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SatMagazine

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JULY/AUGUST 2009

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With the teleport and MSS satellite service provider markets doing well, we wish to offer readers of *SatMagazine* some additional focus on this crucial SATCOM segment. We are also going to take a look at the satellite market in general, thanks to our highly regarded subject-matter experts.

Additionally, if you like your news fresh, tight, and to the point, you can now receive "tweets" directly from ***SatBoy***... each time a news item is placed on the ***SatNews.com*** daily news site, a fresh ***Twitter*** message is sent to those who are following "***SatBoy***". For those on the go, at a desktop who only have a brief moment or two to ingest the news, Twitter is a time-saving and immediate way to obtain timely, industry news. Simply head over to ***http://www.twitter.com*** and sign-in (or establish your FREE account). To obtain the ***SatNews*** goodies, enter "**FOLLOW username: [n]**" — this command allows you to start receiving notifications for a specific person on your phone. **Example: follow SatBoy**. That's all there is to it!

Astrium Services' Toulouse teleport, operated by the Company's subsidiary **London Satellite Exchange**, will be handling commercial communication services to Africa via **Eutelsat**'s ***W2A*** satellite. This new teleport opened last year and their SATCOM services include telephony, notably *Virtual Private Network* (**VPN**) secure services. Eutelsat's W2A satellite entered services in May of this year and provides Ku-band capacity across Europe, North Africa, the Middle East and central Asia, as well as C-band capacity that extends from South America across Africa and Europe.

W2A satellite

In mid-May, **Eutelsat**'s ***W2A*** satellite entered full commercial service of its Ku- and C-band services at the **10 degrees East** orbital slot. This required service transfers from the ***W1*** satellite to ***W2A***, and the Company's teleport came into critical play. Eutelsat's ***Rambouillet*** teleport facility worked closely with all of the Eutelsat client via the Control Center to make certain the transfer was as seamless as possible. Clients that were already operating in the Ku-band experienced full continuity for their services, and Eutelsat now also has additional headroom for new customer expansion and coverage extensions at this key orbital location. The W1 satellite will offer operations from a repositioning to the **4 degrees East** slot and a name change is also imminent — ***EUROBIRD 4A***.

BT in Latin America now offers IP trunking services for business based in *Manaus* and other rural areas of northern Brazil via its teleport and Internet access point in *São Paulo*. This was made possible when the company expanded from 92 to 104 MHz of C-band capacity aboard **SES AMERICOM-NEW SKIES**' ***NSS-10*** satellite. BT also tapped a portion of the satellite bandwidth to support customer single channel per carrier (SCPC) and distance learning services throughout Brazil.

NSS-10 satellite

Bandwidth... constant pressure for companies to acquire and offer more... **Expand Networks** is moving swiftly ahead to ensure such pressure can be alleviated by working with **Level 421**. In fact, Expand's new part-

nership with Level 421, a global satellite broadband communication teleport operator, will find the Company's WAN Optimization technology bringing relief into play. Level 421 uses more than 38 geostationary satellites across the globe, which receive content from four teleports, including Level 421's own teleport in Ulm, Germany. With the Expand intelligent compression algorithms technology, Level 421 will be able to optimize bandwidth.

Intelsat is refreshing its satellite fleet that serves the Asia-Pacific region as well as also investing additional resources to their ground network infrastructure for this area of the world. An upgrade at their ***Paumalu Teleport*** in Hawai'i will result in improved fiber density. Upgraded antennas facilities will expand accessibility and redundancy for Pacific Ocean satellites, with media customers receiving enhanced services. Additionally, Intelsat's *GlobalConnex Network Broadband Managed* services will be expanded, with hubs being added at **KT Corporation**'s teleport facilities in South Korea. Also signing on with Intelsat is ABS-CBNi, who has now signed a multi-year contract expansion with the Company. ABS-CBNi will use capacity on Intelsat's ***Galaxy 19*** satellite, located at 97 degrees West, to offer its clients increased regional programming in North America via its fully-owned and operated **San Francisco International Gateway** teleport. Intelsat's Galaxy 19 satellite, which hosts the largest ethnic video platform in North America distributing to nearly 180 international channels, is located within Intelsat's premier ***Galaxy*** neighborhood.

MacDonald, Dettwiler and Associates Ltd. has been awarded a multi-million dollar contract from **DigitalGlobe Inc.** to provide a remote ground station solution to an international customer to enable support for the ***WorldView-1*** and ***WorldView-2*** satellites. This contract is the fifth international ground station order to-date that MDA has received from DigitalGlobe and MDA will provide a solution capable of programming, receiving, and processing imagery and data from those satellites. As prime contractor, MDA is responsible for developing, integrating and installing their solution at the customer's site by early 2010.

MEASAT-3a satellite

WorldView-2 satellite

MTN Satellite Services and **ERZIA** are going to be building a new teleport in *Santander*, North Spain. This new facility will initiate operations by the end of 2009 and will offer commercial X-band teleport services through two antennas pointing to ***XTAR-EUR*** and ***XTAR-LANT*** satellites, operating at geosynchronous slots **60 degrees West** to **65 degrees East**, covering a region ranging from Western Australia to North America, the Mediterranean Sea, and the Indian and Atlantic Oceans. Uplinks and downlinks from both of these satellites will be supported. C- and Ku-band teleport ops will be added to the current MTN global and terrestrial network, along with point-of-presence and a 24x7

XTAR-EUR satellite

NOC in Santander. ERZIA will be able to improve mobile and fixed VSAT services in Spain and southern Europe. *CyberJaya*, Malaysia, is the location of the **MEASAT Teleport and Broadcast Center**, and this operation will handle the needs of the just-launched ***MEASAT-3a*** satellite. Located at the orbital slot at **91.5 degrees East**, the new satellite offers a 15 year life expectancy and will support DTH, broadcasting, and telecommunication services. Full commercial operations are expected by the close of July.

Teleports require a variety of hardware and software solutions to ensure viable, effective operations. To that end, last month **Newtec** made the announcement that **Asia Broadcast Satellite** (ABS) is going to be working with them to optimize their point-to-point satellite services transmissions via Newtec's DVB-S2 technology. ABS customers will be able to transport live video content directly from their studios to ABS gateway teleports, efficiently and reliably. These contribution feeds will then be multiplexed, encrypted, and uplinked to full transponder MCPC platforms on the ***ABS-1*** satellite for payTV distribution and for DTH broadcasting. The Newtec high order DVB-S2 modulation solution is comprised of their ***Azimuth*** broadcast satellite monitor, the ***AZ110***, and the ***AZ910*** demodulator.

Newtec's AZ110 modulator

With **RAMTelecom's** acquisition by **OmniGlobe Networks** becoming finalized last month, the broadband data and voice business communications services for enterprises in the oil and gas, mining, and forestry sectors as well as government agencies will be formed into a new broadband communications division. Joining the former RAMTelecom services group will be OmniGlobe's WiMAX and broadband operations, with all services based in and operating from Ottawa, Canada, with teleport facilities in Ottawa, Montreal, and a future site in Western Canada. The former president and CEO of RAMTelecom, Mr. *Gilles R. Desmarais*, is now the North American vice president of sales and marketing for both divisions.

The division's MSS and FSS services provide complete coverage of North America.

AMOS-3 satellite

The *National Geographic Wild* programming will now be reaching Romania, thanks to the **INTV Teleport** in *Prague*. **Spacecom**, the operator of the ***AMOS*** satellite fleet, was the recipient of this contract, which will find the programming heading into the teleport via the ***AMOS-3*** satellite. Spacecom will provide the satellite capacity and encryption services with its Viaccess conditional access system. ***AMOS-3*** is located at **4 degrees West** and serves DTH and other TV platforms in Europe and the Middle East.

You read earlier about the **SES AMERICOM-NEW SKIES** work with BT and their teleport services — well, the Company has also signed a multiyear agreement with **Teleport Access Services, Inc.**, for the distribution of 50 Chinese TV channels to customers in Taiwan via the ***NSS-11*** satellite. Three transponders will be used. This satellites overs Ku-band coverage of China, Korea, Japan, the Philippines, South Asia and portions of the Middle East.

By the way, the **World Teleport Association** offers a complete list of global teleports at...

http://www.worldteleport.org/displaycommon.cfm?an=1&subarticlenbr=274

Your time would be worthwhile in visiting the WTA website for a full listing of available teleports — there are also URLs to some of the teleport websites. Select the graphic below for further WTA information.

Hartley Lesser, Editorial Director

As far as the health of our industry, *Patricia Cooper*, the President of the Satellite Industry Association (SIA), said, "The satellite industry continued to post growth in 2008, led by satellite services and ground equipment sales. The results for the past year are encouraging, and frame the need for policy decisions that can affect the industry's future growth such as export controls, broadband stimulus and U.S. government communications requirements."

The SIA's ***2009 State of the Satellite Industry Report*** was released at **ISCe 2009**, revealing a 19 percent growth in overall world satellite industry revenues — with revenues totaling $144.4 billion in 2008. Global revenues for the satellite industry continue to increase, averaging an annual growth rate of 14.2 percent from 2003 to 2008.

SIA commissioned the **Futron Corporation** to conduct its 12th annual ***State of the Satellite Industry Report***. Futron polled more than 70 satellite companies, both SIA members and non-members, to determine aggregate revenues in each of the satellite industry's sectors: satellite services, satellite manufacturing, launch industry and ground equipment.

In 2008, the ground equipment sector was the fastest-growing satellite industry segment, followed by the satellite services sector, which continues to demonstrate increased growth. The report shows that:

