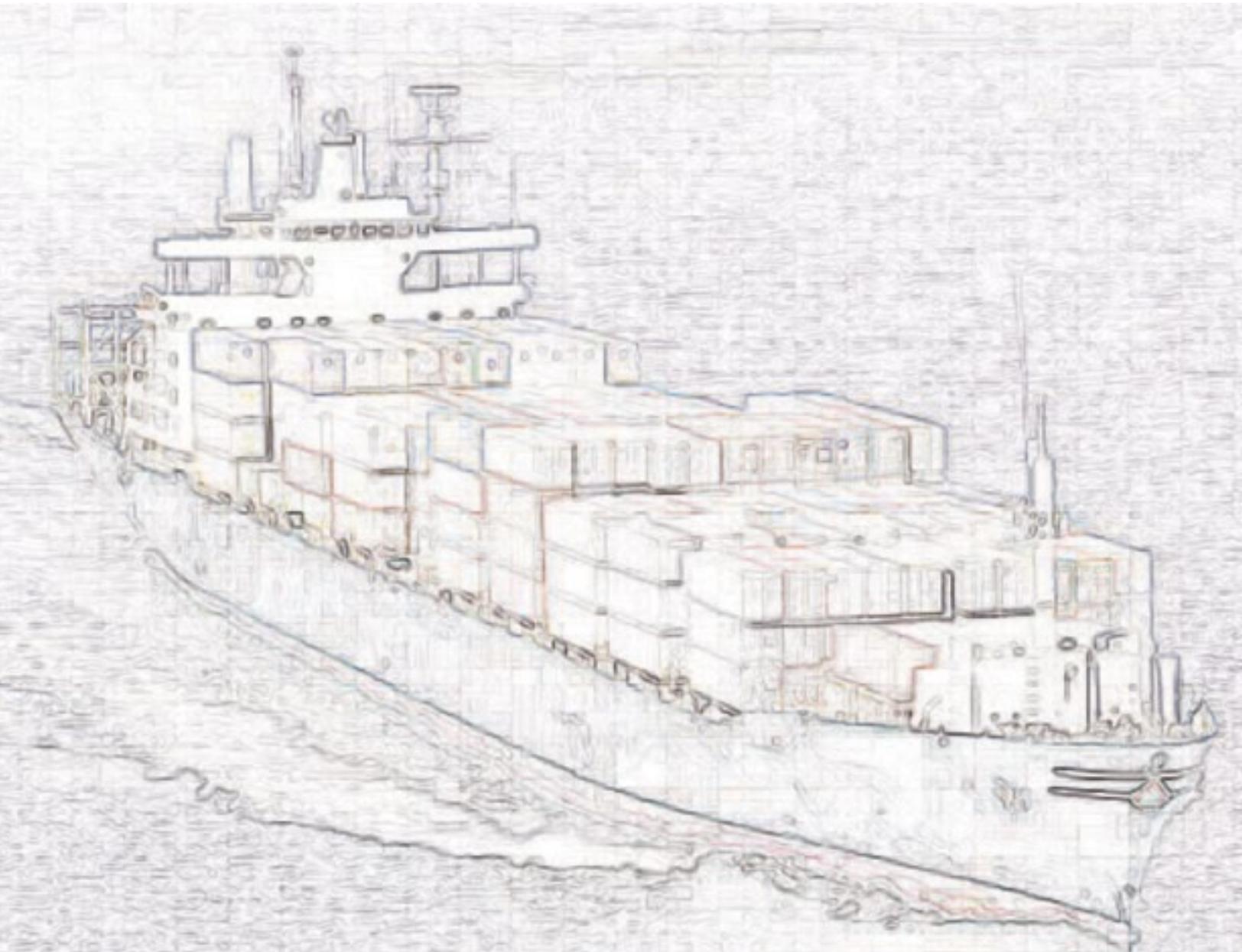
Mr. Tobias Nassif is responsible for the overall management and operation of Intelsat's global fleet of 55 spacecraft, as well as 11 satellites operated for third-party entities. This effort includes the 24/7 operation of the spacecraft, orbit analysis and maneuver planning of the fleet, coordination of spacecraft movement with other satellite operators, and restoration from and resolution of spacecraft anomalies. Additionally, Mr.

Nassif is responsible for the acquisition and maintenance of the ground systems required for the fleet's continual operation. Prior to the merger of Intelsat and PanAmSat in 2006, Mr. Nassif was responsible for the operation of PanAmSat's global satellite fleet.



How To Run A Tight Ship

PACC Ship Managers Pte. Ltd. knows how to run a tight ship. They do it for their parent company, Pacific Carriers Limited (PCL), a Singapore-based company that is a leading owner and operator of dry bulk carriers and product tankers. In addition to serving as PCL's in-house ship management arm, PACC also manages vessels for third parties: A total of 46 vessels including dry bulk carriers, product tankers, chemical tankers, container feeder vessels and multi-purpose vessels, with home ports in Singapore, Malaysia and the United Kingdom. Ship management companies are the outsourcers of the maritime industry. Their clients' core business is moving cargo, and ship managers look after everything else, from manning and equipping to provisioning and maintaining the ship and its systems. Communications is a key piece of the puzzle, for safety at sea, ship management and crew morale.



Managing With se@comm

Since 2005, PACC Ship Managers has been a customer of Telaurus, a Globecom company that provides a comprehensive service platform for the management of maritime communications. Traditionally, communications at sea involves an unwieldy mix of providers (Inmarsat, Iridium) and services (voice, data) with complex pricing that can produce “sticker shock” when the monthly bill arrives. The se@comm™ system from Telaurus provides a single shipboard computer interface for managing email and data services, which typically reduces the cost of data transmission significantly.

The system produces those savings in several ways. It interfaces with Inmarsat so that, instead of charging by the minute or message, Telaurus charges by the kilobit, usually at a much lower rate. The se@comm system then adds advanced compression and encryption to substantially reduce the number of kilobits required. Prior to transmitting any message, se@comm displays its cost and asks if the message should be sent. Powerful filters allow each user to decide what email addresses

they will accept messages from and how large those emails may be.

This sophisticated approach to communications management applies to crew services as well. Intuitive account screens make it easy to set up crew members email accounts using a prepaid scratch card or credit card. Each user receives an email address that can move from ship to ship with the user. The se@comm display screen notifies crew members about newly arrived email without requiring them to query a shoreside server.

Broadband Advantage

To meet its fleetwide needs, PACC subscribed to Inmarsat B service, a traditional offering that provides direct-dial phone, telex, fax and data communications — but at only 9.6 kilobits per second.

“That is a very a narrow pipe by today’s standards,” says Patrick Sim, director of sales and marketing for Telaurus in Singapore. “Inmarsat B service was reliable and proven, but it was gradually becoming a bottleneck for their operation.”

Fortunately, there was an alternative. In 2007, Inmarsat introduced Fleet Broadband, a true maritime broadband service delivered by the company's new I-4 satellites. Fleet Broadband delivers an always-on Internet Protocol service at speeds from 150 to 432 kbps. Like a home or business broadband connection, it supports voice, email, SMS text, virtual private networks, even ISDN for legacy applications.

"Fleet Broadband is really a new world for ship owners and managers," says Sim. "We began talking with PACC about this in 2009, and convinced them of the benefits: Greater capacity, the ability to support new applications, and dollar-for-dollar savings compared with Inmarsat B."

Growing Capabilities

In January 2010, PACC made the decision to convert 35 of its ships to Fleet Broadband provided through the Telaurus system. Telaurus provided the software upgrade, the Fleet Broadband contract and the Thrane & Thrane shipboard antennas, while PACC took responsibility for installing the new antennas on its ships. With a global fleet constantly on the move, the work went in stages, requiring about six months to provision each third of the fleet.

While the capabilities of Fleet Broadband are new, the game is the same when it comes to squeezing the greatest value from that capacity. "Our services are like a data plan for a smart phone," says Patrick Sim. "If you don't have a data plan, you can pay a lot of money per bit. But with the management and compression technologies we provide, PACC can meet all of its needs for a very competitive fixed price it brings capabilities far beyond the reach of a 9.6 kbps service. The PACC installation includes se@SHIELD, for example, a unique variation on traditional antivirus software. Conventional antivirus software requires regular two-way interrogation between the computer and shoreside servers, with frequent updates to virus definitions and the scanning "engine." In a shipboard environment, these are either costly or impossible. Maritime users wind up paying for regular downloads they do not receive, and have a far lower level of virus protection as a result.

With se@SHIELD, the Telaurus shoreside servers "know" the status of every se@SHIELD installation and send only the data required when new updates become available. This reduces two-way traffic. The updates themselves are generally small in size and are transmitted in compressed form. Telaurus also eliminates updates of the scanning engine itself. The se@SHIELD system automatically updates every PC on the shipboard local area network. And it offers specific protection against the most common source of shipboard viruses: "Flash drives" and other external hard drives that are plugged into a PC. When an

external drive is plugged in, se@SHIELD automatically scans it for viruses before any data transfer can take place. The software can also be loaded into any PC on the ship via flash drive or USB stick, even if the PC is not on the local area network.

"The Telaurus fixed cost email system allows better control of our budget," says George Tan, general manager of the technical department at PACC Ship Managers. "The prepaid phone cards for crews eliminate the need for paperwork for crew phone bills as in the old system. The auto updates of the virus list in the se@SHIELD program also eliminate the need to send quarterly virus updates, as with other anti-virus programs."

Next Step: Video?

PACC's interest in Fleet Broadband was sparked in part by the potential of video communications. Military officers around the world have become devoted users of videoconferencing, because they find that it substantially reduces the room for misinterpretation in high-stress situations. The same logic applies at sea, and PACC is interested in giving its captains the ability to videoconference with the headquarters staff.

Even more intriguing is the opportunity to add video surveillance capabilities to its ships. By positioning cameras at strategic locations and having them monitored from shoreside, PACC can potentially improve safety on its decks, reduce pilferage in the hold, and enhance its ability to guard against pirate attacks.

"But adding video also adds costs," says Patrick Sim. While impressed by the potential of video, PACC is waiting for market conditions to justify the next expansion of its capabilities.

"It's a privilege to work with industry leaders like PACC Ship Managers," says Globecomm chairman and CEO Dave Hershberg. "Globecomm has expanded strongly into maritime services over the past few years. From managed Inmarsat and Iridium service to VSAT broadband, we are now serving thousands of ships at sea every day."

A modern ship is a mobile warehouse and office, with the typical shoreside requirement to be tightly integrated into the operations of a global supply chain. But running a tight ship, as PACC Ship Managers does, also requires a sharp eye on the bottom line. With Fleet Broadband service provided by Telaurus, PACC has found the best of both worlds.

[Globecomm Systems website](#)



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Iridium, Inmarsat + Globalstar... Which Service Is Best?

by Alan Gottlieb, Global Maritime Editor



As satellite phone airtime prices have fallen and lower cost phones have been introduced, the market for satellite phones has grown substantially. With the introduction of Inmarsat's low cost IsatPhone Pro and the likely coming revival of Globalstar's duplex voice services, selecting the appropriate provider and hardware is more complicated than ever. Of course, low priced services and hardware that do not fit the user's needs are never a bargain. Deceptively low pricing can be a dangerous allure to the unwary, in particular, for those who have not properly analyzed their needs to determine which products are the best fit. While the new services do offer lower cost terminals, each is distinctly different, making a careful comparison of features and coverage essential. Consequently, an accurate analysis of how and where the phone will be used — U.S. only, +70 to -70 degrees north and south, globally (including Polar and Far North) and for what purpose — exclusively voice, long calls, short calls, email, data — is essential.

For those in search of a new satellite phone provider, Gottlieb International Group analyzed the choices by user type and application and found that the new services have tended to enlarge the SatPhone market by opening new, less mission-critical segments. Based on the type of user and their requirements, here are the advantages, and disadvantages, of each SatPhone offering as we see them:

The Iridium Phone

With more than 500,000 subscribers, Iridium is the dominant player in the satellite phone (SatPhone) market. They offer true global coverage (including extreme northern and southern latitudes and the Polar regions), rugged handsets, location-based services that enable tracking in near-real-time, SMS and email capabilities as well as an unmatched selection of docking stations and industry-specific accessories and applications. Recently, the Company announced its Iridium Force Initiative that includes:

- **New handsets that meet military standards (Mil-Spec 810F) for ruggedness that feature one-button SOS capabilities and Location Bases Services with full GPS tracking ability**
- **Iridium Core, a flexible device platform around which partners can build industry specific applications**
- **An Open software platform that Partners can use to develop web portals for a variety of personal and asset tracking applications**
- **A WiFi Access point that allows laptops and smartphones to connect to the Iridium constellation using either an Iridium Extreme or 955 phone**
- **A Call Center emergency response support service linked to the dedicated SOS feature on the Iridium Extreme phones**



While Iridium is the recognized leader in this space, all satellite phone services have their own unique disadvantages, and Iridium is no different. As Iridium is an LEO constellation, the satellites move constantly, making reception a function of satellite positioning. At times, mountains or other near horizon objects may obscure the satellites and cause interruption of service — a problem that tends to be experienced only on excessively long calls of 15 minutes or longer. Of course, GEO satellites can also experience similar call disruptions if the user is moving. For most users, however, this issue is manageable.

The Inmarsat IsatPhone Pro

With the introduction of its new IsatPhone Pro, Inmarsat offers a possible alternative to Iridium for more cost conscious users and those who can do without global coverage or a wide-variety of value add services. So far, the service has captured 30,000 users, largely due to Inmarsat's excellent reputation as a satellite service provider, and the lower cost of its phones (U.S. \$500.00 range). While low-priced handsets and voice quality are positives, the new Inmarsat service has several notable disadvantages:

- **No "ruggedized" phone models**
- **Excessive wait time for GPS fix and network registration: (Up to five minutes or more)**
- **Inability of the phone to receive calls without the antenna extended**
- **Questionable connectivity above 60 degrees North — especially on the deck of a pitching and rolling vessel — and no Polar coverage**
- **Lack of a one-button SOS feature**
- **No location-based services that allow GPS tracking of the phone. Limited**



accessory availability: In addition, accessories are available from only one supplier, Beam Communications of Australia

While questionable far North coverage and no Polar coverage is not a major issue for most users, we believe that excessive waiting time for satellite connectivity is a serious shortcoming and, under certain circumstances, could be a life threatening issue. At the very least, having to maintain the satellite antenna in an extended position is an inconvenience.

What's Up At Globalstar?

Those users considering Globalstar need to be aware of the Company's ongoing efforts to reconstitute their satellite constellation and upgrade their infrastructure. While Globalstar phones are priced in the same \$500 range as the IsatPhone Pro units, uncertainties regarding the coverage areas and functionality of the new constellation have yet to be determined as only two of the four launches have been completed.

In reconstituting the constellation, four launches of six satellites were planned and two have occurred, one in October 2010 and the second in July of 2011. Those launched in October 2010 experienced problems with their momentum wheels and their longevity is questionable (five are

currently operational, and one is in Safe Hold due to malfunctioning momentum wheels). Thales is providing Globalstar with a software fix to ensure the satellites provide service and complete their planned 15-year mission.

Of those launched in July 2011, three are currently in service, and three more will go online during the next three months. However, according to Thales, the July series of satellites could also experience the same momentum wheel problems as those launched in October 2010. If this occurs, then the same software fix will be used for those satellites.

Currently, of the two final launches in the series, one was launched December 28th and the other for the first half of 2012. However, whether Thales will build additional satellites, and at what price, remains an item of contention and is currently under arbitration — with a resolution expected in early 2012. As coverage is an important issue for the user, the number of operational satellites aloft needs to be considered. As both Globalstar and Iridium are in the process of launching new satellite constellations, potential customers need to follow their progress closely.

Another issue of importance is the transition of the Globalstar platform from Qualcomm to Hughes infrastructure. Globalstar has signed a contract to upgrade its network to the Hughes platform. According to *Anthony Navarra*, "When we put the new services into place in each of the ground stations, we will be advising all our subscribers how they can either transition their service to the second-generation service, or for what period of time they can continue to use their current products and services." Consequently, users purchasing the existing handsets need to be aware that their hardware will become obsolete in the near future, unless, of course, they will use their phones in a region or area where the gateway, or gateways, are not upgraded to the Hughes infrastructure.

Another issue is whether, in actuality, all of Globalstar's third party, international Gateway operators, will undertake the expense to upgrade their regional gateways to the Hughes platform is yet unresolved. At this point, other than in areas where Globalstar owns its own gateways, global compatibility under one platform cannot be assured. In addition, when Qualcomm discontinues support of their platform, Globalstar services may only be available in regions where the platform is upgraded to Hughes. Of course, those users under the Hughes platform should have the option to use the newer Hughes compatible handsets and faster data speeds as soon as the HNS platform is available.

