

# **SatMagazine**

Teleports  
MSS  
Development  
Rural Market  
Cruise Ships  
VSAT  
Products  
Playout

CET GmbH  
WTA  
Euroconsult  
Coleman-Spice  
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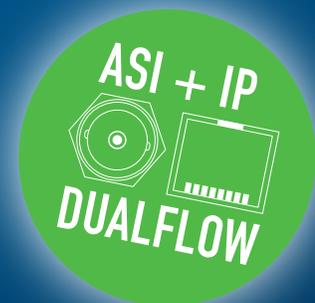
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## ***European Workhorse: CET GmbH***

**CET Teleport is one of Europe's major teleports and was built by Deutsche Telekom in 1987 for satellite broadcast and VSAT services. The Teleport is located in northwest Germany giving it a commanding view of the skies, with visibility from the Eastern Pacific, the West Coast of the USA, South America, and covering Europe and Africa all the way across Russia and China, and all of Asia and down to Australia.**

**The Teleport is host to more than 50 antennas from 15m downwards, operating in C-, Ku-, Ka-, K- and X-bands, fully integrated into Deutsche Telekom's German fiber network, providing CET with access to the terrestrial network for Internet connectivity as well as data and voice backhaul.**

**Access to BT's Global Media Network (GMN) via BT Tower allows for the transmission of video enabled MPLS data & voice services. The STM fiber between the CET hub and the Tower is bi-directional and fully redundant.**

**The teleport has a potential of accessing more than 200 geostationary satellites, located from 58 degrees West to 76.5 degrees East, providing coverage and connectivity across most of the visible globe.**

# Beam

**CET Teleport GmbH** (CET) is a teleporting services provider whose Hameln teleport has enjoyed an excellent reputation for the quality of the network operations that it has offered to its users over the years. The teleport is run by a management and operations team of highly experienced and respected satellite industry professionals who can devise and implement solutions to most of the satellite based communication problems encountered by organizations.

The Teleport provides a wide range of media broadcasting and corporate VSAT services. However, in contrast to most teleports, CET sees its major VSAT

market not as the ultimate end-user, but as a solution for organizations, including other teleports, who are unable to provide the service their customers require. Such challenges include...

- » ***Satellite that is to be accessed that is not visible from designated remote locations or hub***
- » ***There is a lack of space for additional antenna(s) at the hub***
- » ***Shorter and/or more reliable backhaul***



- » **Accessible space segment unable to be obtained elsewhere**
- » **CET already has a fully redundant dish pointed at the required satellite**

CET also provides, monitors, and manages remote-to-remote, roof-top to roof-top SCPC links, and can connect ISPs to the Internet as well as offer GSM backhaul and connection to the PSTN or to VoIP switches for voice and voice and data services. Once contracted to provide a service, CET is able to manage as much, or as little, of the project as the customer may require. This can range from site survey through installation and commissioning to the provision of licencing and on-going maintenance.

The Teleport has extensive disaster recovery facilities plus a 24/7 Help Desk that is backed by a large and highly experienced engineering team who manage and maintain the satellite and hub equipment on site and at numerous remote locations. CET has both **iDirect** and **HNS Directway** hubs installed at its Hameln facility in order to offer a full range of shared hub facilities to its customers, as well as providing SCPC star or full mesh networks when required.

## Services

- » **Broadcast Services**

CET Teleport is expanding its range of broadcast services to provide tailored solutions to broadcasting organizations across the industry, offering Direct-to-Home (DTH) Multiplexed Services as well as facilities for Playout and Distribution, Turnaround, and Occasional Use/SNG services. CET can also provide access to some of Europe's premier DTH bouquets and multi-point content access and storage facilities. By using the latest hardware technology and software solutions in its studio and editing suite, CET can provide global content distribution.

- » **VSAT and Carrier Services**

CET provides the following services and more...

- » **Hubbed and SCPC VSAT Corporate and Enterprise Services**
- » **GSM Backhaul Services**
- » **Voice Services — Carrier and VoIP**
- » **Disaster Recovery Networks**

The Company can arrange local licensing, installation and maintenance with Service Level Agreements guaranteeing the highest level of availability.

- » **Government, Military, and NGO Services**

For many years, the Hameln teleport has provided voice and data satellite services for government agencies, non-governmental organizations (NGOs), and various branches of the military.

These organizations prefer to use satellite links, even when terrestrial ones are available, as they can have virtual private networks (VPNs) and highly cost-effective 'actual private networks'. In this way, they can enjoy much more secure communications over their own exclusive links than is possible using public voice and data networks.

- » **Other Services**

CET Teleport also provides all the services required to ensure customers obtain a system that is tailored to satisfy specific needs, including project management, installation, licensing, field service and maintenance, network monitoring and management, third party hosting and data storage and, for satellite operators, telemetry, tracking and control (TT&C) services.

# Beam

## Co-Location + Hosting

CET is able to provide co-location and hosting facilities to service providers whether they want to locate a major antenna system at the hub or rent rack space for their own electronic equipment to handle traffic being brought down or sent up using a CET antenna.

## Back-Up Power System

CET's warm stand-by 1 MW generator is more than capable of providing all the power the teleport requires to continue operating in the highly unlikely event both of its independent mains power supplies fail. To cover the time between a power failure and the generator coming on stream, the battery pack installed is capable of supporting all the systems at Hameln for at least 30 minutes.

## Fiber Connectivity

Having been built by **Deutsche Telekom**, the CET teleport is naturally directly connected to the DT fiber network by multiple links to ensure complete continuity of service at all times. In addition, the teleport can offer fiber connectivity directly to the **BT Tower** in London and **Telehouse** — no matter where in the world traffic has to be ultimately taken or backhauled, CET has the connectivity in place to handle such needs. Through its Internet portal, CET can provide high speed and high capacity access to various Internet

portals using diverse routing to ensure that Internet connectivity is always available.

### *Ken Armstrong, CEO*

In 2008 Ken spearheaded negotiations with Stratos to conclude the acquisition of the teleport facility. Ken started his career at British Telecom in 1965 and was involved in the development of its backbone System X switching system. He later moved to Audio Conferencing and then Broadcast Services.

### *Matthew Ivey, V.P. Sales*

Matthew joined CET Teleport in March of 2010 to manage all of CET's sales activities.

### *Neil Ashworth, Dir. Business Development/Strategy*

After a career with ICL and Rank Xerox, Neil became a founding director of BankNet in Hungary, which installed the first shared hub in Central and Eastern Europe in 1992. His last position prior to the CET appointment was as Regional Director responsible for CEE, Russia & CIS and the Middle East at Paradigm Communications. 





SES teleport in Betzdorf, Luxembourg, photo courtesy of SES.

## *The Teleport Industry Is Looking Green*

*by Robert Bell, Executive Director,  
World Teleport Association*

Energy costs are spiraling upwards while “carbon footprints” and “sustainability” have become the rallying cry. In addition, customers are increasingly including power consumption and green initiatives as decision criteria in contracts and equipment purchases. So it’s not surprising to find the satellite industry, and in particular the teleport sector, taking on the “Go Green” challenge.





Kenneth A. Miller International Teleport, Hauppauge, New York, USA. Courtesy Globecom Systems Inc.

Teleports spend between three-hundred-thousand and a million dollars every year to power everything from heat and air systems to light bulbs, computers and backup generators. A growing number of teleport operators, however, are finding their age-old nemesis of excessive energy consumption now has a silver lining — plenty of room for savings. Cutting teleport energy usage through green initiatives is a relatively easy way to reduce the energy bill by anywhere from 20 to 40 percent.

## The Road To Green

A recent **IDG Research Group** survey of more than 350 IT professionals found that the primary reasons for companies adopting green solutions include; reducing company energy costs (74 percent), extending the life of hardware (50 percent), reducing IT maintenance activities (39 percent), improving corporate image (37 percent), reducing emissions and energy consumption (31 percent), and freeing up space on the datacenter floor (29 percent).



"I've been to many a teleport over the years," says *Mary Frost Distler*, former CEO of **GlobeCast America** and founder of the newly formed **Power to Change US**.

Frost works with a range of organizations to generate sustainable efficiencies and even new revenue streams from energy conservation. "There are several phases to a successful energy management solution, beginning with an audit to uncover quick, easy energy-saving fixes that can have a major impact on the bottom line. It may

not be exciting to review system efficiencies, but the savings amounts to serious money."

Employees are responsible for as much as 40 percent of the energy usage at the office, so educating them can play a significant role in an organization's energy efficiency plan. "I can't count the number of offices I've visited where employees had heaters at their feet in the middle of summer, complaining the AC was too cold," explains *Frost*.

Programmable thermostats are an easy and affordable way to increase comfort and decrease costs.

Lights, fans and office equipment such as computers and printers are generally left on even when not in use. Consider that a copier left on 24/7 costs between US\$150 and \$200 a year. Soft drink vending machines are energy hogs at \$350 a year. Leaving a computer sitting idle costs about 3 cents an hour. Add up all the computers in a teleport and that can quickly turn into significant money.

Furnaces, boilers and air conditioners are also energy guzzlers. New heating and cooling systems feature energy-saving technologies and use eco-friendly refrigerants. Considering that heating and cooling equipment can represent at least half of the energy cost at a teleport, regular maintenance and replacement of old, inefficient systems should be at the top of the priority list. Replacing old generators with efficient, modular units is another step towards energy efficiency and operational flexibility.

Then there's the obvious, although generally overlooked, items such as ensuring that the weather stripping around doors and windows is tight, or harvesting natural light when possible instead of automatically turning on the office lights.

## Green In Action

Hauppauge, NY-based teleport **Globecomm Systems**, for example, received high marks for having proper lighting in various task areas. Says *Frost*, "Globecomm's Hauppauge teleport has all the right lighting throughout their office, engineering and manufacturing spaces. It's a benchmark facility that has updated its HVAC, control room and teleport infrastructure."

Globecomm, in fact, has segregated the HVAC for employees from the one for critical components. The HVAC dedicated to keeping employees comfortable

has its own monitoring and control to keep the temperature steady. The critical component area includes ambient cooling so when the temperature outside drops below 45° F, the HVAC routes outside air into the system for cooling.

**SES**, the global telecommunications satellite operator based in Luxembourg, aims to significantly cut its greenhouse gas emissions in 2010. The plans currently under implementation at SES' headquarters in Betzdorf, Luxembourg, are expected to yield a reduction of approximately 17 percent of the group's carbon dioxide emissions as measured in 2008.

Under the carbon reduction plan now under implementation, modified heating burners are replacing fuel oil as the main energy source by natural gas, and the cold water chillers currently in use on the Betzdorf campus are being replaced by new and more efficient installations. These initiatives are expected to reduce consumption by more than 500,000 m<sup>3</sup> a year, and will also considerably cut Betzdorf's water consumption. To ensure uninterrupted operations, the new chiller systems are being installed in three stages which are expected to be completed in May 2010.

Since early January 2010, the Betzdorf campus uses electricity sourced from renewable energy — hydropower in this case, which can be considered CO<sub>2</sub>-free when compared to the electricity produced from the standard primary energy mix of fossil fuels and nuclear power. In addition to reducing carbon emissions, the new generation chillers use significantly less ozone-destroying refrigerants, which further minimizes their environmental impact.

## Green Teleport Of 2010

On March 16, during its annual **Teleport Awards for Excellence**, **WTA** announced the recipient of its first **Green Teleport of the Year Award**. The Green Teleport Award honored a teleport operator (independent or carrier-owned) that provides a high



standard of excellence in energy management, in order to lower costs, improve efficiency and reduce the carbon footprint of its operation. The first winner of WTA's Green Teleport of the Year was **Essel Shyam Communication Limited** of Noida, India.

In the spring of 2006, **Essel Shyam** established a green initiative that includes use of solar heating and establishment of a comprehensive plan for use of alternative energy within five years; switching to high-efficiency illumination devices that will reduce energy consumption by up to 15 percent in three years; maintaining the air-conditioning within the facilities at a temperature 0.5 degrees higher, resulting in 18-20 percent savings over three years; and remodeling the existing facility for energy efficiencies and low carbon emissions as well as using recycled materials in future infrastructure where possible.

**Essel Shyam** took on the green initiative with innovative techniques designed to maximize the surrounding environment as well as the seasons. While the company's efforts may not be the latest in high-tech, they've realized a reduction of energy consumption of 8.5 percent in the last year. The company is yet another example of what can be accomplished when management sets green as a corporate goal. ↷

### *About the author*

Robert Bell is Executive Director of the World Teleport Association, a non-profit trade association representing the world's most innovative teleport operators, carriers and technology providers worldwide. The association announced its new "Green Teleports" program in December 2009. More information on the Green Teleport campaign and resources for "Going Green" can be found on the WTA web site at [www.worldteleport.org](http://www.worldteleport.org). Mr. Bell can be reached at [rbell@worldteleport.org](mailto:rbell@worldteleport.org).



# *Beam*

## *Growth On The Horizon For The MSS Sector*

*by Wei Li, Analyst  
Euroconsult*



As the economic climate of 2009 was still under the sway of the global economic crisis that started in 2007, the MSS (Mobile Satellite Service) industry was largely stagnant in 2009 — some MSS operators even reported a decline in revenue. Global wholesale revenue stood at \$1.27 billion for the six MSS operators currently active, reflecting 2.8 percent industry growth from 2008 — the lowest for the last three years (though still higher than the growth in 2005, when the MSS industry suffered from a post-military conflict effect).

Among MSS operators, situations vary significantly from one to another. Inmarsat and SkyTerra are the only operators to have maintained revenue growth during the year, while Iridium, Globalstar and Orbcomm all reported a decrease in revenues. Even though Thuraya does not report financial information publicly, Euroconsult estimates that their annual revenues did not grow given the unfavorable market situation. In terms of market share Inmarsat and Iridium maintained their leading positions, together accounting for 80 percent of MSS wholesale revenues in 2009 with Inmarsat alone having approximately 55 percent.

Due to system degradation, Globalstar lost ground to competitors and ended the year with only 5 percent market share after reaching 7 percent in 2008. Nevertheless, the company announced that

it has slowed the loss of customers for two-way communications, and was successful in acquiring customers for the low cost one-way SPOT service. In addition, its management believes that the worst of customer defection is over. Market share distribution among other operators remained roughly the same as in 2008, with Thuraya, SkyTerra and Orbcomm having approximately 10 percent, 3 percent and 2 percent market share, respectively.

### **Attracting New Customers In A Difficult Economic Environment**

With the turmoil of the global economy, customers in MSS vertical markets have tightened spending on new services. Many previously planned MSS installations were postponed or even cancelled during the year.

Despite the recent release of more capable and lower cost MSS products (for instance, **Iridium 9555** and **Globalstar SPOT 2.0**), new customer acquisition has proven difficult for MSS operators; **Iridium**, **Globalstar**, and **Orbcomm** have all reported significant declines in revenue from their equipment businesses, a key indicator of new customer acquisition. In the case of Iridium, equipment sales fell by 30 percent in 2009, while Orbcomm revenues on equipment sales fell dramatically, representing a mere 7 percent of 2008 equipment sales revenues.

Business from existing customers resisted the economic downturn well. **Inmarsat** and **SkyTerra**, who primarily build business around airtime service with limited equipment sales, maintained revenue growth during the year. Inmarsat reported \$695 million in revenue for its core business in 2009, a 9.5 percent increase from 2008, while SkyTerra reported 2.3 percent revenue growth, although its total revenue (around \$35 million) is still only a small fraction of global MSS wholesale industry revenues. Iridium also reported 11 percent service revenue growth in 2009 despite the decrease in equipment sales. Exceptions to this positive trend are Globalstar and Orbcomm, who suffered from satellite degradation or in-orbit failure; thus it is assumed that the decrease in their service revenue is not directly due to the economic downturn.

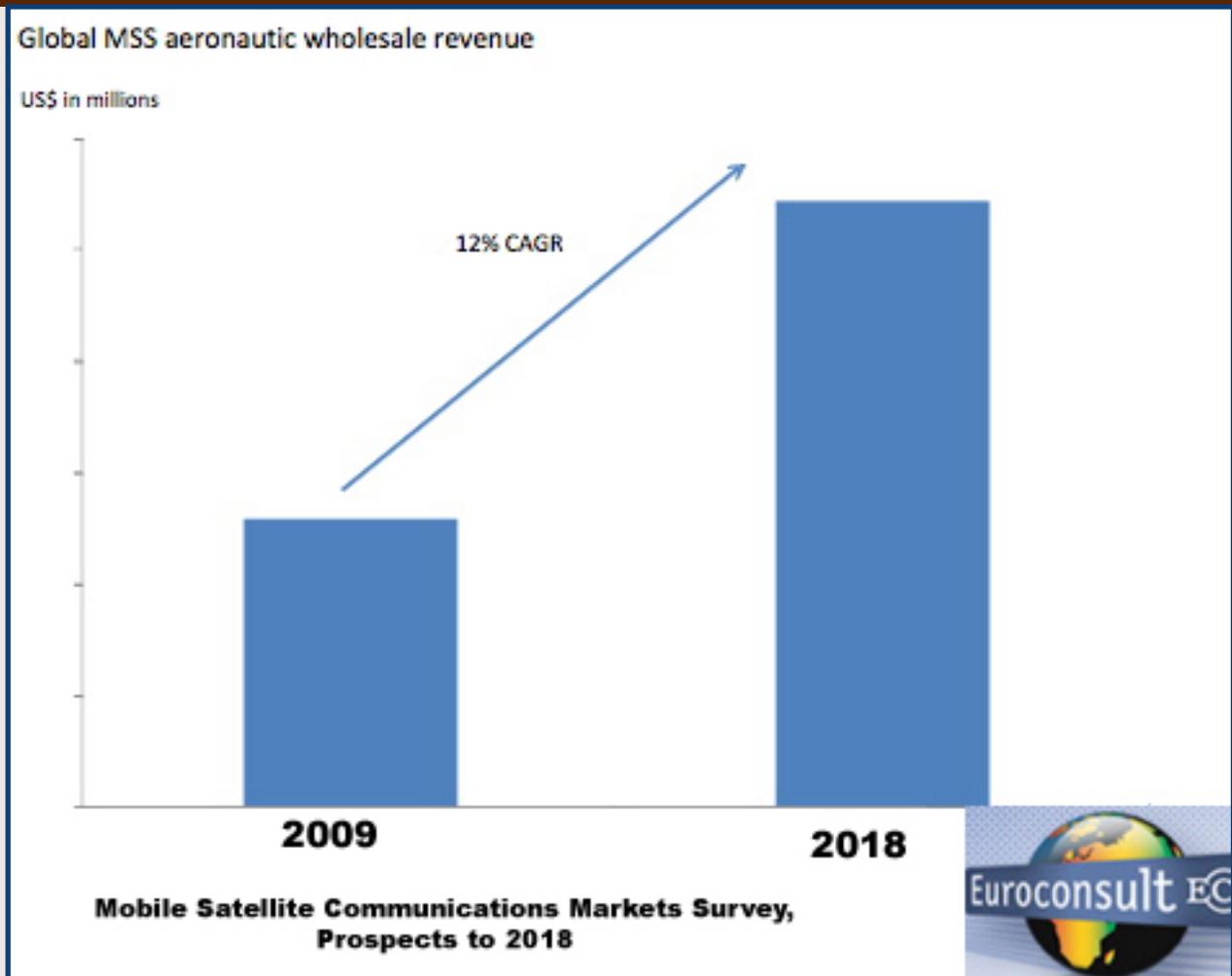
## Export Credit: Helping MSS Operators Secure Financing For Future Satellite Fleets

Except for **Inmarsat** and **Thuraya**, MSS operators are currently in a major satellite replacement phase with high capital expenditures. All three LEO satellite constellation operators — Globalstar, Orbcomm and Iridium — plan to replace their first-generation constellations over the coming years. In spite of the difficult economic environment, they are all on course to acquire financing for their new satellites, largely thanks to export credit agencies.

Iridium has the highest capital expenditure requirements (\$2.7 billion as reported by the company) among MSS operators for its **Iridium NEXT** constellation scheduled to launch in 2014. The company is currently in talks with the **US Export-Import Bank** and the French export credit agency **Coface** for low-cost loans to finance the constellation. Globalstar is already in the replacement process with the launch of the first group of its second-generation satellites planned for late 2010 or early 2011; the total cost for the 24 satellites together with the ground segment was reported to reach about \$1.29 billion. In June 2009, Globalstar secured \$586 million in bank financing from a syndicate of French banks in a deal backed by France's Coface. This export credit has enabled Globalstar to pay its supplier to proceed with satellite construction, and the company expects to restart subscriber growth with the initial launches of its next generation satellites.

## Aeronautic + Maritime Markets: Future Revenue Growth Areas

The pending launch of next-generation satellites should introduce a wide range of new products which could drive the MSS industry to a higher growth period. According to **Euroconsult's Mobile Satellite Communications Markets Survey, Prospects to 2018**, global wholesale revenues in 2018 will reach nearly \$2.46 billion, representing an almost 8 percent CAGR between 2009 and 2018. The current largest market segment, land mobile, is expected to remain in the leading position in 2018, with about \$1.41 billion in wholesale revenues. However, as most vertical markets in the land mobile sector are already considered mature, key growth areas for both established MSS players and new entrants will be the maritime and aeronautic sectors.



Aeronautics is expected to be the fastest growing MSS market over the next decade with a CAGR of 12 percent in wholesale revenue through 2018. Key addressable markets of the sector are cabin and cockpit communications for business aviation, commercial airlines, and general aviation, as well as cockpit and sensor data transmissions for military aircraft — notably for UAVs (Unmanned Aerial Vehicles). Despite several unsuccessful ventures with commercial airlines (such as the recently reported contract termination between **OnAir** and **RyanAir**), the generally positive MSS usage experience with business jets, airlines (e.g., **Emirates Airline**) and other aeronautic sectors, along with a more favorable economic climate, should help MSS services achieve a greater level of acceptance in the aeronautic industry.

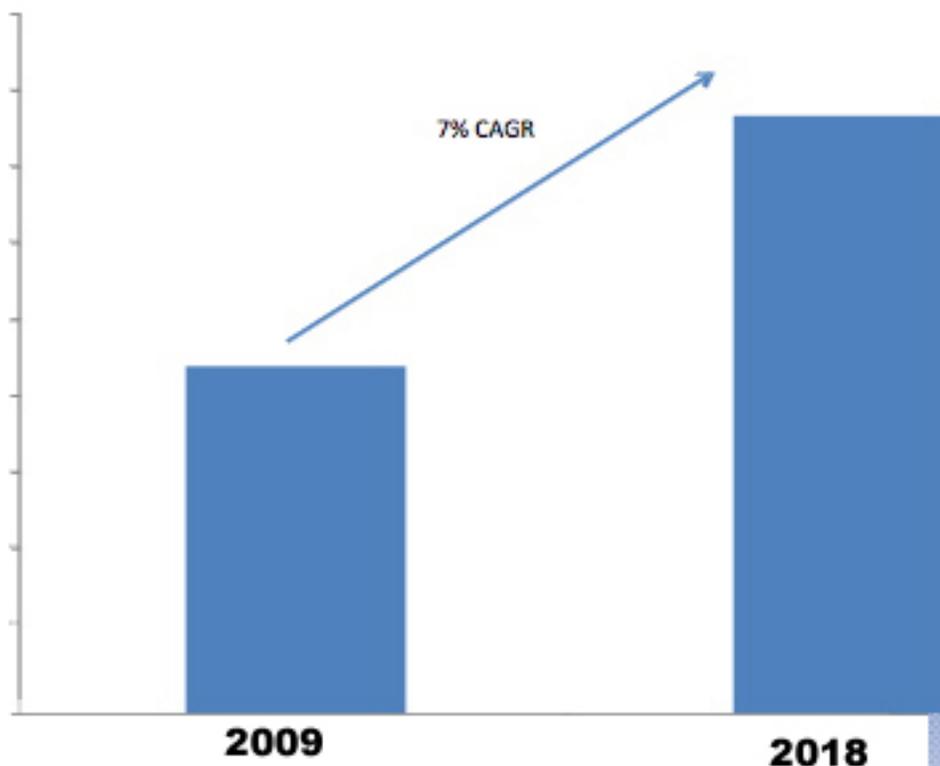
MSS solutions from **Iridium** and **Inmarsat** have become factory options for a number of established aircraft manufacturers, and as of year-end 2009 there were more than 37,000 MSS aeronautic terminals in operation. This number is expected to grow to almost 72,000 in 2018, with almost half from the North American market.