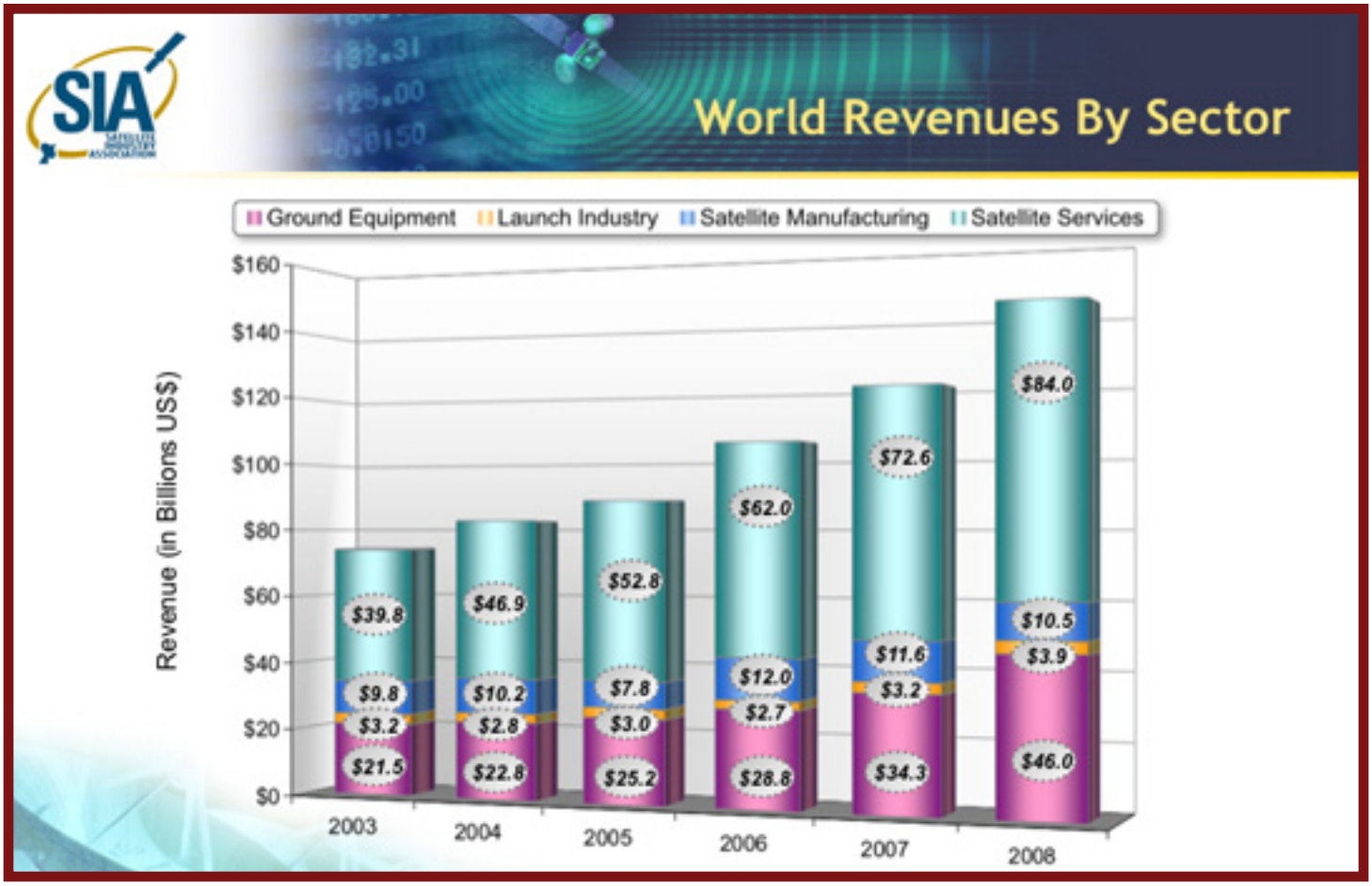
- *Satellite Services revenues maintained a steady growth of 16 percent, with satellite television leading this sector, amounting to a total of $67.3 billion in 2008.*
- *Satellite Manufacturing revenues decreased slightly from $11.6 billion in 2007 to $10.5 billion in 2008, as fewer new satellites were launched.*
- *Launch Industry revenues increased by 20 percent in 2008, with United States launch industry revenues remaining relatively constant at $1.1 billion.*
- *Ground Equipment revenues grew fastest at 34 percent, increasing to $46 billion, second only to satellite services. Consumer-oriented products, including satellite TV and broadband, mobile satellite and GPS devices, led the growth in this sector.*

The SIA chart titled "World Satellite Revenues" at the bottom of this page shows revenues expressed in real-year U.S. dollars (not adjusted for inflation.) On the next page are two SIA charts that reveal the "World Revenues By Sector." As is readily discernible:

- *Overall worldwide industry revenue growth was 19 percent from 2007 to 2008, compared with a 15 percent increase from 2006 to 2007*
- *Satellite Services increased by more than 16 percent from 2007 to 2008, largely due to growth in satellite television revenues*
- *Satellite Manufacturing revenues declined slightly, reflecting fewer satellites launched*
- *Launch Industry revenues grew by 20 percent from 2007 to 2008, fueled by a general increase in launch prices, despite fewer launches*
- *Ground Equipment revenues grew by 34 percent in 2008, a significant increase over the 19 percent growth in 2007*

According to SIA, Satellite Services experienced a growth rate of 16 percent in 2008 — quite robust — which paralleled the 17 percent growth in 2007. Additionally, satellite television (DBS/DTH subscription revenues), which represented three-quarters of total satellite services revenues in 2008, maintained a steady growth, increasing by 17 percent to $64.9 billion. Satellite pay TV subscribers grew by more than 30 percent over 2007 levels, surpassing 130 million globally.

In the U.S., satellite pay TV subscribers exceeded 30 million in 2008. Representing the core of the FSS sector, transponder agreement revenues continued to


World Revenues By Sector
Ground Equipment
Launch Industry
Satellite Manufacturing
Satellite Services
Revenue (in Billions US$)
$160
$140
$120
$100
$80
$60
$40
$20
$0
$39.8
$9.8
$3.2
$21.5
$46.9
$10.2
$2.8
$22.8
$52.8
$7.8
$3.0
$25.2
$62.0
$12.0
$2.7
$28.8
$72.6
$11.6
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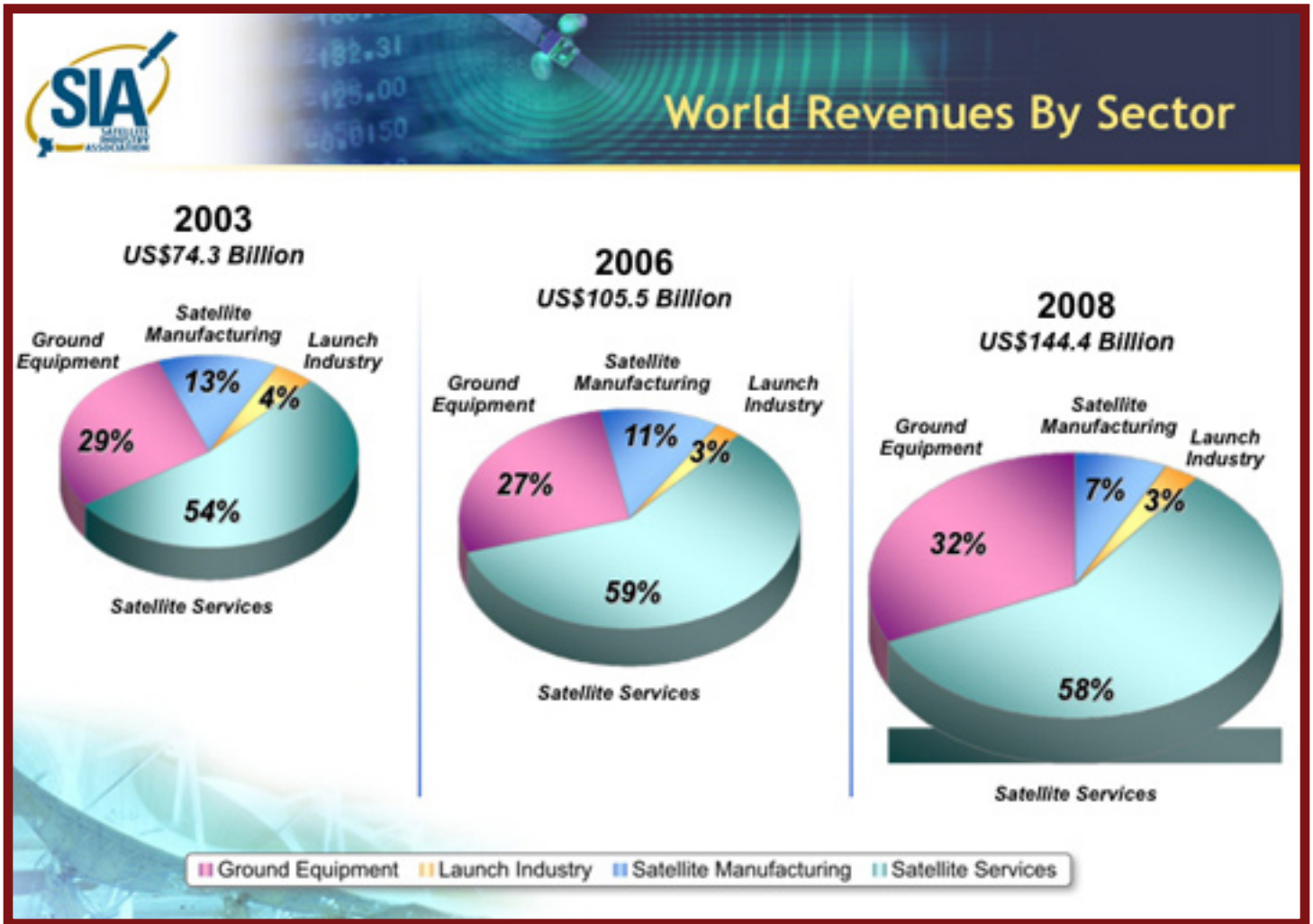
$84.0
$10.5
$3.9
$46.0
2003
2004
2005
2006
2007
2008


World Revenues By Sector
2003
US$74.3 Billion
Ground Equipment
Satellite Manufacturing
Launch Industry
29%
13%
4%
54%
Satellite Services
2006
US$105.5 Billion
Ground Equipment
Satellite Manufacturing
Launch Industry
27%
11%
3%
59%
Satellite Services
2008
US$144.4 Billion
Ground Equipment
Satellite Manufacturing
Launch Industry
32%
7%
3%
58%
Satellite Services
Ground Equipment
Launch Industry
Satellite Manufacturing
Satellite Services

increase by 6 percent in 2008. That figure includes contracts for full or partial transponders and occasional use video services.

Data applications continued to drive mobile satellite services growth, with mobile data services revenues increasing by 22 percent, as compared to 14 percent in 2007 — this now represents almost 70 percent of all mobile satellite services.

Revenues for mobile telephony declined by 24 percent in 2008, largely due to the recent decline in Globalstar voice services. Satellite broadband revenues doubled, driven by subscriber growth in the U.S. Satellite radio (DARS) continued to experience strong growth, although at a lower pace than previously experienced. Subscription revenues increased to $2.45 billion, reflecting an 18 percent growth rate versus the 29 percent growth from 2006 to 2007. Subscribers grew by 13 percent to 20.5 million, roughly half the growth rate of the previous year.

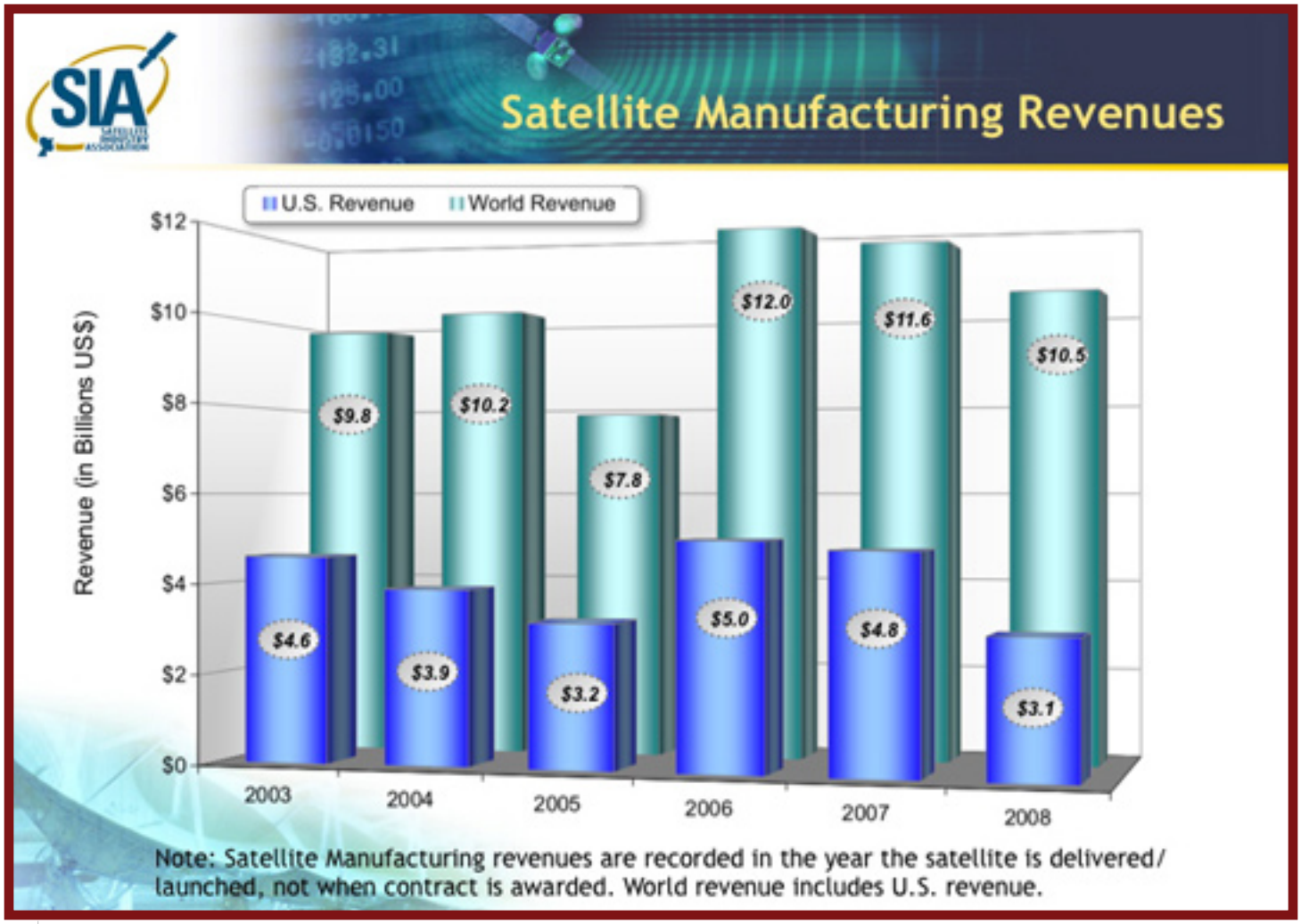
The chart below, "Satellite Manufacturing Revenues," shows revenues decreasing slightly from $11.6 billion in 2007 to $10.5 billion in 2008. The overall revenue decline can be attributed largely to the reduction in number of satellites launched — 94 satellites were launched in 2008, versus 102 in 2007.