Finally, purchasers of Globalstar phones need to know that the models currently available for sale are the oldest of the three phones compared here, and lack many of the features found in the newer phones. The GSP-1700 was originally introduced to the market in early 2006, making it four years older than the IsatPhone Pro and five years

older than the Iridium Extreme. The GSP-1700s currently available for sale are likely to have been manufactured as many as five years ago. While these phones are a bit smaller and lighter than competitive models, the real issue still is how long these handsets will be supported given the transition to the Hughes infrastructure.

Data Services Compared

Inmarsat and Iridium both offer basic circuit switched data speeds of 2.4 kbps. Using a direct Internet feature, Iridium offers compressed speeds of up to 9.6 Kbps. However, using XGate software from Global Marine Networks, both Iridium and Inmarsat are able to achieve data speeds of up to 20 Kbps. Globalstar offers the fastest regional uncompressed data service at 9.6 Kbps and can also reach higher speeds with similar data compression software. Essentially, all services are priced by the minute and the minimal differences in data speed and price are largely irrelevant.

Iridium handsets are also able to take advantage of Iridium's Short Burst Data (SBD) service, a packet data service ideal for small messages. Iridium SBD provides a highly reliable and cost effective method of delivering location reports and messages from the new Iridium Extreme.

In Conclusion

If we carefully consider the strengths and weaknesses of the three offerings, we find; the excessive satellite acquisition delays, characteristic of the IsatPhone Pro; and limited and uncertain coverage areas associated with Globalstar's transition to the Hughes platform, represent significant barriers to adoption of these phones in the high-end, mission critical market. While the Inmarsat and Globalstar handsets are less expensive alternatives in the short run, Iridium's offering of a tough, ruggedized handset, global coverage, continuity of service under

a single platform, and availability of numerous, industry and application specific accessories will continue to make it the service of choice for all but the most casual, cost conscious users.



About the author

Mr. Gottlieb is Managing Director of Gottlieb International Group Inc. Established in 2001, his firm specializes in the application of VSAT Technology in Maritime and Oil & Gas Markets. Gottlieb International's mission is to provide vendors with the "hands-on" information and contacts needed to structure product and service offerings, and to assist Maritime VSAT buyers in selecting the appropriate service and vendor.



Satellite Phone Features — Comparison Table

	Iridium	Inmarsat	Globalstar
Global and Polar Coverage	Yes	No	No
Coverage +/-60 degrees	Yes	Depends	No
Wait for Network Registration	<30 seconds	5 minutes	Varies significantly ¹
Receives calls with Retracted Antenna	Yes	No	Yes
Voice Quality	Good	Good	Good
Military Grade Ruggedized Handset	Yes	No	No
Handset Cost	\$800 ² - \$1,500	\$500 +	\$500 +
Latest Model Introduced:	2011	2009	2006
Short Burst Data Service	Yes	No	No
SMS	Yes	Yes	Yes
Accessory Availability	Exceptional	Satisfactory	NA
SOS Button / Emergency Services	Yes	No	No
Circuit-Switched Data Services	2.4 Kbps to 20 Kbps*	2.4 Kbps to 20 Kbps	9.6 Kbps to 20 Kbps*
In-built GPS	Yes	Yes	No
GPS-enabled location-based services	Yes	No	No

¹ "Varies Significantly." To determine current satellite availability, Globalstar provides a software tool on their website. As additional satellites are added, network registration times should be reduced.

² In order to reduce costs, some dealers are subsidizing phone costs for one-year contracts.

Progression In The World Of SATCOMs @ Sea

by Casper Jensen, V.P. Maritime Business Unit, Thrane & Thrane

The maritime industry has always had a challenging time trying to keep its workforce in place. The financial reward for going to sea, often for months at a time, can be significant but the fact that seafarers are required to spend so long away from home means that many of them don't view life on the ocean waves as a job for life. So crew retention is a major concern for ship operators' human resources departments. The companies with the best track record in supporting long term careers at sea are those that see fit to invest in the best facilities for their crew aboard vessels. Ensuring that there is a safe working environment and that crew members can relax and enjoy their time when off-shift is vital to long-term workplace sustainability, and the majority of major shipping players see SATCOM as a cost-effective way of enabling this.



Inmarsat FleetBroadband, which is the maritime variant of Inmarsat's Broadband Global Area Network (BGAN), is the major Mobile Satellite Service (MSS) for shipping. It's the only satellite broadband service available globally, which, when looking at the global nature of shipping, is a very attractive feature for ship owners and operators.

Although since its launch in November 2007, companies have chosen FleetBroadband across their fleets to provide Internet to crew on-board, ultimately for long term crew retention, many users quickly recognised the operational benefits the system offers. They quickly integrated the system into office and engineering system networks in order to realise the potential of a full IP connection, which has enabled numerous enhancements to safety and operational efficiency.

FleetBroadband is, when compared to VSAT antennas, very easy to deploy aboard a ship. Because the antennas are lightweight and compact, installation can be carried out by crewmembers, who are generally very keen to get broadband Internet on-board.

In the case of Thrane & Thrane FleetBroadband terminals, many of its multi-vessel installation projects are based on the delivery of installation packs to vessels. These could include computer, Ethernet Switch, router, mast, cables and fittings. This approach means that very little external assistance is required during installations. In fact, some crews have had the system up and running within two hours.

It's this ease of procurement and installation that helped FleetBroadband get such a strong foothold on the maritime sector so quickly. Thrane & Thrane has so far shipped over 20,000 FleetBroadband terminals, reflecting the popularity

of the service in the shipping sector, and the company's leading position in the market.

Simplifying VSAT Procurement

At the other end of the scale to FleetBroadband, is maritime VSAT. Until now, it has been widely recognised that these antennas present a number of technical challenges when deployed on ships. The size of antenna, capital expenditure and complicated nature of VSAT procurement have become barriers to the further spread of VSAT within the maritime industry. But with lower cost, fixed airtime and higher bandwidth availability, VSAT has certainly found a niche aboard ships and a new Thrane & Thrane antenna promises to minimise the procurement and deployment challenges.

One of the first steps for Thrane & Thrane when developing the new SAILOR 900 VSAT antenna was to talk to VSAT service providers and end-users and review in detail the issues they faced. This helped to build a picture on the current state of play. With the target in terms of quality and performance set, the design team were determined to develop an antenna that was 100 percent suited to the environment it would be used in. This would rely on a new level of testing, involving the extensive use of real vessel data to ensure that the new antenna would perform reliably aboard any ship, regardless of the sea state or weather.

To accommodate this approach, a unique testing and simulation facility was constructed. The test area is all new; it is a three story extension to the Thrane & Thrane HQ building in Lyngby (seven miles north of Copenhagen) and was implemented solely with the purpose of improving development resources for the design of new antenna systems. Critical to the success of the new testing facility and the SAILOR 900 VSAT, was obtaining real vessel data that could be used to simulate real-life conditions.

Special measurement equipment that records vessel attitude data in regard to heading, roll, pitch, yaw, acceleration, position, temperature, and random vibrations and such, was deployed on different kinds of vessels from 20-300 metres. This data was fed into the multi-axis hydraulic motion testing and simulation platform that replicated exactly the movement of any vessel. Using real vessel motion and conditions, whilst connected to a live satellite provided a realistic long-term testing ground, which supported live sea trials and enabled a huge amount of data to be acquired in a relatively short period.

Simulated antenna testing is a complicated process, not the least because pointing at the satellite from inside a building is obviously a challenge. However, the investment and effort in setting up the new test and simulation facility enabled the team to 'sea-trial' the antenna using a different ship profile at will, resulting in months of extended testing. This testing is an important factor considering the



SAILOR 900

limitations antenna manufacturers face on carrying out live testing during antenna development. Additional facilities in the new test area include a set of vibration equipment and a special chamber for highly accelerated lifetime testing (HALT), which ensured that the antenna could be designed to exceed performance and reliability requirements within the harsh maritime environment.

As a result of Thrane & Thrane's unique approach to developing the SAILOR 900 VSAT, it requires no evaluation, planning, procurement or installation of RF components. It is shipped from the factory ready to install. This removes the need for labour-intensive testing and balancing of the antenna on-board the vessels as Thrane & Thrane live test the antenna during production so that it will work on any Ku-band service, anywhere. The importance of this cannot be understated; it really is a step change in the world of maritime VSAT, which makes SAILOR 900 VSAT a far more attractive prospect to potential users.

The SAILOR 900 VSAT system has already made its mark in the maritime sector, with leading satellite service provider for ships and offshore vessels Marlink signing an agreement with Thrane & Thrane in September this year to add the innovative new Ku-band antenna to its portfolio and offer it to its extensive global customer network.

Integrated Solutions

There is a definite need from the global shipping industry for integrated MSS and VSAT solutions, where VSAT would be the main source of connectivity when sailing within a broadcast

satellite's footprint, and FleetBroadband would be the back-up system when out of VSAT service, offering truly global coverage. The redundancy such a solution provides means that global sailing vessels can now experience continuous connectivity, wherever their trade takes them.

Inmarsat, too, seems to have recognised this, and with the 2010 announcement of the Ka-band based Global Xpress service, is getting ready to enter the world of VSAT. Global Xpress is expected to go live in 2013, and brand-new SAILOR terminals, specifically for use with this revolutionary new maritime Ka-band service, are currently in development as part of Thrane & Thrane's position as a launch manufacturer for the new service.

Extreme Environments

SAILOR products are tested daily in some of the most extreme environments on the planet, which is why Thrane & Thrane is chosen to supply communication systems for the Volvo Ocean Race. The SATCOMs scope of supply for the 2011-2012 race fleet includes SAILOR 500 FleetBroadband, SAILOR 150 FleetBroadband and two SAILOR mini-C systems. The systems will be used to enable the sending of high definition video back to the race HQ by Media Crew Members and also for the downloading of weather data, which is one of the most important tactical tools the Volvo Open 70

skippers and crews have at their disposal. Thrane & Thrane will also supply the race teams, umpires and organisers with a range of fixed and portable VHF radios whilst the media team will also be using Thrane & Thrane EXPLORER BGAN terminals to report from strategic positions on land as the fleet leaves and enters port.

Ten years ago there wasn't much in the way of IP based SATCOM communication at sea, in fact, video from Volvo Ocean Race used to be collected by Navy ships or dropped in floating cans. Nowadays, IP is becoming an integral part of maritime communication and in the future it will be an important aspect of the navigation set-up, too. Even just five years ago, an Internet connection at sea was more akin to an old dial-up connection on land. You turned it on when you needed it, say four to six times per day, just to send some email back to the office, or if you were lucky, to friends and family. It really was still voice-based solutions that were prominent.

Now though, it is possible to stay online and be connected 24/7. The maritime industry has hit the next level of communications possibilities. Seafarers can be in regular contact with loved ones, which makes their life on the job a little bit easier, so choosing a long term career at sea is more viable. We have networks connecting vessels by LAN and WAN to the corporate office, allowing the use of sophisticated fleet tracking and efficiency applications to provide tangible cost savings and reduction in carbon emissions.

Looking forward, FleetBroadband will be getting some exciting new additions in 2012. Multi-voice provides the facility for up to nine simultaneous voice lines on a single terminal and functionality for Inmarsat's new Dynamic Telemetry Services means that FleetBroadband terminals can soon be used for low-throughput tracking and monitoring applications. As FleetBroadband is such a core part of its business, Thrane & Thrane has already announced that these new services will be available on all new SAILOR FleetBroadband terminals and on existing terminals as a firmware upgrade. Over the next few years, it's clear to see that MSS and VSAT are both a vital part of the maritime SATCOMs business.

About the author

Casper Jensen has been with Thrane & Thrane since 1999, having joined after earning an Engineering Masters degree. He holds overall responsibility for developing and implementing strategies for Thrane & Thrane's maritime radio and satcoms product range. Within this role he is tasked with developing markets and bringing valuable market input into R&D to ensure the SAILOR portfolio meets the demands of the end-user.



SAILOR 500

Executive Spotlight

Dan Berkenstock, EVP + Chief Product Officer, Skybox Imaging

Dan Berkenstock is an entrepreneur and engineer from Chicago, Illinois, with a healthy respect for the risks and rewards of doing business in space. He is also fascinated by scalable and novel data streams that revolutionize the ways that consumers, businesses, and governments make decisions in their day-to-day lives.

Dan is currently on leave from the Ph.D. program in Aeronautics & Astronautics at Stanford University, where he also received his master's degree. Prior to co-founding Skybox, Dan researched optimal design methods for spacecraft in the Advanced Supercomputing Division of NASA's Ames Research Center. Dan has also worked as a counterproliferation analyst at Lawrence Livermore National Laboratory, developing methods to keep weapons of mass destruction out of the hands of terrorists.

Dan has worked at several early stage startup companies and served as a cooperative education student for NASA at Johnson Space Center. At JSC, Dan was a certified scuba diver at NASA's Neutral Buoyancy Laboratory where he assisted in training astronauts for extravehicular activities. Dan has supported two space shuttle missions as an assistant to the Assembly Checkout Office in Mission Control, performed computational analysis on the space shuttle, and supported T-38 trainer jet activities at Ellington Field.

Dan's programming language of choice is C, his favorite CAD tool is Solidworks, and he wishes he had more time for camping.



Dan Berkenstock, the co-founder of the Company, says Skybox Imaging brings the scalability of Silicon Valley DNA to the reliability of the aerospace industry; and that will drive better business opportunities for the entire industry. We asked him to expand on this...

SM

Good day, Mr. Berkenstock. You have a most noteworthy career, from NASA to the halls of Stanford University and their Aeronautics and Astronautics Ph.D. program. How did you initially come to the decision to channel your career into the world of aerospace, and ultimately into the imagery market sector?

Dan Berkenstock

I've always been naturally a space junkie and intrigued by everything about the space shuttle program and astronauts. That's what got me into aerospace. Satellite imagery is exciting because of the tremendous amount of untapped opportunity that exists today and will remain until we can see every inch of the globe. There are so many

more ways to provide transparency and to better characterize activity on our planet. I am fascinated with the idea of working for a company that gets to handle tremendous quantities of data and extract interesting patterns from that information in order to derive insight about our planet and ultimately impact humanity.

SM

Tell us about your experience leading up to the co-founding of Skybox Imaging.

Dan Berkenstock

A big theme for me and for Skybox is my dual interest and passion for space and big data. My experience leading up to the co-founding of Skybox includes positions at NASA and the Department of Energy, more specifically, my work in advanced supercomputing, big data analytics, operations and training labs.

The original co-founders of Skybox Imaging are good friends and fellow Stanford graduates. Our

first line of business in formulating the company was to get the smartest people we know from our Stanford circle of friends and create a company built on people first, who share a strong chemistry derived from similar interests and work ethics. With that initial group, we've created the kind of grad student lab experience you hear about at Google that has grown to be a strong culture with equally strong camaraderie.

SM

What was the genesis for launching Skybox Imaging in 2009? Was the timing a key factor, and if so, why?

Dan Berkenstock

It was a combination of things, and timing did play a factor. My personal interest in data streams and the ability to extract interesting information from them for the commercial sector — combined with the big body of knowledge accrued from the last decade of Universities building microsattellites — paved the way for the commercial approach we are shaping today. By 2007, microsattellite capabilities had matured substantially and a team of us from Stanford were going to use this platform to enter the Google Lunar X Prize. Given the economic collapse of that time, our efforts were unsuccessful. However, the by-product of that became our genesis — creating mapping products with the highest quality and highest resolution that can help industries exponentially in satellite monitoring products.

There was the timing of the X Prize and economic collapse — and then there was the timing of finding the right co-founders. I believe this is the hardest part of founding any new company. You have to find the right combination of people who are at the exact same place in their lives relative to risk, trust, experience, and the ability to work well together — and that is timing!

SM

Please explain to our readers how Skybox Imaging has related to, and emerged from, the small satellite industry?

Dan Berkenstock

Over the last 10-12 years, a large number of small satellite missions have shown that it's possible to do business in space with high performance and high reliability, but at a fundamentally different price point. We're taking advantage of those missions: Lessons learned, components developed for each, and a lot of the know-how in managing, scheduling and saving data from those missions. We've been able to stand on the shoulders of brilliant people who have come before us. In a few key areas, we have been able to develop our own proprietary technology

to fill in the gap in order to deliver a high-reliability, high-performance small satellite.

SM

You talk a lot about using timely satellite imagery as a means of revolutionizing access to information that describes daily activity on our planet. How will such access benefit mankind?

Dan Berkenstock

Timely satellite imagery should be able to inform daily lives and decision-making cycles of consumers, businesses and governments across our planet. While GPS has the ability to determine an object's location at any time, satellite imagery holds the promise to reveal the context of any place on Earth at any time.

For example, we envision the most up-to-date mapping product that can allow people to determine the number of cars in parking lots and at retail locations. Business owners can monitor their worldwide facilities, understand the environmental impact of those facilities and oversee their security. Government agencies can use our product to view images alongside borders, helping them better understand conflict.

On a broader scale, we are driving the demand in other areas of the satellite industry, which will hopefully mean more affordable launches and better business opportunities for us all.