Maritime is expected to remain the most lucrative MSS market over the next 10 years. The sector contributed more than 35 percent of MSS industry wholesale revenues in 2009 and had the highest ARPU (Average Revenue Per User) among all MSS market segments.

By 2018 it is expected that MSS maritime wholesale revenues will reach \$768 million, despite the growing competition from maritime VSAT solutions. This growth

## Global MSS maritime wholesale revenue

US\$ in millions



**Mobile Satellite Communications Markets Survey,  
Prospects to 2018**



will be largely due to expanding ITC requirements from almost all types of maritime applications (such as ship operation, crew calling and safety communication), as well as the expected improvement of MSS market penetration (especially for MSS broadband service) in the world merchant shipping, fishing, cruise ship, leisure vessel and offshore sectors. A number of MSS operators are planning to launch new generation maritime services, and it is reported that the current market leader, Inmarsat, is evaluating the idea of carrying high capability Ka-band payloads on its fifth-generation satellite constellation. 

*Figures are from the **Mobile Satellite Communications Markets Survey, Prospects to 2018** research report published in October 2009 as well as preliminary research results for **Global Maritime Satellite Communication Market Survey and Global Aeronautic Satellite Communication Market Survey**, both to be published in 2010. [www.euroconsult-ec.com](http://www.euroconsult-ec.com)*

### *About the author*

Wei Li is an Analyst at Euroconsult





## DVB-RCS VSAT Hubs

Advantech Satellite Networks offers a two-way, open standard (DVB-RCS), broadband satellite access system. SatNet's DVB-RCS Hub, and in particular, its



The RLSS from SatNet is a modular hub sub-system which can be integrated with new or Installed IP/DVB broadcast platforms and IP

Return Link Sub-System (RLSS), is at the heart of the broadband access system.

SatNet Hubs (including the RLSS) are turn-key systems which can be installed in days to enable a wide range of public and/or private network topologies with satellite interactive terminals.

switch/routing equipment to provide two-way satellite broadband access services.

The RLSS is designed to receive inbound traffic, handle inbound and outbound signaling, schedule and control networks of satellite interactive terminals (available from multiple suppliers).

# Product Uplink

A single scalable RLSS unit can support networks ranging from just tens to thousands of simultaneously logged-on terminals.

Advantech Satellite Networks Hubs and Terminals are highly flexible; several different network architectures are possible. Some key features of the SatNet DVB-RCS Hub include:

- » **Frequency independent—hubs, terminals and onboard processors can be operated in any frequency band (e.g., Ku, Ka, C, X or hybrids of these).**
- » **Satellite versatility—the system can operate with the forward and return link on the same satellite, or on different satellites.**
- » **Multi-mode System capability—evolves the DVB-RCS standard one step further by allowing for a centrally managed hybrid DVB-RCS and DVB-SCPC network.**
- » **Terminal diversity—networks can support receive-only terminals at the same time as two-way terminals, as well as both mesh and star topologies of terminals.**

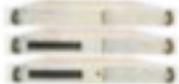
Advantech Satellite Network's entire system, as well as the DVB-RCS standard, have been designed to minimize the cost of scaling a broadband access network from terminal populations as small as a few tens of terminals to tens of thousands.

Performance of access layer protocols is highly dependent on traffic profile. Advantech's implementation of DVB-RCS, using dynamic assignment techniques mandated in the DVB-RCS specification, has been specifically designed and tuned for multi-media traffic.

## NetManager™

Advantech has responded to market demands by developing a powerful management system capable of meeting the functional and scalability requirements of a variety of system configurations. The SatNet Hubs feature the NetManager™, which provides Hub & Network Operator Tools, Service Provisioning Tools and Multiple User Interfaces.

The management of SLAs, Return Link and Forward Link Quality of Service (QoS) and the daily

DVB-SCPC Hub	Micro DVB-RCS Hub	Mini (Plus) DVB-RCS Hub	Max DVB-RCS Hub
			
<ul style="list-style-type: none"><li>• DVB-S/S2 Outbound</li><li>• SCPC Inbound</li><li>• 10's to 100's of remotes</li></ul>	<ul style="list-style-type: none"><li>• DVB-S/S2 DVB-RCS</li><li>• DVB-SCPC</li><li>• Mesh Sub networks</li><li>• Full Featured</li><li>• 18Mbps aggregate throughput</li><li>• Up to 100 remotes</li></ul>	<ul style="list-style-type: none"><li>• DVB-S/S2 DVB-RCS</li><li>• DVB-SCPC</li><li>• Mesh Sub networks</li><li>• Full Featured</li><li>• 55 Mbps aggregate throughput</li><li>• Up to 500 (1500) remotes</li><li>• Scalable</li></ul>	<ul style="list-style-type: none"><li>• DVB-S/S2 DVB-RCS</li><li>• DVB-SCPC</li><li>• Mesh Sub networks</li><li>• Full Featured</li><li>• 155 Mbps aggregate throughput</li><li>• Up to 3000 remotes</li><li>• Scalable</li><li>• Custom Networks</li></ul>

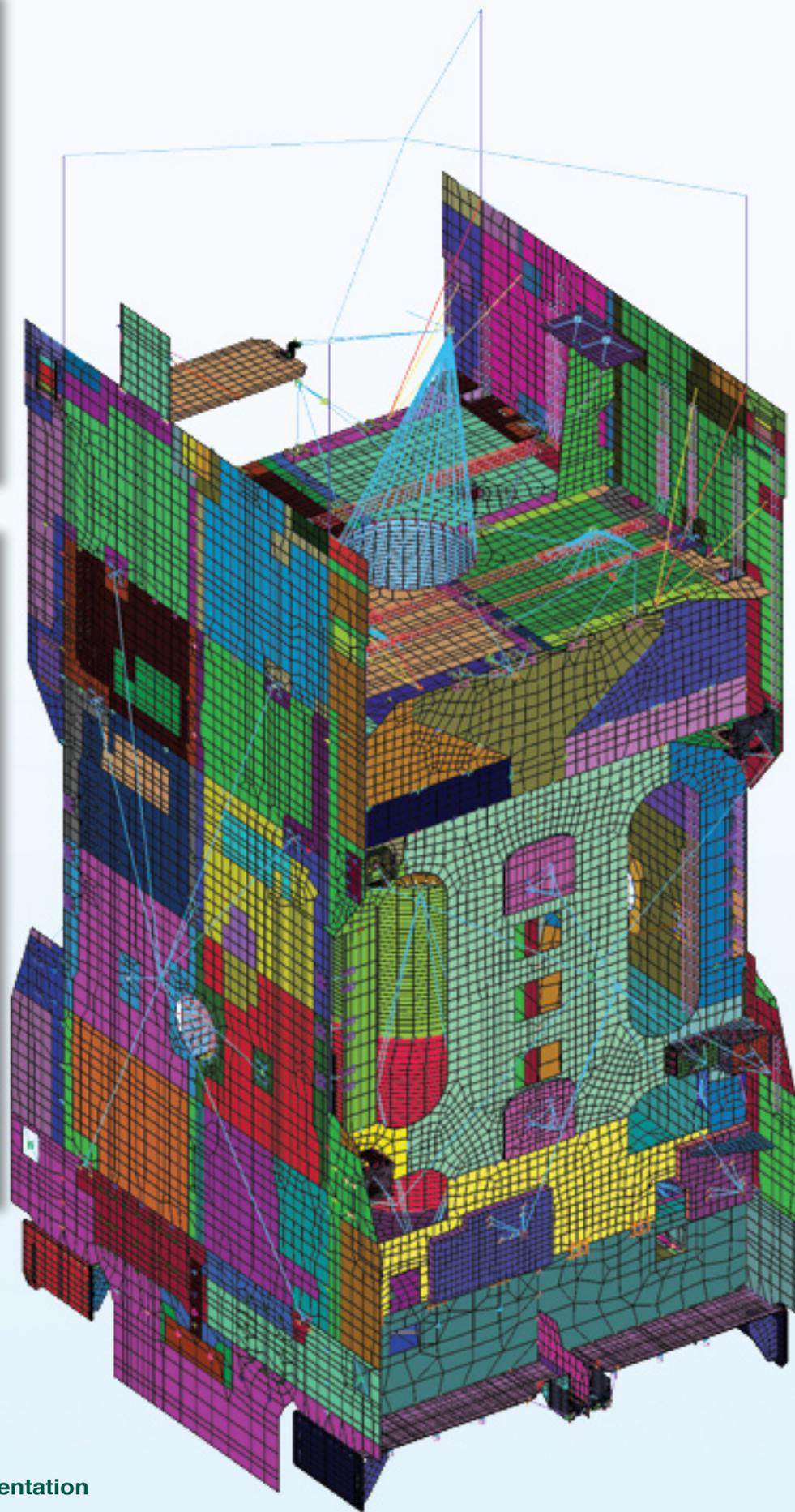
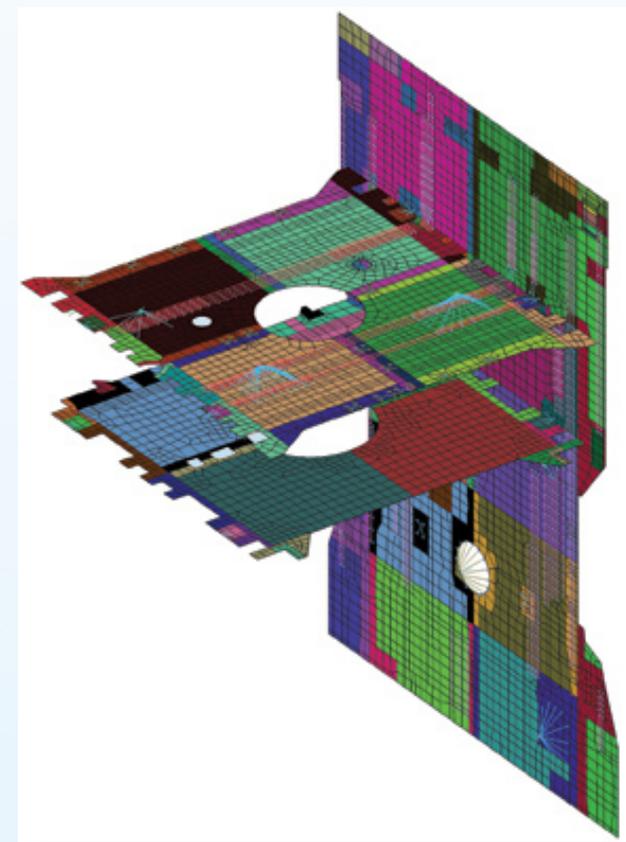
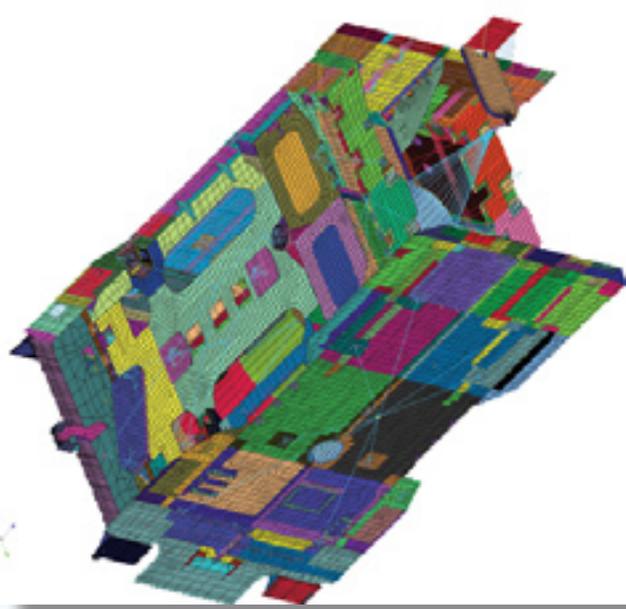
# Product Uplink

management of SITs, is made easy with the use of the SatNet NetManager™.

The Advantech multi-mode connectivity offering revolves around taking the DVB-RCS standard and evolving it one step further. The Advantech multi-mode approach delivers open standard benefits to fixed and mobile users. The S5420 VSAT terminal has the ability to be reconfigured between DVB-S/S2/TCC (SCPC) and DVB-RCS (MF-TDMA). Multi-mode operation brings an extra dimension to networks where the need for SCPC connectivity is frequent within the population of terminals but occasional at the individual terminal level.

The hub provides the forward link DVB-S2 modulated service to the multi-mode terminal using the standard DVB-RCS forward link. The return link operates typically in DVB-RCS mode but can switch to a DVB-S/S2/TCC SCPC mode through the hub station NMS which provides centralized management of the system. The switching mechanism, on the return link, between the DVB-RCS TDMA system and the DVB-S/S2/TCC SCPC modes is customer controlled and can be commanded by the hub Operator.

The Satnet Multi-Mode solution, with its scalability and flexible mix of DVB-SCPC and DVB-RCS terminals, offers a highly cost-competitive solution for any size network. With the addition of the Mesh Overlay capability, Satnet offers a powerful network architecture that can meet the demanding requirements for virtually any application. 



Astrium E3000 satellite bus CAD presentation

## Taking Satellite Development To New Heights

by Tim Nichols, Siemens PLM Software

**Satellites play a crucial role in our lives, from global security and defense to local in-car navigation. On a daily basis we rely on them for telephone communication, television and radio reception, and long-range weather forecasting. Many of these satellites use operating platforms and payloads designed and built by Astrium, an expert in space applications for more than 40 years. Employing 15,000 men and women in France, Germany, the United Kingdom, Spain and the Netherlands, Astrium is a wholly owned subsidiary of EADS, a global leader in aerospace, defense and related services.**

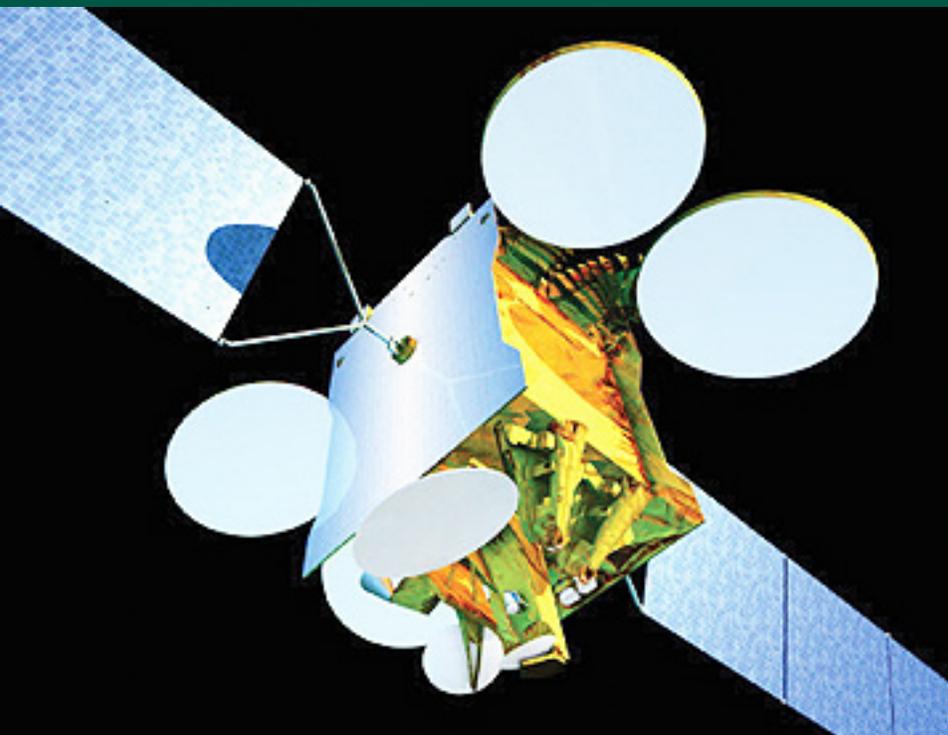
The wide range of equipment that Astrium designs and manufactures includes solar generators; highly stable yet lightweight structures; thermal management systems and components; guidance, navigation and control systems; antennas and reflectors; on-board digital processors; electrical, radio frequency and microwave equipment; sensors; and flight software. Simulation is key to the high standards of quality demanded for space applications, the cost efficiency required by customers and the timely delivery they expect.

*Glenn Harris*, structural analysis engineer at Astrium, explains, “We are always under pressure to meet development deadlines. A typical development cycle is one year and simulation represents six months of that.”

**Astrium** uses **Siemens Femap®** software finite element pre- and post-processor to optimize the simulation process within a concurrent engineering environment.

Quickly getting to grips with complex designs In particular, Femap is used for the creation and analysis of the **Eurostar** telecommunications platform. This is split into two main units — the *Communications Module (CM)* and the *Service Module (SM)*. The CM portion usually has structures unique to a customer’s requirements, whereas the SM portion is common to many of Astrium’s Eurostar range of satellites.

*Harris* points out, “This structure lends itself to being defined by separate Nastran ‘include’ files, files of both new and re-used model data for each region, which



## Arabsat 5a

joined together make up the full spacecraft design. Within each main portion of the satellite are numerous 'include' files for walls, floors, cylinders, cones and payload. The layers feature within Femap greatly aids work on developing and analyzing these 'include' files. Together with the use of the group function to identify nodes and elements in an area of interest, layers can be switched on and off to aid the understanding of complex regions."

According to *Harris*, the data table is invaluable when it comes to confirming the specification: "For instance, the spacecraft structure is largely held together by cleats, which are generally modeled as spring elements. It is important for model quality that the nodes at either end of these springs are coincident, in this case that the springs are zero length.

All the spring elements can be selected within the data table. By adding mass property, the lengths can be added into the table and then sorted to find elements that are not zero length. A group can be

made of these non-compliant elements for subsequent modification. The ability to add results to selections in the data table and to copy and paste this information into external spreadsheets has proved to be very useful."

## Easy Navigation, Modification + Import

The **Femap Application Programming Interface (API)** has been used to develop a program that first locates the separate 'include' files stored on the UNIX® file system, then assigns each file's model data to a unique layer that is identified by its filename. This simplifies navigation through the model and means work can easily be done on separate layers. A file can be imported and modified and any changes made to the model can be retained in the appropriate layer. When the file is exported, the update applies only to the relevant 'include' files.

**Siemens' VisView®** software is used within Astrium to view **Catia®** software **VPM (Virtual Product Modeling)** CAD data. An API routine is used to construct a model hierarchy in the same fashion as opening a file in VisView. This allows the user to navigate to the chosen item and then import the CATIA V4 or V5 model directly into Femap using the API.

Over the course of a project, this can reduce many hours of searching for files. API routines that facilitate modeling include one that creates multiple springs from single springs created by the Femap closest link command. Another routine enables the analyst to check that the rigid elements used as offsets from plates are orthogonal to the local coordinate system, which is required to avoid mechanisms. Yet another routine finds empty node and element numbering ranges in the model and writes this information to the data table. This allows additional modeling to be included with unique numbering.

Using a routine that creates centerlines from sections imported from the CAD viewer, VisView enables the analyst to quickly locate heat pipes in the satellite main walls and floors. These locations are then used to define the panel mesh required. Working with solid mesh would require too high a mesh density for adequate results so this is avoided using the mid-surface function that efficiently creates sheet parts from imported solid CAD data. Individual dimensions can be transferred from VisView in the form of copied text, which is then referenced from the *Windows*® Clipboard program by an API routine to generate a Femap point.

The spacecraft mass distribution is applied to the model from a spreadsheet containing a standard Eurostar mass report. An API routine creates new worksheets by breaking the data into regions of point masses (**CONM2**) and non-structural mass (**NSM**) to be spread over elements. A second routine obtains initial mass and area data from the Femap model, uses the NSM information and updates the Femap model to match the new mass data.

*Harris* describes the way in which Femap saves time during the post-processing of Nastran® software files — “When we check models for strain energy we may find nodes outside of acceptable limits. We can quickly format these into Femap program files to create groups, which allow us to identify and correct the problems. We can view mode shapes and use strain energy contours to understand the nature of a structure and here the transparency function is very useful for looking inside a model. Spreadsheet CSV results files can be read into Femap from in-house Nastran post-processing programs. These sort and provide margins of safety for the numerous load cases run on the spacecraft model.”

## Concurrent Design, Analysis + Simulation

Astrium uses Femap extensively for the iterative process of creating, checking, and viewing models, processing model results, and exploring alternatives.

*Harris* notes, "Having the ability to open several model databases at once allows a copy-and-paste approach to be employed. We can quickly generate new models by copying selected features from existing models. We can also copy and paste images and text into other documents and this speeds report writing."

All the assistance that Femap provides *Harris* and his colleagues boils down to one imperative. "We are working towards the date of the customer design review when we have to demonstrate a fully loaded design and prove the reserve capabilities," says *Harris*. "Within this timeframe we have an initial requirement to deliver the completed model to the prime contractor for dynamic analysis for spacecraft/launch vehicle compatibility. The model will also be used by the Stress Department for static loading analysis to prove the design. Ideally we do not ever want to redo an analysis, but we often have to assume what the design is before it is actually defined and if a design has changed we may need to iterate."

The Y wall is one of the most complicated areas of the platform with many heat pipes (both internal and external), floors, equipment and strut interfaces present. Because there are so many fixed interface points this necessarily results in a complex mesh. "At the moment, model development typically takes six

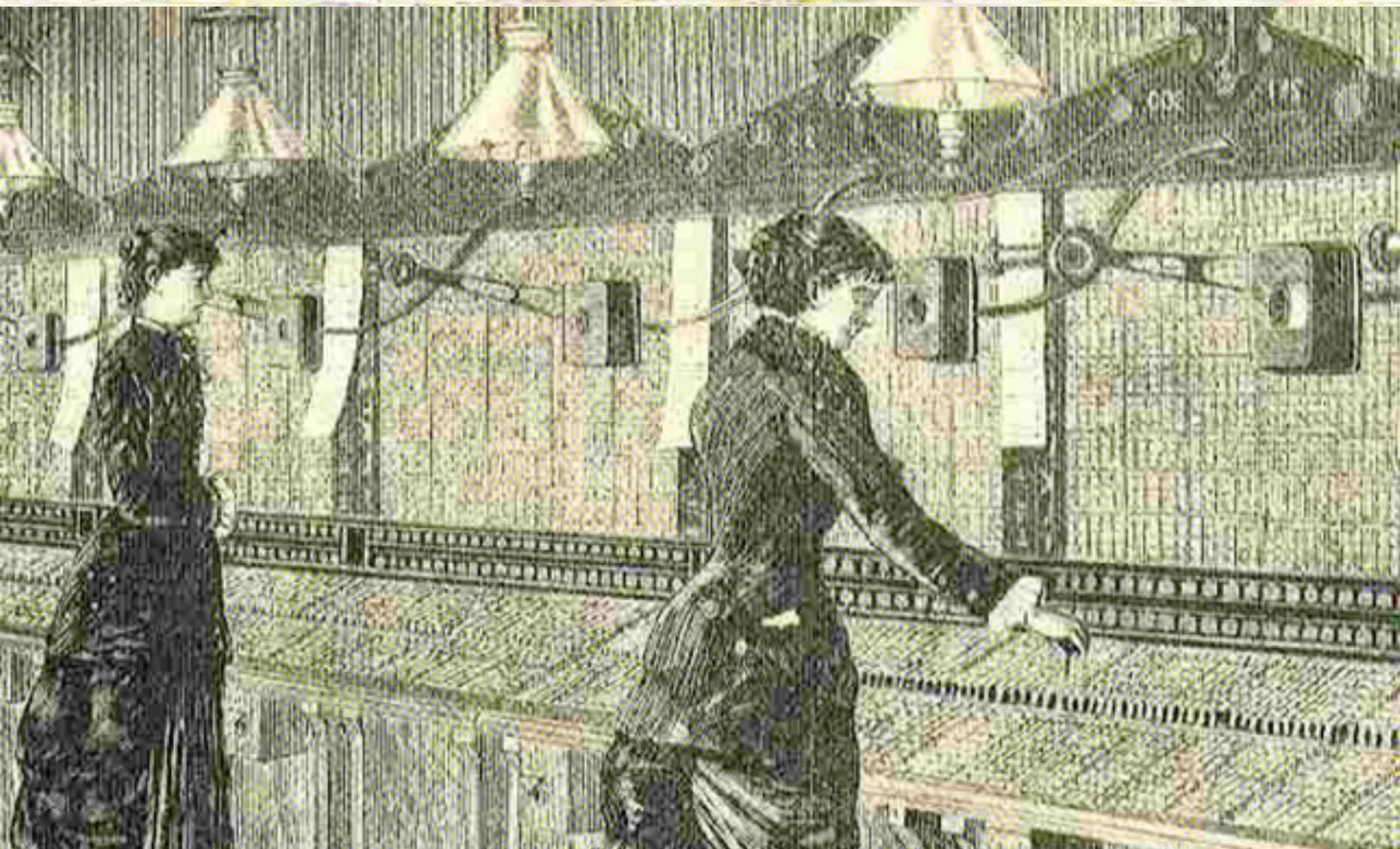
months within an overall analysis process of one year," says *Harris*. "Our goal is to use Femap and its API to eventually automate this process, reducing the time by half through the use of templates, automation and improved access to CAD information." 