Meanwhile, U.S. manufacturing revenues declined from $4.8 billion in 2007 to $3.1 billion in 2008. The U.S. share of manufacturing revenues also fell, from 41 percent of the world total in 2007 to 29 percent in 2008. In 2007, 48 launched satellites were manufactured in the U.S., but in 2008, only 21 launched satellites were manufactured in the U.S.

Global satellite manufacturing revenues from commercial customers grew to $5.2 billion in 2008. The proportion of manufacturing revenues from commercial customers (versus government and military customers) rose from about 33 percent of manufacturing revenues in 2007 to nearly 50 percent in 2008.

In regard to future commercial spacecraft orders:

- *21 new commercial geosynchronous orbit (GEO) satellite manufacturing orders were announced in 2008, the same number as in 2007*
- *U.S. manufacturers received 52 percent of these orders, the same proportion as in 2007*



- *European manufacturers received 33 percent of these orders, down from 43 percent in 2007*
- *Russian, Chinese, and Japanese manufacturers each received one order, together constituting 14 percent of new orders —up from 5 percent in 2007*

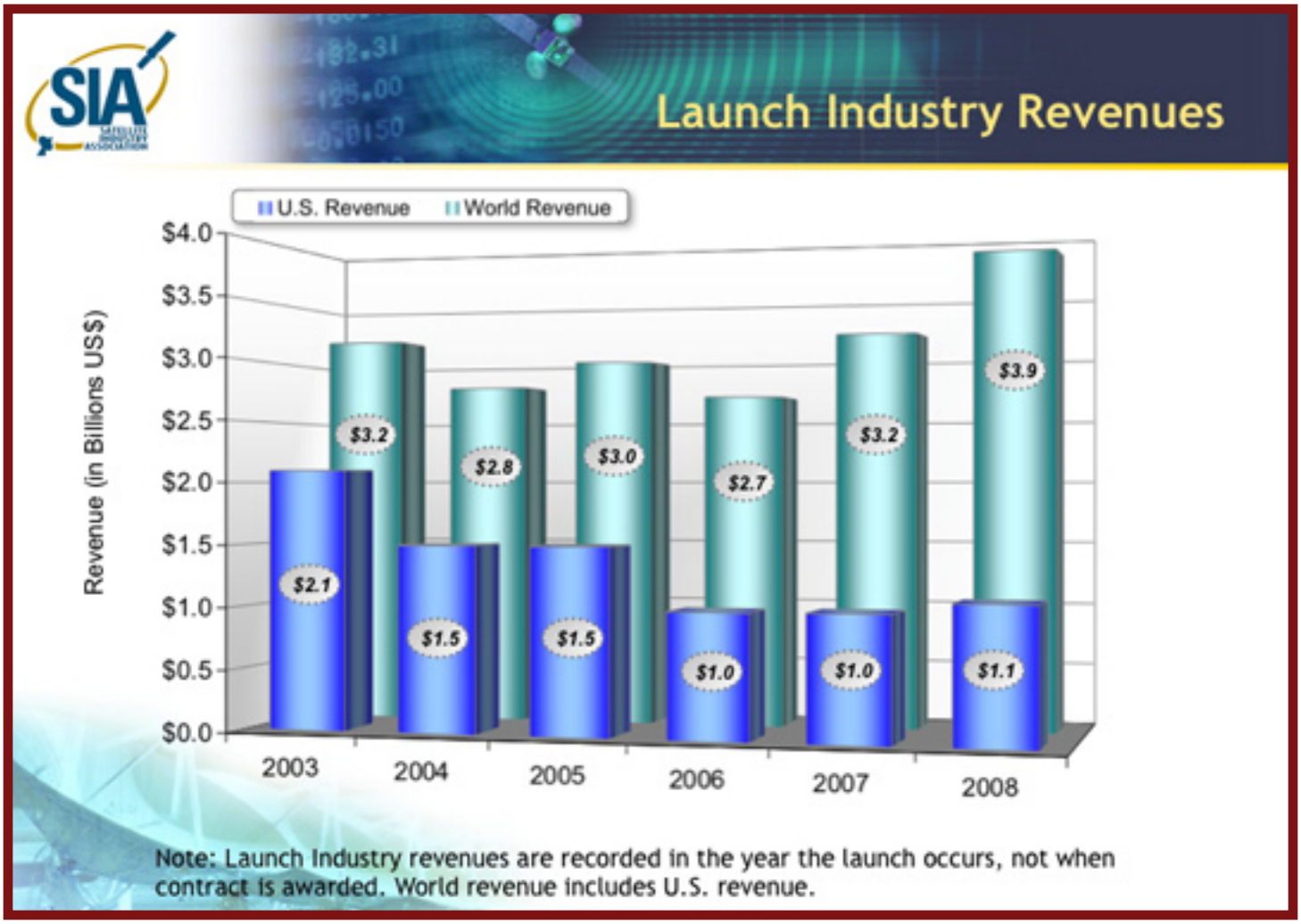
Worldwide Launch Industry revenues increased by 20 percent in 2008, slightly higher than the previous year's growth.

- *Revenues were virtually evenly divided between launch procurements by commercial entities and those commercially contracted by governments*
- *Launch prices rose on average*
- *This was reflected both in input provided by survey respondents, as well as widespread industry media reports*
- *One factor influencing launch price increases was fluctuating exchange rates of the U.S. dollar versus other currencies*
- *37 spacecraft were commercially launched on behalf of government clients, while 41 spacecraft were on behalf of commercial clients*
- *While global commercial launch revenues rose in 2008, U.S. revenues remained relatively constant at $1.1 billion*
- *Despite stable revenues, the U.S. share of worldwide launch revenues declined from 31 percent in 2007 to 28 percent in 2008*
- *However, future U.S. geosynchronous (GEO) commercial launch orders doubled—from three announced orders in 2007 to six announced orders in 2008*

The chart at the top of **page 12** graphically demonstrates the launch industry revenues.

SIA's ground equipment findings uncovered the fact that overall revenue in this sector grew by 34 percent from 2007 to 2008, making it the fastest-growing satellite industry segment. Ground Equipment is second only to Satellite Services as a proportion of satellite industry revenues, contributing 32 percent of all revenues in 2008, up from 28 percent in 2007.

Consumer equipment revenues led growth in this sector, with users of consumer-oriented products such as satellite TV and broadband, mobile satel-



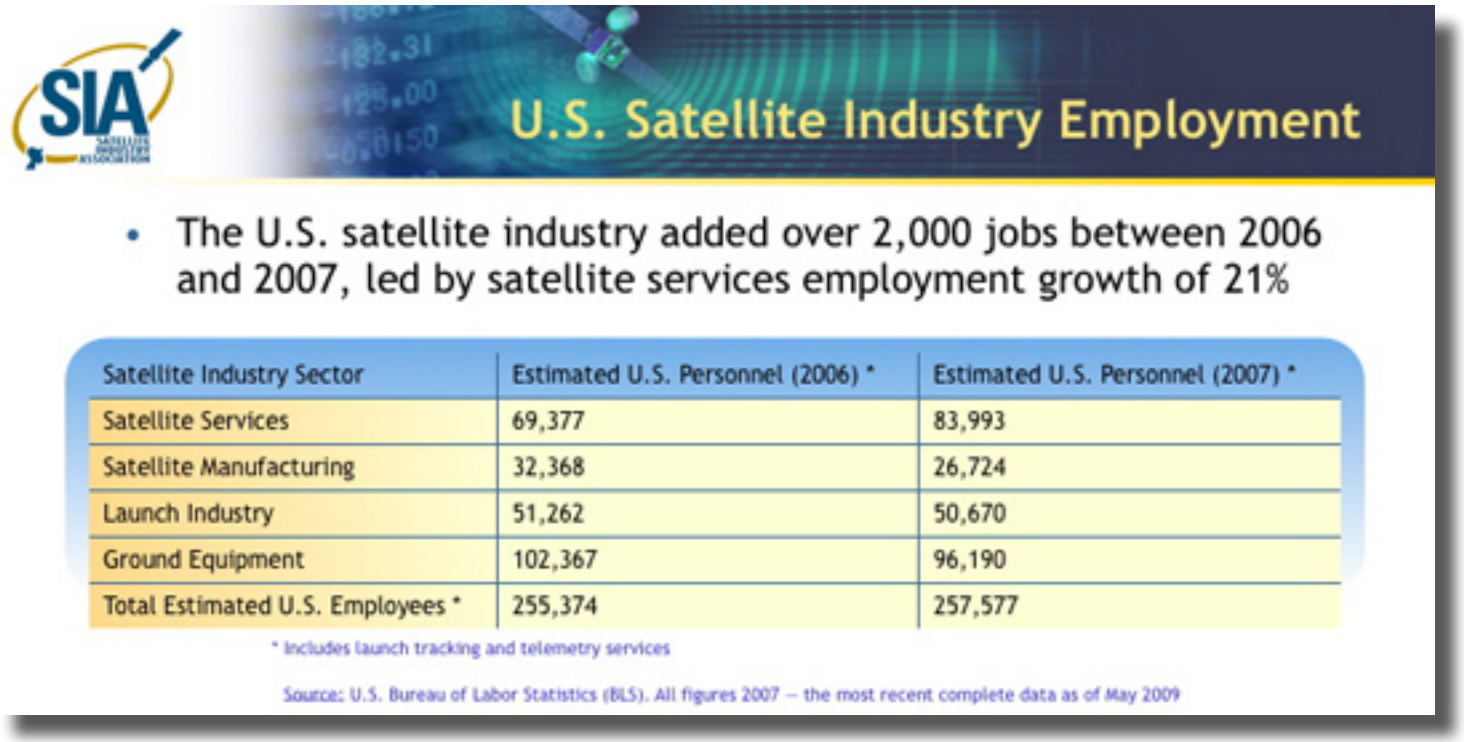
lite, and GPS devices responsible for hardware sales growth. GPS device sales accounted for slightly more than half of ground equipment revenues, with new applications and services driving subscriber churn, which also increased sales of new hardware.