SM

As co-founder, executive vice president and chief product officer, what are your primary responsibilities and priorities within the company?

Dan Berkenstock

My job is to help us get our first steps into the right place for advancement. This means understanding the customer, understanding what the customer wants, fully developing the product offering congruent to their needs, and solving their pain points. I am making sure that we create a conceptual product that can blow users away. We need to build what our customers want and build the best software to sustain it. In fulfilling those duties I currently run our sales, marketing, product and software engineering teams.

SM

What do you see as the core competencies of the Skybox Imaging team?

Dan Berkenstock

There are two. First, we understand how to deal with massive quantities of data — the type that imaging satellites generate — and how to do that in a very efficient and scalable manner. Second, we know how to carefully mix traditional aerospace electronics with more commercial-grade electronics in a way that allows for high-reliability systems at a much lower price point.

SM

The Company has doubled in size over the last year. What has sparked this rapid growth and will you continue at this pace?

Dan Berkenstock

Our growth has been aligned with our overall progress, and the hiring of critical talent is part of that process dependent upon where we are in design and development. Last year we completed a critical design review and this year has been about detail design and actually building the satellite. Our next step is a rigorous test plan which impacts both the ground and software teams. We are in a good place now and will not grow as much next year as it is not required.

SM

Give us an update on the production of Skybox Imaging's first satellite, SkySat-1, and the ground systems development. What does the schedule now look like for this important mission?

Dan Berkenstock

We completed SkySat-1's critical design review in February. It was a big milestone. At this point, the major flight systems have been fabricated and are undergoing environmental testing. We will begin a full integration and test of the complete spacecraft

early next year. Meanwhile, we deployed our first ground station and are doing testing over the next six months. We've also deployed infrastructure and software to demonstrate how we will operate these satellites from the ground. SkySat-1 is projected to launch during fourth quarter of next year. Commercial services will start approximately three months later in early 2013.

SM

When looking at the extensive portfolio of applications your technology offers, from competitive intelligence to emergency response, which application excites you most and why?

Dan Berkenstock

The application that excites me most is the one we don't know about yet. Coming from Silicon Valley, I'm a big believer in big data and making that data as accessible as possible to people around the world to help develop valuable applications. I'm most excited to find the application that we would have never thought of, sitting here in Silicon Valley, California; that a developer somewhere else in the world will find our data and revolutionize the lives of millions of people.

SM

How was the NOAA operating license obtained, and what does that signify for the Company?

Dan Berkenstock

Imaging satellites are very important and sensitive technologies. The U.S. government carefully regulates which American companies get to launch imaging satellites and how they operate them. So, for us, obtaining the NOAA license was an important milestone because that means we've gone through the process with the U.S. government to ensure we meet their criteria to bring a sophisticated approach for how we build and operate satellites. This enables us to deliver greater transparency to the world at large and in a manner that is consistent with U.S. national security objectives.

SM

What has been Skybox's most significant achievement during your tenure?

Dan Berkenstock

There are two things. The biggest one was being able to bring extremely high-quality, very well-known investors from Silicon Valley into a business that involves satellites. That was a huge challenge. I think it takes a lot of vision and courage to invest in a project that, from a technology point of view, is outside of their traditional investment stream, but from a pattern-matching point of view, has many similarities.

The other biggest accomplishment is developing our technology to the point where we've been able to build a complete, flat system of the satellite and demonstrate the entire technology chain required to achieve SkySat-1's mission.

SM

What is Skybox focusing on in 2012?

Dan Berkenstock

The main thing is getting through the launch of SkySat-1 — completing integration and testing of the spacecraft and delivering it to the launch site. Then, we need to continue building out our ground infrastructure for software and hardware. That will be followed by full system-integrated testing between the satellite and the ground infrastructure to prove that when the satellite gets up into space we will be able to download images as soon as possible, and ultimately deliver them to the world.

SM

Who has mentored and inspired you? And, how do you inspire the technological and entrepreneurial geniuses of tomorrow?

Dan Berkenstock

When I was working at NASA, Apollo 13 Flight Director Gene Kranz was still an active speaker. He taught us all that it's possible to innovate and to go after big objectives in space. Mr. Kranz and other Apollo-era innovators have always been a tremendous inspiration in my life — to dream big things and accomplish them. In addition, I was very fortunate to have strong advisors and mentors at Stanford University when we were trying to start this company.

I try to do as much as I can to advise the innovators of tomorrow that I see coming out of Stanford by helping them get initial funding to turn those ideas into the latest and greatest companies.

SM

Which brings us to another important topic — the need to train young students today in the disciplines of STEM. SATCOM companies are finding the talent pools from which they must hire are shrinking, rather than growing. How do we inspire students, from middle school through college, to look at our industry as one replete with excitement and a challenging career? What can companies, such as Skybox Imaging, do to support such programs locally and nationally?

Dan Berkenstock

As an industry, we have a responsibility to prove to the potential aerospace engineers of tomorrow that this is an industry that can be rewarding and challenging. I think that in the last 30 years, the aerospace industry has lost some of the things that made it great back in the 1940s, 50s and 60s — kind of in the golden era, when a young person going into the industry knew they would build airplanes or spacecraft that would fly. They knew that their work would be seen and felt that they were working in an environment where they could be challenged and creatively innovative toward the larger mission.

Too often today, projects have gotten so expensive, have involved so many people and taken so long that it's difficult for young people to convince themselves that it's the most challenging and rewarding way for them to spend the next 30 years of their life.

A concrete step that the industry can do now is to encourage and fund more projects involving small satellites and microsatellites. The more people who are able to be challenged, allowed to be innovative, and are able to see their work fly, then the more people will want to get into this industry.

The aerospace industry tends to be so immersed in process and rigid schedules that there are often too little opportunities for creativity to flourish. As an industry, we need to create an environment where young people want to work for us. In addition, we need more robust intern programs that give

students real work to do. Last summer, Skybox had 10 interns who all did critical things in the design and development of our spacecraft and ground system.



by the Editors

Small Satellites: Changing The Size Of The Industry

How important are small satellites to our industry's ongoing health and long-term financial viability? Please, judge for yourself...

The System F6 satellite formation, image courtesy of DARPA

Let's initiate this examination of some of the elements of the ever-increasing small satellite market by taking a look at NASA. The agency has been running their *Nano-Satellite Launch Challenge* for some time and they recently signed on with the Space Florida Small Satellite Research Center to run their prize competitions for the *Centennial Challenges* (there have been 22 such challenges since 2005). The purpose of this challenge is to launch satellites that possess a mass of 2.2 pounds (1 kg.) minimum into Earth's orbit, and this must be accomplished twice within a one week time span. With a purse of \$2 million, these craft may be small satellites, but their rewards are of major proportions. Hoped for is the realization that the expense of launching small satellites will be in the cost range of what is required to send secondary payloads, obviously with

the goal of attracting customers from the academic environs as well as also commercial and government clients.

When you take a look at NASA and their small satellites programs, the **NPP** project is a must view... when the NPP primary spacecraft was successfully launched from Vandenberg AFB in California, there were six CubeSats aboard. They included...

- ◇ *AubieSat-1, developed by Auburn University*
- ◇ *DICE (actually, two satellites), developed by Utah State University*
- ◇ *Explorer-1 (PRIME) Flight Unit 2, developed by Montana State University*
- ◇ *M-Cubed, from the University of Michigan*
- ◇ *TAX-2, also from the University of Michigan.*



The full fairing of the NPP project, part of NASA's ELaNa program

With a rather packed fairing, these CubeSats are part of the agency's Educational Launch of Nanosatellites (ELaNa) program. Due to the shape of these small satellites, they have been nicknamed as CubeSats. Most CubeSats weigh no more than 2.2 pounds, possess a volume of around one quart, and are about four inches in size.

Those selected by NASA for this program are designed to accomplish a variety of projects, including the test of emerging technologies as well as to examine the viability of Commercial-Off-The-Shelf (COTS) components. The latter could play an important role in future considerations of satellite use, as they would certainly save costs and reduce inventory expenses.

To place these CubeSats into orbit, NASA adapted the Poly-Picosatellite Orbital Deployer (PPD) that was designed and manufactured by **California Polytechnic State University** in San Luis Obispo, California, in conjunction with **Stanford University**. This arrangement has proven to be most capable on other Department of Defense (DoD) commercial launches.

Other NASA small satellite accomplishments include the **Nanosail-D**, which spent more than 240 days in Earth's orbit with the first-ever, solar sail deployment. NASA's research team continues to analyze the data from NanoSail-D to determine how this new technology can be used by future satellites.

Combining both commercial and military aspects, the U.S. Air Force's Space Test Program **STP-S26** included four secondary payload satellites. Launched by a **Minotaur IV** launch vehicle from **Alaska Aerospace's Kodiak Launch Complex** on Kodiak Island in Alaska, there was **FASTSAT** (*Fast, Affordable, Science and Technology SATellite*) which was designed to increase the opportunities for secondary, scientific and technological payloads, also known as "rideshares."

Again, a view to reduced cost was a goal of the project as well as to enable various academic, government and industry researchers to engage in experiments on an autonomous satellite at more affordable cost. Also onboard, there was the *Formation Autonomous Spacecraft with Thruster, Relnav, Attitude and Crosslink* (much easier simply to say **FASTRAC**), the **STPSat-2** itself, and the **FalconSat-5** (FS-5).



Clockwise: FASTRAC, STPSat-2, FASTSAT, FS-5

NASA has also developed the **Edison Small Satellite Demonstration Missions**. A series of NASA-focused small satellite demo missions will be run to accelerate small spacecraft development for the agency for commercial and other space sector users. The focus will be on candidate identification. Those who offer game-changing and/or crosscutting potential for flight, improve or create new capabilities for lower cost, and/or satellite communication/remote observation and space physics, and the ability to demo new apps (such as biological and physical research, servicing, space debris removal and planetary investigations), will be in the selection running. Hands-on experience for university students will be afforded with each project and NASA will manage a close coordination with programs under development at **Air Force Research Laboratory** and the **Operationally Responsive Space Office**. "Small spacecraft" is defined as ESPA class (180 kg.) or less, targeting a specific class of small spacecraft with wet mass ranges:

- **Minisatellite, 100 kilograms or higher**
- **Microsatellite, 10-100 kilograms**
- **Nanosatellite, 1-10 kilograms**
- **Picosatellite, 0.01-1 kilograms**
- **Femtosatellite, 0.01-0.1 kilograms**

The Edison Program anticipates two types of missions: Subsystem flight validation missions and mission capability demonstrations. The total funding by NASA under this program will range from approximately \$1 million to \$20 million, with cost-sharing "encouraged," but not a requirement or a selection criterion. Additional information is available by emailing Andrew Petro at andrew.j.petro@nasa.gov.

Scheduled to be launched during 2012, 2013 and 2014 are small satellite payloads that are approximately four inches long, a volume of one quart, and weigh less than three pounds. Known as CubeSats due to their cube-shape, these satellites are usually carried as auxiliary payloads and address various aspects of education, exploration, operations, science or technology investigations. As part of NASA's *Strategic Plan and the Education Strategic Coordination Framework*, NASA will make their selections as to which satellites will be launched by January 30th of 2012.

From the first two launch initiatives, 32 payloads were selected for the short-list, and represented 18 states.

DARPA's SYSTEM F6

System F6 seeks to demonstrate the feasibility and benefits of a satellite architecture wherein the functionality of a traditional "monolithic" spacecraft is delivered by a cluster of wirelessly-interconnected modules capable of sharing their resources and utilizing resources found elsewhere in the cluster. Such architecture enhances the adaptability and survivability of space systems, while shortening development timelines and reducing the barrier-to-entry for participation in the national security space industry.

The program is predicated on the development of open interface standards — from the physical wireless link layer through the network protocol stack, including the real-time resource sharing middleware and cluster flight logic — to enable the emergence of a space "global commons" which would enhance the mutual security posture of all participants through interdependence. A key program goal is the industry-wide promulgation of these open interface standards for the sustainment and development of future fractionated systems and low-cost commercial hardware for the sustained development of future fractionated systems beyond the System F6 demonstration.

The program will culminate with an on-orbit demonstration in 2015 of the key functional attributes of fractionated architectures. The technology objectives and program plan are driven by a small set of functional on-orbit demonstrations. Program success will be measured by the successful completion of these demonstrations, designed to prove the highest-risk elements of the architecture to potential transition partners and early adopters. The demonstrations will occur in low Earth orbit (LEO), and will be approximately six months in duration.





This image is an artist's rendition of Montana State University's Explorer-1 [Prime] CubeSat. Source: Montana State University, Space Science and Engineering Laboratory.

The U.S. military is certainly onboard with small satellites. In April of 2009, the U.S. Army took delivery of eight, 4 kg. satellites, each one weighing less than 10 pounds, for placement into LEO. Then, the first U.S. Army launch to occur in 50 years took place in December of 2010 when a **SpaceX Falcon 9** rocket lifted **SMDC One** into orbit as an auxiliary payload with the **Dragon** spacecraft. The size of a loaf of bread, this small satellite's objective was to receive data from a ground transmitter and then relay that data directly to a ground station. When the nanosatellite deployed its receiver antennas, despite being in a tumbling mode, contact was made by SMDC One with the ground station located at **Space and Missile Defense Command/Army Forces Strategic Command/U.S. Army Forces Strategic Command (USASMDC/ARSTRAT)** at Redstone Arsenal in Alabama, and a health report was transmitted.

Despite the small satellite's low orbital altitude of 200 miles, the horizon footprint offered a 1,200 mile / 1,9270 kilometer radius. This allowed the satellite to gain line-of-sight to the SMDC/ARSTRAT Battle Lab in Colorado Springs, Colorado. Ground stations overflight occurred 15 times per day. Packetized image and text data downlinked directly to the Battle Lab.

On January 12th, a power failure did terminate the small satellite's functions and its orbit decayed. A sure sign of success is that the U.S. Army's SMDC/ARSTRAT is readying more nanosatellites — four are scheduled for orbit in 2012.

Accompanying this effort is the **Multipurpose NanoMissile System (MNMS)**, based upon a proven rocket artillery family. In less than 24 hours, nanosatellites could be stacked and launched, with a cost per launch of under \$1 million. The **NanoMissile** should be able to launch up to 22

The functional demos are as follows:

- ◆ **Capability for semi-autonomous long-duration maintenance of a cluster and cluster network, and the addition and removal of spacecraft modules to/from the cluster and cluster network**
- ◆ **Capability to securely share resources across the cluster network with real-time guarantees and among payloads or users in multiple security domains**
- ◆ **Capability to autonomously reconfigure the cluster to retain safety- and mission-critical functionality in the face of network degradation or component failures**
- ◆ **Capability to perform a semi-autonomous defensive cluster scatter and re-gather maneuver to rapidly evade a debris-like threat**

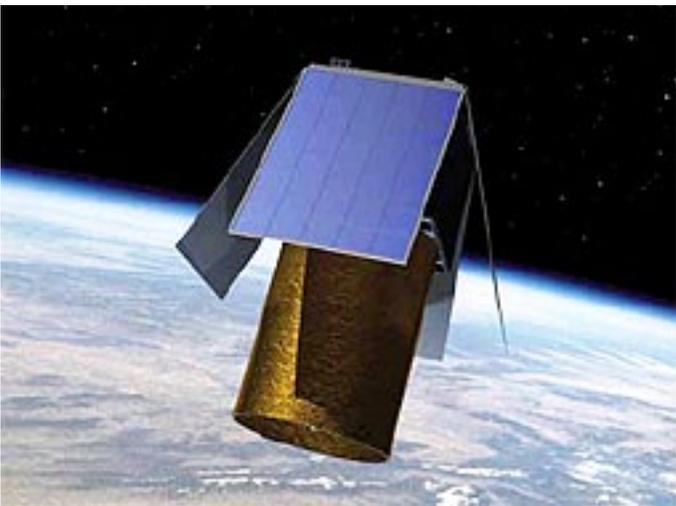
The general philosophy that underlies the technical approach and structure of the System F6 program is to arrive at the on-orbit functional demonstrations enumerated above through a disaggregated series of efforts.

Two key artifacts will be developed in the course of the program. The first is the F6 Developer's Kit (FDK), which is a set of open source interface standards, protocols, behaviors, and reference implementations thereof, necessary for any party, without any contractual relationship to any System F6 performer, to develop a new module that can fully participate in a fractionated cluster. The second is the F6 Technology Package (F6TP), which is a hardware instantiation of the wireless connectivity, packet-switched routing, and encryption capable of hosting the protocol stack and resource-sharing and cluster flight software needed to enable an existing spacecraft bus to fully participate in a fractionated cluster. In essence, the F6TP is a hardware instantiation of the FDK.