### About the author

Tim Nichols is the Managing Director, Global Aerospace & Defense Marketing, for Siemens PLM Software. He coordinates the efforts of a worldwide cross-functional group dedicated to the Global Aerospace & Defense Industry, including commercial and general aviation, defense and space systems, as well as shipbuilding, and related government agencies across the globe. Nichols has more than 30 years of experience in aerospace and defense with several major A&D Original Equipment Manufacturers (OEMs) spanning product management, marketing, new business development and business general management, including nine years of active duty with the U.S. Navy. He is a graduate of the U.S. Naval Academy and also holds two graduate engineering degrees from the Massachusetts Institute of Technology in Cambridge, Massachusetts.







## Unlocking The Rural Wireless Market

*by Andrew Silberstein, Vice President and General Manager, Services, Globecom*

**Today, it's all wireless. Whether pointing a dish at the sky, making a 2G or 3G mobile phone call, or connecting to a WiFi or WiMAX hub, it's all about the magic of radio waves. And yet, until fairly recently, the three forms of wireless existed in separate silos, unable to make the connection.**



As urban and suburban markets have reached maturity around the world, mobile carriers are increasingly turning their attention to rural markets in the developed and developing worlds. This trend coincides with the realization among business executives that there is tremendous economic potential locked up in poor countries if we are just clever enough to find ways to unleash it. Individuals may have low incomes, but they value communications highly and their cumulative demand can be substantial. Just ask the people at Télécom sans Frontières, who began in 2004 to bring satellite phones to disaster areas and offer victims a free 3-minute phone call anywhere in the world.

Satellite technology has become one of the keys for unlocking the rural market. Taking the place of terrestrial circuits, it can link base stations in the most remote locations imaginable. The challenge has always been to make efficient enough use of costly satellite bandwidth to create a paying proposition for both customers and carriers.

That challenge is being met in deployments around the globe. It requires the latest in dynamic bandwidth allocation technologies as well as a great deal of expertise in making otherwise incompatible protocols play well together. But from the Caribbean to Alaska,

carriers are expanding their networks on a satellite backbone and using hosted services to cost-effectively augment their own infrastructure.

## GSM & CDMA Services In The US + Caribbean

Recently, a US-based mobile operator faced challenges in both domestic and Caribbean markets. In the US, the company wanted to extend its GSM coverage to areas with no backhaul infrastructure or affordable switching solution. In the Caribbean, they need to expand a CDMA network while finding a more cost-effective way to handle backhaul and switching.

For both problems, the answer was **Globecomm's SatCell**. We provided satellite-linked base stations that connected through Globecomm's teleport in Hauppauge, New York, to our state-of-the-art mobile switching platforms. Without major capital investment, the operator is now providing new subscribers with GSM and CDMA services, with 2G service and 3G capabilities including voice, voicemail, SMS, MMS, GPRS/EDGE, UMTS, prepaid and post-paid service, E911 Phase 2, CALEA — the list goes on and on. When these GSM and CDMA subscribers hit this operator's network, they are switched by us, but the revenue flows to the operator.

## Digital Services In Rural Georgia

The business model that works in the Caribbean also works in rural Georgia. Many rural areas in the US are served by local carriers who face the challenge of keeping up with the digital revolution without the deep pockets of a national company. We helped one carrier there, which had a successful TDMA business and a GSM license, to start tapping roaming revenues.

The high costs of a new GSM switch and gateways, plus the regulatory requirements affecting them, were high barriers to entry. My company was able to put them into the GSM business by hosting them on our state-of-the-art GSM core switch and providing both terrestrial fiber and satellite connectivity to our teleport. In addition

to the full digital capabilities of their hosted GSM network, the carrier now has a cost-effective forward path to LTE, the emerging wireless broadband standard, without the need to replace switching infrastructure in the future.

## Bringing Mobility To The Village

In 2006, Alaska's leading integrated communications carrier set out to create a level playing field for its customers, whether they live in the state's coastal cities or deep in its rugged interior. It was a striking vision: a single high-capacity, IP-based network serving all of **General Communication's** (GCI) subscribers and capable of supporting the advanced data and video technology emerging from the laboratories of industry leaders such as **Ericsson**.

We were asked to build a rural network serving 200 rural villages. Many of these sites are accessible only for six months of the year due to freezing temperatures and heavy snowfall. Bringing electricity to them, and keeping equipment warm through outages, were major issues. So was their location near the Arctic Circle. Satellites in GEO orbit have a tough time reaching so far north because of the curve of the earth. GCI's service area was right at the limit of territory that can be served via satellite. In fact, our planning assumed that the network would go down from time to time — which does not comply with FCC E-911 regulations, nor maintain the all-important connection to the cellular *home location registry* (HLR) that authenticates roaming subscribers.

The solution took a new approach to base station design. We used software-defined radios that could receive firmware updates through the satellite link, saving countless service calls. We equipped each base station with its own IP media gateway and HLR. The effect was to create a distributed switching system, in which each base station operates independently as well as interfacing with the core switch in Anchorage. If the satellite link goes down, local service continues, not only for those who make that area their home but also for

roaming visitors. When the satellite link comes back up, the local media gateway restores long-distance service and re-synchs to the HLR at the core.

In rural markets, communications can be more than a matter of convenience. One village customer of GCI went out hunting on his snowmobile, only to have it break down. The temperature was 30 degrees below zero and he was an hour's walk from town. But he was able to call a friend who brought him a replacement part on another snowmobile. It probably saved his life.

## Wireless IP In Paradise

For one of the largest mobile carriers serving the Caribbean and Central America, we have long functioned as their "satellite guys." We have placed SCPC terminals for international traffic into islands and small national markets throughout the region. But as the company expanded into countries with a bigger geographic territory, we suggested to them that SCPC was no longer the most appropriate answer. We proposed, instead, an all-IP demand-assigned TDMA network design. The reason? SCPC uses fixed-capacity links, which can be a poor match for the dynamic bandwidth usage of a mobile network. Switching to demand-assignment would sharply reduce bandwidth requirements.

The company was not thrilled at the idea, as they had experimented with a TDMA design from another company. The results were bad enough to make them swear off any technology but SCPC for satellite backhaul.

We persisted — putting a satellite link into the middle of a city to handle all the traffic from a terrestrial network is a perfect SCPC application. But if satellite is serving base stations in remote locations, trunking E1s is grossly inefficient; there are only a few peak hours a day when you get your money's worth from the link.

Eventually, we persuaded them to try it. The results were two all-IP C-band networks in Central America,

capable of voice, SMS and 3G data to the in-country hub, which would continue to use SCPC for the aggregated international traffic.

The design was actually a hybrid. In a TDMA design, the remotes share a pool of satellite bandwidth with the hub. This saves money and provides great flexibility. However, there is always the possibility that one or two of the circuits will get really busy and soak up most of the bandwidth, starving the other remotes. We designed the system to allow the customer to remotely reconfigure any remote to an SCPC circuit. If one part of the service area is spectacularly successful, it would not bring down the whole network.

Serving rural markets does, indeed, have its challenges. Reaching some sites in Central America required travel in a chartered plane and canoe, with a long walk at the end. At one site, our engineer was riding shotgun with a Cessna pilot when the plane overshot the runway. It went crashing into bushes and trees and stopped just ten feet short of a river. Our man was injured. What was he going to do? No plane, no hospital — ended up he and the pilot hiked one hour to the site, completed the installation and waited until the next day for a plane to pick them up. We were extremely glad to get him back in one piece. 

### *About the author*

As Vice President and General Manager of Globecom's Services business, including cellular and global IPTV services, Mr. Silberstein plans and executes growth strategies, engages in strategic business development, as well as sales and execution of the company's on-going service contracts.



The Global VSAT Forum is escalating a global effort to have public money earmarked for SATCOM projects. The opportunity has its roots in an international effort to bridge the “digital divide”; an increasing number of governments have established *universal service funds (USFs)* in which billions of dollars are now deposited for use in supporting communications projects. However, allocation of those funds is often delayed, or governments are unaware of the unique role that SATCOM services can play in enabling USF-supported projects.

GVF has already taken action with respect to this opportunity. In July of 2009, GVF hosted a summit for USF directors with the *Commonwealth Telecommunication Organisation*. The event was held in Lusaka, Zambia. Directors of USFs from six African nations attended the meeting. The event was made possible through a GVF partnership with the *US Agency for International Development (USAID)*. GVF has also been conducting bi-lateral meetings with other countries to explore their intentions with respect to USFs, and ongoing USF dialogues are currently underway in the Caribbean, Australia, Vietnam, and elsewhere. GVF is inviting broader Membership participation in the following areas of the USF Initiative:

- » *A white paper has been drafted by GVF legal counsel, Squire, Sanders & Dempsey, that provides background and insights into how GVF Members may approach the USF opportunity.*

- » ***The GVF Regulatory Working Group is developing USF Guidelines that will offer consensus-based policy guidance to USF directors. As many USFs are administered by regulatory agencies — and in view of the enabling role of effective regulatory reform — this will be modeled on the GVF Satellite Regulatory & Policy Guidelines, which have proven to be a very effective document among national administrations and inter-governmental groups.***
  
- » ***Complementary policy papers are envisioned on specific regulatory questions related to USFs, such as the importance of technological neutrality or the issues related to partnerships with foreign service providers. These and the aforementioned USF Guidelines will be used to build capacity in the regulatory community and to promote regulatory approaches that enable more successful mobilization and application of USF-supported satellite communications solutions.***

The **GVF Regulatory Working Group** welcomes broader participation from Members. The next steps for the initiative were discussed during a conference call that occurred earlier in April.

For details and to obtain a copy of the *USF White Paper*, please contact the GVF RWG Chairman, *Matt Botwin* at [mbotwin@regentsquaregroup.com](mailto:mbotwin@regentsquaregroup.com). GVF looks forward to including all organizations in this important opportunity. 

## ***BGAN Adoption Surges Across Multiple Markets***

*by Ian Canning  
V.P. Marketing and Product Management, Stratos Global Corp.*

**In just a little more than four years, adoption of Inmarsat's BGAN broadband mobile satellite service has surged to more than 30,000 activations across multiple vertical markets. In nearly 200 countries, prominent media organizations, military agencies, first responders and other remote professionals have come to rely on the service for reliable, high-speed**

**communications in areas where terrestrial or cellular networks are damaged, congested, non-existent or too difficult to deploy.**



**Thrane & Thrane BGAN**



## Cost Control + High Security

To meet those objectives, customers carefully evaluate the value-added services from Stratos and other Inmarsat DPs. Within these offerings, customers seek tools to monitor airtime, restrict unauthorized usage and manage costs. The online **Stratos Dashboard** is an excellent example — the product provides real-time information on the amount of BGAN traffic used for voice and data, and the associated costs. Stratos Dashboard is fully automated and enables customers to activate SIM cards in minutes and modify service configurations in real time, as well as manage the consumption per user or groups of users.

Other popular value-added services provide firewall management, full traffic information, pre-paid facilities, high security options, easy VPN access, messaging services and full IP range.

To ensure security for BGAN services, customers insist on a personal firewall residing between the Internet and the BGAN network. This feature, of which Stratos Trench is an example, provides additional security and cost savings by blocking specific web traffic and applications via an online, user-friendly interface. It also allows customers to block access to streaming services which can prevent unwanted high costs.

## Broadcasters Cite Reliable Performance

Nowhere is the need for reliable remote connectivity and security more pressing than in the broadcasting market. The world's largest media organizations were BGAN's early adopters. Today, they continue to use the service for live broadcast and store-and-forward video clips from remote locations, or areas where communications infrastructure has been badly damaged. (BGAN was used extensively by major broadcast networks in Haiti, in the weeks following this year's earthquake.)

**Some of the world's largest media organizations use BGAN worldwide.**

This steady rate of adoption is gratifying for **Inmarsat** and its *Distribution Partners (DPs)*. Many of the world's largest militaries, federal governments and mining companies — in addition to elite broadcasters such as the **BBC, CNN, Fox News** and others — have established the lightweight BGAN terminals as easy to use and efficient to own for a wide range of critical applications.

To achieve this broad market penetration, **Stratos** and other Inmarsat DPs have expended a great deal of effort and creativity to address a variety of customer requirements. This includes bundling equipment and airtime with no capital investment, and offering starter plans with low usage allowances. Prospective customers also need the assurance that BGAN costs can be easily managed and that secure communications is guaranteed.

# Insight

The expanded use of BGAN in this market is coming in two areas. First, smaller broadcasters — including specialty sports, music and financial networks — now see BGAN as a viable alternative. They are drawn to BGAN by its relative affordability. They also appreciate that BGAN offers a number of options for delivery of traffic, including low-cost video codecs, which bypass expensive leased lines and deliver video back to their headquarters locations.

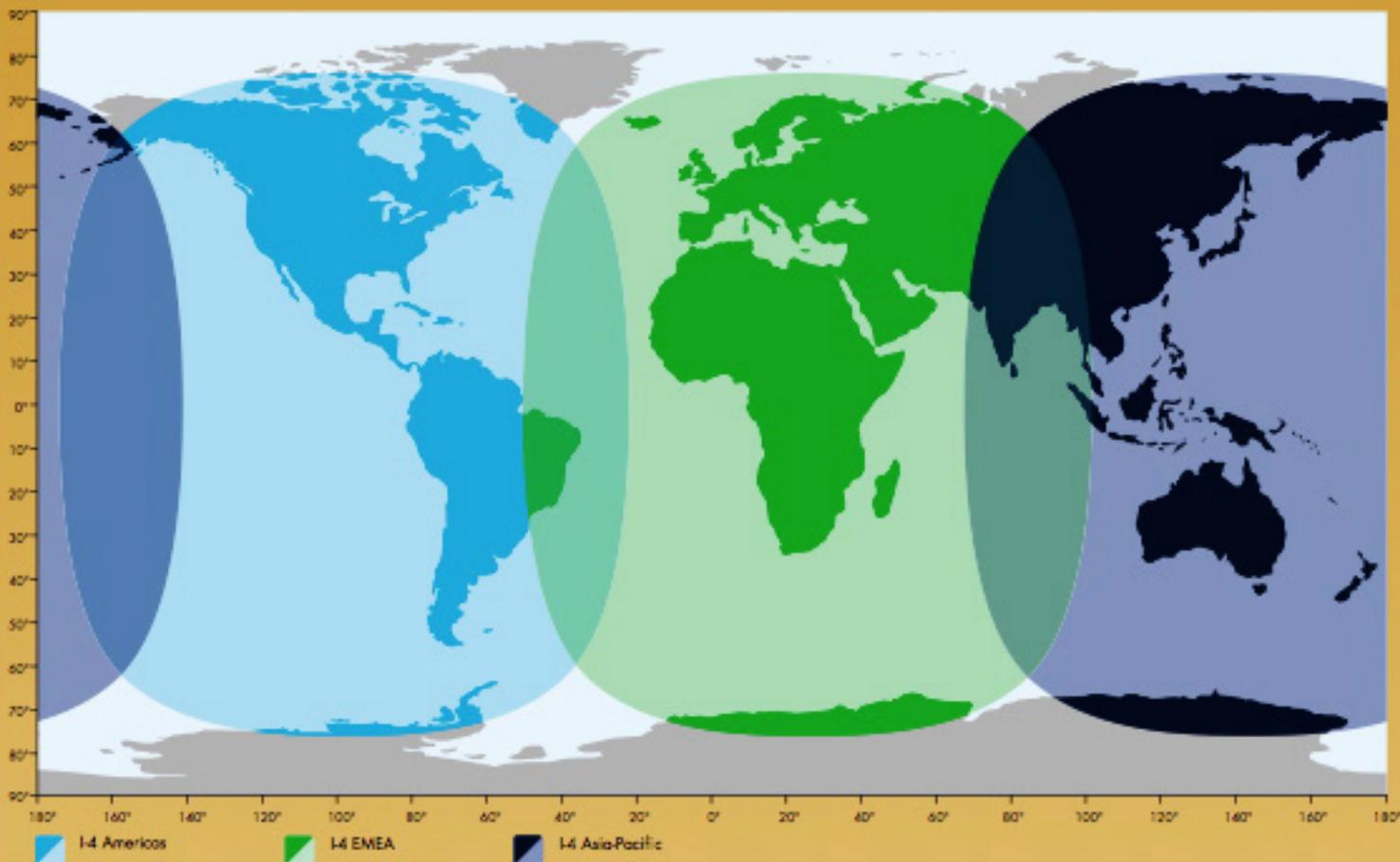
Also, affiliate broadcasters for the major networks have discovered BGAN's appeal. More than ever before, these affiliates depend upon BGAN as a portable, rapid-deploy solution. BGAN can be used

for broadcast in remote parts of their territories, or in situations where a VSAT truck is not available or cannot be physically deployed.

BGAN offers satellite communications in a form factor that is easy to deploy. It offers a reliable L-band solution that eliminates the need to coordinate VSAT connectivity, and provides the ability to be on the air in less than five minutes. BGAN is also unaffected by harsh weather conditions.

The premium **BGAN X-Stream** service, introduced early last year, offers a guaranteed minimum video streaming rate of 384 kbps, with streaming up to

## BGAN coverage



This map depicts Inmarsat's expectations of coverage, but does not represent a guarantee of service. The availability of service at the edge of coverage areas fluctuates depending on various conditions. BGAN coverage February 2009.

[inmarsat.com](http://inmarsat.com)



450 kbps expected under optimal conditions. In February of this year, BBC News deployed BGAN X-Stream from Stratos to broadcast live coverage of *Helen Skelton's* record-breaking Amazon River kayak journey to benefit Sport Relief. The deployment represented BBC News' first use of live 384 kbps video streaming from a remote location.

In August of last year, **BBC Northern Ireland** deployed **FleetBroadband from Stratos**, the BGAN maritime equivalent, onboard the tall ship *Bark Europa* to broadcast coverage of the final leg of the **Tall Ships Atlantic Challenge** between Halifax and Belfast.

For their time-critical data, the BBC, Fox News and other international broadcasters use **Stratos GuaranteedAccess** to extend guaranteed bandwidth from the BGAN terminal through to the terrestrial infrastructure to the broadcast centers. Stratos GuaranteedAccess is enabled by **StratosNexus**, a Stratos-managed **Global Core** network for traditional and IP-based services.

## Meeting The Connectivity Challenges For Remote Professionals

Reliability and cost efficiency have also helped BGAN become established as an ideal solution for remote professionals in the mining industry, where the need is growing rapidly for real-time information and "extended office" connectivity worldwide. Personnel in the field require fast, dependable communications with operation centers in order to meet operating requirements and maximize efficiencies.

In the mining exploration phase, teams of geologists venture out to remote locations, often well beyond the scope of fixed-line or cellular coverage. There they take rock samples and gather data via BGAN, which needs to be analyzed to see whether there are valuable mineral deposits in the area. If the decision is made to construct a mine, the mining company uses BGAN to establish a communications infrastructure within

minutes, expanding to aid the construction process until fixed-line communications are established.

During the construction phase, BGAN is being used to liaise with contractors and suppliers. The service also can be used for telemedicine applications in the event of accidents or illnesses, and for voice communications between workers employed on different parts of the site.

Creative applications, such as **Stratos ChatCard Data** service, can be used in conjunction with BGAN to provide an effective solution for personal calling – enabling the remote workforce to stay in touch with friends and family back home.

BGAN has been successfully deployed by Toronto-based mining company **Phoenix Geophysics**, where advantages include: the requirement of fewer people in the field; more efficient troubleshooting; faster transmission of data; and savings in transportation costs. In Australia, surveying company **Haines Surveys** is using BGAN with great success during the exploration phase. Haines undertakes geological surveys on behalf of clients in the mining industry.

## Creative Applications For Oilfield Services

The mining and oilfield-services markets have similar applications requirements. In both markets, the demanding connectivity needs of remote professionals must be met to ensure optimal corporate productivity. Satellite-based **SCADA** (*Supervisory Control and Data Acquisition*) systems enable operators to monitor, control, optimize and start or shut down assets and processes anywhere in the world, from central sites.

Most SCADA operators still must make trips to remote sites for maintenance purposes and for general inspection. As a result, most SCADA customers employ significant field labor forces who need to stay in touch, both from a voice and network perspective. BGAN is ideally suited to meet this remote-communications requirement, as it provides users with quick access to



## Many military organizations across the globe have adopted BGAN

email, corporate networks, Internet or voice. Its compact design, the size of a laptop computer, makes BGAN a valuable resource for system operators when they must venture out to their remote sites. Stratos and Inmarsat are also testing BGAN terminals as a fixed-site SCADA communication tool.

In addition, a number of BGAN terminals are undergoing rigorous testing to determine their capabilities in the general SCADA environment.

Among those now being tested is the Addvalue Ranger, which is specifically built for permanent outdoor remote unmanned SCADA applications. It features a ruggedized housing to withstand environmental challenges.

Another terminal being tested for SCADA use is the **Hughes 9201** BGAN terminal. In its SCADA configuration, the rugged 9201 can be coupled with a pole-mountable option for use in outdoor environments.

## Military + Government Adoption Increases

The advent of ruggedized terminals has also helped spur BGAN adoption by some of the world's largest military agencies. BGAN systems keep field commanders connected at all times, enabling them to access *command-and-control (C2)* systems and maximize the effectiveness of their forces. BGAN also features *Mobile Packet Data Service (MPDS)* that enables users to pay only for data packets transmitted and received.

BGAN systems provide advanced voice services, including **STU-III/STE**, **Brent** and **FNBBDT** compatibility for secure calls. Stratos goes the extra mile by installing a SecureComms gateway with NET shout technology into the BGAN network, for multiple secure voice calls. The service supports up to 10 seconds of satellite delay — which is critical to ensure secure-call reliability.

BGAN systems also provide broadcast-quality transmissions for e-mail, file transfer, Internet access and video teleconferencing. These capabilities enable

battlefield commanders to maintain true, mobile-office connectivity wherever they travel. This helps maximize the utility of key officials by enabling extended travel and mobility without decreasing their day-to-day effectiveness or readiness status.

Overall, military users are in the midst of a paradigm shift to IP-based satcom solutions. The new Inmarsat mobile broadband services, such as BGAN and FleetBroadband, helped affect this shift by ensuring end-to-end, IP connectivity with high information security and encryption.

Commanders appreciate that leading Inmarsat DPs such as Stratos have the terrestrial-connectivity capabilities to bring secure communications into the heart of military operations, regardless of whether they are in the USA, UK or Australia. To demonstrate the importance of offering leading edge technology to military agencies, Stratos recently signed agreements to distribute ruggedized BGAN terminals from **ViaSat** and **Harris**. These provide customers with an affordable, high-performance military-rugged satellite solution.

On the civilian government side, perhaps the highest-profile BGAN deployment was by the *Brazilian Electoral Superior Court (TSE)*, which recently used a 1,200-site BGAN network to support municipal elections. Stratos channel partner Tesacom was selected by TSE to deploy and operate the BGAN network at voting precincts in rural communities nationwide.