Terminals in Service (Millions)	2007	2008
Satellite TV	100.5	133.6
Satellite Radio	18.0	20.4
Mobile Satellite Services	1.83	1.9
Mobile Satellite TV	0.95	1.3
End-User Broadband	0.68	1.0

Note: For consumer services, terminal number estimates are based on reported subscriber numbers

The table above shows end-user terminal number growth across all sectors. Growth of end-user broadband between 2007 and 2008 occurred primarily in the U.S., with U.S. satellite broadband subscribers growth ranging from approximately 622,000 in 2007 to approximately 842,000 in 2008. Mobile satellite TV is currently offered mainly in Asia, although service is also starting in the U.S. and Europe.

Growth in satellite carriage of *High Definition Television* (**HDTV**) continued to drive both transponder and DTH service revenues. The number of HDTV channels worldwide grew by almost 170 percent over 2.5 years (between the end of 2006 and May 2009) and more than 60 percent of HDTV channels currently serve North American market.



Remaining HDTV channels primarily serve European and Asia-Pacific markets.

When dealing with employment in the satellite industry, SIA and Futron found that the U.S. satellite industry managed to add more than 2,000 jobs between 2006 and 2007, led by satellite services employment growth of 21 percent.

The overall satellite industry growth of 19 percent indicates fundamental robustness. Relative industry composition demonstrates the increasing weight of the Satellite Services and Ground Equipment segments, as these two segments, combined, constituted 86 percent of satellite industry revenues in 2006 and have now grown to 90 percent.

Consumer services, both satellite TV and satellite radio, continue to lead overall Satellite Services growth and fuel revenue growth in the Ground Equipment segment. Launch price increases, rather than more launches, fueled an increase in Launch Industry sector revenues between 2007 and 2008. Despite fairly constant revenues, the U.S. share of world launch revenues decreased from 31 percent in 2007 to 28 percent in 2008, with lower Satellite Manufacturing revenues reflecting fewer spacecraft launched in 2008 than in 2007. To reiterate, the U.S. share of manufacturing revenues fell from 41 percent in 2007 to 29 percent in 2008. Some industry-wide trends continue...

- *Commercial satellite operators replace and realign their fleets*
- *Robust global appetite continued for consumer satellite applications, mobility, and convergence*
- *Carriage of HDTV continued to reach critical mass in major markets globally*
- *The full impact of the global economic downturn on the satellite industry is not yet reflected*
- *Economic downturns have historically had a delayed impact on the satellite industry, but growing interdependence among all four sectors may serve to shorten negative business cycles*

The preceding information is excerpted from the SIA's annual report that offers comprehensive satellite industry statistics. Conducted by **Futron Corporation**, the report included surveys of more than 70 SIA members and key companies in the industry, and was augmented with publicly available data and research to derive industry revenues and statistics. For more info on the SIA, access the graphic below.

Euroconsult, a leading international research and analyst firm that specializes in the satellite sector, has just released their *Satellites to be Built & Launched by 2018, World Market Survey.*

This informative report estimates **1,185 satellites** will be built and launched for the period 2009–2018, an increase of about 50 percent compared to the previous decade (1999–2008). Market revenues generated from the manufacturing and launch of these satellites are forecast to grow by the same rate, reaching $178 billion for the period 2009–2018.

Both the government and commercial sectors will contribute to this market growth, albeit unequally, said *Rachel Villain*, the editor of the survey and the *Director for Space & Communications* at Euroconsult. "The ongoing global economic crisis will have a limited impact on the industry. Governments around the world remain committed to space technology development and only a small number of commercial satellite operators with business or financing issues will be affected by the downturn."

Governments drive future satellite demand – particularly for civilian applications. Civilian and military government agencies will launch a combined **770 satellites** in the next decade, a 55 percent unit increase over the past ten years. Two-thirds of these satellites will be for civilian or dual use.

Civil satellites represent a higher proportion of government satellites than the previous decade. While ongoing defense and security concerns create opportunities for dedicated satellites, or hosted payloads on commercial satellites, demand for proprietary military satellite systems remains concentrated in a limited number of countries.

Market growth will be derived from three distinct groups of countries (see the table below). Together, they will procure satellites for operational missions in...

- *Earth observation*
- *Meteorology*
- *Navigation*
- *Communications*
- *Developing space science & exploration missions as well as technology demonstration satellites*

Earth observation is emerging as the largest application, with a total of **230 satellites** over the next decade as more governments order and launch satellites through national space agencies, multilateral agencies, and public-private partnerships for both civilian and military uses of satellite imagery.

At $116 billion over the decade, the government market is almost double the commercial market but it is largely closed to non-domestic suppliers. Most of that market is for satellites whose final destinations are low Earth orbits (41 percent) with higher altitude orbits (GEO, MEO, HEO and deep space) making up the difference.

Commercial satellites are still primarily for communications and broadcasting services from the geostationary orbit. The commercial satellite market is forecast to grow by over one third in both number of satellites and market value. This growth reflects two distinct trends:

- *The maturity of the commercial geostationary communications satellite industry (GEO comsat). This dominant segment of the commercial market is now driven by replacement of in-orbit satellites with fewer new entrants, resulting in cyclical investments for such systems (ex. nearly three quarters of the 88 satellites ordered in the past four years are for the replacement or expansion of existing orbital slots). Euroconsult forecasts 235 satellites to be launched over 2009–2018 with a market value of $52 billion. The peak of the cycle will occur early in the decade with over 30 units to be launched per year, declining to fewer than 20 units per year at the end of the period.*

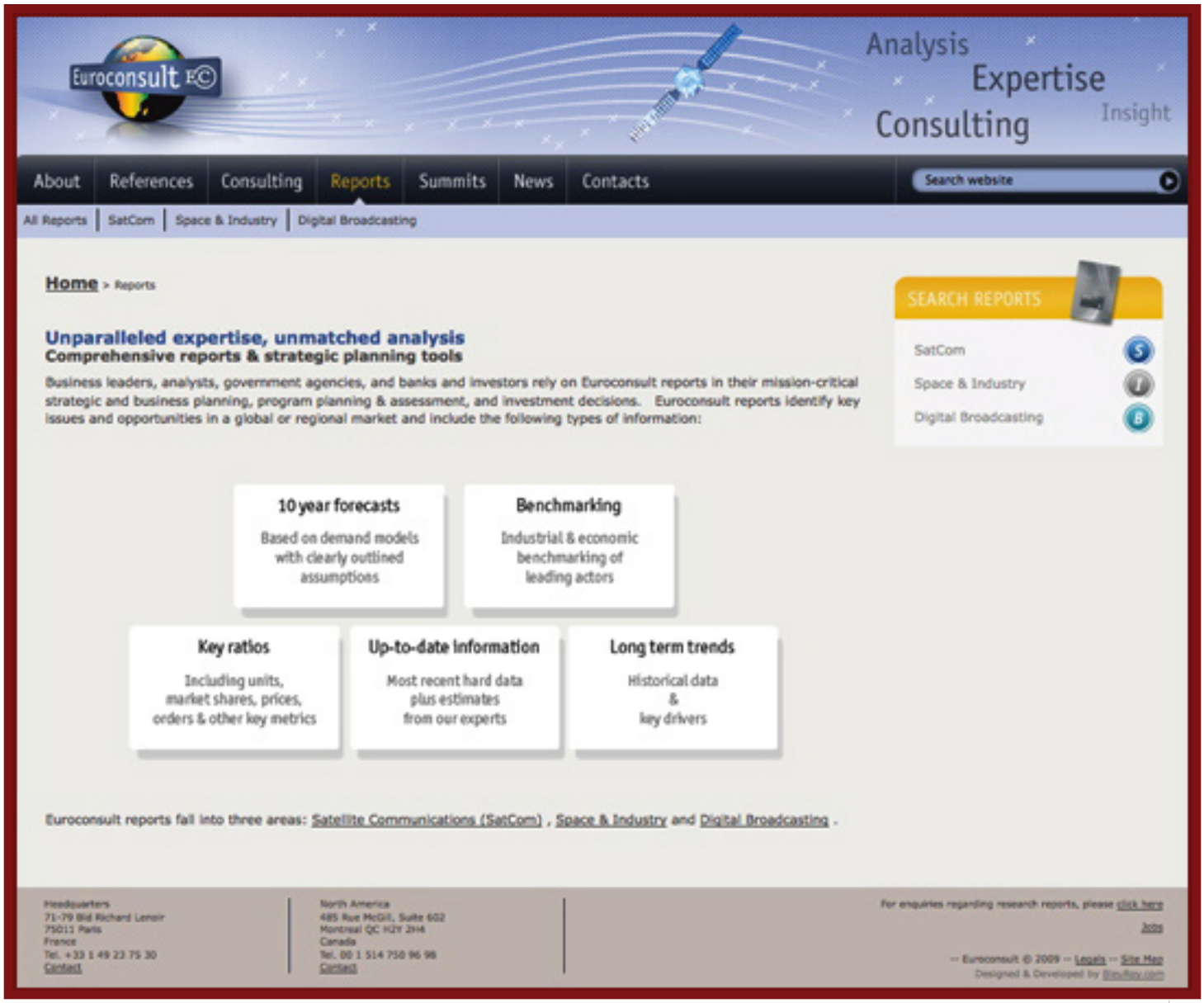
Use of Satellite Technology (Demand)	Manufacturing & Engineering Capabilities (Supply)	Countries
Long tradition of satellite services and space science	Established domestic industry	US, Russia, European countries, Canada, China, Japan, India
Growing use of comsat and Earth observation satellites	Ongoing programs to develop domestic capabilities	Israel, Brazil, South Korea, Malaysia
Developing to respond to social & economic development needs	No domestic capability yet	Turkey, Algeria, Nigeria, Chile, Vietnam, ...

- *Growth in commercial satellite services outside the geostationary orbit, with a total of 180 satellites to be built and launched during the period, up from 104 the previous decade. These are communications satellites being launched into low Earth orbit for the second generation of Orbcomm, Globalstar and Iridium and into medium Earth orbit (O3b) in addition to optical and radar Earth observation satellites launched into low Earth orbit (e.g. Infoterra, GeoEye, RapidEye). According to Euroconsult, at $9.5 billion, the market value generated by these satellites will jump 73 percent, though will remain small compared to GEO comsat.*

Report Profile

The 12th edition of ***Satellites to be Built & Launched by 2018, World Market Survey*** is the landmark study for all industry actors concerned with satellite systems and their launches. The report provides the information that's key to understanding the global space market — present and future. The report includes exclusive 10-year forecasts, including breakdown by customer and by orbit number and mass of satellites to be manufactured and launched and market value.

The report offers a review of strategic issues from both supply (industry) and demand (customers), perspectives and an analysis of leading actors' performance. It also includes a comprehensive and detailed demand database for commercial and government satellites including: application, launch date, satellite platform, manufacturer, launch provider.



The Business of Space

by Hoyt Davidson

The Space Foundation, along with Toffler Associates, recently hosted the *2nd Annual Space Business Forum* in New York City. The panels and featured speakers were very engaging and covered many topics of current interest. All participating believe the space industry represents attractive investment opportunities, both from the stability of the industry and the recession resistance offered by the more established aerospace and commercial satellite companies. In addition, there's high potential growth with the more promising, new space entrepreneurial activities.

The difficulty was in presenting "space" in a way that enticed greater investment community interest and representation. The Space Business Forum offered the challenge of bringing space business leaders and investors together as well as entrepreneurs, astronauts, and space tourists sit down with aerospace executives, government policy makers and investors to further their mutual understanding of the industry and its potentials.