The U.S. Army logo is prominently positioned on the SpaceX Falcon 9 rocket the night before launch. The first Army-built satellite in more than 50 years, SMDC-ONE nanosatellite, is onboard the second stage directly behind the Army logo.

pounds (10 kilograms) into LEO, (providing satellite constellation augmentation when needed by commanders.) John London, of SMDC's Space and Cyberspace Technology Directorate, said, "There is an emerging seriousness in DoD that these satellites [small satellites] would be very beneficial to the warfighter." Fellow Space and Cyberspace



Artistic rendition of a Kestrel Eye small satellite, courtesy of USASMDA/ARSTRAT Public Affairs office

Technology Directorate manager *David Weeks* said the Army is serious about small satellites, which the Army sees as crucial to getting information down to the Brigade Combat Team level. *Richard White* of SMDC's Space and Cyberspace Technology Directorate said the images delivered by the small satellites are considered unclassified, and could be shared with America's allies. Though not up to the clarity of high resolution images long used by the defense community, he said the images give the essential information needed by warfighters. "There is a difference between what the Army is doing and what the intelligence community is doing," adding that a constellation of Kestrel Eyes would provide the persistent theater coverage needed by the Army. Kestrel Eye is a small, low cost, visible imagery satellite demonstrator that offers the tactical-level ground component war-fighter real-time imagery.

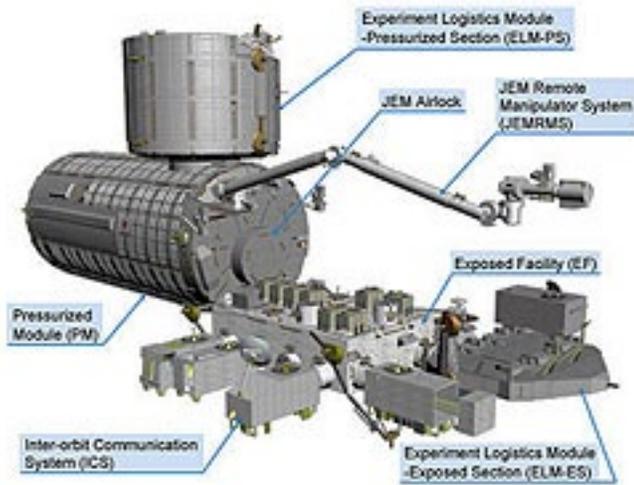
Smaller satellites are being tested all over the globe. In August of 2011, Russian cosmonauts at the ISS released a 30 kg. satellite named *Kedr*, which was built by students to honor *Yuri Gargarin's* first manned-mission into space. Although the second antenna of the satellite was not deployed properly from the satellite, *Kedr* was able to send data back to Earth as originally planned, although performance was degraded. The satellite remained aloft for approximately nine months.

The **Japan Aerospace Exploration Agency (JAXA)** is planning to launch small satellites during a demo mission in September of 2012. Using an unusual launch aspect, these small satellites will actually gain space from the agency's *Kibo* manned



Russian cosmonaut Sergei Volkov, Expedition 28 flight engineer, poses for a photo with the KEDR satellite in the Zvezda Service Module of the International Space Station. Volkov and Russian cosmonaut Alexander Samokutyaev (out of frame), flight engineer, will deploy the satellite during their spacewalk.

Japan's first manned space activities facility



experimental facility aboard the **International Space Station**, with the ISS robotic arm then releasing the satellites into space. The small satellites planned for this excursion include **RAIKO**, at 2U size; **FITSAT-1**, at 1U size, and **WE WISH**, also at 1U size. (1U equals 1.75-inches (44.45mm) of rack height, and are the maximum dimensions.

A student CubeSat project from Poland, the **PW-Sat**, has been delivered to the **European Space Agency's ESTEC** technical center in the Netherlands and is scheduled to ride into orbit as one of seven aboard the first **VEGA** rocket, with a hoped-for launch date between January 26th and the first week of February this year. This will be Poland's first satellite and is a project led by the **Warsaw University of Technology**. A few months later, Poland's **BRITE-PL** "Lem", a scientific satellite, is expected to be launched aboard a **Dnepr** rocket.

One of the European Space Agency's small satellite success stories is their **Proba-1** microsatellite, which has just celebrated its in-orbit status of 10 years, having become initially operational in 2001. Proba is the acronym for **PRoject for OnBoard Autonomy**. As stated by **Frank Preuad'homme** of **QinteiQ Space**, "Proba-1 remains the most agile and stable satellite platform in its range. These attributes are a prerequisite for high performance remote sensing." This small satellite started out as a technology demonstrator and ended up becoming an EO mission, acquiring some 20,000 environmental science images via its **Compact High Resolution Imaging Spectrometer (CHRIS)**. Those images have been accessed by 446 research groups in 60 countries. What makes the Proba-1 unusual is that it rolls in its orbit to capture images, using spinning reaction wheels that are guided by

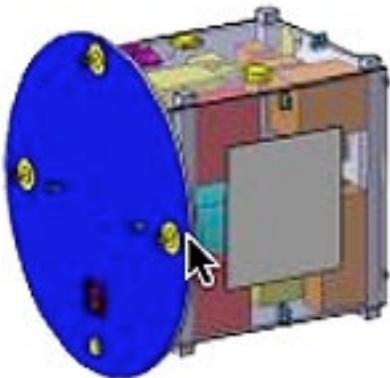
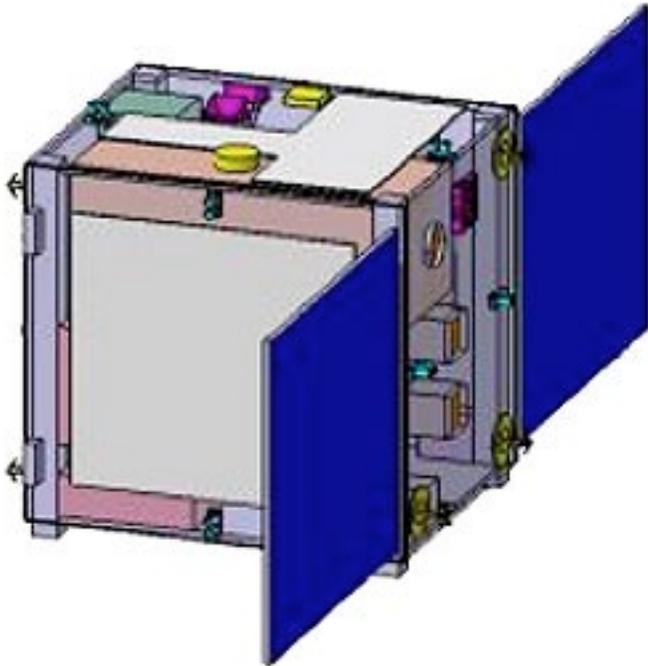


Artist's concept of ESA's Proba-1 during an image capture run

a startrack to roll up to 25 degrees side-to-side and 55 degrees along its path.

There were 10 European countries and Canada involved in the construction of ESA's **Proba-2** satellite, which launched on November 2, 2009, with the **SMOS** satellite, part of the ESA's **Earth Observation Envelope Program**. The two space weather experiments aboard were developed by a consortium from Czechoslovakia — the **Institute of Atmospheric Physics** and the **Academy of Sciences of the Czech Republic**. Aboard were 17 technological developments and four scientific experiments. The goal of the Proba small satellite series is to ensure that small companies can have access to space and give them the experience necessary to ensure European industries remain competitive and innovative.

Proba-3 is in its preparatory study phase and will be comprised of two independent, three-axis stabilized spacecraft flying close to one another, with the ability to accurately control the attitude and separation of the two craft. Using either cold-gas or electrical thrusters for agile maneuvering, and both radio-frequency and optical (laser-based) metrology techniques for accurate position measurement and control, the combined system is expected to achieve a relative positioning accuracy of the order of 100 microns over a separation range of 25 to 250m. The launch is expected sometime in the 2015 to 2016 timeframe.



Preliminary designs. Top, the larger of the Proba-3 spacecraft. Bottom, the smaller of the two spacecraft. Image courtesy of ESA.

A total of nine CubeSats will be launched by Vega, all housed within P-POD deployment systems, which themselves will be mounted on the **LARES** primary payload. The CubeSats were developed by six European countries and include...

- **Xatcobeo (a collaboration of the University of Vigo and INTA, Spain)**
- **Robusta (University of Montpellier 2, France)**



Artist's impression of Vega on the launch pad at Europe's Spaceport in Kourou, French Guiana. Credits: ESA-J. Huart, 2011

- **E-St@r (Politecnico di Torino, Italy)**
- **Goliat (University of Bucharest, Romania)**
- **PW-Sat (Warsaw University of Technology, Poland)**
- **MaSat-1 (Budapest University of Technology & Economics, Hungary)**
- **UniCubeSat GG (Università di Roma 'La Sapienza', Italy)**

The Vega itself was designed to deliver smaller satellites into LEO or SEO.

Scottish-based **Clyde Space** has been involved in the small satellite market for years. Not only has the firm developed double-deployed solar panels for CubeSats that can increase the generated power required for various missions and orbits, the Company has also developed a **CubeSat Shop**. When you consider more than 40 percent of all CubeSat missions fly hardware from Clyde

Space, they would have an extremely competent “handle” on vendor products of the highest quality for such spatial endeavors. The shop offers everything from the CubeSat platforms themselves to on-board computers, harnesses, batteries, structures, ground stations, and more.

A leader in the small satellite revolution is **Surrey Satellite Technology Limited (SSTL)**, which is owned by **EADS Astrium NV**. Working on the U.K.’s technology demonstration satellite **TechDemoSat-1**, the Company completed a milestone with the successful testing of the engineering model of the first payload, which is a novel, charged particle spectrometer design. The **Charged Particle Spectrometer (ChaPS)**, built by UCL’s **Mullard Space Science Laboratory (UCL-MSSL)**, has a form factor of a 1U CubeSat. It will demonstrate a payload design that combines the capabilities of multiple analyzers by using four miniaturized sensors to perform simultaneous electron-ion detection. Each of the sensors is optimized to carry out electrostatic analysis of the different space plasma populations expected in Low Earth Orbit (LEO).

ChaPS is extremely attractive as it saves mass, power and volume — and, ultimately, mission cost — while providing an enabling technology for future space missions, such as ESA’s proposed **JUICE** mission to Jupiter. Its low cost also opens up new applications for such instrumentation that were simply not feasible in the past.

ChaPS is one of eight British payloads that will be flown on TechDemoSat-1 which is the first collaborative **U.K. Space Agency** mission. Funded by the **Technology Strategy Board (TSB)**, the **U.K. Space Agency** and the **South East England Development Agency (SEEDA)**, TechDemoSat-1 is being built by SSTL to demonstrate the advanced capabilities of small satellite technology and provide invaluable in-flight demonstrations of new British equipment and technologies. TechDemoSat-1 is due to launch in 2012. The U.K. Space Agency is currently in early discussions with the European Space Agency regarding a suitable launch for TechDemoSat-1 (Please see the *TechDemoSat-1 sidebar for more information.*)

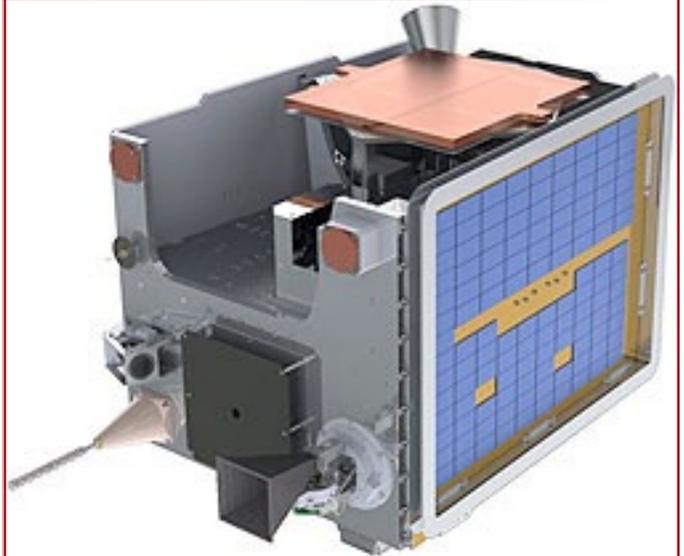
Since 1981, SSTL has built and launched 36 satellites and has provided training and development programs, consultancy services, and mission studies for ESA, NASA, international governments and commercial customers, with its innovative approach that is changing the economics of space.

In India, a new CubeSat communication system was unveiled during the recent **Hamfest India 2011**. A 435/145MHz linear transponder, with a bandwidth of 590kHz and capable of one to three watts PEP output, was described by Mr. **Ganesan Namachivayam**. **AMSAT-India**, part of a global organization of radio amateurs interested in satellites, also plans to develop a smaller, linear

TechDemoSat-1 (TDS-1): The Mission

U.K. industry and academia are working together with Surrey Satellite Technology Ltd (SSTL) on a new innovative satellite that will trial U.K. space technologies and hopefully win substantial international business for the companies collaborating on the project.

The TechDemoSat concept envisages a baseline platform, derived from heritage technology which will function as an ‘in-orbit test facility’ for the U.K. Space Agency once launched, qualifying onboard payloads as well as U.K. satellite software.



The project is funded through two paying customers, TSB and SEEDA. The satellite is based on the SSTL 150 platform developed for the Rapid Eye mission (built under contract to MacDonald Dettwiler Associates), however, modifications and upgrades will be made to the platform design to accommodate the payloads.

At around one meter cubed (roughly the size of a refrigerator or a dishwasher) and a light mass of around 150kg, TDS-1 will carry no less than eight payloads, plus a mixture of heritage and new product development systems from SSTL. Among the new systems being considered to fly on the satellite is an enhanced on-board computer that will offer greater ability to conduct software experiments remotely, a new battery charge regulator, and newly qualified cell types on two of the solar panels.

transporter for CubeSats that can support a data rate of 1200 to 9600 bps via a 435MHz half-duplex narrow-band FM transceiver and is also able to operate as a Morse Code beacon. More information regarding **AMSAT India**.

Vietnam's first Earth observation satellite is being constructed by **Astrium**, with **Spacebel** of Belgium also being brought into construction mix for a 100 kg. EO spacecraft that will pack a 2.5m resolution black and white, and a 10m color, optical imager. Engineers from Vietnam are already being trained by Astrium as well as by **Qinetiq Space** of Belgium, a member of the Spacebel consortium.

Consider **QB50** — an international network of 50 CubeSats in LEO for lower thermosphere and



The AMSAT-India 435/145MHz Linear Transponder

re-entry research. Why 50 CubeSats? According to the QB50 site, a single CubeSat is simply too small to carry the sensors required for significant scientific research. With a large number of such spacecraft addressing the issue, scientific questions can be addressed that would, otherwise, be inaccessible. With lower cost considerations, and the fact that even if a few of the CubeSats fail, mission objectives could still be achieved.

This data gathering would be complimentary to the remote-sensing observations by EO satellite instruments as well as ground observations with lidars and radars. The launches would occur from Murmansk in northern Russia into a circular orbit at about 320km altitude, with an inclination of 79 degrees. Orbital lifetime is expected to be approximately three months. The third **QB50 Workshop** will be conducted on February 2, 2012, following a major CubeSat Symposium running from January 30th to February 1st, in Brussels.

What are the analysts forecasting for small satellites? *Marco Caceres*, lead analyst for the

The propulsion system will see a smaller tank size with a new high performance resistojet thruster along with new sun sensors in the Altitude and Orbital Control System (AOCS), adding increased accuracy to the previous sensors used. The total amount of technology on board has led the internal communications system to be operated on an upgraded CANbus to ensure noise immunity, and minimal contention between nodes. CANbus is standard protocol that includes the physical level (voltage levels and pin connections) as well as defines a software driver level protocol. This gives a bus which can be connected to all modules on the spacecraft, allowing decisions on module priority.

A large mission for a small satellite, the successful delivery and ultimate decommissioning of Tech-DemoSat-1 will enable UK industry and academia to qualify onboard payloads and UK satellite software, thereby overcoming the problem of a lack of in-orbit flight heritage that often becomes a major barrier to commercial success in the space industry.

More than your average payload ability

The payloads on board the satellite currently make up four suites — a Maritime suite, Space Environment suite, Air and Land Monitoring suite and a Platform Technology suite.