The BGAN systems quickly transmitted encrypted electoral results from local precincts to TSE's headquarters in Brasilia. The systems also supported voice and high-speed data connectivity for elections officials at the precincts. During the deployment, nearly 500 BGAN terminals achieved simultaneous data transmission on a single spot beam from Inmarsat's I-4 F2 satellite. As part of this service offering, secure transmission of election results was ensured via the

**Stratos BusinessAccess** dedicated private network over a VPN.

These case studies demonstrate the broad appeal of BGAN across multiple business and government sectors. Customers feel confident investing in a service that is accessed globally on the **Inmarsat-4 (I-4)** satellites, which are among the world's largest and most advanced. The I-4s were designed with IP communications in mind, and are optimized to deliver high-quality and reliable data communications.

For those who require broadband connectivity anywhere, anytime, BGAN has become the industry standard. Witnessing such a high rate of BGAN adoption is truly gratifying. For Stratos, the ultimate challenge is to continue providing solutions that make BGAN easy to use and affordable to own.

### *About the Author*

Ian Canning is Vice President, Marketing and Product Management for Stratos Global Corp. He has more than 25 years experience in the global satellite communications and telecommunications industries. Mr. Canning is



responsible for all marketing and product management functions for Stratos' entire line of mobile satellite services, including its industry leading value-added services known as The Stratos Advantage. His responsibilities include all of Stratos' key vertical markets, including maritime, land mobile, aviation and government. He can be reached at [ian.canning@stratosglobal.com](mailto:ian.canning@stratosglobal.com).

# TV Playout & Distribution



# SatBroadcasting™

## 20:20 VISION: Advanced Playout

by Malcom Campbell

Commercial Director, Broadcast Services (EMEA), Arqiva Satellite & Media

**“In recent years broadcasters have had to rethink their playout strategies as consumers have demanded increasing volumes of video content, in more formats, to an increasing array of devices.**

**With on-demand increasing in popularity in recent years, the challenge is also about ensuring that content is available as and when consumers want to view it. For broadcasters, used to**

**playing out linear channels to a handful of platforms, the new multichannel, multi-platform environment has meant revisiting both the business and delivery models. Success will require flexibility and collaboration between broadcasters and broadcast services providers to ensure that consumers are provided with the content**

**they want, on the platform of their choice.”**

The last decade has seen a revolution in viewing technology, and the pace of change in both consumer devices and broadcast technology is likely to accelerate. For broadcasters, used to playing out linear channels to a handful of platforms, the new multichannel, multi-platform environment has meant revisiting both the business and delivery models. Broadcast services providers have also had

to develop new offerings that enable their clients to deliver content to multiple platforms, devices and, increasingly, create bespoke packages for specific regions or territories.

Barrie Woolston, Commercial Director, Arqiva Satellite & Media, explains that only by understanding how consumers will consume video in 2020, can broadcasters

# SatBroadcasting™

ensure that they don't miss out on future revenue opportunities. To do this, they need to work closely with their broadcast service suppliers to develop a next generation playout strategy that provides ingest, encoding, compression and packaging of linear, non-linear and on-demand content for distribution to the consumer.

## Today's Broadcast Environment

The changing broadcast landscape in recent years has forced broadcasters to rethink their entire infrastructure, content and business strategies as consumers have demanded increasing volumes of video content, in more formats, to an increasing array of devices. With on-demand increasing in popularity in recent years, the challenge is also about ensuring that content is available as and when consumers want to view it.

As a supplier of content services to broadcasters, **Arqiva** is able to obtain a close up view at what broadcasters want to do now. Increasingly, the Company is being asked to anticipate the future broadcast landscape to ensure that systems are being developed broadcasters will need — not just next month or next year, but five years from now, as well. This puts Arqiva in a real position of responsibility, but also enables us to provide an insight into what the broadcast industry will look like in 2020.

This article will focus on the two areas that will undergo radical change and which, Arqiva believes, will converge: playout and asset management. As well as being two areas of radical change, we also believe that they will be the key to successful management of future broadcast services.

Why? Because some of the main drivers affecting how broadcasters distribute content reveals such is the case. They include...

- » *The continuous search for new revenue streams.*
- » *A need to reach wider audiences, and, in many cases, with global reach will be required.*
- » *An increased number of viable delivery mechanisms.*
- » *Accelerating the search for efficiency and cost-effectiveness.*

## The Broadcast Environment Of The Future

To see how the broadcast world has changed, it is interesting to think about a typical channel on a large satellite network, such as **BSkyB** in the UK. Five years ago, most of these channels would just have been on the Sky DTH platform with no streaming web presence, and mobile TV considered as something for the future rather than a must-have viewing platform. Even the largest and best-funded channels would have been deployed on a maximum of three delivery mechanisms, with DTT and cable in addition to BSkyB's satellite network.

Today, most channels will be streamed live on the web, and many channels are looking to distribute their output to other territories, generally via satellite, to serve either niche content audiences or expatriate communities in other countries and some broadcasters are planning for the near future when Ethernet-enabled set-top boxes (STBs) provide exciting new interactive revenue streams and open up truly global audiences.

At the same time as this increase in complexity has occurred, broadcasters have also been looking very closely at cost-cutting and efficiency. Arqiva see this as a trend that will continue and, it's our belief, that this will mean that only the larger media groups will be able to cope with the cost and complexity of implementing the new systems, and the impact it will have on the culture

of their organizations, required to take advantage of the new broadcast opportunities of the next decade.

That's not to say that smaller broadcasters can't take advantage of these opportunities but they will simply choose to outsource their playout and distribution, rather than building their own infrastructures. This makes it imperative that remote systems are designed that allow channel owners to outsource playout, workflow and asset management without any loss in control and functionality.

As Arqiva peers into the future, noted is a mega trend that will affect every decision facing a broadcaster: the increasing fragmentation of broadcast audiences — both by territory, platform, and demographic — leading to pressure on broadcasters to provide content in multiple formats to protect [or take advantage of] advertising and subscription incomes and build new businesses in previously un-served territories.

In this environment, broadcasters with access to content that people want to consume will increasingly use the following measures to increase revenues:

- » ***Increase broadcast viewership by increasing the number of territories and languages served through broadcast distribution.***
  
- » ***Get much smarter about how to make 'new' content using existing footage — and do this at minimal cost.***
  
- » ***Increase the number of distribution methods through over the top (OTT), mobile, etc . [growth of these products is expected to increase 55-fold between 2008 and 2014, reaching 58 million ].***

# SatBroadcasting™

- » *Integrate web commerce with broadcast and OTT distribution*
- » *Protect and build channel brand awareness throughout all distribution methods and territories served*
- » *Increased use of IP throughout the content chain to increase flexibility and reduce costs.*

## Integrated Content Management + Playout

Increasingly it's important that broadcasters and their suppliers take an integrated, holistic, view of playout, asset management, and the workflow systems that link them. Only by having fully integrated systems can broadcasters take full advantage of automation to reduce costs and increase flexibility.

Arqiva has developed a workflow system where content is ingested as early as possible and kept in a digital state as it is managed, manipulated, stored and distributed. Workflow tools then enable end-users to create jobs or tasks on the central workflow system and to manage, track and monitor the customer content through these tasks. Broadcast software and hardware tools then enable the manipulation and delivery of pre and post-production media between national and international content owners and their agents, and ultimately the automated playout system that is also controlled through the integrated workflow system.

Workflow and Broadcast Tools provides an efficient means for broadcasters to exploit and manage their content through a number of efficient working practices. These include: ingesting once and using many

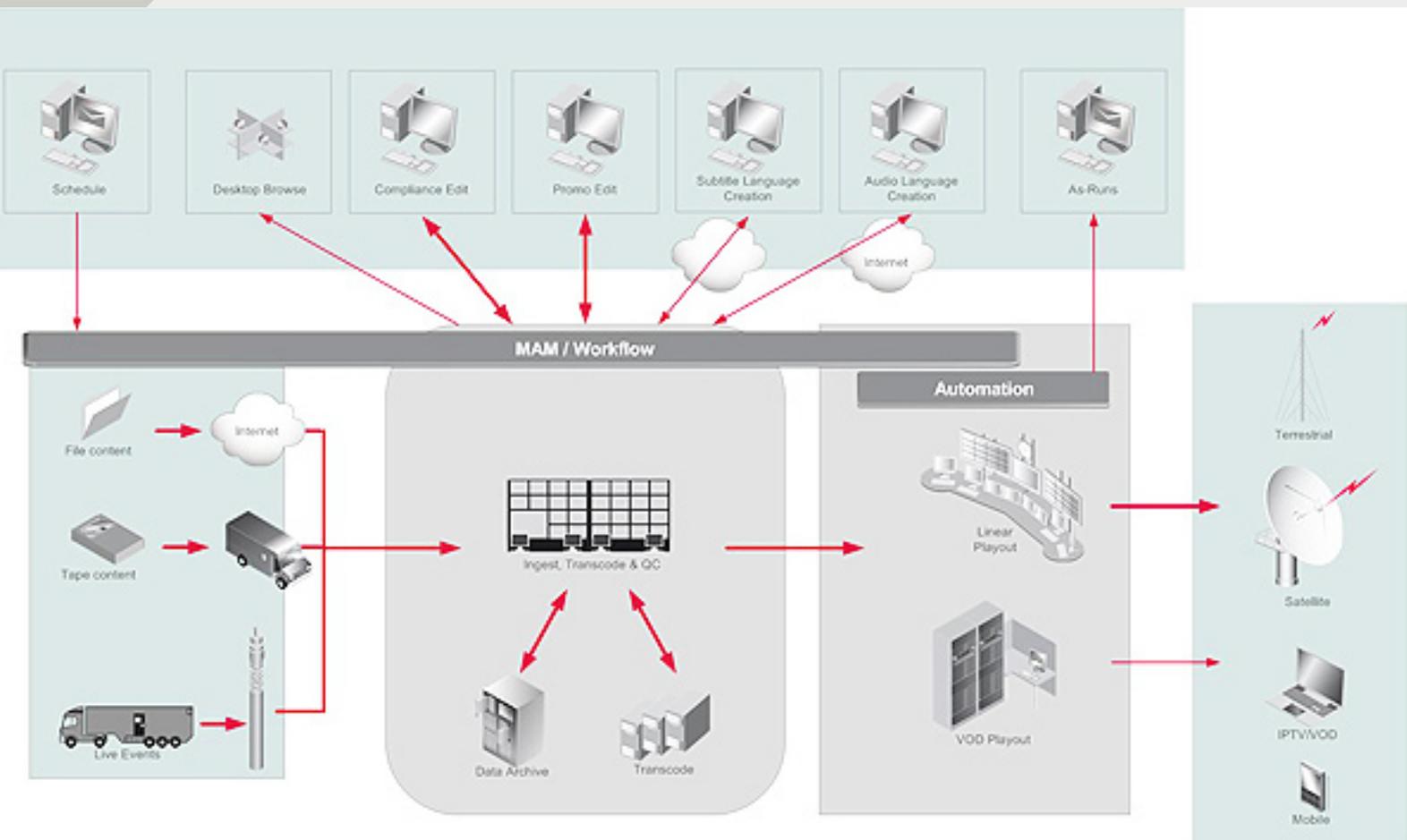


Figure 1: Overview of an integrated workflow

times, repurposing content for different platforms and reversioning content to reach new audiences.

These tools also lead to increased revenue possibilities and provide greater control and visibility of workflows. This reduces turnaround time and makes putting content on air easier. And, as the number of platforms, content formats, distribution networks and language variations that are required to satisfy as many TV consumers as possible increases for each asset – as analysts predict it will in the coming decade - being able to simplify the workflow needed to deliver multiple outputs of each piece of content will become critical.

Arqiva's approach is to build in intelligence to a workflow is through the channel's *broadcast management system (BMS)*. Workflows are built and saved as presets within the workflow system. The BMS issues workflow requests (jobs) which are actioned by the workflow system with status information, updates and media information exchanged.

## **Ingest and Quality Control**

**(QC):** content is delivered as tape or a file and is ingested to electronic high resolution and low-resolution 'browse' (also called 'proxy') copies, stored on the content server. QC is carried out, both automated and human checks. All assets can be browsed frame accurately in low resolution, from which the customer can remotely

produce an **EDL** (*Edit Decision List*), with a copy saved for compliance, repurposing and promo production purposes. The EDL is used to generate the high resolution media. Where necessary, the customer can remotely browse the content and forward over an IP link to an external audio houses to prepare new language tracks. The workflow is also designed to handle the receipt of the language track from the audio house and

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use data tags to ensure the correct language version is played out correctly at the end of the process.

The final broadcast ready content is stored until the transmission date, when the workflow system passes the content for playout, after which it is purged, or stored until played again or reversioned.

## Remote Playout

*Remote Playout and Distribution (RPAD)* will be a critical consideration for broadcasters looking to deliver fully tailored television to multiple audiences speaking different languages across many regions and time zones.

The unique advantage of RPAD is that it allows a channel to be customized at the point of delivery to meet the exact requirements of a local audience, content owner or advertiser, including content replacement, tailored branding, time shifting and localized advertising, subtitling and voiceovers. Content is centrally stored in a secured main playout server, from where each tailored version is delivered through a managed IP network to the appropriate remote playout device for fully managed local broadcast. This will undoubtedly create new revenue opportunities for broadcasters/content owners through the sale of linear spot substitution advertising as a result of being able

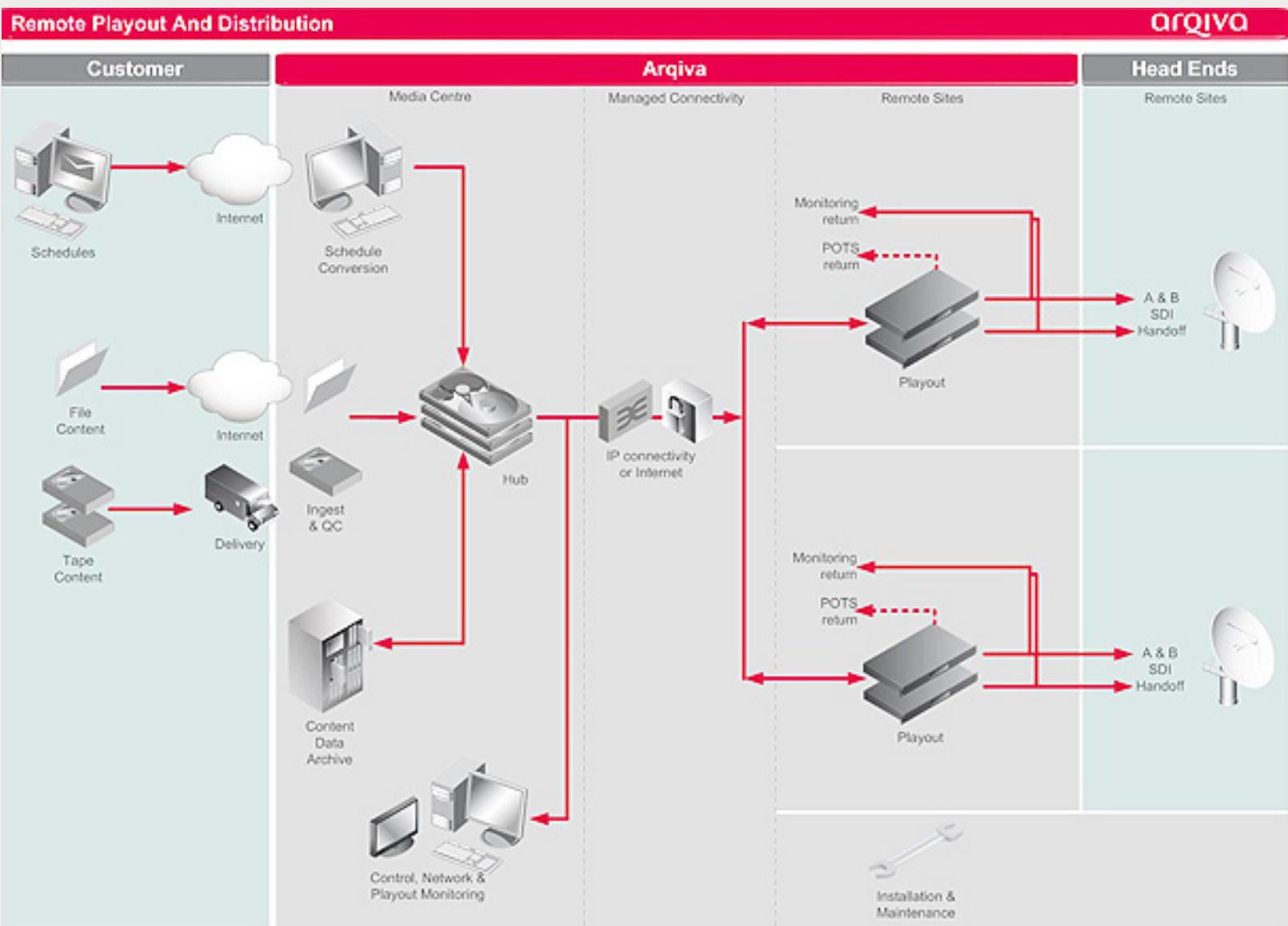


Figure 2: Schematic of typical operation of Arqiva RPAD

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to provide an increased number of eyeballs for each content asset. It will also enable advertisers to more accurately target demographic groups – making TV an increasingly attractive media.

## Playout – The Next Steps

Arqiva believes that there are a number of key technologies that will need to be developed to help broadcasters to tackle the opportunities – and challenges - that the market will present over the next 10 years.

That said broadcast services companies, including

Arqiva, are already looking at these critical issues in order to provide advanced playout solutions to broadcasters that will help them take advantage of the nexgen of broadcast opportunities.

Key focus areas for the Company as it moves toward 2020 include...

- » **Using IP connectivity to enable customers to choose which workflow elements they control directly**

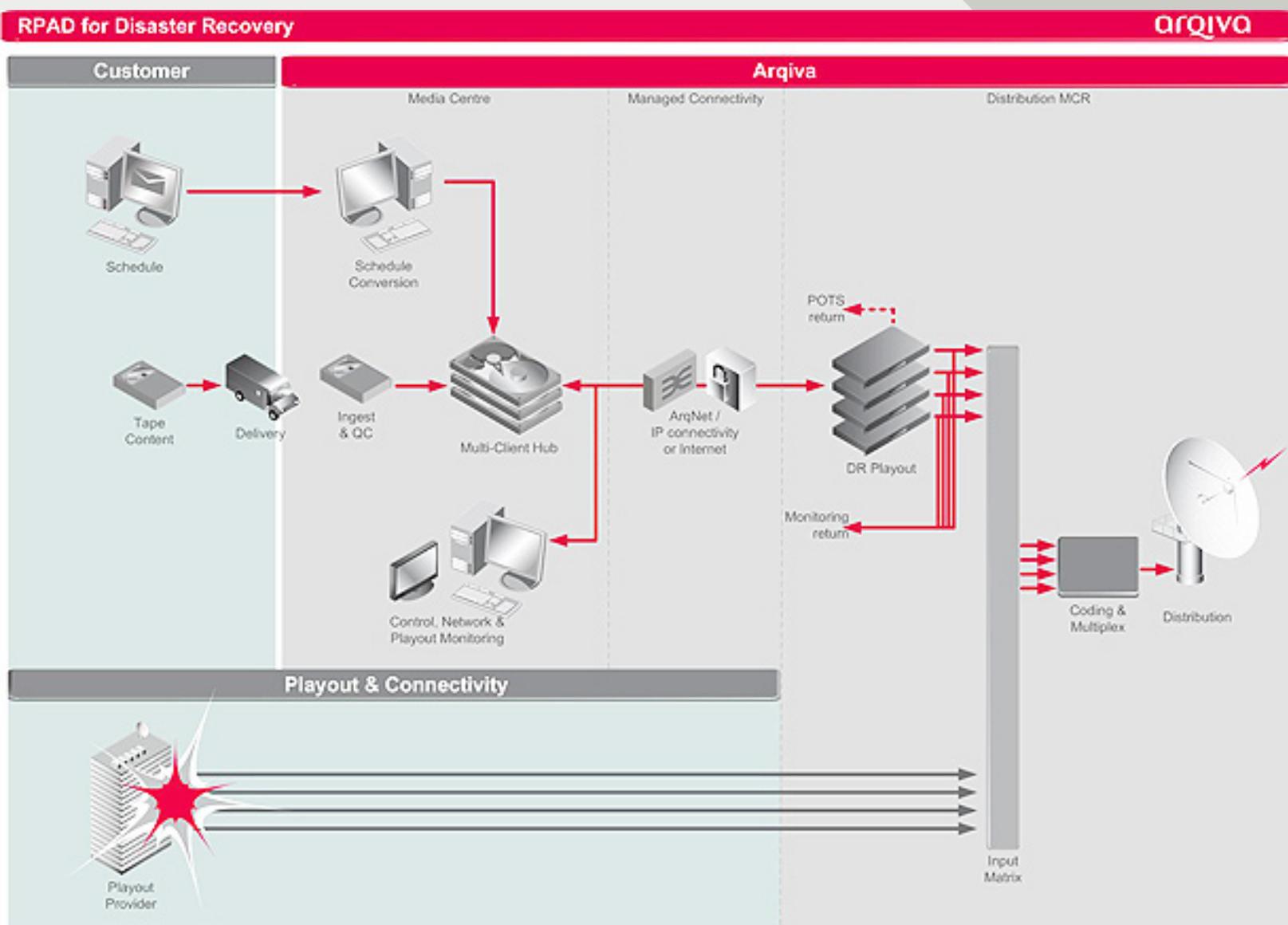


Figure 3: Typical use of Remote Playout and Distribution for disaster recovery



Arqiva London Docklands Teleport

» *Using IP networks to receive programming, graphics, advertising content, schedules, and so on.*

» *Providing an integrated workflow to control every aspect of the post-ingest content chain*

» *Providing disaster recovery and business continuity over IP networks (RPAD is ideal for customers looking for cost-effective disaster recovery)*

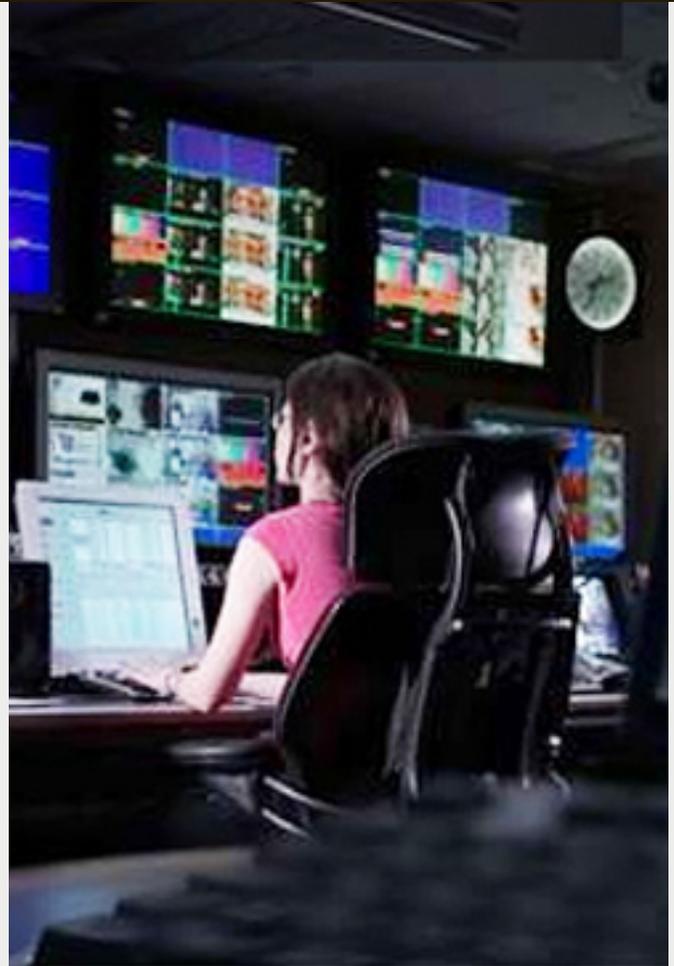
## **Ignore The Trends + Perils Await**

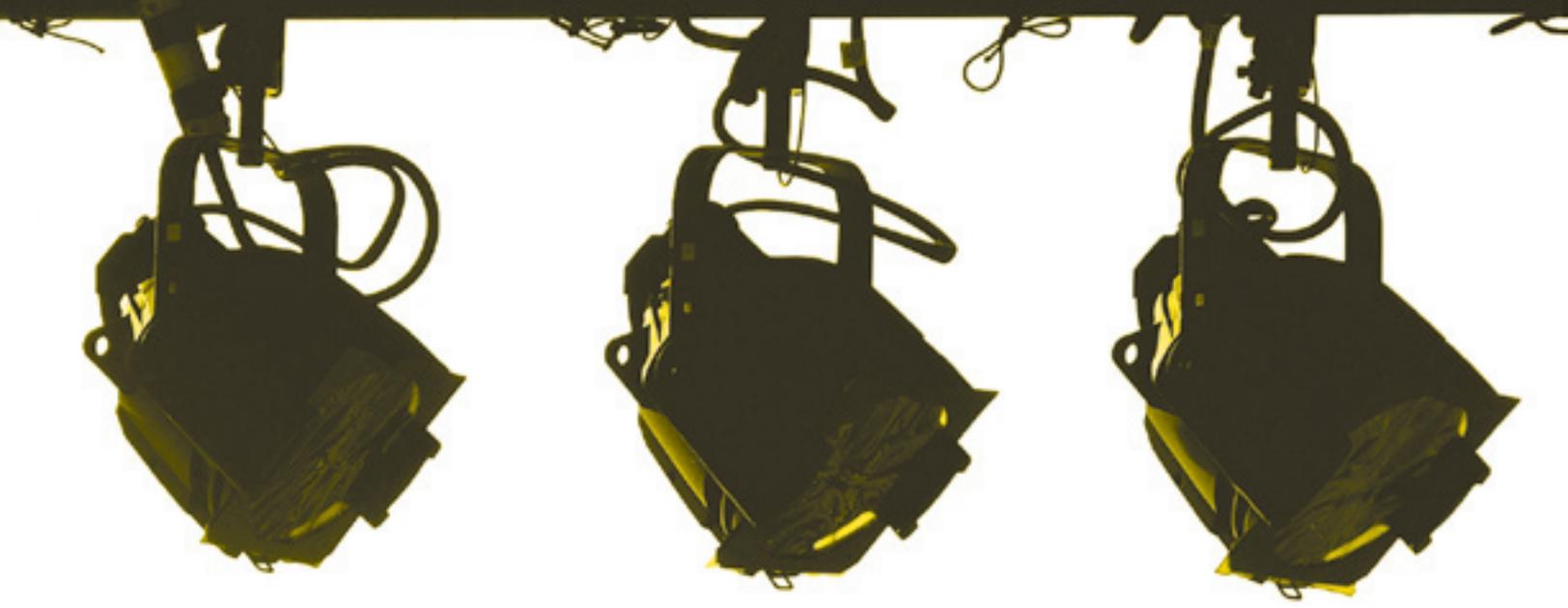
Greater complexity of content distribution is a near certainty for broadcasters with good quality content that is popular in more than one country or region over the next 10 years — you only have to look at how the landscape has changed in the last decade to see how much broadcasting has changed in this time. Broadcasters will be seeking solutions that enable them to handle increased complexity with a minimum of CAPEX expenditure, and without needing to hire additional staff.