Tom Hendricks, President of *Aviation Week*, reminded the audience of how large and global the space industry has now become.

- *Revenues for 2008 reached $257 billion, up from $251 billion in 2007 a remarkable achievement in a difficult year, but slower growth than the 11 percent enjoyed in 2007. Continued growth is expected in 2009–2010.*
- *Commercial satellite services and infrastructure make up 67 percent of total revenues with government space budgets representing 32 percent. Innovation and entrepreneurial activity remain high.*
- *Commercial competition will only get more intense as Europe, Russia, China, India, Japan, South Korea, and other new space faring nations join the party. For instance, more than half of the 636 expendable launch vehicles projected over the next decade will be from Russia, Ukraine and China.*
- *On the civil space front, greater international collaboration is expected, both for ISS and future lunar exploration.*
- *The U.S. space industry employs more than 262,000 people and at pay scales roughly twice the national average, yet availability of trained engineers remains a key issue, especially for domestic talent.*

Anita Antenucci, Managing Director at **Houlihan Lokey**, moderated the opening panel themed ***Space In Today's Global Economy***. *Andy Africk*, Senior Partner at **Apollo Management**, and *Heidi Wood*, Senior Equity Analyst — Aerospace at **Morgan Stanley**, joined her for the discussion. Key insights included:

- *Aerospace industry stock and bond performance held up better than the general market during the downturn, but is likewise enjoying less of a pop in the post March recovery.*
- *Commercial satellite companies were taken down with the rest of the market, but have actually shown superior revenue and profitability. Those with strong backlog (FSS) and loyal customers (DBS/DTH) are showing good recession resistivity and sound business models. MSS is the next sector that must prove its business models to investors and will be a focus of 2009/2010 with Iridium, Globlstar, ICO, SkyTerra and TerreStar all facing major financing or operational events.*
- *The panel shared a feeling that the public equity investor base was still less sophisticated in terms of risk reward analyses for the space industry than debt investors. More education and perhaps more equity successes will be needed to truly open up the public equity markets.*
- *Part of the equity problem is that some commercial satellite companies went public too soon, before they really had stable or well understood business plans and sufficiently predictable earnings.*
- *Funding "New Space" will remain difficult until revenue generation becomes more clear and predictable. Long negative cash flow periods are a major obstacle to funding in weaker economic cycles like now.*
- *Some cautiousness over future prospects for aerospace/defense industry as military budgets may get hit or at least restructured.*

Steven Kenney, a Partner at **Toffler Associates**, led a discussion on ***Space As An Element Of Economic Infrastructure***. *Steven* reminded those in attendance that the space industry is increasingly part of the larger terrestrial telecom, media, weather, and security industries. His major points included thoughts from:

Richard Sanford, Chief Strategist, **Global Government Solutions Group** — **Cisco**, discussed the future of satellite telecomm. He believes that with development of new satellite technologies use of space by consumers will be just another economic decision versus a last resort. High throughput satellite broadband technologies were mentioned as an example. Mr. *Sanford* believes the need to eliminate the last mile barrier will provide a large market for space companies as laying fiber to the user will remain too expensive for many markets. In ten years or so, he also sees intra- and inter-linked satellite constellations and small satellites operated in networked and reprogrammable fashions to provide more flexible services.

Edward Morris, Executive Director of Strategic Business Development, **ITT Space Systems**, focused on the tremendous contribution made to the global economy by GPS. He indicated GPS is responsible for billions in productivity gains and the enabling of whole new economic activities like automotive navigation and handheld positioning devices. Mr. *Morris* also discussed GPS 2.0 with its promised four civil signals and the U.S. Air Force's commitment to continued high quality 24x7 service (despite recent rumors of gaps). Lastly, he reminded us GPS is not just about positioning, but also provides timing signals from atomic clocks, which will increasingly enable synchronization of actions in a growing M2M industry.

Richard Buenneke, Deputy Director for Space Policy, **U.S. Department of State,** was the final speaker on this panel. He stated that the new Administration had started policy reviews in several areas involving space, but clearly understands the vital nature of space infrastructure to our economy and security. Our embassies, for instance, rely on commercial satellites for much of their communications. DHS is tasked with protecting our domestic satellite infrastructure in a partnership with DOD. Protection of space infrastructure is an agenda item for bilateral talks with our allies and using satellites to expand prosperity to the "global village" is also part of our future diplomatic efforts. Mr. *Buenneke* also discussed the growing importance of space situational awareness given increased crowding and the space debris problem. The U.S. Air Force has recently expanded the number of objects they track and intends to notify commercial and non-U.S. satellite operators of potential collisions. Lastly, he discussed ongoing efforts by ISO working groups to develop global standards for space communications and operations, which should benefit everyone.

Mr. *Thomas Pickens III*, the CEO of **Astrotech Corporation**, then offered a brief summary of the newly restructured and renamed **SpaceHAB**, now doing business as Astrotech and trading under the ticker **ASTC**. The focus of Mr. *Pickens*' talk covered the company's **Buenneke** subsidiary. Mr. *Pickens* and his team at **Astrogenetix** have studied more than 2,000 space manufacturing experiments to determine what does and does not work and what activities have the greatest chance of profitability.

NASA has been focused on completing **ISS** before retiring shuttle fleet and has, therefore, pushed microgravity research to the side. Astrogenetix had special access and knowledge, given SpaceHAB's heritage, and was named an **ISS National Lab Pathfinder** business.

The decision was to focus on projects such as discovering biomarkers for vaccine development, which rely on microbe growth. Microbes grow virulently in space due to better cell diffusion. Mr. *Pickens* stated that a vaccine that might cost $100 million to develop on Earth could cost only $30 million if developed on ISS and perhaps even less on another platform with less red tape and astronaut handling requirements. The salmonella vaccine was chosen as the first target. Some vaccines could have billion dollar markets.

Protein crystal growth is another promising market. Barriers to entry include the bureaucracy that's involved in getting experiments flown is daunting (*e.g.*, 7,000 pages just to stay on the shuttle) and there is a general reluctance by pharmaceutical companies to engage in new and riskier drug development technologies. Mr. *Pickens* believes ability to use sub-orbital systems exists for R&D, mostly limited to shorter tem experiments such as metallurgy.

Joseph Fuller, CEO of **Futron Corporation**, moderated a panel on "new space". Panel members included *Gwynee Shotwell*, the CEO of **SpaceX**, *Andrew Nelson*, COO of **XCOR**, and *Patricia Grace Smith*, Former *FAA Associate Administrator for Commercial Space Transportation* and a **Virgin Galactic** consultant.

Mr. *Fuller* reminded the audience that new space is not just space tourism, but also includes activities NASA and DoD are supporting. The general consensus was that entrepreneurs were doing things the existing aerospace community was not well equipped to lead — the best outcome would be one of collaboration versus hostility. There was also consensus that space tourism was the only "one trick pony" for new space. Expanding sub-orbital space tourism flights to handle other missions and eventually orbital services was an ambition the three panelists agreed upon, in addition to potential terrestrial point-to-point flight services.

— BEAM — Near Earth LLC —

Gwynne Shotwell brought the audience up to speed on the ***Falcon I*** success to date and the status of ***Falcon 9*** development. She hopes to get two Falcon 9 launches completed this year and then highlighted a 29 mission, $2 billion backlog, mostly COTS use of ***Dragonlab*** for ISS supply missions. Clearly, COTS is doing what it was intended to do and the hope is that NASA will use this success to create additional COTS style programs for other commercial space activities, such as lunar cargo supply missions. Ms. *Shotwell* also offered to give tours to anyone visiting the Los Angeles region.

Andrew Nels gave a most persuasive talk centered on debunking many cherished "myths" about space development. For instance, **XCOR**'s development and flight-testing of its piston-pumped "green thrusters" ***Lynx*** vehicle, with as many as seven takeoffs and landings in one day, has proven that not all rocket-based vehicles require government funding. XCOR is focused on jet-like operations for space tourism and other sub-orbital applications with a projected 2014 market size of $7.5 billion.

Patricia Grace Smith reminded the audience it was *Burt Rutan* and the original **X-prize** winners that truly launched space tourism into the realm of plausibility and the support of **Virgin Galactic** added much needed respectability and capital. Ms. *Smith* stated that ***SpaceShip 2*** was 75 percent complete and was expected to roll-out this Fall.

Richard Garriott, famed videogame developer (***Ultima*** rules!) and private space explorer, was interviewed by *Tom Shelley*, the V.P. of Marketing for **Space Adventures Ltd.** Mr. *Garriott* offered a most engaging travel log of his recent ***Soyuz*** trip to ISS. Three major lessons learned:

- *Going to space is "way cool and addicting" (best experience of his life — he wants to return, but not at $30 million a pop),*
- *The Russians are now better capitalists than Americans and,*
- *If you spend some time, you can find companies willing to pay you to conduct experiments in space — for millions rather than tens of millions of dollars.*

Mr. *Garriott* is convinced companies such as **SpaceX**, **XCOR**, **Virgin Galactic**, **Armadillo**, and **Blue Origins,** will be wildly successful and substantially lower the cost per pound of access to low Earth orbit in his life time.

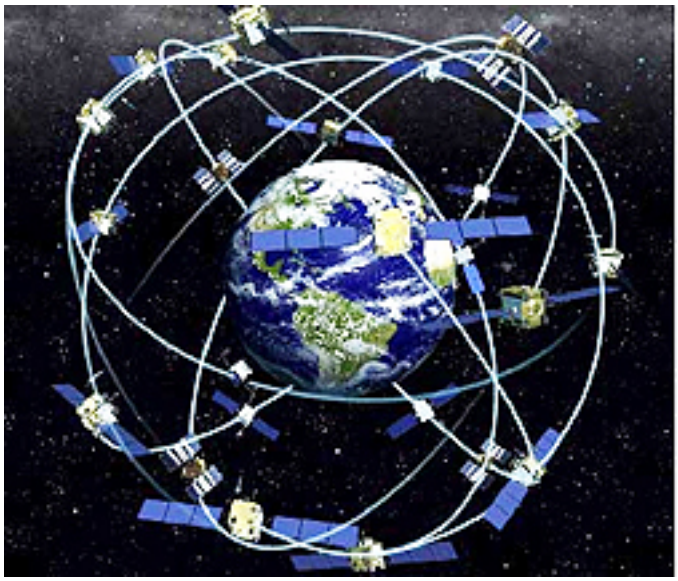
Garriott believes strongly that the amount of money you can generate by working in space will, in the near future, exceed the cost of getting to space. In his mind, "new space" cannot be stopped — it will happen. Many in the audience remained skeptical of the time frame for these cost improvements in launch, given the historically slow pace of chemical rocket-based propulsion advancements. In short, Mr. *Garriott* is the epitome of the space enthusiast, having spent much of his videogame fortune on a series of space ventures and now personal space flight — his enthusiasm and optimism are quite contagious, save for those who have been immunized in the school of hard knocks.

John Higginbotham, the CEO of **Integral Systems, Inc.**, shared with the audience his impressions, to date, of running a public space company after having managed **SpaceVest**, a leading venture capital / private equity firm. John thought *Sarbanes-Oxley* and normal regulatory compliance were a piece of cake (just be honest). What gets you, he said, are the unseen regulatory requirements. He was also critical of accounting rules for employee option expensing, which hurts innovative growth companies. The short-term public investor focus on earnings was another known, if unfortunate, issue, but more worrisome was an unfair litigation environment that favors the plaintiff, frequently costing public companies hundreds of thousands of dollars to fight frivolous lawsuits. In short, he has made the transition from private to public, and while bemoaning the extra cost, work and risk inherent in being public is focused on growing Integral Systems and creating shareholder value.