The Maritime Suite

*The Maritime Suite consists of SSTL's **Sea State Payload (SSP)**. An evolution of SSTL's SGR-RESI payload, the SSP uses an enhanced GPS receiver*



Integrating the ChaPS payload

Teal Group's World Space Systems Briefing, said, "We're seeing an upward trend in nanosatellites and picosatellites that are being launched... We've seen more nanosats and picosats go up in the past four years than in the previous 16 years, and we expect this trend to continue. The kind of LEO launch activity that we are projecting has not occurred since the first-generation of small mobile communications satellites was orbited in the second half of the 1990s. The difference between now and then is that, in addition to the mobile comsats, we will now also have dozens of tinier satellites weighing between 1-20 kilograms that will be headed to LEO, thus making for an unusually robust segment of the launch services market." According to *Caceres*, the launch programs that will most benefit from the boom in LEO launch services will be Russia's **Soyuz** rocket, which is commercially marketed by **Arianespace**, and to a lesser extent, **SpaceX's Falcon 1**, **Eurokot Launch Services' Rocket**, **ISC Kosmotras' Dnepr**, and India's **PSLV**. **Teal Group Corporation website**

During the **24th Annual AIAA/USU Conference on Small Satellites**, research and analysis firm **Futron** presented a white paper

to monitor reflected signals to determine ocean roughness. By using components from Astrium's **Synthetic Aperture Radar (SAR)** to operate as a coarse altimeter, the SSP pulses radio waves onto the ocean. The echo waveforms that return give an independent measurement of the sea state and the information gathered can then be applied to meteorology, oceanography, climate science and ice monitoring. Astrium Portsmouth will also contribute an antenna design using the same technology as the SAR antenna but on a smaller scale.

The Space Environment Suite

The Space Environment Suite consists of the **MuREM**, **ChaPS**, **HMRM** and the **LUCID** payloads. **MuREM**, supplied by the Surrey Space Centre, provides a flexible, miniature radiation environment and effects monitor which can be flown as a standard radiation alarm and diagnostic package, enhancing the security of future space missions.

The **Charged Particle Spectrometer (ChaPS)**, supplied by the **Mullard Space Science Laboratory (MSSL)**, is the first prototype of a new class of compact instruments to detect electrons and ions, building on 40 years of experience at UCL-MSSL. ChaPS will demonstrate the principles on-orbit and open the way to use the techniques on other missions where mass and power are at a premium, for example spaceweather constellations. ChaPS will operate in three modes, to measure electrons in the auroral regions, electrons and ions in other regions and also to measure the spacecraft potential

The **Highly Miniaturised Radiation Monitor (HMRM)**, supplied by **Rutherford Appleton Laboratory** and **Imperial College**, is a light-weight, ultra compact radiation monitor designed to measure total radiation dose, particle flux rate and identify particle species (electrons, protons and ions). The instrument is designed to provide housekeeping data on the radiation environment to spacecraft operators to correlate the performance of spacecraft subsystems, raise alerts during periods of enhanced radiation flux and to assist in diagnosing spacecraft system malfunctions.

TechDemoSat-1 also reaches beyond the U.K. space industry to incorporate the U.K. scientists of the future. As the winning entry of a U.K. space competition developed by Sixth form college, **The Langston Star Centre**, the **LUCID (Langton Ultimate Cosmic ray Intensity Detector)** payload will also fly on

entitled “*Emerging Opportunities for Low-Cost Small Satellites in Civil and Commercial Space*,” authored by *Jeff Foust*. His paper identified emerging opportunities through renewed interest in technology development and commercial scientific research. However such is offset by emerging competitive threats to small satellites in the form of hosted payloads on larger spacecraft, as well as commercial suborbital vehicles underling active development. One offset for small satellite implementation would be to take “other steps smallsat proponents can take now, primarily by utilizing excess capacity on larger launch vehicles that today is often wasted. One solution would be for NASA, or another government agency, to work with other government customers and industry launch providers to establish a coordination scheme to identify missions with excess capacity and payloads by agencies, companies, and universities seeking access to orbit, be it for clusters of CubeSats or for larger smallest.” **You can download the entire Futron report here.**

The wealth of information regarding smaller satellites is indicative of the importance these spacecraft play in the commercial and government/military projects today and in the future. Given lower construction and launch costs, and the ability to more readily prepare technological investigations and orbit EO/sensory tools, small satellites are paving the way for more effective use of satellite technology, given the budgetary concerns confronting the industry.

As Sir *Martin Sweeting* stated, back in October of 2008 regarding his Company’s (SSTL) work with Russia’s ISC Kosmotras, “The provision of affordably priced launch services is critical to the success of the new small satellite business...”



SSTL's 1300 platform

the space environment suite. LUCID allows characterization of the energy, type, intensity and directionality of high energy particles. The device makes use of COTS sensor technology developed at CERN (**The European Organisation for Nuclear Research**) using **Timepix** chips from the **Medipix Collaboration**. Part of a family of photon counting pixel detectors, Timepix allows for recording time information regarding when events occur relative to when the shutter opens. The data obtained from LUCID is of interest to NASA in terms of radiation monitoring but also provides inspiration to the next generation of physicists and engineers by giving school students the opportunity to work alongside research scientists and take part in authentic research.

Air and Land Monitoring Suite

Currently, the Air and Land Monitoring Suite consists of a single **Compact Modular Sounder (CMS)** system being provided by **Oxford University's Planetary Group** and **Rutherford Appleton Laboratory**. The CMS is a modular infrared remote sensing radiometer unit, designed to easily mix and match subsystems and fly multiple versions on multiple platforms at low cost by tailoring it to specific customer requirements once flight heritage has been proven.

Platform Technology Suite

While the companies and academia organizations flying payloads on the other three suites will make full use of the three year mission on board TDS-1 to prove their technology, **Cranfield University** must wait until the end of life decommissioning activity to prove theirs. One of two technologies within the Platform Technology Suite, Cranfield is working on a 'de-orbit sail' that will safely bring TDS-1 back into Earth's atmosphere to burn up at the end of the mission. The other payload in the Platform Technology Suite is the **CubeSAT ACS** payload, supplied by SSBV, which is a complete 3-axes attitude determination and control subsystem designed for Cubesats.



Newtec: Expanding... + Compressing, Simultaneously!

Chris Forrester, SatNews Publishers' European Editor, interviews Serge Van Herck, CEO, Newtec

“This past year has seen the U.S. dramatically reduce its equipment buying levels, and this is the first time we have seen this in the U.S.,” says Serge Van Herck, CEO at Newtec. “We have been able to grow very nicely in other parts of the world and this has stabilised and compensated those lost revenues. Our view for 2012 is that the U.S. market is at last picking up, and we see clear signs of this already. But, like everyone else, we hope that Europe does not move into recession.”

“For future growth we expect further improvements to come from Asia, and India in particular. Brazil is also showing solid signs of growth and there’s no let up as far as the Middle East is concerned. They all represent real signs of further growth. Latin America for us is extremely busy,” Van Herck added.

Newtec is an acknowledged powerhouse in the TV industry. For example, their modulating equipment, either under their own brand-name or OEM/badge-engineered by the likes of Cisco/Harmonic, Motorola, Thomson and others, for DTH uplinking and cable head-end installs. They consider themselves to have an 80 percent market share of this sector. “We are not on the reception side, but the uplinkers almost all use our equipment,” adds Van Herck. “This means that in countries like Brazil and India the broadcasters themselves use our equipment.”

Newtec's equipment is also extremely popular amongst the Contribution & Distribution community which guarantees the successful — and efficient — transmission of content from Outside Broadcasts as well as SNG and ENG broadcasts and uplinks. "For example, our MENOS technology links dozens of ASBU (Arab States Broadcasting Union) sites for news and programming exchanges, and has been hugely successful for them. This is now extending beyond the Middle East into Africa. MENOS allows broadcasters to automatically exchange news and information in a hugely efficient manner, and covers TV, radio or IP-based formats."

Van Herck mentioned that Newtec's clients were almost all digital, and increasingly use high-definition for broadcasting. "This is great news for everyone, especially viewers, but it also places pressure on us to increase efficiencies in transmission, finding better ways to utilise the bandwidth available. Everyone wants to use HD but not necessarily to pay for extra satellite capacity. We are a major player supplying higher-efficiency products in particular for the 32APSK (Amplitude & Phase Shift Keying) modulation methods, even to quite small dishes," says Van Heck.

"Service providers like Globecast and Arqiva are using our equipment, but also broadcasters themselves. Much depends on the individual

Newtec, based in Belgium and established in 1985, is a privately-held business. The company celebrated its 25th Anniversary in 2010. An MBO in 2007 led to Serge Van Herck joining the business as CEO. The company has been growing its revenues year by year, and achieved a record year in 2009. Since then revenues have somewhat levelled reflecting the state of the broadcasting industry over the past couple of years.

country and how that market is organised. For example, Sky Italia has made great use of our 'Equalink' DVB-S2 pre-distortion solution which gives them an overall 10 percent extra performance increase, or the equivalent to two 'free' channels on each of the 23 transponders it uses."

Newtec is also busy in the fast-growing market for Ka-band solutions, both for professional and consumer use. "We work closely with Astra2Connect in Europe. They launched in 2008 using our technology and today still use our equipment. We have delivered more 100,000 terminals.

"Today they are all Ku-band but there's now a shift to Ka-band as the capacity becomes available. We have been very successful in delivering broadband by satellite over Ku-band, and we know everyone is anticipating great economies of scale from Ka-band. Newtec equipment is seen as the



What about Commoditisation?

The threat for any consumer device, such as Newtec's Ku/Ka band terminals, is that they rapidly become commoditised, and subject to low-cost units from China, South Korea and Thailand.

"We have the lowest priced units in the market. We are the engineers, and we design everything. But we also outsource production in order to keep prices as low as possible," said Thomas Van Den Driessche, Newtec's Director of Vertical Markets.

"That way our suppliers can produce in the many thousands, and keep prices really keen. The other answer is that we stay as innovators, and try and lead the market through innovation. The moment there's any sign of our sort of technology becoming commoditised then we innovate to the next level. We also try to license our patents. It is also true that for many products the prospects of China or another market stepping in with a superior product is slim. Some vendors do offer ultra-cheap products, but we also ask whether a multi-million dollar broadcaster is going to risk all their business to save a thousand dollars here or there..... It isn't realistic." — Serge Van Herck

most efficient, most reliable and cost-effective equipment on the market. Our kit always comes out on top in consumer surveys. Ka-band will increase the interest in these technologies given that it offers higher throughput at very similar, or even lower, prices for users. Today our largest customer in this area is Astra2Connect and next September (2012) they will launch their Ka-band service for commercial use and we will be ready to support them. They've already got some Ka-band capacity available for professional use, but these need slightly larger dishes. Our consumer offering, which we call Sat3Play is a self-installable, plug-and-play, end-user terminal which is truly future-proofed as far as DVB-S2 is concerned with Adaptive Coding & Modulation, bandwidth optimisation and embedded acceleration and pre-fetching software. The current products, dish and modem are all Ka-band compatible. The only element that needs changing is the LNB."

Van Herck sees Newtec's broadband-to-consumer products as remaining highly competitive when compared to imported units from ViaSat which are being used exclusively by Eutelsat's

Ka-Sat service and which went live earlier in 2011. "We also like Eutelsat! They're installing one of our Sat3Play hubs for a service targeted into Africa. I believe we are moving towards a situation where [supplier] exclusivity will not matter so much. We see more and more indications where service providers, who are actually retailing Ka-band solutions, want a multi-vendor approach. We think this is sensible, and where the satellite operator just sells Mega-Hertz of capacity but where the service provider accesses that capacity through gateways."

He could just as easily have enthused about Intelsat, which via its SkyeVine client, is providing a Newtec-based broadband service from Intelsat's New Dawn craft into Southern Africa, or the UAE's YahSat which is using Newtec solutions for its YahClick 2-way broadband service.

However, SES has frequently stated its view that it does not share Eutelsat's optimism for Ka-band over Europe. This is not to say that those countries bordering Europe, or nations further afield, would not benefit from Ka-band deployment. This is also Van Herck's view. "I'd hope he might change his mind thanks to Astra2Connect



Somewhere in the Middle East, a government fixed installation for Newtec

and our equipment, but we have to recognise that 100,000+ terminals installed is good but is not perhaps good enough to convince Astra just yet to launch an all Ka-band satellite. I can fully understand SES' current philosophy which is to be risk-averse as far as Ka-band is concerned, and from a financial perspective it is a prudent approach. Time will tell as to how successful Eutelsat is and whether Astra's caution was sensible or not."

Newtec, as well as Astra2Connect, might also benefit from any national or pan-regional marketing and sales effort for Ka-Sat conducted by Eutelsat, on the 'rising tide lifts all boats' mantra. "It is always good to have competition," says Van Herck. "The main road block to these services are the telcos. There is no European telco actively promoting these sorts of services. If you look to the USA you'll find our type of services being vertically integrated by major operators, and often bundling or linking them in to other services like DTH."

Newtec's view of 2011

This year has been a particularly successful one for the satellite industry. Whilst the global markets in 2011 have been steady but lacklustre in many regions, they have been particularly strong in rapidly developing parts of the world. The satellite industry has been buoyant with connectivity, increasing TV transmissions, IP broadband traffic, a growing requirement for mobile backhaul and also implementation of technological innovations such as Ka-band pushing it forward.

Van Herck says the quite amazing thing is that its Astra2Connect terminals have not been heavily installed in rural, or remote unserved-by-broadband areas as initially expected. "The reality is quite the contrary. We see most of the demand



Newtec modulation on board this UAV

coming from countries which already have high penetration. Even in cities and urban areas, or in the suburbs where the ADSL connection is not so strong. Currently the two most important markets for us are France and Germany, not exactly famous for lack of broadband!”

Newtec's consumer products have benefitted from the company's supply-side links with the military and other governmental clients, not least its FlexACM solution for NATO's 'morale, welfare and recreation' (MWR) applications. Extremely active in Afghanistan and throughout the Middle East, Newtec supplies to Stellar Group to help link up to 40,000 military personnel with their homes and families and supplying voice and data links in what can be extremely hostile environments. The 'hostility' can come from enemy action, of course, but it also comes from the environment where heavy weather, dust, sunshine and monsoon-type rain can all impact the equipment. FlexACM allows for maximising the bandwidth available whilst also optimising link availability and reliability while at the same time keeping control over operating expenses. Stellar Group supplies 200Mb/s into its base in Afghanistan, for example, and manages to squeeze an extra 30 percent of throughput into that existing capacity.



Newtec's Sat3Play being used during the Tour-De-France

Newtec has had similar success using these MWR solutions for oil rig workers based hundreds of miles away from homes. Indeed, the same core technology was also used for an installation in Antarctica, where again the extreme weather (and low satellite elevation) provided the challenges. Hardly ever talked about is the use of Newtec's FlexACM on unmanned aerial 'drones' used by the military and which need sophisticated satellite links from their sometimes extremely remote controllers. These applications have both benign as well as military uses. The benign aspects come in the forms of disaster surveillance, emergency response, search and rescue, environmental monitoring, convoy protection and maritime surveillance generally, as well as border control. Newtec's modulation and demodulation boards for these needs are made in a lightweight but robust form thereby helping extend a drone's mission.

Newtec is expanding rapidly and now has full overseas offices as far afield as Sao Paulo, Dubai, Singapore, Hong Kong and Beijing. Van Herck sums up Newtec's basic strategy: "Our core belief is to help our customers and partners to succeed through innovation and cutting-edge technology."

About the author

Chris Forrester is a well-known broadcasting journalist and industry consultant and has been reporting on the "broadband explosion" for more than 25 years. Since 1988, Chris has also been a freelance journalist who specializes in content, the business of television, and emerging applications on all delivery platforms. He founded Rapid TV News and also files for Advanced-Television.com. In November 1998 he was appointed an Associate (professor) of the prestigious Adham Center for Television Journalism.





Insight

Spatial Repurposement + Awards

by Janet Stevens, V.P. Marketing + Communications, Space Foundation

Space folks don't always feel the love these days... U.S. human spaceflight capability has lapsed... the NASA budget languishes at a measly 0.45 percent of the federal budget... citizens, distressed with the economy, muse about why we spend anything on space... People who are in the space business know very well that the space industry deserves a lot of respect — and love — for many things... the joy of pure discovery... the ability to publicly signal scientific and technological prowess... the boost that high-tech jobs and high-tech manufacturing give to our economy... the inspiration for some darn good movies and TV shows... and, most of all, the way space research makes our lives better, easier, safer and more comfortable.

A huge volume of vastly diverse research has gone into building rockets, sending people into space (and safely bringing them back), deploying satellites, examining the distant cosmos and planning long-duration missions. Plus, a wide range of scientific experimentation has been conducted in the microgravity environment of the International Space Station. What we learn in these scientific pursuits eventually gets translated into products and services we use every day here on Earth.

The range of products is broad: The GPS system that helps us find our way, conduct transactions, move products and protect our national security; pressure-relieving surfaces that originally cushioned Apollo astronauts and now make comfy mattresses; sunglasses that block dangerous UV radiation; water purification systems; ultra-light-weight heatsheet blankets and radiant barrier insulation; temperature-regulating clothing; bio-friendly oil spill remediation systems; chiropractic diagnostic and treatment equipment; medical equipment; life-saving food supplements; energy-saving vehicle designs; cordless tools; and on and on and on.

When we're in the business, we know about these things. We celebrate them. We tend to believe that everyone grasps — the way we do — how much space research benefits society. But, they don't! And, if we know what's good for us, part of our job is to help them understand so that they, as citizens and voters and students, will support our business in their communities, at the ballot box, in the stock market and in their education and career choices.