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Simultaneously, these channels will need to ensure that channel branding is maximised across all Asian territories and an increasing number of distribution methods. Solutions such as RPAD ensure that broadcasters can handle multiple languages and territories from a single point. Such solutions will become increasingly important as more and more broadcasters need to retain control while outsourcing equipment and services.

As a result, the broadcast industry will increasingly see outsourcing, remote control, importance of channel branding and the need for flexibility to support new business models. Companies that provide services and solutions to channel owners will ignore these trends at their peril — while those that understand and prepare for these inevitable trends will prosper. ↷





# *Executive Spotlight*

*Martin Coleman  
CEO, Coleman–Spice*

*Martin Coleman started Colem as a satellite and broadcast engineering services and design consultancy. His next step was to create high quality Network Management Systems. At IBC, he announced a new company, Colem-Spice, formed by the union of Colem and Spice Design, long-term business partners. He was recently appointed Chairman of SUIRG's Carrier ID Video committee.*



*SUIRG (Satellite Users Interference Reduction Group) is a global industry organization dedicated to combating the increasing and costly problem of satellite radio frequency interference.*





## **SatMagazine (SM)**

*Martin, can you tell our readers why satellite interference is such a big problem for the Industry?*

## **Martin Coleman**

With a plethora of broadcasters and other organisations using satellites for all kinds of purposes, from global positioning to broadcasting satellite television, there is always going to be some crossover that will naturally cause interference. The television viewing experience will then be hampered, which of course, in the mind of the viewer, reflects badly on the broadcaster. Add to that the cost to find and rectify the problem is time consuming and expensive.

## **SM**

*What initiatives has SUIRG been spearheading to reduce satellite interference?*

## **Martin Coleman**

Our main focus over recent years has been Carrier ID. If all satellite users have an ID assigned to them, and pinpoint which satellites they will be using, errors in operation are reduced and interference can be avoided.

When interference does occur, it will be far easier to identify the source and, therefore, quicker to rectify, which will lead to less down-time for the broadcast affected. Three groups have been set up to deal with Video, Data, and VSAT.

## **SM**

*What technology and product innovations do you note that can help to reduce interference?*



# Executive Spotlight



## **Martin Coleman**

Taking a typical SNG vehicle as an example, **Colem-Spice**, through its work with many broadcasters and suppliers, has proven that operational errors are significantly reduced by automating the task carried out by the transmission equipment of that vehicle. Less mistakes lead to much more efficient operation and reduced interference. Add to this proper scheduling, an area within which Colem-Spice already has a great deal of experience, then planning of transmission services are simplified and conflicts avoided.

My belief is that any terminal should be able to self-monitor and take appropriate action to avoid dual illumination interference (a very common problem) and report this quickly and simply to operations personnel.

Colem-Spice is already working on exactly this scenario in its latest product range of automated SNG and FlyAway management systems. In addition, we are looking at bringing this automation forward to include the media itself, giving broadcasters more flexibility than has been possible in the past and with significant reduction in causing interference.

## **SM**

*What's planned next for SUIRG?*

## **Martin Coleman**

Carrier ID is something we, at Colem, have been discussing and diligently working on for a number of years. I believe it is important to ensure roll-out as soon as possible.

We are there now, and it's time to move onto new projects. I believe this will be the introduction of better automation and management of all transmission systems, with emphasis at the source. Already training initiatives have now been put into place and with Colem's experience in the automation of SNG and FlyAway terminals, this is where the industry must focus.

Website: <http://www.colemspice.com/>



**Satellite interference continues to be a big issue, especially for our military. Here, Staff Sgt. Nomer Alinas works on a Satellite Interference and Resolution System dish in Southeast Asia. Sergeant Alinas is deployed from the 76th Space Control Squadron, Peterson Air Force Base, Colorado. Photo is courtesy of Air Force Space Command**



*Focus*



*No Small Matter...*

***SATCOM For World's Largest Cruise Ship***





The Royal Caribbean's Oasis of the Seas, the world's largest cruise ship, has been equipped with MTN Satellite Communications' (MTN) state-of-the-art VSAT satellite communications system. The 1,184-foot (360.9-meter), 225,282-gross ton Oasis of the Seas carries up to 5,400 passengers and a crew of more than 2,000. The satellite communication requirements for such a massive ship presented special challenges.

"The communications suite is a critical component for operating the ship and its passenger services," said **Max Schmidt**, vice president of information technology, **Royal Caribbean Cruises Ltd.** "We worked closely with MTN's engineering teams to develop a system that would be capable of supporting the unprecedented requirements of a ship this large and complex, with more than 2,700 passenger staterooms, dozens of dining and entertainment facilities and seven distinctly designed themed neighborhoods."

There has never been a ship as grand, innovative and imaginative as the Oasis of the Seas. The seven themed neighborhoods include...

- » *Central Park features boutiques, restaurants and bars including access to the Rising Tide bar, which can be raised or lowered to three separate levels. It is the first living park at sea with over 12,000 plants and 56 trees.*
- » *The Pool and Sports Zone features a sloped-entry beach pool and two surf simulators.*
- » *Vitality at Sea Spa and Fitness Center.*
- » *Boardwalk features a handcrafted carousel, restaurants, bars, shops, two rock-climbing walls, and a tattoo parlor. Its outdoor 750-seat AquaTheatre amphitheater hosts the ship's largest freshwater pool.*

- » **Royal Promenade features restaurants and shops and is viewable from a mezzanine.**
- » **Youth Zone features a science lab and computer gaming.**
- » **Entertainment Place.**

“For the inaugural voyage of Oasis of the Seas, we supplied the highest bandwidth ever used on a single ship in the history of the cruise industry,” said *Brent Horwitz*, senior vice president of MTN. “The total bandwidth exceeded 26.6 Mbps, including 10 Mbps for Internet, 3 Mbps for voice and corporate data, 9 Mbps for an ABC live TV broadcast, 2 Mbps for video streaming, 1.5 Mbps for cellular phone service, and 1 Mbps for radio broadcasts and phones.

“A communications system was installed that uses two separate 2.4-meter stabilized C-band satellite antennas, which can simultaneously track two different satellites on MTN’s global C-band network, with automatic beam switching to eliminate outages from satellite blockage,” according to *Horwitz*.

“When crossing the Atlantic to its home port in Fort Lauderdale, the ship’s dual antennas with automatic beam switching technology, supported by our global shore network infrastructure, enabled the ship to transition seamlessly from one satellite footprint to another with no disruption of service,” he said.

“The system on **Oasis of the Seas** provides an extensive range of voice and data services. The system is designed to support over 40 simultaneous satellite phone calls through state-of-the-art **Cisco Voice-over-Internet-Protocol (VoIP)** gateways, allowing guests and crew to make calls directly from their cabin phones.

“For mobile phone users, full cellular coverage is provided onboard Oasis of the Seas via **Wireless Maritime Services (WMS)**, a joint venture between **MTN** and **AT&T Mobility**. The WMS service enables cell phones, **BlackBerrys** and **iPhones** to continue to operate while the ship is at sea, by relaying the voice and data traffic through the satellite network. In addition to all the telephony systems, also provided is broadband Internet connectivity for the WiFi networks and Internet Cafés onboard, along with a private, secure data channel for the ship’s business.

“A number of industry firsts for the cruise industry are delivered that include at-sea cellular service, Internet Cafés and WiFi. In March 2010, Another industry breakthrough, **MTN Worldwide TV** (premium TV programming from six major U.S. and international television networks) was also announced for cruise ship passengers located anywhere on the high seas.

“Passengers are able to enjoy programming from **BBC World News**, **CNBC**, **Fox News**, **MSNBC**, **Sky News**, and **Sky Sports News** in their cabins while at sea or in port, with no interruption. Additional programming packages, including entertainment and sports channels, are to be added in the near future.

“The MTN Worldwide TV service has been thoroughly field tested and more than 40 ships with a total of more than 32,000 cabins are already under contract for the unique broadcast service,” added *Horwitz*. 



**Oasis of the Seas deck view**



***Oasis of the Seas sports activity deck***

### ***About MTN Satellite Communications***

MTN Satellite Communications (MTN) is the global service provider of communications, connectivity and content services to remote locations around the world. MTN's maritime VSAT solutions and global satellite communications network offers the reliability that only "Always On — Always Available" systems can provide. More than 500 vessels and land-based terminals worldwide, including cruise ships, government and military vessels, private yachts, ferries,

offshore drilling and production sites, and commercial ships depend on MTN's voice and data networks to allow them to "be in the middle of nowhere and at the center of everything." Premium services include remote access for Internet, fixed and mobile phones, fax, television, onboard newspapers, banking services, direct payroll deposit for crew and other enterprise solutions. MTN is based in Miramar, Florida. For more information, visit ...

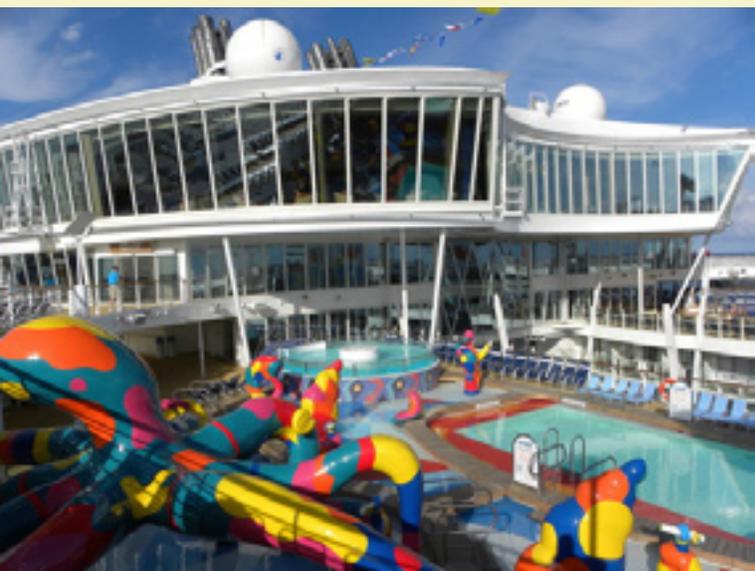
<http://www.mtnsat.com>



### ***About Royal Caribbean***

Royal Caribbean International is a global cruise brand with 21 ships currently in service and one under construction. The line also offers unique cruise tour land packages in Alaska, Canada, Dubai, Europe, Australia, and New Zealand. For additional information or to make reservations, call your travel agent, visit...

<http://www.royalcaribbean.com>



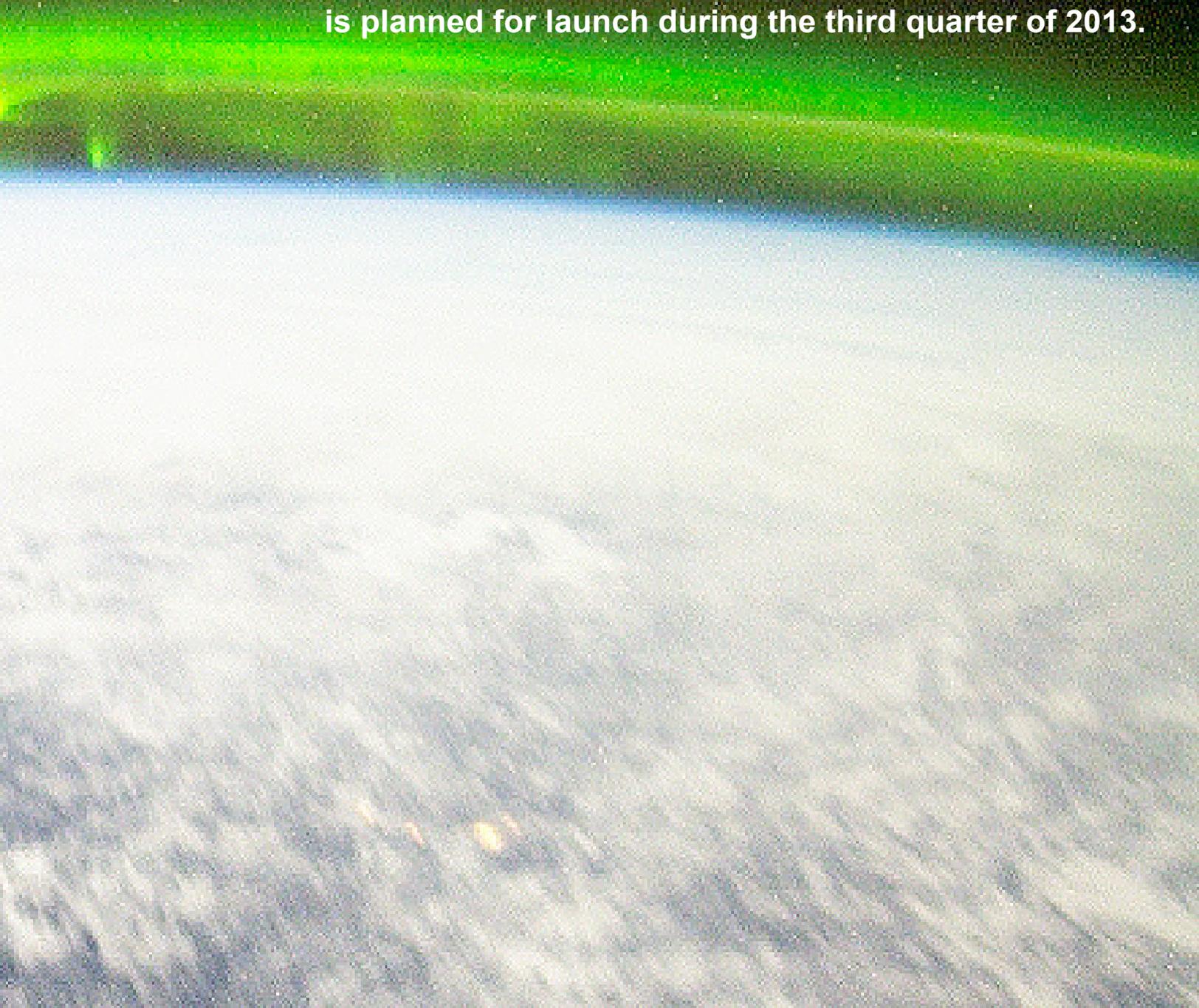
***Oasis of the Seas pool area***

The Aurora Borealis or northern lights and the Manicouagan Impact Crater reservoir (foreground) in Quebec, Canada, were featured in this photograph taken by astronaut Donald R. Pettit, Expedition Six NASA ISS science officer, on board the International Space Station (ISS). Photo courtesy NASA



## ***Aiming High With CANUK-1***

Montreal-based OmniGlobe Networks recently announced its intention to procure, launch and operate its first Ka-band Fixed Satellite Service (FSS) geostationary communications satellite serving Canada. The application for the the orbital slot was initiated in 2009 and CANUK-1, a medium-sized high throughput spacecraft, is planned for launch during the third quarter of 2013.



**OmniGlobe's** decision to enter the satellite operations market is an integral part of its overall growth strategy and will consolidate its position as a leader in the provision of turnkey telecommunications services in remote Canadian markets. This logical step follows from successful earlier diversification into terrestrial infrastructure ownership and operation, in addition to Canadian cellular spectrum licenses through the Company's partnership in **Lynx Mobility**. Vertical expansion into space-based infrastructure and spectrum is therefore a natural evolution.

The primary motivation for securing increased access to space segment derives from the current lack of availability of ubiquitous Ka-band capacity serving Canada. This current supply shortage of openly-available Ka-band capacity is not the result of lack of innovation, nor motivation, in the Canadian market. In fact it is quite the opposite, with Canadian industry pioneering the commercial use of Ka-band frequencies since 2004. However, due to ever-increasing traffic demands from higher-bandwidth network services and the relatively high proportion of hard-to-reach rural Canadian residents, capacity is in high demand.

"Our focus has always been to develop the best-available technological solutions and to bring vital information and communications services to underserved markets throughout the globe, but the Canadian marketplace for satellite capacity is undersupplied and lacking in remote and rural communities. This project demonstrates our firm commitment to ensuring that we have adequate spectrum to meet our customers' present and future requirements," explained *Jason Neale*, CEO of OmniGlobe. "We go beyond simple telecommunications. Our connectivity solutions have a real impact on our customers' quality of life and putting their needs first remains our top priority," he added.

The privately-held company, which was incorporated in late 2004 to address the communications gap in

broadband Internet and cellular telephony services, has undergone a rapid international expansion through both organic growth and strategic acquisitions. Since its first full year of operations, it has grown annual revenues at between 100 and 400 percent per annum including during the 2009 fiscal year, despite the global economic downturn. This successful track record has led to widespread industry recognition, including being named as the fastest growing high-tech company in Canada in the 2009 **Branham 300** listing.

Today, the company delivers affordable and reliable satellite and terrestrial wireless connectivity solutions to a diverse customer base ranging from residential consumers in Ontario and British Columbia to remote **First Nations'** communities in the far north of Quebec and large scale businesses in the Middle East. Its enterprise customers include commercial, banking, GSM and telecom carriers, broadcasters, government markets and international *non-governmental organizations (NGO)*. Also offered are a wide range of communications services to the oil, gas, mining and forestry markets, and the Company has networks deployed in more than 75 countries.

The satellite program will be led by **OmniGlobe Space Inc.**, a wholly owned subsidiary of **OmniGlobe Networks, Inc.** As part of this initiative, the company has appointed *Julian Costley* as Managing Director and *Judy Harte* as the Satellite Program Director. "We are a leading player in a rapidly growing and dynamic market at a time when the next generation technological solutions are emerging and is therefore extremely well positioned to capitalize on this opportunity" said *Costley*, an experienced entrepreneur and investor, himself previously founder and CEO of several highly successful international ventures in the telecommunications and investment sectors.

"What's particularly exciting about CANUK-1 is that it will be the first Ka-band GEO satellite dedicated to serving Canada," said *Harte*, who brings over 25

years of experience in the satellite communications industry to the role as Director of the satellite program. She added that, "This allows us to optimize our design for the Canadian market, to provide not only excellent population coverage, but also widespread geographic coverage to reach unserved individuals and communities in the most remote areas." Existing customers already span the majority of Canada with installations from Nova Scotia in the east to British Columbia in the west, southern Ontario to northern Quebec and also Canada's northern Territories.

The multiple beam satellite will be designed to facilitate the delivery of a wide range of advanced services including broadband Internet access, Voice over IP (VoIP), Virtual Private Networks (VPNs), videoconferencing, cellular telephony backhaul, telemedicine and distance learning. It will also be suitable for the provision of smaller, transportable, quick-deployment solutions such as wireless hotspots and instant cellular telephony infrastructure to support emergency and disaster recovery situations. The satellite's advanced payload technology will enable enhanced services to customers, while efficiently addressing the widespread Canadian demand for satellite broadband direct to the home or business.

Ka-band frequencies enable the use of much smaller regional coverage beams, known as spot beams. This is in contrast to the 'broad beam' continental or multi-national coverage typical of traditional lower frequency C- and Ku-band systems. Ka-band thereby allows frequency re-use in non-adjacent geographic areas, thus maximizing the capacity for the allocated spectrum, while also delivering higher power level. These two

advantages reduce both CAPEX (for example smaller ground terminals) and OPEX (due to improved spectral efficiency) in Ka-band systems, making low-cost residential satellite services a practicable proposition.

availability by keeping the satellite link up, even in severe weather conditions. This has allowed Ka-band satellites to be deployed in support of enterprise users and private networks.

Space Shuttle photo of red tipped arcs in the Northern Hemisphere. Courtesy NASA



Traditionally, C- and Ku-band satellite services have been favoured by enterprise and government users due to their perceived higher availability. This has historically been true and explains why most Ka-band capacity over North America is currently used for residential services. However, since the market introduction of DVB-S2 and the *Adaptive Coding and Modulation (ACM)* feature in particular, the technology now exists to maintain system

OmniGlobe has consulted extensively with a diverse range of Canadian satellite service user groups, many of which are already OmniGlobe Networks' customers today. In addition, OmniGlobe has analyzed extensive and detailed data sets representing the predominant residential segment of the Ka-band FSS market. From these activities OmniGlobe has a clear view of the Canadian market and the market potential. OmniGlobe

believes that demand for new Ka-band services will increase substantially in coming years, even after taking into account the known competition for supplying Ka-band capacity within Canada. This market still convincingly supports OmniGlobe's planned **CANUK-1** satellite while allowing additional market space for future growth. "Not only must affordable capacity be available, but it must be available in enough volume to make a difference in the marketplace," said *Harte*.

OmniGlobe declined to comment in any detail on the financing aspects of the project but confirmed that it has received strong interest, both from its existing funding partners and also from the wider investment community as a whole. OmniGlobe did acknowledge that this was a larger initiative for them but drew attention to both their highly successful record of delivering new technology solutions and also their consistency in meeting their annual financial growth targets, year after year.

Neale also added, "In addition to the technical and management expertise of our internal team we also leverage the extensive experience of OmniGlobe's Board, who have previously successfully delivered on many large initiatives while in senior leadership roles in some of the world's largest telecommunications companies."

As for the design and build of the spacecraft, OmniGlobe advised that it has had advanced discussions and extensive consultations with industry leaders within the international satellite manufacturing community. "We have also had a very immediate and positive response to our recent press release announcing this initiative," said *Harte*, "We are currently following up with many of the well known players in the wider satellite industry, on both the ground and space segment, to explore potential opportunities for collaboration."

OmniGlobe will lead the design and manage the build activities and is confident of finding the required technological solutions for their lower cost Ka-band satellite in what they described as an increasingly competitive satellite manufacturing marketplace.