As for the general public equity market for space companies, he believes the aerospace/defense is well accepted; the commercial space industry is now viewed as real, and there are a growing number of sophisticated, long-term, public investors. Mr. Higginbotham also believes we are moving into a third wave of globalization. As for the "new space" versus "old space" debate, he doesn't buy it. In his view, there are real companies such as SpaceX that happen to be at an earlier stage, and more mature companies like Integral Systems that are ready to be public. It's a case of development stage, not a new versus old mind set.

Kenneth Gordon, CEO of **Antelum Capital Partners**, moderated a panel that dealt with the expectations in space acquisition from the new Obama Administration. The panel included representatives from the major players and space budget entities, including the U.S. Air Force, NASA, NOAA and the FAA.

Gary Payton, **Deputy Under Secretary of the Air Force for Space Programs,** confirmed that DOD's acquisition policies were under review. We may see an increase in fixed price contracting, but he does not see a near term decrease in the overall space budget, despite the



cancellation of ***TSAT. GPS 2.0*** will be funded as will increased space situational awareness. He also confirmed an increased interest in small satellite applications and said the first ***Operationally Responsive Space*** mission got funded to support a request from a regional commander.

Alan Ladwig, Senior Advisor, **NASA**, said many key decisions would be under review for a while as the new Administrator went through confirmation and the new team came on board. NASA's budget has a one time boost from the stimulus package and then flattens out, so difficult choices will have to be made. He suspects NASA will have a continued interest in supporting commercial participation in civil space activities as with the COTS program. International cooperation will also increase.

Maureen Wylie, CFO of **NOAA**, discussed her agency's focus on getting ***GOES-R*** up and the difficulties with the **NPOESS** program. Perhaps luckily for the com-

mercial sector, the cost challenges with these main NOAA programs have created a need and willingness to work with commercial suppliers of atmospheric, oceanic, and weather data. She summarized a long list of data NOAA needed following their decadal review, such as GPS radioccultation measurements for more accurate weather prediction.

Ken Davidian, EFP Program Lead, **FAA Office of Commercial Space Transportation**, has a much smaller space budget than his peers on the panel, but certainly the FAA is a key player. Mr. *Davidian* seems to be following in the same tradition of Ms. *Smith* and should be a supporter and asset to the industry. He focused much of his remarks on the FAA's new drive to create more accurate predictions of the increasingly complex launch service market.

In conclusion, *Hoyt Davidson* (article author) of **Near Earth LLC** states space is expensive and difficult and involves an allocation of resources away from other pressing needs, with benefits often intangible or distant in their realization. The future of space will, instead, depend on the hard work, dedication, and financial resources of a vast number of people and entities, many of whom are not yet even engaged. A small number of wealthy enthusiasts can be applauded for jump-starting our imaginations again and pointing us along the next leg of our journey into space.

If we are going to accomplish everything we can and should in space, we will need numerous and deep new pockets of financing. Government funding alone has proven fickle and insufficient, even if it does continue to provide the backbone for our national security requirements and most civil space exploration. New technologies and business models need to be privately financed to make space activity more cost effective and bring us more powerful space infrastructure and services as well as more affordable access. Innovative new ways also need to be explored to leverage the support of governments to unleash the creative energies of an enthusiastic even passionate private sector. I hope these issues are the focus of future **Space Business Forums**.

The World Teleport Association (WTA) earlier this year announced the recipients of the organization's 14th annual Teleport Awards for Excellence. The awards are presented each year to organizations and individuals whose achievements have been deemed exceptional by the international trade association and its awards committees, made up of industry members from across the globe. The global nature of the teleport industry was clearly evident on the podium, with recipients from Israel, Russia, Belgium, and the United States. The 2009 recipients are:

Independent Teleport Operator of the Year

- *RRsat Global Communications Network Ltd. (Israel) — RRsat was chosen as Independent Teleport Operator of the Year based on an impressive year of accomplishments that included two major acquisitions, inauguration of an HD playout center, additional satellite platforms added to the portfolio, and launches of new TV channels. RRsat provides comprehensive global satellite and fiber distribution services including production, playout, uplink, downlink, turnaround services, as well as end-to-end transmission for television, radio and data channels. The company was founded in 1991 with one teleport and four SNG trucks. In 2009 RRsat completed the acquisition of two teleports — Hawley Teleport in Pike County, Pennsylvania, USA and the Emeq Ha'ela Teleport in Israel, bringing its count to six teleports. RRsat also expanded its capabilities with the inauguration of a new HD playout center. Four additional satellite platforms were added during the year to the 30 satellite platforms already in operation, expanding coverage with a new solution for cable operators in Russia and Asia, and additional DTH services to Europe, the Middle East, Africa, North America, Australia, and Asia. In November 2006 RRsat became one of the few publicly traded independent teleport operators in the world. Under the leadership of Founder and Chief Executive Officer, David Ravel, who was selected as the association's 2007 Teleport Executive of the Year, RRsat was ranked in WTA's list of the Global Top Twenty operators in 2008 as well as among the Independent Top Twenty for three consecutive years.*

Corporate Teleport Operator of the Year

- *Gazprom Space Systems (Russia) — Gazprom Space Systems was selected as the Corporate Teleport Operator of the Year based on a 48 percent revenue growth rate in 2008. Mixing support for Gazprom corporate operations with service to outside customers, Gazprom currently operates three mid-size Yamal satellites covering Russia/CIS and most of the Eastern hemisphere, four teleports in Moscow and the Moscow regions connected by a fiber network, as well as a wide network of Earth stations across Russia. As an operator, service provider and system integrator, Gazprom serves over 200 customers with a satellite fill rate of over 90 percent. In 2008, the Gazprom Board of Directors approved a prospective plan for growing the space business through 2015 including the addition of eight satellites and building a new teleport in the Moscow region. Gazprom was listed to WTA's Global Top Twenty in 2008 and to The Fast Twenty in 2008 and 2007.*

Teleport Technology of the Year

- *Newtec's FlexACM (Belgium) — In a time when companies are tightening budgets, a product that can help reduce costs, improve customer satisfaction and achieve high service reliability was the clear top choice. Newtec's FlexACM is a unique end-to-end solution for implementing Adaptive Coding Modulation (ACM) technology, IP shaping, compression and acceleration in an efficient way for IP trunking and IP backbone satellite links. The implementation of FlexACM can result in a doubling of the data throughput in a given satellite segment while also guaranteeing a 100 percent link availability. FlexACM is the first commercially available system which integrates DVB-S2 ACM with advanced IP optimization technologies such as traffic accelerating, compression and shaping. In order to anticipate degrading link conditions, the FlexACM system relies on a unique patent-pending Noise and Distortion Estimator (NoDE) capability on each of the receiving points, resulting in the most accurate estimation*

available on the market. To further optimize efficiency, FlexACM includes cross layer optimization by using advanced features such as traffic acceleration to compensate for the transmission delay inherent in satellite communication, and dynamic "on-the-fly" compression of the IP traffic.

Teleport Executive of the Year

In addition to the above honorees, *Doug Tutt*, Chief Operating Officer and President of Global Energy Services at **CapRock Communications** (United States) was presented with the ***2009 Teleport Executive of the Year*** award.

The WTA

The WTA is dedicated to advocating for the interests of teleport operators in the global telecommunications market and promoting excellence in teleport business practice, technology and operations. Companies that do business with teleports also find that WTA is the best investment they can make to open new channels to the industry. More information is available at ***www.worldteleport.org****.*

Emerging Apps Driving MSS Industry Growth

by Richard Roithner

The MSS industry is currently at a crucial point with several operators about to replace their aging satellite constellations, an economic crisis that impacts several key vertical target markets and a difficult environment for financing. Nevertheless, the industry is expected to grow in the years to come, driven primarily by data applications, increasing use of MSS in maritime and aeronautical markets and rising demand in emerging regions.

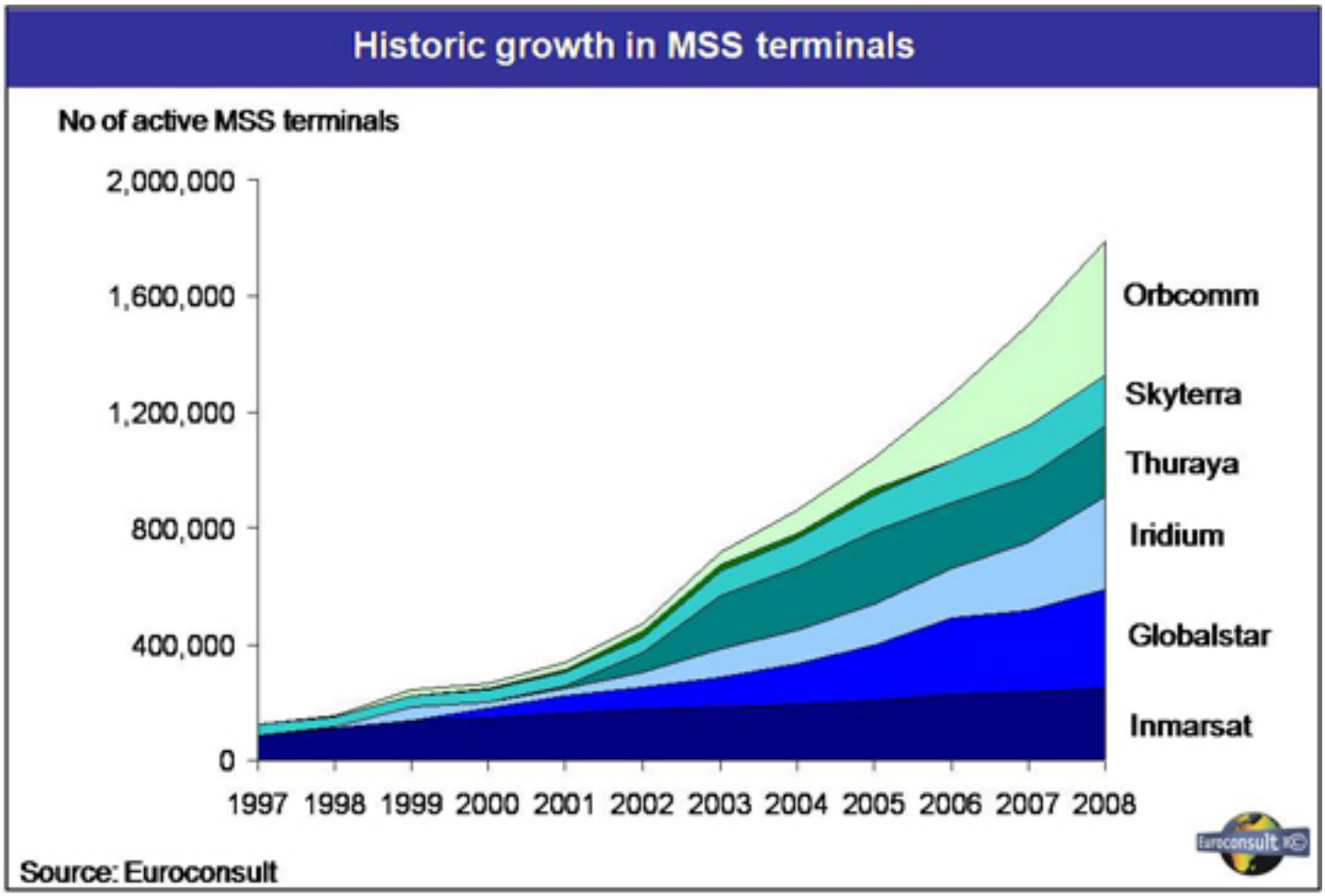
In 2008, MSS operators generated total wholesale revenues of $1.23 billion, a 6 percent growth over 2007. The leading three operators **Inmarsat**, **Iridium** and **Thuraya** account for close to 88 percent of the total industry revenues, with Inmarsat alone having a market share of over 51 percent. The three leading MSS operators, **Inmarsat**, **Iridium** and **Thuraya,** also reported a positive EBITDA for 2008, with the remaining three operators **Globalstar**, **SkyTerra** and **Orbcomm** reporting negative results. The number of global active MSS terminals has increased from less than 500,000 terminals in 2002 to close to 1.8 million terminals in 2008, largely driven by the strong growth in M2M terminals.