That's why the Space Foundation sponsors two important Space Awareness programs: Space Certification™ and the Space Technology Hall of Fame®. Both recognize significant space innovations that have been translated into valuable technologies to improve our lives on Earth. Both educate about the value of space exploration and utilization. And both, through their very existence, advocate for space.

Space Certification is a marketing program. Products and services that display the Space Certification™ seal are guaranteed to have stemmed from, or been dramatically improved, by technologies originally developed for space exploration, or to have significant impact in teaching people about the value of space utilization.

The program serves three purposes:

- Providing a unique marketing edge from a space connection
- Demonstrating to the public how space technologies improve life on Earth
- Making space knowledge more interesting and accessible to everyone

Space Certification has three classifications:

- Certified Technology Products — Products or services that directly result from space technology or space program development or advances in space technology
- Certified Educational Products — Products used in educational environments to stimulate interest in, and knowledge about, space
- Certified Imagination Products — Entertainment products, games or toys that increase interest in, and excitement for, space and inspire new generations to take an active interest in space

Space Certification products and services have been scrutinized by the Space Foundation, which works closely with NASA, the European Space Agency (ESA) and other organizations engaged in space research

and development to identify and validate that they are eligible for and deserving of recognition.

We work with our partners to help them use Space Certification to market their products — and, in so doing, they help spread the word that space produces tangible benefits for all of us.

The Space Technology Hall of Fame® is a prestigious and scholarly recognition program that honors those who transform space technology to improve the quality of life here on Earth. Induction into the Space Technology Hall of Fame® is considered — and, rightly so — a high honor for the space innovators. Plus, it also serves to increase public awareness and encourage further innovation. Since 1988, we have proudly inducted more than 65 technologies and honored hundreds of organizations and individuals in the Space Technology Hall of Fame®.

The Space Foundation manages these programs for two reasons: to support our mission to advance space-related endeavors to inspire, enable and propel humanity; and to support the space industry and our space industry partners. In other words, we do this for our industry and for our belief that space exploration is a worthy endeavor.

In return, we ask our industry to help us make these programs better and stronger. There are many things that can be done: Facilitate introductions with businesses that manufacture or sell space-derived products; nominate extraordinary innovations for the Space Technology Hall of Fame; educate customers, employees and the media about space technologies, using the two Space Foundation programs as “teaching tools;” and buy Certified Space Products whenever you can. We all want the same thing: A robust, productive and relevant space industry. Let’s all work together to make that happen.

Need more information? Check out these sites:

<http://www.SpaceCertification.org>

<http://www.SpaceTechHallofFame.org>

<http://www.SpaceFoundation.org>

Watch these videos:

<http://www.youtube.com/user/SpaceFoundation#p/u/33/G0VoKsqbXUo>

<http://www.youtube.com/user/SpaceFoundation#p/u/53/TjFGOlvt70I>

<http://www.youtube.com/user/SpaceFoundation#p/u/1/XMAoSbUD70>

http://www.youtube.com/user/SpaceFoundation#p/u/12/_IXaUnQvSDU

<http://www.youtube.com/user/SpaceFoundation#p/u/51/7gwZCfSojzU>

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Janet Stevens, APR, is responsible for the Space Foundation’s marketing and public relations programs, including public relations and marketing strategy, media relations, brand identity, advertising and promotion, graphic design, web communications, social media, community relations, and public outreach. Janet has spent more than 30 years in public relations, advertising, and quality management positions at GTE, Fidelity Investments, and Verizon. Ms. Stevens, who has a bachelor’s degree in mass communications from the University of South Florida, Tampa, Florida, is accredited by the Public Relations Society of America.



Media Server Considerations

by Matt Allard, Director of Marketing, Servers & Digital Production, Grass Valley

A media server is a much more complex system than one might first think. When choosing such a system for a facility, there are a wide number of issues that should be carefully considered. Today's best media servers leverage the core technologies of the general IT industry, and then optimize and enhance those technologies specifically for the real-time, high-availability requirements of television broadcast and video production. The best suppliers build systems that use standard file systems, storage, and networking. These suppliers provide added value by optimizing and tuning IT technologies for media applications in ways IT vendors can't or won't. The implementation of the latest technology produces more cost-effective solutions.

A media server should incorporate a variety of the latest technologies. **These include 8 Gb Fibre Channel backbones with 15/7.2K SAS drives in RAID-5 or RAID-6 topology.** Storage components alone will not provide a satisfactory solution, they must also be integrated with a complete infrastructure. An IT server component must be included to act as a data bridge and to manage dynamic and deterministic bandwidth requirements. For optimum throughput, a 64-bit operating system and file system are desirable. A way to provide scalability and cost-effectiveness is to adapt the **iSCSI protocol over 10 Gb/1 Gb Ethernet** to provide real-time and deterministic performance for media movement.

Technologies and infrastructure should be combined to manage bandwidth. Bandwidth is a primary factor in determining how reliably a system will perform and what capabilities it can provide. A server system should be architected to manage the multiple levels of bandwidth that may be needed for deterministic operations. This can be provided by a shared file system that includes Quality of Service mechanisms.

Three levels of managed bandwidth should be provided:

- **The first level with highest priority is for real-time Media where clients are designed to never exceed stated bandwidths. This real-time performance is a service level not needed by most regular IT systems.**
- **At the other end of the spectrum is managed shared bandwidth for non real-time operations such as file transfers.**
- **In between these two levels there should also be a reserved bandwidth level for time-critical production activities, such as editing, where each individual client gets allocated bandwidth that it cannot exceed.**

All three levels should be available simultaneously. On many systems there is only one level

of bandwidth management and it cannot be relied on to perform all tasks reliably and consistently. A proper media server system has built-in redundancy, buffering, and multiple levels of processors for guaranteed throughput. The supplier of such a system characterizes the storage performance for various production uses, and measures bandwidth performance by individual LUNs, servers, and controllers.

Another unique aspect of media servers is file management. Unlike files found in most regular IT server systems, media server files are large... very large. The system, including storage controllers and file system, must be specially tuned for such files.

In a standard IT server system there are a large number of small, simple files with rapid reads/writes to and from storage. It is not necessary to read during the write process; delays and latencies can be tolerated.

In media, delays and latencies are not acceptable as they translate to black frames and audio dropouts. In media, working with large files means storage has many simultaneous reads during the write process.

For proper media file management, the server system should provide specialized buffering and pre-fetching, enhanced on-the-fly error correction, packaging of multi-track essence inside media file containers, and optimization of the application layer to read/write efficiently and deterministically. When assessing a server system for media production, this is an area that should be examined very critically. Many systems that claim they are suitable for media do not offer these optimizations, and consequently fall short of delivering the constant performance necessary for content delivery.

Platform Flexibility

A media server should be versatile so it can deliver different solutions suited to a variety of unique requirements. It needs to scale to any dimension of performance and redundancy. Expandability needs to scale along multiple, independent vectors. A system may need to increase media channels, storage capacity, file transfer bandwidth, or operational bandwidth for production needs such as

off-speed play and editing. A server for broadcast and video production must be equally adept as both a media server and a file server.

As there are no second tries when delivering media data, redundancy on multiple levels is required. The system must provide redundant data paths between media clients, media servers, and storage — a design that inherently has “no single point of failure.” In terms of implementation, this means specific practices, such as redundant RAID controllers, redundant network interface controllers connected via multiple servers, and multiple switches should be available. On a device level, there should be redundant power supplies, redundant cooling, and redundant storage drives.

For media interfacing, a standard PC with some processor cards is simply not reliable or robust enough. A purpose-built, appliance-type device for broadcast and production that incorporates selected IT technologies should be used to provide a highly available play and record service for 24/7 environments.

With this approach, a variety of benefits can be attained. The device can be ruggedized for use even in mobile environments. Modular components can be easily accessed and serviced. A dedicated device can utilize specialized embedded and real-time operating systems along with multi-level general purpose and customized processors to offer unique and complex features with reliable performance. Some of these features include multi-purpose channels

that can manage audio/video recording, audio/video playback, recording of super slow-motion, recording and playback of combined left-eye/right-eye 3D, recording and playback of combined video/key, multiple compression formats, and resolution up/down/crossconversion.

All this can be augmented with the creation and management of low-resolution proxy media as well. At the same time, this type of device incorporates all the advantages of a standard platform for storage, interface displays, graphics, and network connectivity for simple integration and lower costs.

An integral part of any media server system is storage. Broadcast and production environments have diverse requirements, so a server system must offer a range of storage solutions.

The simplest implementation is serial attached SCSI (SAS) drives that are located internally to the media client. To simply increase capacity, external RAID chassis with serial attached SCSI drives can be connected to the media client through a host bus adapter.

For the highest performance and flexibility, a media server should support a *Storage Area Network (SAN)*. A SAN is a dedicated storage network that provides access to consolidated storage. The networked storage devices are accessible to the servers such that they appear as if they are locally attached to the operating system, allowing direct read/write requests to the storage disks. The server component acts as a data bridge between the Ethernet and Fibre Channel connectivity. It also hosts a shared file system to provide a file abstraction that applications and networks can interact with. A SAN provides the scalability, connectivity, bandwidth, and storage to permit a range of production scenarios.

As a server platform provides the essential infrastructure for file-based production, there are a number of features that should be provided to make interoperability easy and efficient. Files should be stored as elementary streams on disk for direct editing and metadata operations. There should be import and export of media in parallel with other operations to networked storage, removable media, editors, and archive. Media files should support standard video compression formats such as **MPEG-2**, **MPEG-4**, **DV**, and **AVC-Intra**. These files should be available for sharing in common wrappers such as **MXF** and **QuickTime**. Other file types such as **WAV** for audio, **QuickTime 32** for graphics, and MPEG transport/program stream

for video should also be compatible. Files should be transferable using standard **FTP** and **CIFS** protocol, as well as via the direct iSCSI connections. To help automate the process of moving files, there should be watch folder services to bring files on and off the server platform.

As content owners want to re-purpose material, creating, saving, and exchanging metadata must be associated and managed with media files by the server system using an open standard such as **XML**.

Managing the server system and its capabilities, as well as keeping operating costs and total cost of ownership low should be provided for. To simplify how systems are used and maintained, there should be an integrated toolset and utilities to assist in deploying, maintaining, configuring, and upgrading the system.

Application Integration

A server system is only as useful and interesting as the applications that it can be used with. To have complete solutions, a server supplier must also enable applications that people need to use. There should be applications that permit people to use a server system for workflows in live production, news, entertainment, and playout. A server system supplier needs to create applications to enable innovative and affordable solutions. Some of these applications include ingest, replay, clip store, editing, channel control, and playout. Application services should be provided to offer proxy operations, common edit decision lists/playlists, common metadata keywords and markers, and content management. Having these applications available show that the supplier understands the details of how complete solutions need to work across the entire broadcast infrastructure.

User experience and feedback are what should drive application design. Applications should focus on reducing learning curves and making usage simple. Ease of use should also apply to upgrades and maintenance. All applications should have common user interfaces and terminology. They should share common file



format support, proxy, metadata, and edit decision list/playlist information.

No media server supplier can produce all the applications that may be needed by production users. Therefore, it is necessary to have an API available so additional applications can be developed by third-party companies and even end-users. The API should support common programming environments that do not require proprietary languages. A traditional capability for an API is for media channel control. With the transition to file-based production, the API must also incorporate content management capabilities. The API must provide direct access to media assets. There should be access through network services for system-wide assets with the ability to initiate file transfer through FTP and CIFS protocols. All new functionality should be openly supported through the API. To create sophisticated application frameworks, there should be an API that supports a service oriented architecture (SOA) abstraction layer to provide services for content management, proxy, ingest, playout, search, transfer, and metadata.

With a well executed API, a media server supplier should have a staff of development support engineers to foster a diverse community of active developers. They will help to enable the supplier to develop a broad array of supporting applications.

Testing + Validation

For a media server to provide all these capabilities and integrations, an extensive amount of research and development has to occur long before any solution is delivered. While careful software development and hardware design at the engineering level are expected, there are some other critical technical processes that need to be incorporated as well.

With the goal of having tight integration of a variety of standard IT components and sub-systems, rigorous validation has to be performed.

Some of the technology evaluation criteria that should be included as part of validation...

- Does a certain technology deliver on the promise of its features and specifications?
- Can the technology be effectively used for its intended application?
- Can the technology function well as a building block for the overall system?
- Will the development cycle to integrate the technology be predictable?
- Will the technology scale as expected and operate under various loads?
- What will be the operational behavior in error conditions?

Some of the evaluation criteria for storage validation should include...

- Benchmarking performance over multiple days during rebuilds, and while running various server input output configurations
- Price versus performance versus latency
- Bounded latency with augmented storage sub-systems that respond within a certain time limit
- Hot-swapping storage controllers under a full load, live firmware updates under a full load

Some of the evaluation criteria for the file system validation should include...

- With a shared SAN, how is access managed and controlled for concurrent access of real-time and non real-time applications?
- Automatic management of the file system profile so defragmentation is not required even under 24/7 operation

Some of the evaluation criteria for network data movement validation should include...

- Management of the network data stacks and fabric so that transfers are effectively lossless
- Characterization, configuration and management of device initiators and targets, network interface cards, and network switches so they operate as one clean lossless connection from end-to-end
- Analysis of network switch internal architecture, port setup, and microcode versions

Once a design has been completed and software created, a multi-stage component/system validation and testing process must be completed. This process should be implemented on a long-term basis and be highly scalable. For on-going support and new releases, the functionality and behavior of each technology piece, and the overall system, must have extensive regression testing.

As technology advances, there will be subsequent generations of components. As they are incorporated, the system must be retested with new versions of storage drives, RAID controllers, file system, data servers, network interface cards, host bus adaptors, and switches to ensure the system behaves as specified.

To put the necessary effort into perspective here are some examples of what typically should be done with every generation of components to guarantee the performance of the system.

Storage RAID

Six months with two engineers at the media server system provider and three engineers at the supplier to validate.

Three months for firmware release, regression testing, QA, configuration tool analysis.

Shared Storage Drive Series

Four to six months with two engineers to develop firmware, validate, and test.

Part of the validation is for extended multiple-year serviceability so that storage can be expanded with future generations of drives and have the drives, drive groups, rebuilds all work within the expected performance levels.

Internal Drive Series

Four to six months with two engineers to develop firmware, validate, and test

Performance analysis and validation, failure analysis, special mode page handling for media usage, integration of management and serviceability tools.

As with shared drives, not every drive family or drive supplier will meet the necessary standards.

Media Networking

After years of initial development, nine months with three engineers to develop the latest 10 Gigabit-based media networking tools, performance benchmarking, failures analysis, supplier qualifications, and integration.

Six months of release testing, scaling, and configuration tool analysis

Services + Support

After a media server has been selected, the interaction with the supplier needs to enter a new phase. Now the supplier must deploy service expertise to effectively design and implement a system that meets your business needs, and support that system efficiently over its useful life. Evaluating the supplier's capabilities in these areas is critical for realizing the benefits of the new technology, minimizing risk, and controlling total cost of ownership.

Effective system design is essential if you are to realize all of the benefits of media server technology. In this step, the supplier's system architects must engage in a discovery process to gather detailed technical requirements, and

then translate those requirements into a system design. An experienced system architect will ask basic questions about your requirements, such as preferred compression and bit rates, projected amounts of storage, and numbers of ingest and playout channels. A true consultative approach from best-in-class suppliers should also explore potential future expansion of the system, interface points with other systems in the enterprise, long-term data continuity planning, and total system fault-tolerance. These considerations should influence the design process as much as the simple bits, bytes, and channels data, which often take precedence outside of a consultative engagement.

If an effective system design is the vision, then the reality is built during on-site system implementation. Here, the media server supplier's team of project managers, field service engineers, and trainers combine to commission new systems in real-world environments. The system must be configured and tested for optimum performance, and then the users must be trained on operation and maintenance procedures.

Every media server supplier should have these basic capabilities. For systems of greater complexity and size, such basic implementation capabilities must be orchestrated by a detailed project management methodology to control project cost, timing, and risk. In any supplier evaluation process, each supplier should be asked to explain their project management methodology, including the statement of work, project scheduling, supplier/vendor communication, system documentation, and issue tracking.

A properly designed and implemented media server system can provide years of operation as the heart of various media delivery infrastructures. However, all systems inevitably require technical support to troubleshoot failures, keep the system current with supported software releases, replace defective hardware components, and generally maintain system uptime. Potential suppliers must demonstrate their capabilities and investment in these core areas to ensure that capital investments are protected. Beyond core technical support capabilities, media server suppliers with advanced customer support infrastructure should be capable of providing high-availability services such as...