"Greater vertical integration up and down the value chain is happening right across the global satellite industry" said *Neale*, "In Ka-band, satellite services and operations are becoming intrinsically symbiotic; services need a secure supply of low-cost capacity, and high-volume mass-market capacity needs serviced and managed customers. OmniGlobe is today very well positioned to leverage this relationship and we firmly believe that CANUK-1 can play a major role in removing the digital divide still affecting so many remote and rural Canadians." 

### *About OmniGlobe Networks*

Founded in 2004, OmniGlobe Networks is a global telecommunications company that provides affordable and reliable services in the regions of the world where the terrestrial infrastructures are either unavailable, unreliable, or simply too expensive. In Canada, OmniGlobe is now dominant in the remote and rural markets. In the European, Middle Eastern and African (EMEA) regions, we have won several major contracts with international operators. Today, OmniGlobe's customer base ranges from domestic consumers and aboriginal communities to government agencies and private institutions worldwide.

**Website:** <http://www.omniglobenet.com/>



# *Executive Spotlight*

**Chris Hoeber**  
**Senior Vice President of Systems Engineering and Program Management**  
**Space Systems/Loral**

*Christopher F. Hoeber has more than 35 years of industry experience and he leads the systems engineering and program management groups as well as oversees all of the company's research and development programs. Mr. Hoeber has a broad base of experience in systems test and engineering, and program and functional management — he was the leader of the systems engineering team that developed SS/L's geostationary satellite platform, the modular 1300.*

*He was also the program manager for the Superbird satellites, built for Space Communications (SCC) of Japan, which were the first implementation of the 1300 platform. Before being named to his*





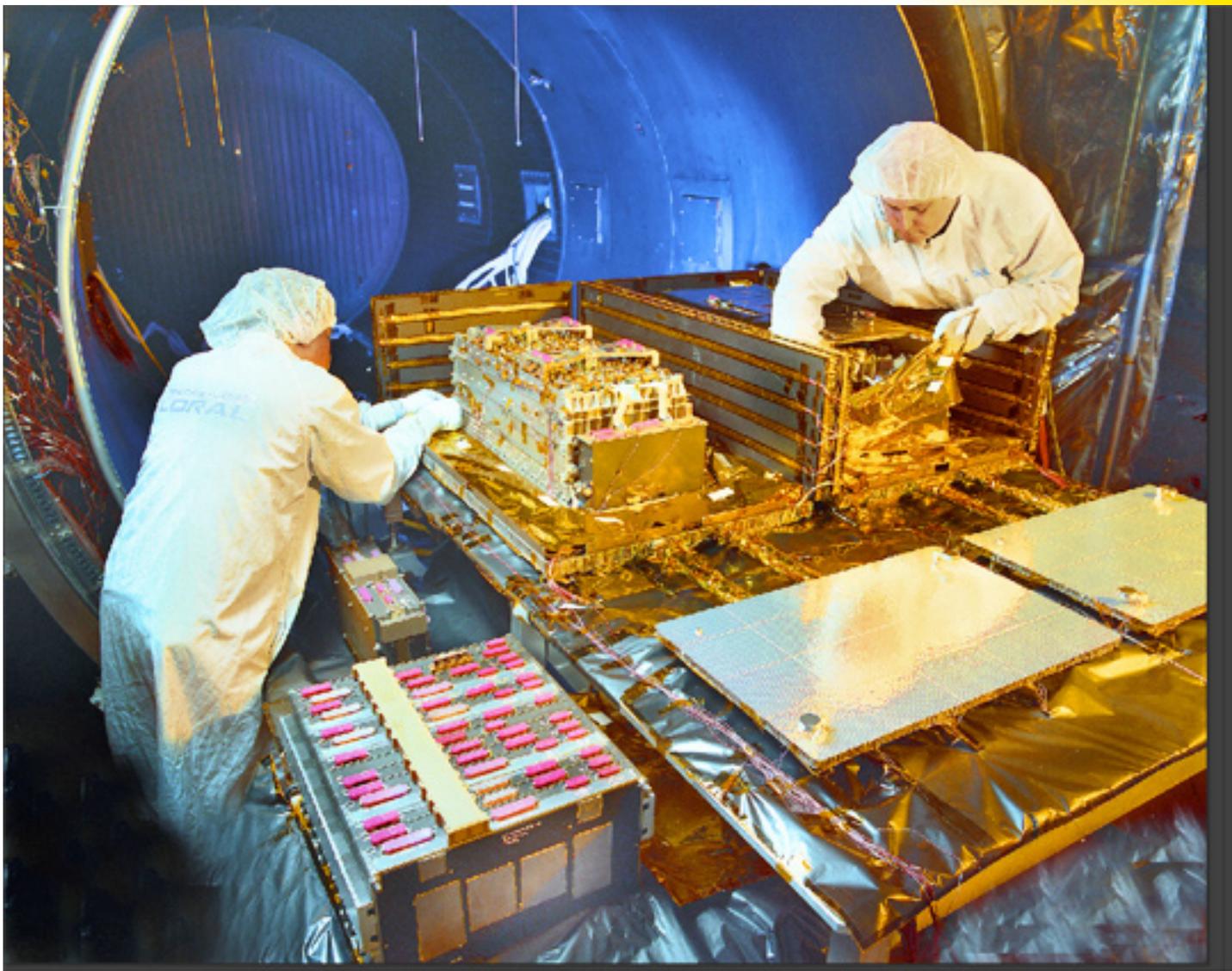
*current position, Mr. Hoeber was vice president of business development for SS/L and before that he was the chief engineer of the company.*

*Before joining SS/L in 1975, Mr. Hoeber was with Hughes Space and Communications Corp. for five years, where he led a group that performed payload testing of Intelsat IV and the first generation of domestic communications satellites.*

*In 2009 Mr. Hoeber was named a Fellow of the American Institute of Aeronautics and Astronautics (AIAA). He is also a member of Institute of Electrical and Electronics Engineers, Inc. (IEEE) and is a member of both the AIAA Technical Committee on Communications, and the board of directors of the California Space Authority. He has written extensively on the communications satellite industry and has contributed to a number of studies of export control and technology transfer. He is an AIAA Distinguished Lecturer.*



# Executive Spotlight



Satellite Ion Battery Production and Testing at SS/L—Image courtesy of SS/L

## **SatMagazine (SM)**

*Mr. Hoeber, would you please explain to our readers your duties with Space Systems/Loral as the Senior Vice President of Program Management & Systems Engineering? That's quite an expansive title!*

## **Chris Hoeber**

Space Systems/Loral is the world's leading provider of GEO commercial satellites and I like to believe that I have contributed to this success. Our strategy has been to design and build satellites using a standard flight-proven modular platform, which can be reconfigured for specific applications and for specific customers. I am responsible for the successful completion of all of our satellite programs and contracts, from a business perspective, and I also oversee the company's research and development program.



# Executive Spotlight



**NSS-12 undergoing gravity spin test at SS/L—image courtesy of SS/L**

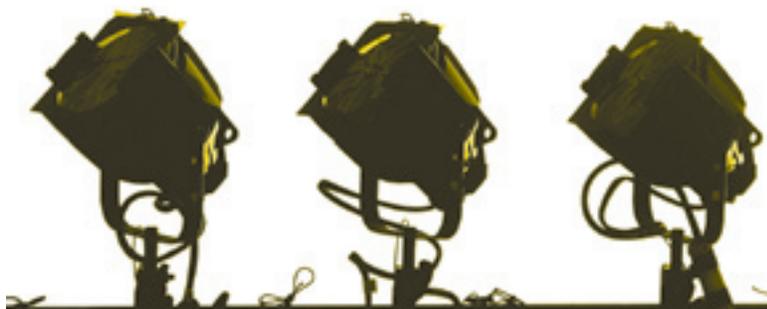
## **SM**

*Why did you decide a move to SS/L was the correct step to take?*

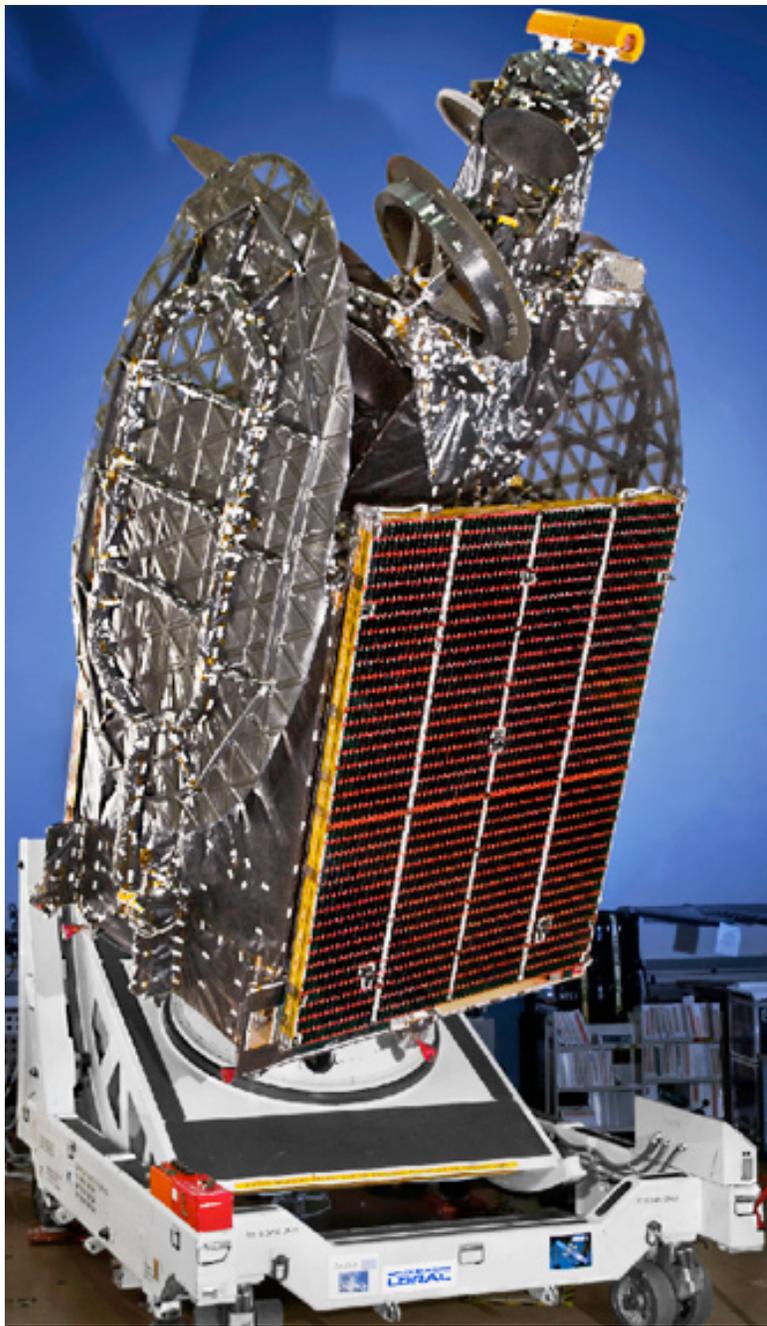
## **Chris Hoerber**

I moved to SS/L almost 35 years ago, when it was Philco-Ford. I saw a relatively small organization that was very entrepreneurial and I saw an opportunity to get in at the beginning and make a difference. With 20-20 hindsight, I can tell you that I made the right decision at the correct time. After I had been at Philco for a year (it had then been renamed Aeronutronic Ford), we won the Intelsat V Program and I joined the Systems

Engineering team, responsible for the communications payload. Since that time, I have had the opportunity to contribute, at many levels, to SS/L becoming the player in the commercial satellite industry that it is today.



# Executive Spotlight



AsiaSat 5 completed and ready to load for shipping from SS/L—Image courtesy of SS/L



## SM

*You worked at Hughes Space and Communications working on the 1G of domestic COMSATS. What was the impetus for your involvement in those programs?*

## Chris Hoerber

I left college in 1970 and my wife and I moved across the country to start a new life. To make a long story short, after we had settled into our apartment in southern California, my promised job fell through and I began knocking on every door within a 50 mile radius looking for work. I got an interview at Hughes in El Segundo and my interviewer arranged for a tour of the Hi Bay where I saw the prototype Intelsat IV spacecraft. I still remember coming home and saying, "I fell in love with what I saw — I know what I want to do."

My first assignment was to write the test software for Anik A, the first domestic comsat. But before I could do that, I had to write an interpreter so that the brand new Hewlett Packard mini-computer could interpret HP Assembly language. The test computer had 16 K 16-bit words of memory and we communicated to it through a 10 bps teletype machine. The test job was perfect for me — within a couple of years I had learned something about every aspect of the spacecraft design and operation. That knowledge, along with my natural curiosity, has provided the knowledge and experience that I have depended on for my entire career.

## SM

*With 35 years of satellite industry experience, how different is the SATCOM world today than when you started your career? Where do you see our industry heading over the next year or two? In five years?*

## Chris Hoerber

Satellites have changed dramatically in the 35 years that I have been in the industry. They are much bigger and more powerful than they were in 1975 and they are much more capable. They are also much more reliable. As they are bigger and more powerful, they can do

# Executive Spotlight

many more things so the services that they deliver have also changed significantly.

In the late 1970s, satellites were used predominantly for telephony and broadcast television. Satellites broadcast only to huge ground stations that then delivered the signals to the television networks and to other organizations that further distributed the data. In the early 1990s, with the advent of Direct-to-Home (DTH) television, the paradigm changed so that satellites frequently broadcast directly to the consumer at their homes and offices. Now we are seeing the next wave in satellite technology which delivers information to mobile devices. Sirius XM Radio is a good example of this, as is our customer TerreStar, which has a satellite just now going into service that provides phone service to typical PDA-size phones that automatically switch from cellular signals to satellite when needed. Note that this is a complete reversal of the paradigm 35 years ago, eliminating the need to collect huge volumes of data in one location for redistribution on a local system.

Today's advanced satellites can provide hundreds of high definition television channels and as broadband services become more and more crucial as an enabler for economic growth, high throughput broadband satellites can deliver service to areas around the world where terrestrial broadband infrastructure is not available.

Although I have described the different services that satellites provide, many of which can be classified as entertainment, we never forget that the ability to provide instantaneous communications services has much more important social implications — including saving lives.

## SM

*Research and Development is such a crucial arena for any company involved in the satellite industry — millions of dollars are reserved for projects that are indicated as being critical for the company's growth. How do you determine in which direction such efforts should be extended?*

## Chris Hoeber

We have a well defined process called “roadmapping”. Each application, for example, DTH, has a service roadmap. We ask ourselves questions such as:

- » ***What will be the impact of must-carry for local stations?***
- » ***What will be the impact of HDTV?***
- » ***What will be the impact of turning off analog over-the-air service?***
- » ***What will be the impact of IPTV?***
- » ***What will be the impact of 3DTV?***

Once we've done that, we go the next level, which is how do we design a spacecraft to meet those needs. Then we also have to consider the product line implications, for example to propulsion or antennas? After all of that kind of analysis, we decide what new developments need to be implemented.

In parallel with the top down effort that I just described, our experts in hardware, such as propulsion and antennas, are telling us what is possible and what breakthroughs are around the corner. Often these pending breakthroughs stimulate the thinking of the systems folks and they come up with ideas that they couldn't have come up with on their own.

The R&D process also includes some intuition and a huge amount of industry knowledge. As an industry



# Executive Spotlight

leader, we find that we sometimes influence the way applications evolve. In order to produce great results once you have charted your course, you need to have world class experts with hundreds of individual skills, which we have at SS/L.

At SS/L, we have an experienced and highly resourceful workforce with a passion for excellence, in a culture of open collaboration with our customers. I can't claim to be an expert in anything, except possibly satellite testing, but I am good at synthesizing solutions to problems by tapping into those areas of expertise. Our success shows that this process works.

## SM

*In your world of R&D, what technological areas and investments are you looking toward to help boost SS/L's competitiveness?*

## Chris Hoerber

First, we are right at the end of developing our next generation on board computer system which provides attitude control and command and data handling. This system will provide a new level of robustness and features that will be very attractive to our customers and which will help enable future advances in payload capability. Beyond that, we have a very broad array of developments going on. These include projects for Broadband, Mobile, Direct To Home Television and DARS Radio and they also provide trickle down capabilities to the core FSS business.

## SM

*SS/L has quite a history in the satellite industry — from Courier MILSATCOMs to the 1300 series — do you see more investment by government agencies in your product in the future? How will commercial satellites support government agency needs, due to various budget cutbacks?*

## Chris Hoerber

We recently announced that we are providing a propulsion system for a NASA lunar mission, and in late 2009, a Department of Defense Joint Capability Technology Demonstration (JCTD) was launched on one of our satellites. I think the line between government and commercial projects is beginning to blur and commercial processes will help provide best value solutions to the government.

Personally, I don't like the term "commercial." We have a product line with the same kind of natural evolution that you see in other industries. This process of constantly improving the product is much faster than advances that are dependent on specific government funded programs can be.

If you look at the computer industry — think of the progress made since the first chip was put into a PC only 25 years or so ago. Before that time, computers had evolved in government labs with much more limited applications. There is no reason why the government can't benefit from the inherent cost savings and reliability built into the product line concept for satellites, the same way they have for computers.

There is a lot of interest in hosted payloads, such as the Cisco IP Router that we integrated onto Intelsat 14 and the navigation payload for the European Union that we are currently integrating onto a satellite we are building for SES. We expect there to be increasing demand for this kind of integration of government and commercial projects and we have the experience to help both parties benefit.



# Executive Spotlight

## SM

*How will SS/L compete globally with the increased competition by other international firms pressing for satellite manufacturing and launch contracts?*

### Chris Hoerber

This has always been a very competitive industry and we continue to believe that competition makes us better. SS/L builds the world's largest and most powerful satellites, and we see increasing demand for larger satellites that help leverage the cost of a launch over more transponders. Large, powerful satellites also lend themselves well to the kind of multi-mission project that I mentioned previously, such as hosted payloads or condosats. Also, our long history of reliability is always in our favor when we compete for business.

## SM

*Could you tell us about the Mission Control Center in Palo Alto and how such plays into SS/L's overall mission?*

### Chris Hoerber

We actually have four Mission Control Centers in Palo Alto capable of performing a number of missions in parallel. SS/L successfully launched, deployed and transitioned seven satellites in 2009 so our mission control group was very busy. We are particularly proud of our success in managing two launches that occurred on separate continents just 22 hours apart.

On June 30, 2009 Sirius FM-5 was launched for SiriusXM Radio from Baikonur in Kazakhstan, followed by the TerreStar-1 launch for TerreStar Networks from the European Spaceport in Korou, French Guiana on July 1, 2009. The TerreStar-1 and Sirius FM-5 launches demonstrated the depth of resources and capability strength of the SS/L Mission Operations and launch crews.

These control centers continue to provide service to our customers for the full life of the satellites that we provide, even if that lifetime is far greater than what the contract calls for. An On-Orbit Program Manager and

SS/L resources, are available 24/7 for at least 15 years after a satellite is launched.

## SM

*What satellites is SS/L currently at work building? Are there any potential contracts we should know about to further our knowledge of your company?*

### Chris Hoerber

We currently have a backlog of 20 satellites and we have a number of active proposals. I can't tell you which ones we expect to win in the near term, but let me just say that in addition to launching seven satellites last year, we were awarded contracts to build seven new satellites. We're capable of taking on a new program on an average of once every six or seven weeks or so. I know that keeps us busy, but that is the way we like it.

In recent years, I have focused a lot of my energies on recruiting, and I always look for college grads that have the same drive that I did 35 years ago. I tell them that, although I don't know the name of the satellite now, if they come to work for us they are likely to be assigned to a project and see it through to launch in two or three years. It's a great feeling to know that what you were working on last year is now providing an important service from 23,000 miles above the earth's surface. That feeling is still what keeps me young. 



# *Product Uplink*

## *Go Green — iNetVu® SolarPack System*

To pollute or not to pollute, that is the question... Yes, a misquote of the famous Shakespearean line, but you have to admit, it IS catchy. Thank you, William.

Usually the answer to that question is not a conscious decision. In the satellite business, some people would say we are very green. After all, other than when they are launched, thousands of satellites floating around in space are all running on solar power. No coal by-products, little fossil fuels being burned (just enough to keep them in orbit), no nuclear waste — the sun is being used to generate power. This is so green; it's hard to get any greener.



Figure 1: The iNetVu® SolarPack System

We in the satellite business can relax and go home, thinking we are saving our own little piece of the planet, correct?

Wrong! Let's leave the launch side of the business for another day. What we want to discuss is the habit most of us have that causes harm to the environment we live in. Often deploying and operating VSAT antennas require the vehicle's internal combustion engine running to produce the power. Apparently, we are in a business that requires us to operate our products in situations where we have no electrical outlets to plug into. Use of generators or vehicles is the most common solution in such cases, although not the most environmentally friendly.

Products that are easy to use, safe, and environmentally friendly are being designed into every new C-COM product. National and International standards such as FCC, CE, and RoHS are part of quality objectives to our design teams. This ongoing commitment led C-COM to develop a solution which could prevent people from creating this non-green problem. Our clients were forced into situations where the production of CO<sub>2</sub> (Carbon Dioxide) is a by-product

of doing business. C-COM decided to become pro-active and provide a remedy for such a dependency and has designed, and now manufactures, a **SolarPack** solution that can eliminate the dependency on fossil fuels for powering the iNetVu® line of mobile VSAT solutions. In keeping with the C-COM mission statement, we designed a cutting edge solution using the latest and 'best in class' products to produce a solution that combines ease of operation and low maintenance at a very attractive price.

The iNetVu® **SolarPack** is offered in a neat compact package, containing all of the components required to configure a complete power solution capable of powering all of our antenna products from Flyway to vehicle mount platforms. The base unit contains a 100 amp hour battery, available in either a lead-acid or lithium choice, a charge control unit capable of handling 340 watts of solar generated power, two flexible, high output solar blankets (62 watts each), a 600 watt power inverter (which can handle most platform requirements) and all of the cables needed to connect the system.

A number of manufacturers offer solar solutions, but often, the solutions have not been designed properly

# Product Uplink

and consequently, do not work as intended. We have spent more than two man years developing and testing this solution; designing, prototyping, testing, modifying, re-building and re-testing, until we had a design that produced the results we expected.

The iNetVu® SolarPack can deliver 120 watts (with 2 solar blankets) of continuous power during daylight hours and then offer this same 120 watts of power for another 12 hours of darkness and keep this cycle going continuously. What if, you say, you need more power?

Well, we simply add two more solar blankets to the system and 240 watts is attained. Still need more? You can connect a maximum of six solar blankets for a total of 340 watts of power. If this is still not enough, you can add another

battery, which allows for the addition of two to six more solar blankets and now you can as much as 680 watts of continuous solar power. You can further expand the SolarPack to produce up to 680 watts of additional power. As long as you do not need to draw more than 600 watts of AC power from a single power plug, we have the solution for you.

One may think that a portable generator can also perform the same operation more economically. Let's look at this statement in more detail. In order to verify this, we need to add up the total cost of your generator solution and compare it to our greener, solar solution.

Let's make some assumptions and then 'do the math'. If you have a nice reliable generator, say a Honda EU model that consumes about 2 gallons of petroleum per day, then the following table can be generated based on fuel prices in different countries. If we look at the '**# of Running Years per \$5000 in Gas**' column, we can see that the ROI (Return On Investment) works out to as little as one year, depending on the country you live in. This is based on the SolarPack price minus the generator cost leaving you with about \$5,000.00 to purchase petroleum. This does not take into consideration oil changes or the remedial or preventive maintenance that the generator will require to operate properly.