The years 2002 to 2005 were highly successful for the MSS industry, with total industry wholesale revenues growing from roughly $740 million in 2002 to close to $1.2 billion in 2005, mainly driven by military and government activity in the Middle East and increased usage of MSS in vertical industries throughout North America, Europe an Asia.

After 2005, several MSS operators started to struggle for various reasons. Middle East-based Thuraya's results have been impacted by technical issues with the satellite and a high number of pre-paid users who stopped using their phones. U.S.-based Globalstar has seen a sharp decline in financial performance beginning in 2007, due to technical problems with the satellite. The 2007 financial crisis added to the industry's woes as operators needed to replace their aging satellite constellations.

New applications driving the industry

Today, the MSS industry is undergoing a major shift from legacy voice dominating traffic towards more and more data traffic. This has led to a number of new products and applications over the last years, such as low data rate **M2M** products as well as **MSS** broadband systems. MSS broadband (*i.e.*, >128 kbps data rates) has seen strong growth over the last 2 to three years with more than 30,000 terminals deployed



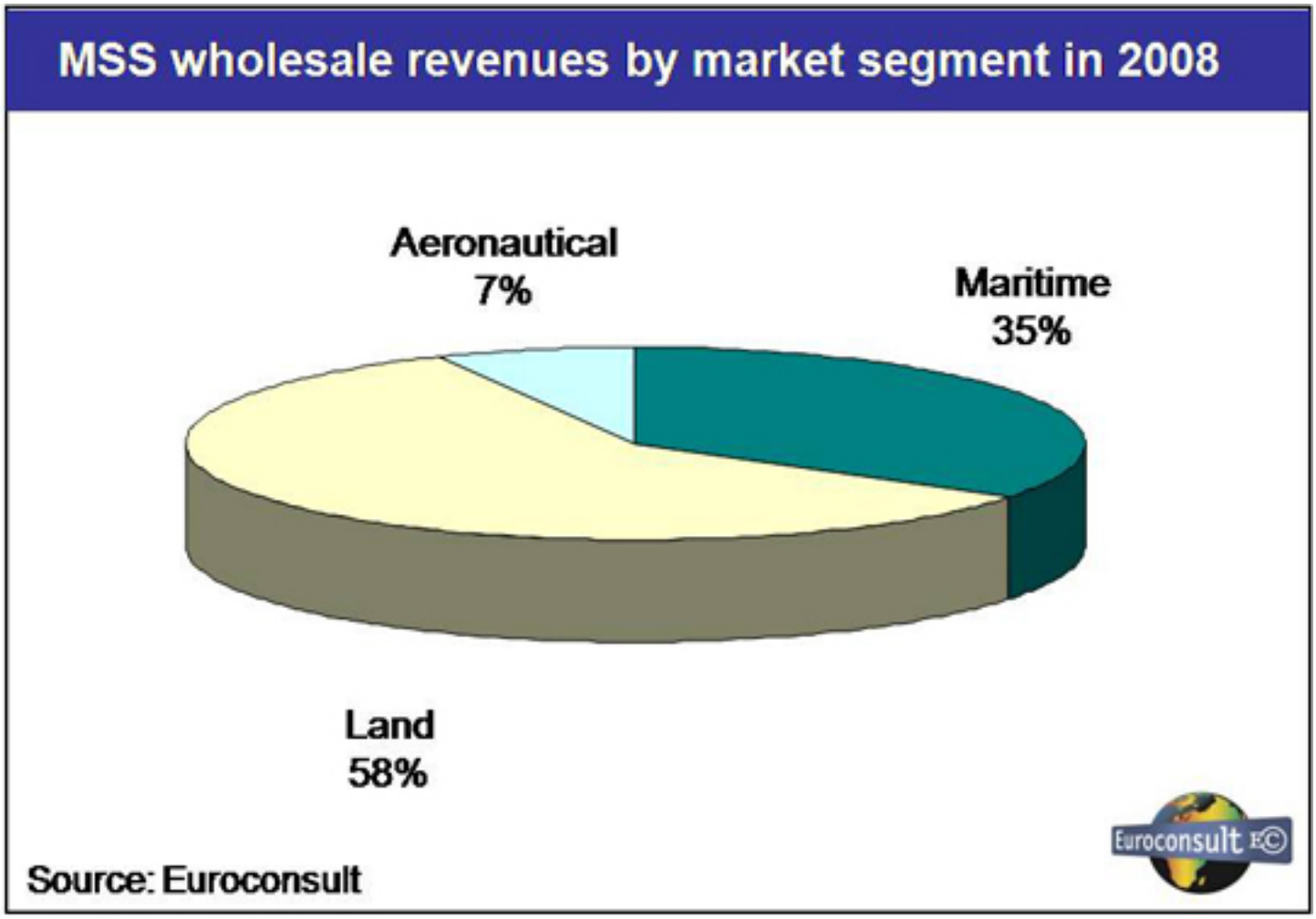
at year end 2008. First launched for the land-mobile market, with main users being government/ military, media, and the oil & gas sector, MSS broadband is now also gaining momentum in the maritime and aeronautical markets with dedicated products for those markets. Inmarsat 's BGAN is still the dominant product in the market.

Launched in 2005, more than 27,000 BGAN terminals were deployed as of December 2008. Growth rates for MSS broadband systems are expected to remain high over the next years with the total number of terminals expected to more than triple by 2014. The main drivers underlying this growth are the increasing need for remote mobile data communications in a number of vertical markets (*e.g.*, media, merchant shipping, business aviation, etc.) and a number of new end user applications supported by the higher data rates. With new end-user applications, data usage per terminal is expected to increase leading to higher ARPU and revenues.

The market for mobile satellite M2M and low data rate products has equally been strong, increasing over the last few years from around 200,000 terminals in 2003 to roughly 1.2 million today. Growth has mainly been driven by increasing use in vertical markets including land transport, energy, utilities, constructions, heavy machinery as well as in some maritime markets. With a decrease in hardware and service pricing, satellite has become instrumental in those markets for data collection, fleet management, telemetry and SCADA. M2M is becoming also increasingly important in the maritime market tightening regulatory requirement including AIS and LRIT. In terms of revenues the M2M market stays however primarily an equipment and value added service market and is thus not a major contributor the wholesale MSS revenues. With an increasing number of end user applications and higher M2M data capabilities the ARPU is expected to grow.

Land mobile still the largest MSS market with fast growth in maritime and aeronautical

Initially created for maritime communications, the largest user base for MSS today is in land mobile mar-



kets, which accounted for roughly 86 percent of total MSS terminals in 2008. Distribution of MSS revenues among the segments is more balanced with maritime accounting for roughly 35 percent and land for roughly 58 percent of wholesale revenues in 2008.

Future growth of the MSS industry is in particular expected to be driven by the aeronautical and the maritime markets, both estimated to gain in importance in terms of operators revenues. The current economic crisis which is deeply affecting those end-user markets could however slow growth, at least in the short and medium term.

Growth in the maritime market in recent years has primarily been driven by data applications. MSS operators and service providers are pushing for higher bandwidth products. Inmarsat launched its ***Fleet-Broadband*** product (up to 432 kbps) in late 2007, Iridium is currently starting commercial service of ***OpenPort*** (128 kbps) and Thuraya recently launched a broadband version of its ***ThurayaMarine*** system.

In addition to broadband, voice remains an important application for crew welfare and safety communications. Major maritime segments include merchant shipping, fishing, government/ military, oil & gas as well as some leisure markets including yachts and private vessels. The impact of the financial and economic crisis in some of these markets could lead to a significant slowdown in growth in the maritime MSS market.

In particular the merchant shipping and the fishing industry feel a significant impact of the economic crisis in various ways such as it currently leads to reduced maritime traffic, increasing pressure on prices and a decline in ship orders. As an illustration, the *Baltic Dry Index*, an indicator for the prices of maritime cargo transportation came down from over 10,000 in mid 2008 to under 1,000 in the first quarter of 2009. A recovery of the industry in the middle term could however rapidly result in a return to growth for MSS in maritime markets.

The aeronautical market for MSS solutions is still in its infancy, with slightly more than 30,000 terminals estimated to be deployed at year end 2008. However, MSS has become an essential part of aeronautical communications, in particular for long-haul, trans-oceanic flights. The growth of aeronautical MSS terminals and revenues has been significantly accelerating

in recent years due to an increasing network of distributors and service providers and numerous new MSS products launched for the sector with a trend towards data communication terminals both, for high data rates (*e.g.*, ***Swift64***, ***SwiftBroadband***) and low data rates (*e.g.* Iridium's ***SBD***).

A major growth driver for MSS in the aeronautical market could be the uptake of in-flight passenger cabin communication systems. MSS seems in particular to be a viable solution to support in-flight GSM systems as currently offered by service providers **OnAir** and **AeroMobile**. However, the aeronautical industry is strongly affected by the current crisis, with the *International Air Transport Association* (**IATA**) forecasting a total industry loss for commercial aviation of $8.9 million for 2009 and an unprecedented revenue decline of 15 percent in 2009. The effect of these difficult conditions in the aeronautical industry on MSS may be a slower take up in market penetration than expected, in particular for in-flight entertainment applications.

Despite current difficulties, MSS industry poised for growth in the coming years

The MSS industry is currently facing some challenges, such as the financing needs for the upcoming satellite replacements, the economic crisis deeply affecting some of the key vertical markets for MSS, and the tough competition by other technologies including mobile VSAT. However, we see a number of growth opportunities for the industry lying ahead, in particular the increasing use of MSS broadband in the aeronautical and maritime markets, low data rate satellite M2M applications, as well as the ongoing increase in demand by government and military customers. All in all the market is expected to stay a niche market. Beyond the traditional MSS business, hybrid satellite/terrestrial systems in the US (ATC) and Europe (CGC) plan to launch their services throughout the next two years. At the moment the business case as well as the system's impact on the traditional MSS market remains unclear and a number of candidates are struggling with technical issues, system financing and partnerships for the terrestrial parts of the networks. However, if the systems are successfully implemented and the business cases prove viable, the MSS industry as we know it could change significantly in some years from now.

About the author
Richard Roithner, Senior Analyst, Euroconsult, specializes in the strategic analysis of satellite operators and service providers.

Geography On The Map — And Markets!

by Ian Fichtenbaum

If you're on the lookout for 'green shoots', economic or otherwise, it helps to have a bird's eye view of the globe to find it. As luck would have it, on May 14th, 2009, we got both a green shoot in the financial markets and a bird's eye in the sky. DigitalGlobe, the Colorado-based operator of imaging satellites and geospatial analysis solutions, made its entry to the public markets with the fifth IPO of the year. From the financial markets' point of view, it was yet another step towards re-establishing a normal IPO market. From the satellite imaging sector's point of view, (indeed, for the entire geospatial industry), it is yet another sign that, where the financial markets are concerned, they've arrived.