- 24/7 technical phone support
- Remote system diagnosis
- Access to continuing software releases and associated installation services

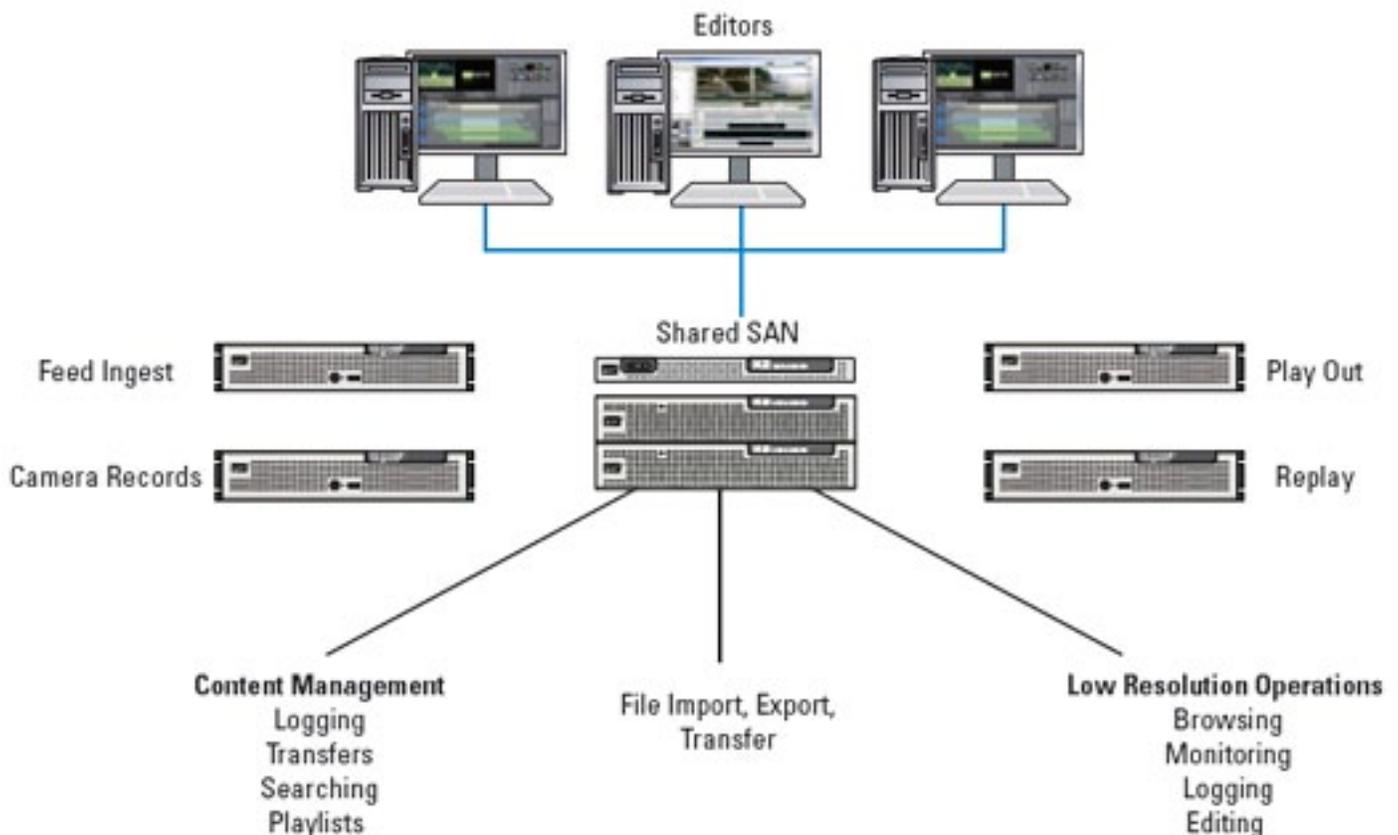
- Advance exchange hardware replacement with next business day delivery
- Field service engineering

Media server suppliers who can offer such high-availability services are able to dramatically minimize any system downtime while ensuring the profitable flow of media assets to the overall enterprise, on-air ployout, and online operations. In addition, best-in-class customer support organizations are able to offer high-touch services such as dedicated technical account management, 24/7 remote system monitoring, and even outsourced engineering support.

Grass Valley infosite

About the author

Matt Allard is the global Director of Marketing for the server and digital production systems product lines. He is responsible for product marketing of live production, studio, news, and integrated ployout solutions focused around server platforms and software frameworks within Grass Valley™. Matt has played a key role in the launch and management of the entire product line portfolio including the K2 Media Server, K2 Summit™, K2 Dyno™, Aurora™ News Production Suite, and STRATUS™ Media Workflow Application Framework. In addition to his eight-plus years with Grass Valley, Matt has had international marketing, product management, and partner management roles at Commodore, Tektronix (Grass Valley), Microsoft, Chyron, and Intel.

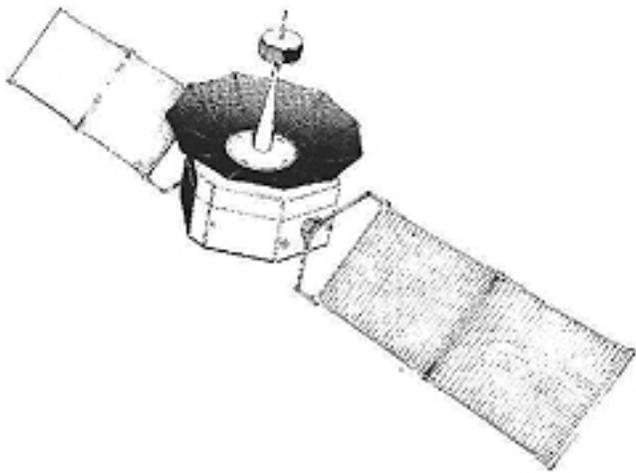


Aerosat: A Brilliant Idea Gone Wrong

by Jos Heyman, Contributing Editor

In the early 1960s various ideas for dedicated application satellites were advanced including one for aeronautical communications that was being considered in the United States as well as the European nations, the latter through the European Space Research Organisation (ESRO). Unfortunately the market was not ready for this development and the proposal was cancelled. However, today and many years later, with new technology and in a different market, this may be one application that deserves revisiting. The impetus for the use of satellites in aeronautical communications originated from the need to find better communications facilities for the ever increasing fleet of airliners. After World War II, HF communications were being used for aeronautical communications but the efficiency was poor as HF suffered from interference from electric storms making, at time, communications fade altogether. HF had, however, the advantage of being able to bounce on the ionosphere, allowing long distance communications.



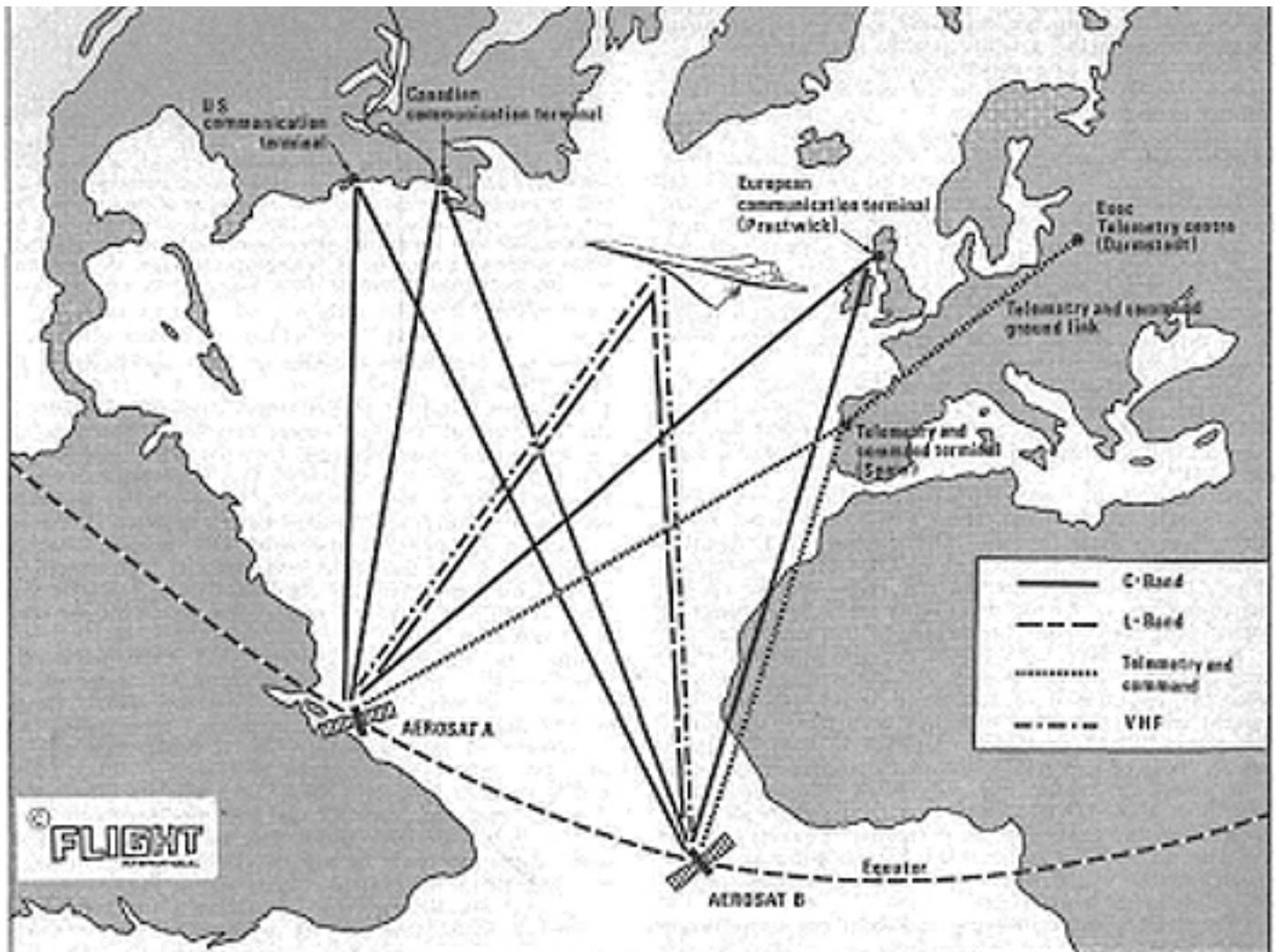


Aerosat: A
Source: Flight International, September 25, 1975

Experts were looking at the use of the VHF band and the so called L-band (at around 1600GHz) as alternative frequencies. These frequencies had the advantage of being free from interference and propagation effects but, on the other hand, needed the high orbit platform that was provided by a satellite in geostationary orbit.

Research and studies started separately in Europe, where the L-band frequencies were favored, and the United States, where NASA favored the VHF band. It was just a matter of time before the two parties pooled their resources.

In a separate move, Comsat, a commercial U.S. organization, had submitted a draft plan to the U.S. Government for the development of two hybrid satellites with VHF and L-band capabilities to be deployed over the Pacific Ocean. The VHF band was seen as an immediate operational capability whereas the L-band was seen as a long range development capability. The Comsat proposal, made to the Federal Aviation Authority (FAA), envisaged one satellite to provide the service with a second satellite as a ground spare.



Source: *Flight International*, September 25, 1975

In 1971, the U.S. government made the decision that the FAA, and not NASA, was the appropriate agency to manage an aeronautical communications satellite project. All the previous work carried out by NASA in partnership with ESRO was, in effect, turned over to the FAA and the Aerosat project, a joint venture of the FAA and ESRO, was established in August 1974. Initially it was hoped to get Australia, the Philippines and Japan to join and represent the Pacific Ocean region, but these nations were not interested and instead the project started to focus on trans-Atlantic air traffic.

In 1974, Canada joined the venture and the percentages were ESRO and FAA each 46 percent with Canada at 8 percent. In 1975, ESRO's share was taken over by the newly established European Space Agency (ESA).

By November 1975 a two phase plan had emerged. In the first phase, several experimental satellites were to be developed and launched to perform a variety of experiments to determine preferred system characteristics of an operational system. Two satellites were to be located in geostationary orbit at 15 degrees West and 40 degrees West, with launches taking place in late 1977 and early 1978. The contract would have included a third ground spare satellite as well as ground stations.

Hawker Siddeley Dynamics, a British company, headed the *Mesh Consortium* that was selected to develop the **Aerosat** satellites from the ESA's **OTS** platform, in a similar manner as that platform was to be used for the ESA's **MAROTS** experimental maritime communications satellite.

Originally, the satellites were to carry only L-band equipment to meet the European requirement, in which case the satellites could have been launched by a **Delta 2914** launch vehicle. The inclusion of the VHF equipment necessitated a shift to a **Delta 3914** launch vehicle.

Each satellite was to have six L-band channels and two VHF channels for applicational use, with one C-band channel for groundstation-to-satellite service communications.

An integral part of the Aerosat experimental satellites was the fitting of new communications equipment to nine European and 12 U.S./Canadian aircraft. The subsequent operational phase was anticipated to be run on a commercial basis by a private concern with launches commencing in the late 1980s.

Comsat, which had made earlier proposals, as well as **RCA**, **ITT** and **Western Union** had expressed their interest. Eventually Comsat won the development contract in 1975.

Up to this point the potential users of the system, the airlines, had not been asked for their opinions. This proved to be a recipe for disaster especially since in 1973/74 the prospects of civil aviation looked gloomy. Global inflation and the dramatic increase in the oil price, and hence aviation fuel costs, as well as the introduction of the wide body Boeing 747, reduced the number of

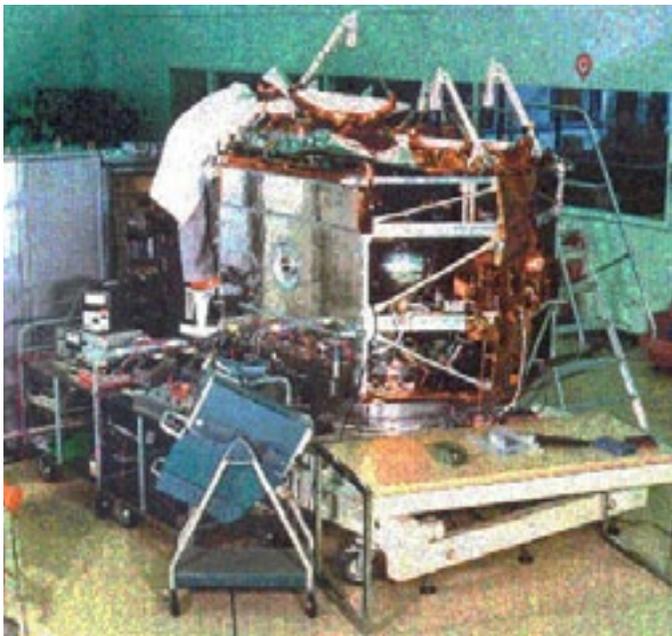
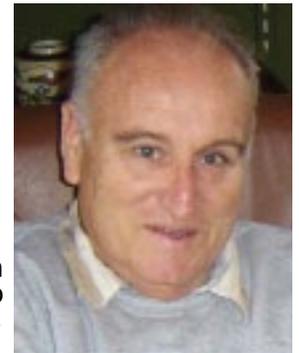
flights across the North Atlantic. In addition there was the cancellation of the American supersonic SST aircraft and the reduction in the number of Concorde, both of which had been used to justify the Aerosat program. All this caused airline companies to withdraw their support.

At the same time the cost of the Aerosat project was increasing and, eventually, in 1977, the FAA pulled out and ESA decided to cancel further work.

With this decision, the dream of a satellite system completely devoted to aviation died, then and there, never to be revived. At that point, maritime applications were to take center stage.

About the author

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



The first geostationary communications satellite built by the MESH consortium which included Matra (France) and Hawker Siddeley Dynamics (UK), two companies now merged in Astrium. The two models launched in 1977–78 were the forerunners of the 19 satellites in the ECS series and the precursors for the Eurostar series. Photo courtesy of Astrium.



The Road To The Future — Sales Support

by Bert Sadtler, President, Boxwood Executive Search



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

This issue's inquiry:

Dear Bert,

We are a growing services and manufacturing company with the need to recruit a senior level sales professional. We have had mixed results hiring sales talent. What are your thoughts on the key areas of successfully recruiting a sales professional?

Thank you,
DT, Division President

Dear DT,

Many business leaders feel that sales producers are a special breed. The good ones embrace rejection, work tirelessly, deliver new customers, compliment their support team and significantly contribute toward growth. The bad ones make promises that are not delivered, generate internal conflict, drive customers away and deliver little or no revenue.

Here's what I recommend. As with all good recruiting, the first step toward acquiring sales talent is to communicate internally and determine your requirements.

- Is your organization structured for performance based goals and rewards?
- Are you comfortable if an over-achieving sales performer earns more in base plus bonus than the senior leadership of your organization?

By determining what will work best within your organization, you can pursue the sales talent who will best fit your company and your corporate culture.

Revenue producing positions require that attention be given to a well-constructed compensation plan that is also a focal point in attracting and retaining the right talent. A good plan should be aligned so there are similar goals for the front line producer, the manager and the leadership team. A good plan also attracts the kind of talent you want and discourages the sales talent who is a poor fit.