Country/Territory	US\$/gal	# of Running Days per \$5000 in gas	# of Running Years per \$5000 in Gas	Date of price
Australia	3.79	660	2	12/07/2009
Brazil	5.07	493	1	15/08/2009
Canada(Ontario)	3.55	704	2	15/05/2009
China	3.05	820	2	20/06/2008
Eritrea	9.58	261	1	01/06/2009
France	6.89	363	1	26/12/2009
Germany	7.19	348	1	28/12/2009
Greece	5.83	429	1	19/12/2009
India	3.79	660	2	21/08/2009
Indonesia	2.23	1121	3	16/07/2009
Israel	6.13	408	1	01/06/2009
Japan	5.19	482	1	01/06/2009
Libya	0.57	4386	12	01/06/2008
New Zealand	3.03	825	2	11/10/2008
Nigeria (Lagos)	1.67	1497	4	25/12/2009
Russia (Moscow)	2.33	1073	3	22/02/2009
Saudi Arabia (Riyadh)	0.61	4098	11	31/07/2008
Singapore	4.62	541	1	05/08/2009
South Africa	2.73	916	3	20/11/2008
UAE	1.4	1786	5	30/12/2009
United Kingdom	6.51	384	1	23/12/2009
United States	2.63	951	3	26/11/2009
Venezuela (Caracas)	0.19	13158	36	20/03/2009

# Product Uplink

The cost to offset one ton of CO2 ranges from a low of \$1.00 to a high of approximately \$30.00. If we use an average cost of \$15.00 per ton of CO2 then we can look at that cost as well. (Paradoxically, one gallon of gasoline produces 20 pounds of CO2.)

<http://www.fueleconomy.gov/Feg/co2.shtml>

If we are using approximately 2 gallons per day, we consume 730 gallons per year. For a larger (more than 1000 watts) unit, and one that is not so efficient, these numbers are going to increase accordingly. Therefore, such a solution will not only turn out to be expensive in the long run, but will also pollute the environment.

Now that we have established that you should be using solar power and, in particular, the iNetVu® SolarPack 1600 system, let's look at the type of batteries you should use. With the SolarPack, you have two choices. You can use traditional lead-acid or the newer type lithium batteries. There are significant differences between them.

The lead-acid battery can provide good power transfer, is fairly inexpensive, but there is a trade off against the number of charge cycles it can handle and it also weighs quite a bit. The lithium battery, on the other hand, is very light, can still operate below 80 percent capacity, and can deliver large amounts of energy when needed. It is also significantly more expensive than the lead-acid type. The following table shows the calculated run times for both the lead-acid and lithium batteries using a variety of load conditions. If you need

more run time at a certain power level, you can add an additional battery pack, which will increase the run time by approximately 80 percent. The lead-acid battery we have chosen to use provides 100 amp hours of power and the lithium provides 110 amp hours. These figures assume **NO** power generation from the solar panels.

After reviewing the run time statistics for the two different batteries offered with the iNetVu® SolarPack solution, you may still not know which battery is the correct choice for you. There are some additional features that need to be considered.

Watts at 120 volts AC	Load in Amps.	Lithium Battery - Maximum Run Time (in hours)	Lead-Acid Battery - Maximum Run time (in hours)
50	4.17	26.64	22.92
100	8.33	12.87	9.31
150	12.50	8.41	5.49
200	16.67	6.21	3.78
250	20.83	4.92	2.83
300	25.00	4.06	2.23
350	29.17	3.45	1.83
400	33.33	3.00	1.54
450	37.50	2.65	1.32
500	41.67	2.37	1.15
550	45.83	2.15	1.01
600	50.00	1.96	0.91

The table on the next page describes the operational parameters that must also be considered...

Just to make sure you have all of the information you need, we would also like to provide a small comparison of the price difference between these two different battery solutions.

If we create a real-world situation and then apply the costs to that situation, we can analyze the options in greater detail. Assume an operation that draws 250 watts of power from the battery, has solar power to

# Product Uplink

**SolarPack Battery Comparison**

Feature	Lead Acid	Lithium
Weight	Heavy	Light
Size	Large	Slightly smaller
Operational Suggested Discharge Level	50%	80%
Capacity - in AMP/HOURS	100	110
Run Time at 25 amp draw	2.23 hours	4 hours
Maximum # of Recharges at 100% Discharge	200	2,000
Maximum # of Recharges at 30% Discharge	1,100	30,000
High Temp Operation	Better	Power begins to reduce at temp. over 35°C
Cold Temp Operation	Better	Power begins to reduce at temp. under 0°C

To maintain the 5 years of battery life, as in the case of the lithium battery above, we will need to replace both lead-acid batteries 9 times (once every 200 days).

While the lead-acid battery costs approximately \$500.00 each, over 5 years, it will cost \$9,000 to replace lead-acid batteries (2 batteries to replace 9 times) using the above described scenario. The lithium battery will only

cost \$3,000 and will not need to be replaced during its 5 years of usage.

As with any technology, a decision should be based on these facts. When all the facts are known about a solar-based solution, it becomes clear that not only is it a green solution, but it can be a very practical solution as well. Before you buy, ask the tough questions, get the correct answers, verify the answers and enjoy your power without the monthly bills. ↷

### *About the author*

Paul Seguin is a Satellite Application Specialist with C-COM Satellite System Inc. Paul has more than 18 years of communications experience, which include developing software and hardware as well as communication and security applications for the Canadian Banking industry.

recharge the system, needs to run for 14 hours per day, and has sun available for 10 hours per day. Based on these parameters, we will need to generate power from the batteries for 4 hours per day.

If we check in the run time table we will see that the lithium battery can produce 4.92 hours of power at 250 watts and we can use a single battery to run for the 4 hours required. As this requirement will draw the battery down to near 100 percent discharge, the lithium can do 2,000 cycles before the battery has reached its expected life. That translates into 5 years and 5 months of usage, based on 7 days usage per week.

If we do the same calculation using lead-acid batteries, the results are quite different. In order to provide 4 hours a day of power during absence of sun light, we would need 2 lead-acid batteries (*see table above*). This current draw will discharge the batteries to near 100 percent of their power.

The lead-acid battery can be discharged to 100 percent only 200 times before the battery becomes unusable.



## **Methods To Increase Throughput For Point-to-Point Links**

*by Louis Dubin, Comtech EF Data*

Today's service providers and satellite operators are under substantial pressure to maximize profits and minimize costs while providing customers improved reliability and higher capacity services. In the race to compete with industry peers, wireless services and terrestrial capacity, service providers and operators must constantly look to improve bandwidth use and user throughput to stay ahead.

Advances in modulation, coding gain, fade adaptation and carrier cancelling technologies can provide substantial savings in bandwidth, improved capacity, improved reliability, or all three, while maintaining contracted

*service level agreements (SLAs)*. This article summarizes the technical and financial benefits of these technologies independently and in combination for several real world scenarios being used to generate power. This is so green it's hard to get any greener.

## Intro To Adaptive Coding + Modulation (ACM)

**Adaptive Coding and Modulation** is a statistical, non-static advantage that enables dynamic changes in user throughput. Benefits and value vary over time and are not guaranteed, but are predictable.

ACM technology converts link margin to an increase in the data throughput of satellite links. Only non-synchronous data networks (such as Ethernet packet-based networks) can take advantage of a dynamic data throughput rate. All satellite links are designed to function at a certain annual availability. The

closer to 100 percent we demand of our link availability, the more link margin we need to meet this demand.

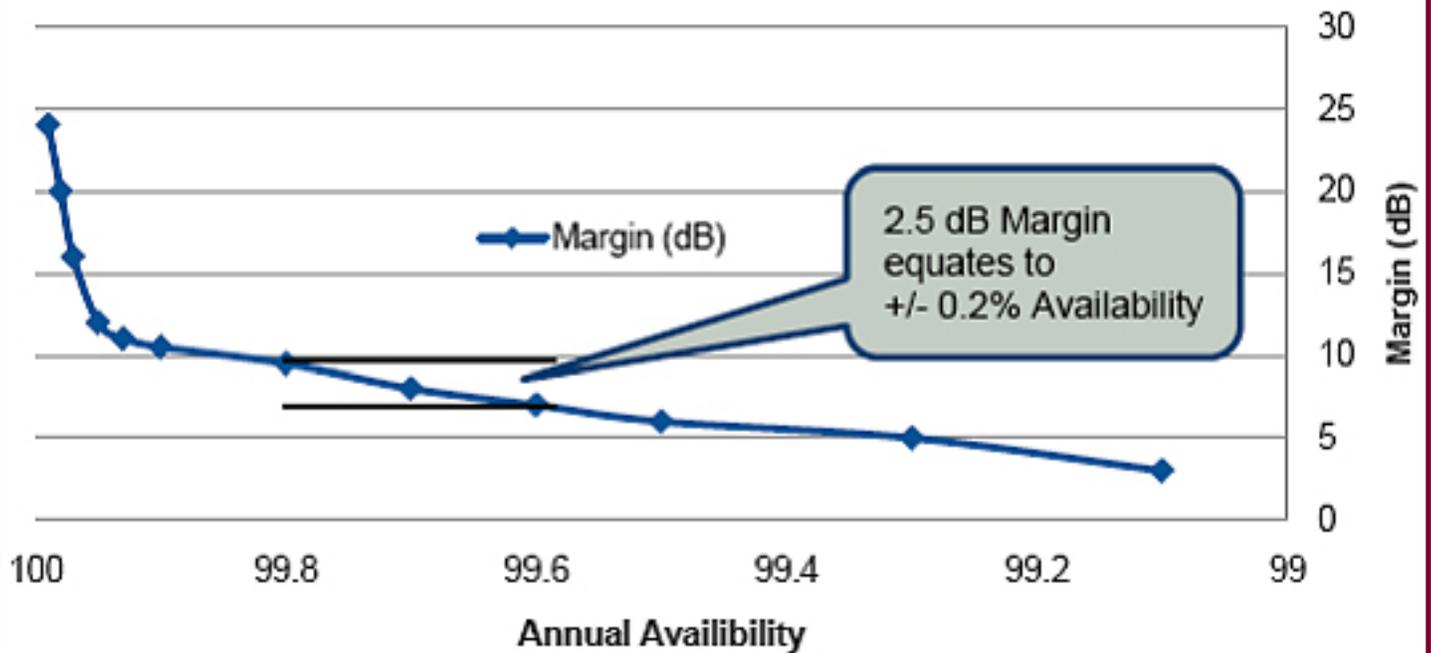
*Figure 1* on the following page is a graph of availability vs. link margin of a Ku-band link from Germany to Nigeria. A change in guaranteed annual availability from 99.8 percent to 99.6 percent (as little as 0.2 percent per year) equates to 17.5 hours per year (365 Day \* 24hours/day \* .002 = 17.5 Hours).

In *Figure 1* it can be seen these 17.5 hours/year demands or saves 2.5 dB of link margin. This means someone who requires 99.8 percent availability instead of 99.6 percent availability would need to factor an additional 2.5 dB of link margin for the entire year.

Conversely, deciding to run this link with 99.6 percent availability would save 2.5 dB of link margin for the

# Tech Channel

Figure 1: Ku-Band Link Margin (dB)



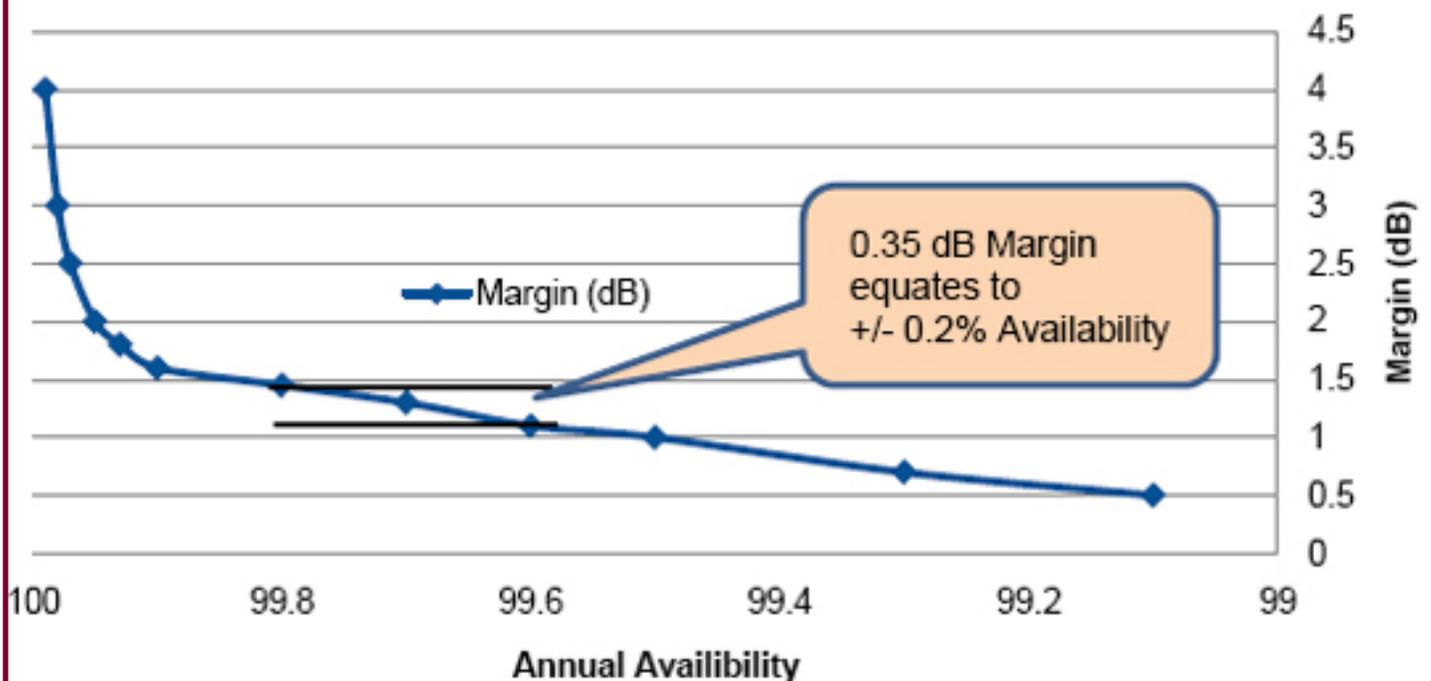
entire year.

Different links have different link margin requirements. Consider a C-band link between Italy and China with very different link availability characteristics. In *Figure 2*, you can clearly see that the same change from 99.6

percent availability to 99.8 percent availability requires a mere 0.35 dB of additional link margin.

Rain fade, inclined orbit satellite operation, antenna pointing errors, noise and interference can all degrade satellite link conditions. All of these conditions determine the overall link margin of a system. Because ACM converts

Figure 2: C-Band Link Margin (dB)



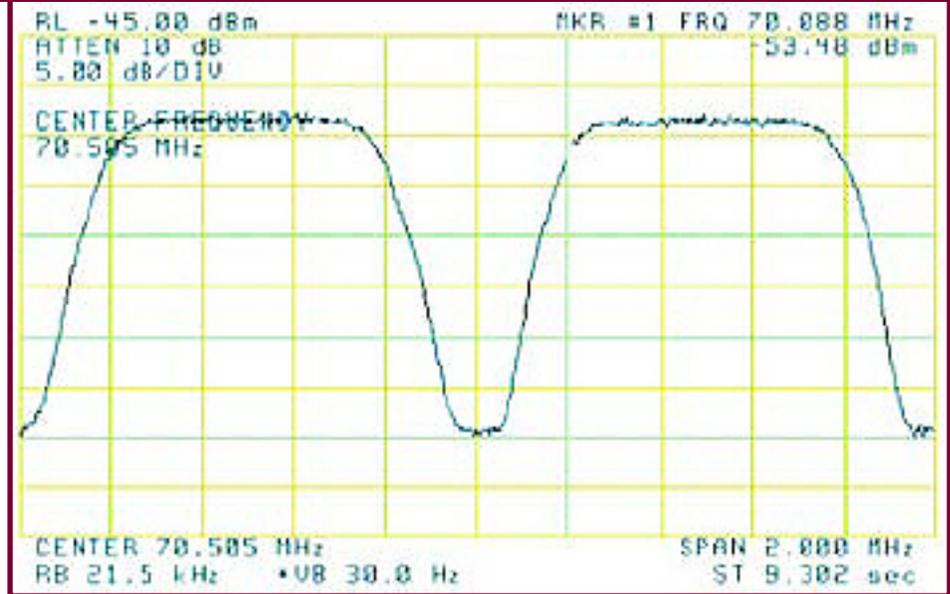
link margin to additional user throughput, it can be clearly seen that the greater the link margin, the greater the benefit of ACM. As link margin is reduced, so too is the value of ACM. It can also be stated that as guaranteed availability is increased, link margin will also need to be increased. Conversely, as availability requirements are reduced, link margin will also be reduced and the value of ACM will therefore be reduced.

## Intro To Double Talk Carrier in Carrier

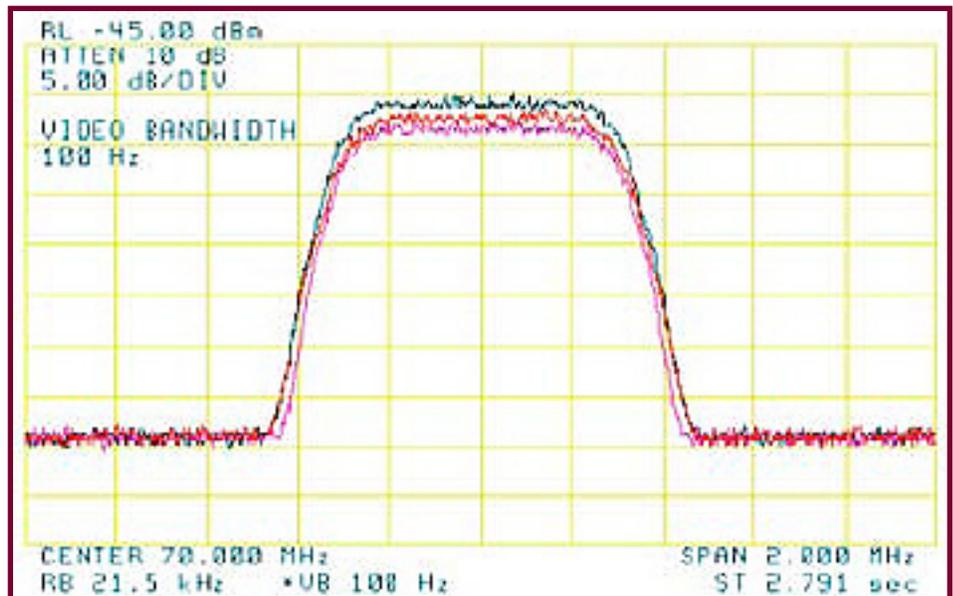
Unlike ACM, **DoubleTalk Carrier-in-Carrier** technology is a calculable, definitive, and static advantage. Carrier-in-Carrier is based on **Applied Signal Technology's DoubleTalk** bandwidth compression technology.

DoubleTalk uses "Adaptive Cancellation," a patented technology that allows the transmit and receive carriers of a full-duplex satellite link to be transmitted in the same transponder space. When combined with advanced forward error correction and modulation techniques, DoubleTalk Carrier-in-Carrier can deliver unprecedented operating expense savings. In addition to *operating expense* (**OPEX**) savings, DoubleTalk Carrier-in-Carrier can also provide *capital expenditure* (**CAPEX**) savings by allowing a smaller BUC/HPA and/or antenna.

*Figure 3* shows a conventional full-duplex satellite link, where two carriers are adjacent to each other and centered and different frequencies. *Figure 4* shows the typical DoubleTalk Carrier-in-Carrier operation, where the two carriers are centered at the same frequency, thus sharing the same spectrum. When observed over a spectrum analyzer, only the Composite is visible.



**Figure 3: Conventional Full-Duplex Satellite Link**



**Figure 4: Duplex Link with DoubleTalk Carrier-in-Carrier**

Carrier 1 and Carrier 2 are shown in *Figure 4* for reference only.

DoubleTalk Carrier-in-Carrier is complementary to all advances in modem technology, including advanced FEC and modulation techniques. As these technologies approach theoretical limits of power and bandwidth efficiencies, DoubleTalk Carrier-in-Carrier (using advanced signal processing techniques) provides a new dimension in bandwidth efficiency. DoubleTalk Carrier-

in-Carrier allows satellite users to achieve spectral efficiencies (i.e. bps/Hz) that cannot be achieved with traditional links. For example, DoubleTalk Carrier-in-Carrier when used with 16-QAM approaches the bandwidth efficiency of 256-QAM (8 bps/Hz).

As DoubleTalk Carrier-in-Carrier allows equivalent spectral efficiency using a lower order modulation and/or FEC code, it can simultaneously reduce CAPEX by allowing a smaller BUC/HPA and/or antenna. DoubleTalk Carrier-in-Carrier can be used to save transponder bandwidth and/or transponder power, thereby allowing successful deployment in bandwidth-limited as well as power-limited scenarios.

## Case Studies

Using the highly regarded *Intelsat Lease Transmission Plan Program (LST)* link budget tool and actual *Intelsat* satellites, we have run four (4) satellite link budget scenarios. For the purpose of this exercise, all links in **scenarios 1-3** require a duplex guaranteed minimum 10 Mbps data rate. All calculations are made using only **DVB-S2** modulation and coding combinations to ensure there is no confusion between link budget operational points and inferior coding techniques. All BW figures use a transmit filter figure of 0.27 to calculate occupied BW (= SR \* 1.27). **Scenario 4** is a special case study specific to E3 link optimization.

Note that in all of the scenarios, link margin remains consistent within each scenario. Link margin is directly related to link availability and therefore it follows that link margin remains consistent when doing a true comparison of technologies, whether you are running a conventional link, conventional link with ACM, Carrier-in-Carrier, or Carrier-in-Carrier with ACM.

## Definitions

**[1] Occupied BW:** This is the bandwidth that the carrier(s) actually occupy on the satellite. For conventional links, the occupied BW is equal to the Symbol Rate of the carrier times one plus the filter figure (Occupied BW = 1.27 \* SR). In CnC links, when the carriers have equal symbol rates, we show the Occupied BW as (x.xx/2) because two carriers are using the same physical BW. Note, regardless of rolloff or filter figures used, all comparisons will equally benefit or suffer by the same percentage. This is a true comparison of technologies, not a misleading comparison using dissimilar criteria.

**[2] Threshold Mod/Cod:** In conventional links, this is the most spectrally efficient Mod/Cod with a QEF performance Es/No that is at or BELOW the Threshold Es/No for the link. In CnC carriers, the Threshold Mod/Cod must be the most spectrally efficient Mod/Cod with a QEF performance Es/No + CnC Es/No Penalty that is at or BELOW the Threshold Es/No for the link.

**[3] CnC Es/No Penalty:** This is the undesired penalty that must be added to the Threshold Es/No to determine the Threshold Mod/Cod that can be used when running CnC link budgets.

**[4] Threshold Es/No Req:** This is the worst case Es/No (most faded condition) the link will experience to accommodate the availability of the link. The Threshold Es/No will be negatively impacted (lower) when Link Availability is increased 99.8 percent -> 99.9 percent and will be higher when Link Availability is decreased 99.9 percent -> 99.8 percent.

**[5] Clear Sky Es/No:** This is the best Es/No value (least faded condition) the link will ever experience with the given satellite, earth station equipment, weather conditions etc.

**[6] Link Margin:** This is the difference between the Clear Sky Es/No and the Threshold Es/No. This is essentially the maximum delta in dB between best and worst case fade conditions.

**[7] Total Allocated BW:** In conventional links this is the sum of the Occupied BW of Link A to B and Link B to A. In CnC links, this is the larger of the two carriers, or if the carriers are the same size it is the sum of the Occupied BW of Link A to B divided by 2. A satellite operator will charge for the larger of either Total Allocated BW or Total PEB.

**[8] Total PEB BW:** Total Power Equivalent Bandwidth (PEB) relates to the amount of total power used by the carriers represented as a bandwidth equivalent. A satellite operator will charge for the larger of either Total Allocated BW or Total PEB.

**[9] Clear Sky Mod/Cod A to B:** In conventional links, this is the most spectrally efficient Mod/Cod with a QEF performance Es/No that is at or below the Clear Sky Es/No for the link A to B. In CnC carriers, it is the most spectrally efficient Mod/Cod with a QEF performance Es/No + CnC Es/No Penalty that is at or below the Clear Sky Es/No for the link A to B.

**[10] ACM Max DR A to B:** This is the maximum data rate achievable in clear sky conditions. This is calculated by multiplying the Clear Sky Mod/Cod A to B spectral efficiency with link A to B symbol rate or: Clear Sky Mod/Cod A to B spectral efficiency with (link A to B Occupied BW / 1.27).

**[11] Clear Sky Mod/Cod B to A:** In conventional links, this is the most spectrally efficient Mod/Cod with a QEF performance Es/No that is at or below the Clear Sky Es/No for the link B to A. In CnC carriers, it is the most spectrally efficient Mod/Cod with a QEF performance Es/No + CnC Es/No Penalty that is at or below the Clear Sky Es/No for the link B to A.

**[12] ACM Max DR B to A:** This is the maximum data rate achievable in clear sky conditions. This is calculated by multiplying the Clear Sky Mod/Cod B to A spectral efficiency with link B to A symbol rate or: Clear Sky Mod/Cod A to B spectral efficiency with (link A to B Occupied BW / 1.27)

**[13] Total DR Increase Percent:** This is the difference between the minimum guaranteed DR (10 Mbps \*2 = 20 Mbps) and the sum of ACM Max DR A to B and ACM Max DR B to A as a percentage.

**[14] Summary Section:** BW/PEB is the greater of Total Allocated BW or Total Power Equivalent BW (it's what the satellite operator will base the per Hz price on).

**Scenario 1** — 10 Mbps Synchronous fixed Data Rate duplex — Determine the best overall modulation technique when considering: (1) synchronous data, (2) 99.95 percent link availability, and (3) Typical Ku-band rain fade conditions.

## System Configuration Information

Satellite: IS-1002

Location: 359 °E

Beam" 312

Txpdr Center Freq." 13.955 / 12.705

Station A: Tripoli, Libya

Station A Antenna: 7.8 m

Station B Location: Oran, Algeria

Station B Antenna: 2.4 m

### Scenario 1a: Conventional two (2) carrier link: No ACM Value

	Occupied BW [1]	Threshold Mod/Cod [2]	CnC Es/No Penalty [3]	Threshold Es/No Req.[4]	Clear Sky Es/No [5]	Link Margin [6]
Link A to B	7.06 MHz	8-PSK 3/5	0.0 dB	6.7 dB	11.1 dB	4.5 dB
Link B to A	7.06 MHz	8-PSK 3/5	0.0 dB	6.7 dB	11.1 dB	4.5 dB

Tot Alloc BW [7]	Tot PEB BW [8]	Clear Sky Mod/Cod A to B [9]	ACM Max DR A to B [10]	Clear Sky Mod/Cod B to A [11]	ACM Max DR B to A [12]	Total DR Increase % [13]
14.12 MHz	12.81 MHz	8-PSK 3/5	10.0 Mbps	8-PSK 3/5	10.0 Mbps	0.0%

### Scenario 1b: Carrier in Carrier link: No ACM Value

	Occupied BW	Threshold Mod/Cod	CnC Es/No Penalty	Threshold Es/No Req.	Clear Sky Es/No	Link Margin
Link A to B	(9.52/2) MHz	QPSK 2/3	0.3 dB	4.0 dB	8.5 dB	4.5 dB
Link B to A	(9.52/2) MHz	QPSK 2/3	0.3 dB	4.0 dB	8.5 dB	4.5 dB

Tot Alloc BW	Tot PEB BW	Clear Sky Mod / Cod A to B	ACM Max DR A to B	Clear Sky Mod / Cod B to A	ACM Max DR B to A	Total ACM DR Increase %
9.52 MHz	9.25 MHz	QPSK 2/3	10.0 Mbps	QPSK 2/3	10.0 Mbps	0.0%

### Scenario 1 Summary (% Improvement vs. Conventional Link)

[14]	Conventional Link	Conventional with ACM	CnC without ACM	CnC with ACM (Reduced BW)	CnC with ACM (Max Throughput)
BW / PEB	14.12 MHz	14.12 MHz (0.0%)	9.52 MHz (32.5%)	9.52 MHz (32.5%)	N/A
Guar. DR	20 Mbps	20 Mbps (0.0%)	20 Mbps (0.0%)	20 Mbps (0.0%)	N/A
Max DR	20 Mbps	20 Mbps (0.0%)	20 Mbps (0.0%)	20 Mbps (0.0%)	N/A

## System Configuration Information:

Satellite: IS-1002

Location: 359 °E

Beam" 312

Txpdr Center Freq." 13.955 / 12.705

Station A: Tripoli, Libya

Station A Antenna: 7.8 m

Station B Location: Oran, Algeria

Station B Antenna: 2.4 m

### Scenario 2a: Conventional two (2) carrier link: Without and with ACM

	Occupied BW	Threshold Mod/Cod	CnC Es/No Penalty	Threshold Es/No Req.[1]	Clear Sky Es/No	Link Margin
Link A to B	5.64 MHz	8-PSK 3/4	0.0 dB	9.0 dB	10.6 dB	1.6 dB
Link B to A	4.76 MHz	16-APSK 2/3	0.0 dB	10.6 dB	12.1 dB	1.5 dB

Tot Alloc BW	Tot PEB BW	Clear Sky Mod / Cod A to B	ACM Max DR A to B	Clear Sky Mod / Cod B to A	ACM Max DR B to A	Total ACM DR increase %
10.40 MHz	9.84 MHz	16-APSK 2/3	11.8 Mbps	16-APSK 4/5	11.9 Mbps	18.5%

### Scenario 2b: Carrier in Carrier link: Without and with ACM

	Occupied BW [2]	Threshold Mod/Cod	CnC Es/No Penalty	Threshold Es/No Req.	Clear Sky Es/No	Link Margin
Link A to B	(14.1/2) MHz	8-PSK 3/5	0.3 dB	6.9 dB	8.4 dB	1.5 dB
Link B to A	(14.1/2) MHz	8-PSK 3/5	0.3 dB	6.9 dB	8.4 dB	1.5 dB

Tot Alloc BW	Tot PEB BW	Clear Sky Mod / Cod A to B	ACM Max DR A to B	Clear Sky Mod / Cod B to A	ACM Max DR B to A	Total ACM DR increase %
7.05 MHz	6.62 MHz	8-PSK 2/3	11.1 Mbps	8-PSK 2/3	11.1 Mbps	11.0%

### Scenario 2 Summary (% Improvement vs. Conventional Link)

	Convention Link	Conventional with ACM	CnC without ACM	CnC with ACM (Reduced BW)	CnC with ACM (Max Throughput)
BW / PEB	10.4 MHz	10.4 MHz (0.0%)	7.05 MHz (32.2%)	7.05 MHz (32.2%)	10.4 MHz (0.0%)
Guar. DR	20 Mbps	20 Mbps (0.0%)	20 Mbps (0.0%)	20 Mbps (0.0%)	29.5 Mbps (47.5%)
Max DR	20 Mbps	23.7 Mbps (18.5%)	20 Mbps (0.0%)	22.2 Mbps (11.0%)	32.7 Mbps (63.5%)

**Scenario 1** exemplifies a conventional synchronous circuit. Synchronous circuits and synchronous data interfaces, such as **G.703**, **RS422**, and **V.35**, do not allow for variances in data rate once the circuit is established. They are static in throughput and have strict clocking and timing requirements. For this reason, a statistical and dynamic technology such as ACM cannot be used in these types of circuits and provides no value regardless of the available link margin.

As discussed earlier, Carrier-in-Carrier is a static technology that provides an unchanging advantage and proves to be of substantial value in synchronous circuits. As seen in the **Scenario 1** summary section, CnC without ACM provides a 32.5 percent BW/PEB savings over a conventional link. In all other scenarios, the result is either unimproved or not applicable.

**Financially Speaking:** Assuming a cost per MHz of BW/PEB is \$3000.00 USD per month, a service provider could save \$975/MHz \* (14.12 – 9.52) = \$4,485 per month or \$53,820 per year by deploying CnC on this circuit.

**Scenario 2** — Guaranteed minimum 10 Mbps SLA duplex link – Determine the best overall modulation technique when considering: **(1) Asynchronous, packet-based Data, 2) Link 99.65 percent availability, and 3) Typical Ku-band rain fade conditions.**

In **Scenario 2**, we can see that packet-based networks (when combined with ACM) can yield a higher data throughput. In this scenario, however, due to the 99.65 percent Link Availability chosen (vs. 99.85 percent in scenario 1), the link margin needed is only about 1.5 dB. Due to this lower link margin, we see only a minimal (18.5 percent) increase in data throughput due to ACM alone. As shown in the column CnC with ACM (Reduced BW), Carrier-in-Carrier offers a 32.2 percent savings in allocated bandwidth, plus an 11.0 percent increase in data throughput due to ACM.

**Financially Speaking:** Assuming a cost per MHz

of BW/PEB is \$3000.00 USD per month, a service provider could save \$966/MHz \* (10.4 – 7.05) = \$3,236 per month or \$38,833 per year by deploying CnC and would increase user throughput by an additional 2.2 Mbps for the majority of the year.

What happens if we convert the savings in bandwidth to additional throughput? As seen in the CnC with ACM (Max Throughput) column of the Summary section, a user could choose to convert BW savings into additional throughput by running a 10.4 MHz CnC link (equivalent to the **Scenario 2a** Total allocated BW). Even in the most highly faded condition, running 8-PSK 3/5 Mod/Cod, CnC alone would give the user 29.5 Mbps of capacity (14.7 Mbps each way).

This is a 47.5 percent increase over the 20 Mbps guaranteed SLA. CnC, without ACM, in a highly faded link condition provides a 29 percent throughput advantage over ACM in *CLEAR SKY CONDITIONS!*

When clear sky conditions do arise, CnC with ACM will run at Mod/Cod 8-PSK 2/3 offering 32.7 Mbps of capacity (16.3 Mbps each way). This is 63.5 percent over the contracted SLA figure of 20 Mbps and 45 percent better than ACM alone.

As we are running a BW limited link (being charged by BW not by PEB or power), we know that the cost per month for the CnC 10.4 MHz is the same as the Conventional (non CnC) 10.4 MHz and we have now increased our Data Rate capacity by up to 63.5 percent over our SLA. When looking at all available options, it is clear that CnC combined with ACM provides the best overall result.

**Scenario 3** (next page) — Guaranteed minimum 10 Mbps SLA duplex link – Determining the best overall modulation technique when considering: **(1) Asynchronous, packet-based, Data Link, 2) 99.7 percent availability, and 3) Ku-band rain fade conditions in severe rain fade locations.**

## System Configuration Information

Satellite: IS-907

Location: 332.5 °E

Beam" 71

Txpdr Center Freq." 14.0425 / 10.9925

Station A: Abidjan, Côte d'Ivoire

Station A Antenna: 7.8 m

Station B Location: Lome, Togo

Station B Antenna: 2.4 m

### Scenario 3a: Conventional two (2) carrier link: Without and with ACM

	Occupied BW	Guaranteed Mod/Cod	CnC Es/No Penalty	Threshold Es/No Req.[1]	Clear Sky Es/No	Link Margin
Link A to B	6.35 MHz	8-PSK 2/3	0.0 dB	7.8 dB	15.9 dB	8.1 dB
Link B to A	4.23 MHz	16-APSK 3/4	0.0 dB	11.7 dB	18.6 dB	6.9 dB

Tot Alloc BW	Tot PEB BW	Clear Sky Mod / Cod A to B	ACM Max DR A to B	Clear Sky Mod / Cod B to A	ACM Max DR B to A	Total ACM DR increase %
10.58 MHz	10.15 MHz	32-APSK 5/6	20.8 Mbps	32-APSK 9/10	14.9 Mbps	78.5%

### Scenario 3b: Carrier in Carrier link: Without and with ACM

	Occupied BW [2]	Threshold Mod/Cod	CnC Es/No Penalty	Threshold Es/No Req.	Clear Sky Es/No	Link Margin
Link A to B	(14.1/2) MHz	8-PSK 3/5	0.3 dB	6.9 dB	14.9 dB	8.0 dB
Link B to A	(14.1/2) MHz	8-PSK 3/5	0.3 dB	6.9 dB	13.8 dB	6.9 dB

Tot Alloc BW	Tot PEB BW	Clear Sky Mod / Cod A to B	ACM Max DR A to B	Clear Sky Mod / Cod B to A	ACM Max DR B to A	Total ACM DR increase %
7.05 MHz	7.53 MHz	32-APSK 3/4	20.8 Mbps	16-APSK 5/6	18.5 Mbps	96.5%

### Scenario 3 Summary (% Improvement vs. Conventional Link)

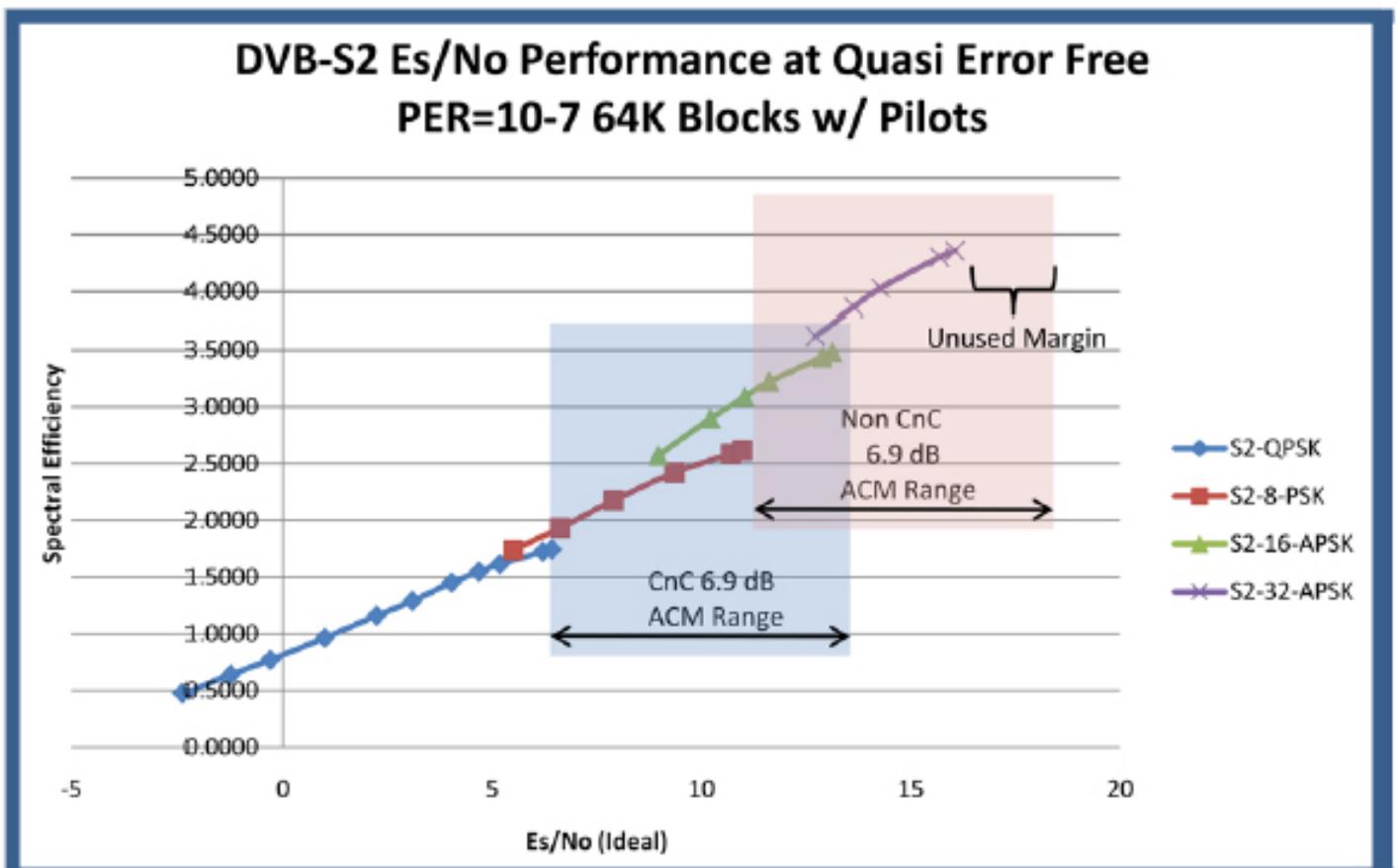
	Conventional Link	Conventional with ACM	CnC without ACM	CnC with ACM (Reduced BW)	CnC with ACM (Max Throughput)
BW / PEB	10.58 MHz	10.58 MHz (0.0%)	7.53 MHz (28.8%)	7.53 MHz (28.8%)	9.90 MHz (0.0%)*
Guar. DR	20 Mbps	20.0 Mbps (0.0%)	20 Mbps (0.0%)	20 Mbps (0.0%)	28 Mbps (40.0%)
Max DR	20 Mbps	35.7 Mbps (78.5%)	20 Mbps (0.0%)	39.3 Mbps (96.5%)	55.1 Mbps (175%)

In **Scenario 3** we see that packet-based networks running ACM can improve data throughput by a significant amount. In this scenario, a 99.7 percent Link Availability, Ku-band operation, and a combination of geographical locations that experience severe fade conditions creates a Link Margin demand of 6.9 to 8.1 dB. Due to this high link margin, we see substantial (78.5 percent) increase in data throughput due to ACM alone. Carrier in Carrier offers a 28.8 percent savings in allocated bandwidth combined with a 96.5 percent increase in data throughput due to ACM as seen in the CnC with ACM (Reduced BW) column. It can be seen in this scenario the increase in data rate due to ACM was slightly higher in the CnC with ACM (Reduced BW) circuit than in the ACM only circuit (96.5 percent vs. 78.5 percent). The reason for this is quite simple. The Link margin of 6.9 dB (scenario 3a Link B to A) available in clear sky conditions far exceeded the most efficient Mod/Cod (32-APSK 9/10) Es/No requirement and, therefore, could not be further converted to increased capacity. This is another advantage of using

CnC technology in combination with ACM. In virtually all CnC circuits a lower mod/cod can be used as we are spreading the signal, requiring a lower Es/No but over a larger occupied BW. As can be seen in the graph below, when you can attain your minimum SLA by using a mod/cod that requires a lower Es/No, more link margin can be converted to user throughput.

Furthermore, as you can see in the “Ideal” spectral efficiency vs. Es/No graph below, for every 5 dB of change in Es/No, there is roughly an increase of 1.6 to 1.8 times the spectral efficiency. Meaning, for every 5dB of link margin, in an ideal DVB-S2 implementation, throughput should increase by 60 to 80 percent regardless of where you begin (Threshold Es/No).

**Financially Speaking:** Assuming a cost per MHz of BW/PEB is \$3000.00 USD per month, a service provider could save \$864/MHz \* (10.58 – 7.53) = \$2,635 per month or \$31,622 per year by deploying CnC and would increase user throughput by an additional 19.3 Mbps for the majority of the year.



## System Configuration Information:

Satellite: IS-1002

Location: 359 °E

Beam" 312

Txpdr Center Freq." 13.955 / 12.705

Station A: Tripoli, Libya

Station A Antenna: 7.8 m

Station B Location: Oran, Algeria

Station B Antenna: 2.4 m

### Scenario 4a (E3): Conventional two (2) carrier link: No ACM Value

	Occupied BW	Threshold Mod/Cod	CnC Es/No Penalty	Threshold Es/No Req.	Clear Sky Es/No	Link Margin
Link A to B	24.25 MHz	8-PSK 3/5	0.0 dB	6.7 dB	11.1 dB	4.5 dB
Link B to A	24.25 MHz	8-PSK 3/5	0.0 dB	6.7 dB	11.1 dB	4.5 dB

Tot Alloc BW	Tot PEB BW	Clear Sky Mod/Cod A to B	ACM Max DR A to B	Clear Sky Mod/Cod B to A	ACM Max DR B to A	Total DR Increase %
48.50 MHz	44.03 MHz	8-PSK 3/5	34.368 Mbps	8-PSK 3/5	34.368 Mbps	0.0%

### Scenario 4b (E3): Carrier in Carrier link: No ACM Value

	Occupied BW	Threshold Mod/Cod	CnC Es/No Penalty	Threshold Es/No Req.	Clear Sky Es/No	Link Margin
Link A to B	(65.47/2) MHz	QPSK 2/3	0.3 dB	4.0 dB	8.5 dB	4.5 dB
Link B to A	(65.47/2) MHz	QPSK 2/3	0.3 dB	4.0 dB	8.5 dB	4.5 dB

Tot Alloc BW	Tot PEB BW	Clear Sky Mod / Cod A to B	ACM Max DR A to B	Clear Sky Mod / Cod B to A	ACM Max DR B to A	Total ACM DR Increase %
32.73 MHz	31.80 MHz	QPSK 2/3	34.368 Mbps	QPSK 2/3	34.368 Mbps	0.0%

### Scenario 4 (E3) Summary (% Improvement vs. Conventional Link)

	Conventional Link	Conventional with ACM	CnC without ACM	CnC with ACM (Reduced BW)	CnC with ACM (Max Throughput)
BW / PEB	48.50 MHz	48.50 MHz (0.0%)	32.73 MHz (32.5%)	32.73 MHz (32.5%)	N/A
Guar. DR	34.368 Mbps	34.368 Mbps (0.0%)	34.368 Mbps (0.0%)	34.368 Mbps (0.0%)	N/A
Max DR	34.368 Mbps	34.368 Mbps (0.0%)	34.368 Mbps (0.0%)	34.368 Mbps (0.0%)	N/A

As we have done in **Scenario 2**, let's see what happens if we convert the savings in bandwidth to additional throughput. In **Scenario 3**, the CnC link is power limited, running a 7.05 MHz carrier is equivalent to using 7.53 MHz PEB. For this reason, we need to compare a 9.9 MHz (Total Allocated BW) CnC link equating to a 10.58 MHz BW/PEB, as this will give us a realistic equivalent satellite cost.

As seen in the CnC with ACM (Max Throughput) column of the Summary section, a user could choose to convert BW savings into additional throughput by running a 9.9 MHz CnC link. In the most highly faded condition, running 8-PSK 3/5 Mod/Cod in both directions, CnC alone would give the user 28.0 Mbps of capacity (14.0 Mbps each way). This is a 40.0 percent increase over the 20 Mbps guaranteed SLA even in the most faded of conditions (where ACM will provide little to no value).

When clear sky conditions do arise, CnC with ACM will run at Mod/Cod 32-APSK \_ in one direction and 16-APSK 5/6 in the opposite direction offering 55.1 Mbps of capacity (29.2 Mbps A to B, 25.9 Mbps B to A). This is 175 percent over the contracted SLA figure of 20 Mbps and 96.5 percent better than ACM alone. Again, it is clear that DoubleTalk Carrier-in-Carrier combined with ACM provides the best overall result.

**Scenario 4 (E3 Link Optimization)** — E3 (34.368 Mbps) Synchronous fixed Data Rate duplex – Determine the best overall modulation technique when considering: **(1) synchronous 34.368 Mbps E3 data, (2) 99.95 percent link availability, and (3) Typical Ku-band rain fade conditions.**

**Scenario 4**, as with **scenario 1**, exemplifies a conventional synchronous circuit. E3 circuits and synchronous data interfaces, such as G.703 do not allow for variances in data rate once the circuit is established. They are static in throughput and have strict clocking and timing requirements. For this reason,

a statistical and dynamic technology such as ACM cannot be used in these types of circuits and provides no value regardless of the available link margin. Carrier-in-Carrier's static benefit provides an unchanging advantage and proves to be of substantial value in E3 circuits. As seen in the Scenario 4 summary section, CnC without ACM provides a 32.5 percent BW/PEB savings over a conventional link. In all other scenarios, the result is either unimproved or not applicable.

**Financially Speaking:** Assuming a cost per MHz of BW/PEB is \$3000.00 USD per month, a service provider could save  $\$975/\text{MHz} * (48.50 - 32.73) = \$15,375$  per month or \$184,500 per year by deploying CnC on this circuit.

## Conclusion

When considering bandwidth conservation, user data throughput maximization or a combination of the two, there are many choices and technologies available. Synchronous circuits greatly benefit by using Carrier-in-Carrier's definitive and static BW/PEB savings, and cannot benefit through the use of ACM. Non Synchronous, packet-based circuits can be improved by ACM, but these improvements are even more substantial when a combination of ACM and Carrier-in-Carrier technologies are deployed. **Comtech EF Data** has a team of sales engineering personnel who can help analyze the benefits of using these advanced technologies on your existing or newly provisioned links.

### About the author

Louis Dubin is Vice President of Product Management at Comtech EF Data. In this role, he is responsible for business development and product management of the high speed modems, TDMA modems, and broadcast products.





# Masthead + Advertiser Index



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