Questions to ask when determining the best plan for your organization and defining the type of sales talent you want to recruit might include:

- Do you have an established revenue stream and want to expand growth or are you penetrating a new market and developing new customers?
- How is sales success measured? (In gross revenue, net profit, or other objectives?)
- Is the role of your sales talent to simply generate revenue or more than that?
- What is a realistic time-frame for results? (weeks, months, one year, two years)
- What are the "On-Target-Earnings"? (base compensation plus bonus plus other)
- Have you validated that your On-Target-Earnings are competitive in your marketplace to both attract and retain top talent?
- Does the compensation package encourage sales performance that exceeds the revenue target?
- Is there an included bonus earnings cap?
- Is the compensation package clearly defined and understood by members of sales, management and leadership?
- Are you insuring that earned commission is paid accurately and on time?

Hope you find these suggestions to be helpful to you and your organization. Best of luck with the new hire.

Sincerely,
Bert Sadtler



Janne Morstøl, COO, T-VIPS AS

A portrait of Janne Morstøl, a woman with short dark hair and glasses, wearing a bright pink jacket over a black top. She is smiling and looking towards the camera. The background is dark.

Janne T. Morstøl is COO of T-VIPS AS, a technology company providing professional video transport solutions. She is one of the founders of the company, and manages key functions within the company including R&D, Support, Finance and Administration. Ms. Morstøl joined T-VIPS from TANDBERG Television where she served in several management positions in Engineering and Business Development. In 2001 and 2002 she worked as Program Director at Zonavi, a Telenor-owned ITV company. Ms. Morstøl is also on the Board of Directors of Vizrt, a Norwegian-based provider of 3D graphics and asset management tools for the broadcast industry. Ms. Morstøl holds a Siv.Ing (equivalent to Master of Sciences) from the Norwegian University of Science and Technology and an MBA from the Norwegian School of Economics and Business Administration. Ms. Morstøl currently resides in Oslo, Norway, and has been a member of the Company's board since November 2010.

SM

Good day, Ms. Morstøl. The broadcasting industry and its connection to satellite communications possesses a strong technical bond and continues to increase, with satellite broadcasting now outpacing cable delivery of content. What role does T-VIPS play in this industry?

Janne Morstøl

T-VIPS is a leading IP-based video network that empowers high-profile network operators, broadcasters and post-production customers in more than 50 countries with innovative solutions that deliver significant operational and financial benefits. T-VIPS pioneered the use of JPEG2000 for high quality video transport.

We have recently launched our first MPEG-4 video gateway with the goal of targeting low bit-rate contribution links such as Satellite transmissions. T-VIPS' engineering team have deep experience in transport stream processing and have introduced innovative solutions to ensure reliable delivery of high quality video over IP-based video networks. We specialize in delivering solutions for transporting, processing and monitoring professional video broadcast signals. Our products are used in live broadcast contribution, transport of video between studios, feeding from broadcaster to transmitters in terrestrial networks, regional content handling, local adaptation systems and monitoring and switching.

T-VIPS' close involvement in video standards bodies, leadership in JPEG2000, expertise in IP and transport stream multiplexing, processing and monitoring results in state-of-the-art technology that makes complex broadcast network operations simpler and preserves the integrity of high-end video streams. T-VIPS solutions are also used in many demanding applications, including 1080/60p, 3DTV, alternative content for digital cinema, live HD sports and news back-haul, and the transport of HDTV programming over IP networks.

Among those currently deploying T-VIPS IP-based video transport solutions are News 12 Long Island, who use TVG430 HD JPEG2000 Gateways for transmission of HD and SD signals over IP.

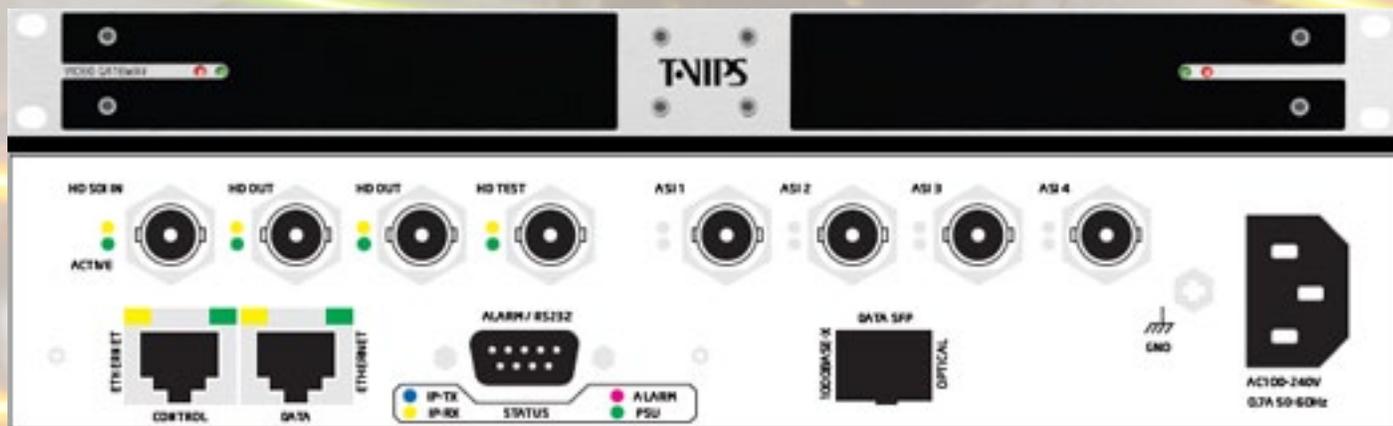
The Atlanta CBS affiliate WSB, uses T-VIPS' TVG415 SD JPEG2000 Gateway for ENG transmission from mobile trucks to the studio. WFTV-DT, an ABC affiliate in Orlando, employs T-VIPS' TVG420 ASI to IP Video Gateway systems for real-time backhaul of HD ENG news footage over IP networks.

Global Crossing, a leading global IP service provider, uses T-VIPS TVG425 Transport Stream Gateways for IP conversion. Optimum Lightpath, a provider of MetroEthernet-based data, Internet, voice and video transport solutions to the New York City area, a substantial number of T-VIPS units in its IP contribution network.

PBS station WNET in New York City selected the T-VIPS TVG420 ASI to IP Gateway solution to transmit the stations' locally produced programming over an IP network to the PBS Network Operations Center, in Alexandria, VA. Another PBS affiliate uses T-VIPS' CP525 cMUX remultiplexers to achieve increases reliability by monitoring and switching of incoming transport streams and for local PSIP rebranding at each of its transmitter sites, across its multi-station network. Boston PBS affiliate, WGBH, employs the T-VIPS CP510 Transport Stream Processor to filter select services from the WGBH-DT transport stream for delivery to Thames Valley Communications, a cable television, high-speed Internet, and digital phone service provider in Groton, Connecticut.

Numerous additional TV stations in the U.S. are using T-VIPS' CP505 ATSC Processor and CP525 cMUX remultiplexers to insert PSIP information into transport streams.

Several high-end Hollywood post production facilities, including MTI Film and Skywalker Sound, deploy T-VIPS JPEG2000-based Video Gateways for real-time transmission of high-quality video



T-VIPS TVG430 HD JPEG2000 Gateway

Executive Spotlight

and audio for offsite reviews, color correction, approvals and collaboration.

T-VIPS is privately-held company and headquartered in Oslo, Norway, with Americas' headquarters in New Jersey.

SM

You have several years of experience, ranging from being a Program Director for a Telenor-owned ITV firm, to engineering and business development positions with TANDBERG Television. What was your motivation in founding T-VIPS?

Janne Morstøl

I saw that the video world was moving to IP – I was responsible for the IPTV business segment with Tandberg Television so I was aware of the opportunity for utilizing IP as a video transport technology. At the same time, I recognized that the focus of the larger vendors was in last-mile compression technologies and saw an opening to drive innovation in the contribution segment. In parallel the Digital Cinema industry was embracing JPEG2000 and we were excited by the possibility that this technology might provide in high quality video contribution.

SM

What are T-VIPS' strengths in the satellite broadcasting segment? Why do you believe T-VIPS' products offer greater efficacy than other offerings?

Janne Morstøl

T-VIPS brings unique expertise in delivering high quality contribution technology over IP video networks. With the launch of the TVG650/610

MPEG-4 products we now offer the market a best of breed point solution for low bandwidth contribution and addition assist the Satellite operators in deploying hybrid solutions including satellite and fiber based IP networks. We believe the timing is right for Satellite operators to take advantage of the flexibility and cost benefits of IP. T-VIPS pioneered the JPEG2000 codec for broadcast applications because of the anticipated growth of IP in broadcast and understood that this codec was particularly well suited for IP video transport.

As the quantity, quality and value of digital assets grows, content owners, producers and broadcasters want to avoid image degradation and maintain the highest video quality from acquisition and production through to distribution and storage.

Sending JPEG2000 compressed video over IP networks enables programmers and content owners to preserve the highest image quality and repurpose their digital assets for all device formats. This allows the broadcaster to not only deliver the content to big HD/3D screens but also reformat the content to deliver a high-quality internet or mobile video viewing experience.

Moving JPEG2000 compressed video over IP transport networks addresses the technical challenges facing broadcasters today and well into the future.

SM

We note your recent launch of your Company's TVG650 and TVG610 MPEG-4 Contribution Encoders. What was the impetus behind the development of these products? What are the goals for these products?





Janne Morstøl

We're a growing company and have decided that the time now is right to extend our product offering to cover lower bandwidth contribution solutions. We have been a pioneer in delivering high quality contribution solutions and this launch continues in that same tradition. The bandwidth footprint of our existing product portfolio is from 80-160 Mbit for HD all the way up 600 Mbit for 3D. With the TVG610/TVG650 we will meet the needs of customers with available bandwidth of 10 to 60Mbits. The new products fill a gap in our product portfolio. With the launch of these new products we will gain access to new market segment and additional revenue streams. The products are aimed at the Satellite and lower bit rate Telco contribution segments. We believe the TVG650/610 will prove to be the best high end MPEG-4 10 bit solutions available in the market.

The TVG650 and TVG610 combine easily with other T-VIPS products to provide a robust satellite or

telco contribution solution, in particular the CP525 cMUX Remultiplexer for intelligent processing, multiplexing and scrambling of MPEG-2 transport streams and the TNS541 Seamless TS Monitoring Switch for intelligent 1+1 redundancy switch-over between two MPEG-2 transport streams.

SM

How will commercial operators benefit from using either of these units, and how will they impact an operator's bottom line and operational efficiency?

Janne Morstøl

Deploying high quality TV services over a cost effective IP video infrastructure brings competitive advantages as well as commercial benefits. In terms of reliability, today's IP video transport solutions are robust with a built-in quality of service (QoS), including advance error handling techniques such as Forward Error Correction (FEC). The availability, reliability and uptime of

Executive Spotlight

IP networks has improved dramatically in the last decade, and they have now reached the quality level required for video transport. Those currently using microwave links can introduce IP in the microwave network. IP is an extremely flexible domain. Signals can be routed to many different locations. Microwave transmission operates on a point-to-point, line-of-sight basis. IP-based video networks are ideal for sending the same signal to multiple locations. IP connectivity has a lower cost than satellite or legacy Telco networks. IP also means that video can be distributed over generic Ethernet networks, rather than the whole distribution network being video or broadcast-centric. This saves cost and makes it easier to contribute content from wherever it's generated. This is particularly true for news footage or for sports and events at smaller venues that may not have dedicated links already installed.

ATM and SDH/SONET systems are more expensive to deploy and harder and more costly to maintain than today's IP-based networks. IP/Ethernet switches are commodity-off-the-shelf hardware, enabling an inexpensive deployment process. The availability of manpower with knowledge and IP/Ethernet know-how is abundant. There are cost-savings and flexibility benefits when moving to an IP-based infrastructure that make for an attractive ROI scenario.

IP connectivity has a lower cost than satellite or video telco networks. IP also means that video can be distributed over generic Ethernet networks, rather than the whole distribution network being video or broadcast-centric. This saves cost and makes it easier to contribute content from wherever it's generated. This is particularly true for news footage or for sports and events at smaller venues that may not have dedicated cable or satellite links already installed.

SM

Would you please take the time to describe a best case scenario in terms of a satellite operator employing your encoder/decoder products?

Janne Morstøl

We would like to see customers deploying the 10 bit option of our MPEG-4 Encoder to contribute high value video assets such a live premium sports event over their existing Satellite infrastructure.

SM

With your Company's focus on these products, does this indicate T-VIPS is going to abandon JPEG2000 technology in its product line? Please explain...

Janne Morstøl

We have been the pioneers of JPEG2000 for as long as we have existed — we lead the market with our JPEG solutions we intend to remain at the

forefront of JPEG2000 developments. We continue to believe that where customers have access to the required bandwidth, JPEG2000 out-performs all contenders. With the TVG610/TVG650 we will meet the needs of customers with available bandwidth of 10 - 60 Mbit. The new products fill a gap in our product portfolio.

With the launch of these new products we will gain access to new market segment and additional revenue streams. The products are aimed at the Satellite and lower bit rate Telco contribution segments. We believe the TVG650/610 will prove to be the best high end MPEG-4. 10 bit solutions available in the market.

From the start, our strategy has been to deliver high quality contribution solutions. We believe the time is right for MPEG-4 with availability and maturity of MPEG-4 AVC 10-bit 4:2:2 coding technology for SD and HD signals.

We are growing as an organization and now have the manpower and skills to carry a wider range of products. We strive to be responsive to our customer requirements and believe these new products will be a good match for the needs expressed by some of our customers (particularly in the APAC region).

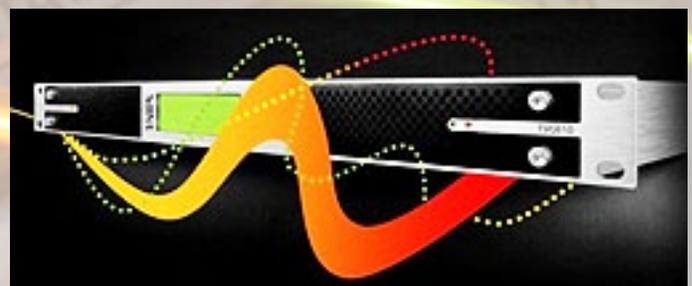
The applications for these two new products include: satellite and IP contribution, live event coverage, primary distribution, studio-to-studio media exchange, outside broadcast production, and professional broadcast contribution. And we have no plans to enter the DTH market. Our current focus continues to be the high end contribution market.

SM

T-VIPS already offers a number of products, from video gateways to management solutions... does T-VIPS have plans for additional technologies and product lines, such as was demonstrated by your aforementioned encoders/decoders debut?

Janne Morstøl

We are constantly reviewing market trends and listening to our customers and will naturally bring new products and solutions to the market but we cannot go into details at this time.



TVIPS' TVG610 MPEG-4 Contribution Decoder

SM

Would you tell us something about your T-VIPS Connect monitoring solution?

Janne Morstøl

T-VIPS' CONNECT is a web-based client server management system for the management and operation of video transport networks. From CONNECT, an operator can handle the management of inventory, set-up and tear down of connections between T-VIPS transport stream processors, multiplexers and gateways. Connect also enables equipment configuration, status monitoring and scheduling of connections. The entire video transport process is combined in one managed system and operated from one screen.

SM

What challenges do you foresee for the satellite broadcasting industry, both from a technical product development standpoint as well as in terms of entering this market as a Company unfamiliar with many of the network providers?

Janne Morstøl

Entering the Satellite space means maximizing limited bandwidth and that in turn means delivering the highest quality video at the lowest possible bit rate. Our best of breed products utilize the most efficient video compression technologies to meet this challenge.

SM

How will mobile technologies, OTT, IPTV, web streaming and so on impact T-VIPS' product lines? How will you market into these arenas?

Janne Morstøl

As operators need to reach multiple device types as well as merging broadcast services with broadband content distribution, the flexibility of IP contribution networks becomes increasingly relevant.

The customer expects a high-quality visual experience, regardless of the viewing device. The broadcaster has to deliver content compatible with the highest video quality device - the large TV set in the living room. This means the broadcaster has to design, at least the first part of his content delivery network, the contribution network, to deliver the highest video quality possible.

There's a clear trend now among broadcasters of designing contribution infrastructures to support 10 bit/1080p, even though most of their current contribution is in HD at 1080i or 720p or even SD. The transcoding to prepare the content for different viewing devices happens in the studio, allowing the quality and format to be tailored for the various device screens and resolutions and simultaneously archiving the content for future re-purposing. The use of IP networks makes it economically viable to keep the content at high-quality for as long as possible throughout the video chain, which makes transcoding more effective and efficient when handled centrally.

SM

Given your years of experience, what projects that you have accomplished bring a smile of satisfaction to your face?

Janne Morstøl

If I think back, our greatest achievement was launching the company's first video gateway - the TVG420 ASI to IP Gateway, and I'm still smiling because it is still in the field and still working flawlessly.