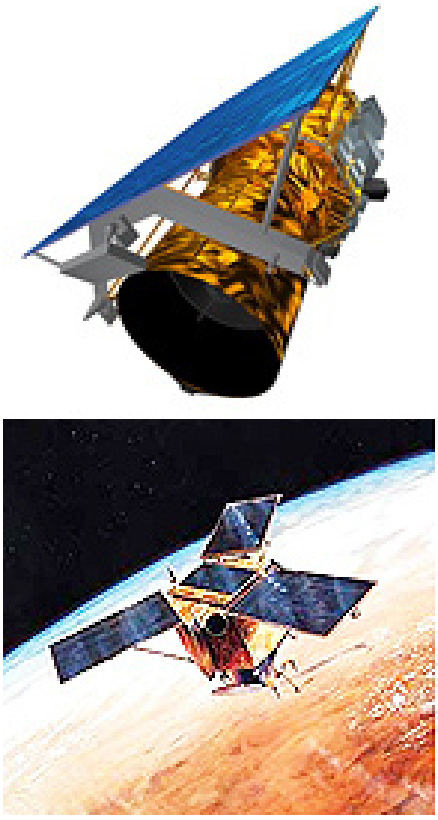
For public companies, no less than individuals, one is too often the loneliest number — all the more so the case with **DigitalGlobe's** rival, Virginia-based **GeoEye Inc.** GeoEye has been public now for almost three years and yet seems like an orphan, the only traded commercial imaging satellite shop on the block. With two active, publicly traded competitors, we can now make comparisons.

Both companies operate a set of high and medium resolution satellites, both are heavy clients of the U.S. government (particularly the **NGA**), and both will have roughly the same revenues once GeoEye's ***GeoEye-1*** is fully operational. Even though both have their significant differences, they are (at the time of this article's writing) both trading with an enterprise value at 3.6 times revenues and both at a PE ratio of around 15 — decently bullish, perhaps owing to the strong government component to their revenues.

DigitalGlobe's Worldview-1 and -2 satellites

Comparisons aside, the real question for both companies is, as usual, what next? What are their eventual fates?

Improving technology and greater demand for more detailed imagery and geospatial analysis will keep a going arms' race of ever more powerful imaging satellites for some time — though only within limits that the U.S. government (a customer of 70 to 80 percent of GeoEye's and DigitalGlobe's revenues) allows. Moreover, neither is likely to overpower or acquire the other in the foreseeable future, (*e.g.*, **Sirius** and **XM** in satellite radio), if only because it continues to be the US government's interest to maintain the balance of power between two competing viable commercial imagery sources.



GeoEye's GeoEye-1 + IKONOS satellites

Acquiring another rival isn't likely in the cards, either. While the rest of the commercial satellite imagery field is highly fragmented in both capability and scale, (operators **Spot Image**, **ImageSat,** and **RapidEye** compete on low and medium resolution, while **MDA Geospatial** and **Infoterra** offer radar sensing), almost all of these companies have a government participation that, similarly, makes acquisitions difficult. One needn't look farther than **ATK**'s thwarted acquisition of MDA Geospatial for a case study of a government (in this instance, Canadian) protecting its satellite imaging crown jewels. Cooperation is likely the way to go for the time being, with larger operators adding to capabilities in overlooked areas, such as ubiquitous low-resolution coverage as well as continue to develop capabilities in aerial photography and intelligence.

Even as many barriers to entry persist, (*i.e.*, high capital costs, government participation), the product (imagery) becomes more and more commoditized on the commercial end of the business. In addition to pictures from orbit, we have pictures from aerial vehicles, floating balloons and dirigibles, travelling cars

with street view cameras, as well as crowd sourced data from millions of clicker-happy tourists.

We haven't reached the point of real-time high resolution video of the Earth, and are likely still a ways from it, but already the gushes of data is making raw imagery less than scarce for most non-government purposes. As the product becomes less valuable, margins inevitably get squeezed. When that happens, where does the money get made? Just as the telecom satellite industry offers network and systems integration services to augment its transponder leasing business, imaging satellite operators offer geospatial processing, manipulation, and interpretation services. In theory, this sounds like a recipe for vertical integration into high value services. In practice, much as in telecom, value-added services are often engineering and manpower heavy, while margin light.

Even if the imagery business continues to avoid commoditization through innovation, it is unclear where, ultimately, the pivot of this industry lies. Both GeoEye and DigitalGlobe are decently sized firms, and bound to get larger, but for all intents and purposes, these are small cap companies. In scale and in commercial significance, they are overshadowed by the major players in GPS devices, such as **Garmin**, **TomTom,** and **Trimble**, as well as by **ESRI**, one of the largest players in the GIS/Geospatial software sector.

Certainly, even these are tiny compared to two of the most significant commercial customers, **Microsoft** and **Google.** Telematics, asset tracking, land management, and geospatial analysis are believed by many to be growth industries: any one of the large players, or others, may feel that the market needs a true end-to-end solution and proceed to roll up manufacturers, developers, and service providers across the value chain, including the imagery providers...

...if it makes any sense. Although many companies may feel that they'd best stay out of the business of operating satellites, the idea that someone might seek to take control of a strategically important source of data (geographic or otherwise) for commercial reasons is not out of the question, as long as

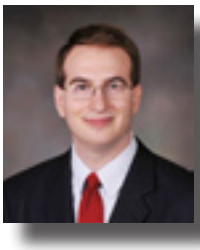
it does not trample over national security concerns. The acquisition of **NAVTEQ** by **Nokia** and of **TeleAtlas** by **TomTom** vividly illustrated the extent that the GPS OEMs would go to assure access to the two primary repositories of digital road data. Could satellite imaging companies be subject to bidding wars on imagery assets just as the roadmap companies were? Perhaps.

Then again, NAVTEQ and TeleAtlas's advantages were the millions of man-years put into painstakingly mapping, cataloging, and updating every automobile accessible crevice of western civilization. When up against that barrier to entry, the cost, effort, and time to build, launch, and operate a satellite almost seems like child's play.

"*HC SVNT DRACONES*", or "*Here be dragons*" reads a famous 16th century globe, now on display in the New York Public Library. A pity that DigitalGlobe or any of its competitors were not around at the time — if so, they might well have captured beautiful high-resolution images of those dragons, bathing and sunning themselves in the tropical Pacific.

The dragons of today are likely far less photogenic and might look more like widening credit spreads, toxic asset-backed securities, bank failures, and other hazards of the financial world. Not to mention the dragons of limited M&A and the risk of commoditization. Regardless of future direction, with a successful IPO under its belt and room for growth, DigitalGlobe has shown that, even though it can't exactly photograph these dragons, it can certainly shoot them down. Most would agree: those would be a sort of green shoots worth cheering for.

About the author



Mr. Fichtenbaum is an Associate for Near Earth LLC. Hailing from Canada, he is a graduate of the Master of Management program at the University of British Columbia as well as a Bachelors of Engineering at McGill University. Since graduation, Ian has built a variety of business experience in both the satellite and financial worlds, having worked at the financial firm, Divine Capital Markets, and advised the Montreal-based small satellite startup, CANEUS NPS. He also worked at UBC's Center for Operations Excellence, providing quantitative analysis and decision support tools to industry clients. Mr. Fichtenbaum is also a proud alumnus of the International Space University, having participated in the 2006 Space Studies Program in Strasbourg, France.

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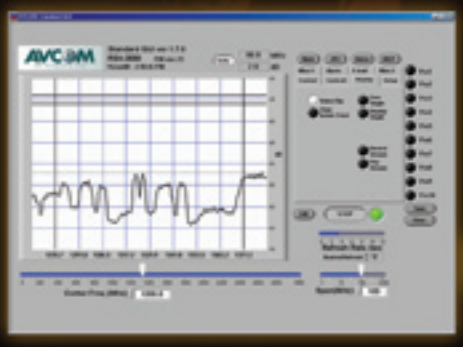

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'Smart Card' Encryption Under Pressure

by Chris Forrester

Piracy is never far from the pay-TV industry's thoughts. Two recent documents throw some light into the murky world of Conditional Access. First, a White Paper from *Barry Flynn* and his colleagues at Farncombe Technology* looks closely at the challenges facing traditional Conditional Access systems, and especially those commonly used in satellite DTH. The report states that the traditional one-to-many delivery processes for programming are rapidly changing, and with these changes new CA methods might be needed.

Farncombe says: 'Pure' broadcast networks are becoming a thing of the past as they are increasingly hybridized with broadband ones:

- *An increasing number of pay-TV businesses are operated by Internet players over IP networks*
- *The diversity of video consumption modes and their associated devices is growing exponentially, eroding the dominance of traditional linear TV consumption*
- *Piracy is increasingly performed by simply distributing content or by sharing scrambling keys (so-called 'control words') over the Internet*

"All of these developments are leading to video services becoming increasingly available in 'connected' environments. This raises the question of whether the traditional method of protecting pay-TV content from piracy and securing its distribution — i.e., through a smartcard-based system originally designed to secure content broadcast on one-way networks – remains appropriate," says *Farncombe*.

"This raises the question of whether the traditional method of protecting pay-TV content from piracy and securing its distribution remains appropriate"

Traditional DVB-based schemes potentially contain a weakness, the report suggests: "The scrambling algorithm used to make the content unreadable is standardized, as well as the reciprocal descrambling one. In other words, the descrambling function is the same in all DVB STBs, and is not diversified at all (either on a per-smartcard or on a per-STB basis).

This means that there always exists a physical location in the STB where these clear and non-diversified control words can be intercepted (this is at the point where they are communicated to the standard descrambler). They can thus be re-used, *as is* by any other standard implementation of the DVB descrambling algorithm, and so give access to the scrambled content."

"This risk was not that significant before the days of widespread broadband penetration, but today many CA systems are being compromised by this type of attack using so-called control-word sharing. This is where a 'hacked' STB is used to feed a stream of in-the-clear control words across the Internet to a large population of pirate devices — which only need to contain a DVB-standard descrambling system to be able illegally to access premium content. Tracing the 'hacked' master device in such a situation is extremely difficult."

"Clearly," says the White Paper, "in this type of CA process, the vulnerability lies within the set-top box. This means that when a pay-TV operator buys a CA system, the level of security afforded by the STB hardware in protecting the interface between the smartcard and the descrambler is as important as the resistance of the smartcard itself and of the cryptological mechanisms it uses.

"It is, therefore, absolutely critical to the overall security of any CA system operating in a DVB environment that the communication channel between the smartcard and the silicon of the DVB descrambler be made opaque: this minimizes the opportunity for the interception of in-the-clear control words. This level of security must be ensured on 100% of the devices that can potentially host the CA system, since only one device needs to be hacked for control words to be disseminated around the globe across the Internet."

The merits (and challenges) of card-based systems are well understood, but *Farncombe's* White Paper also examines the pros and cons of a cardless approach. "On the face of it, cardless solutions should have one advantage, at least, over smartcard-based ones, in that there are probably more ways to hide large secrets in the software and hardware system of an STB than in a simple smartcard. There is also no smartcard interface to be rendered secure, since the 'smartcard' is — conceptually speaking — embedded inside the STB software itself." "Balanced against this advantage is the problem of relying on off-the-shelf devices to hide these essential secrets. Further, in the DVB control-word context mentioned above, cardless solutions still need to protect themselves against control-word sharing attacks, for the same reasons as smartcard-based systems do, as — in principle — control words are still used. Once discovered within the STB they may be used in any other STB that includes the common scrambling algorithm."

"Consequently," says *Farncombe*, "providers of cardless solutions also need to require a very high level of tamper-resistance from STB manufacturers, across 100% of the hosting devices (not just most of them: as mentioned earlier, only one device needs to be hacked for control words to be disseminated around the globe across the Internet)."

Latens says smart-card CA is "finished"

Software conditional access specialists **Latens** say that the market is increasingly receptive to software-based (and card-less) conditional access. "We've been pushing software conditional access for six years saying that this is the way the market's going to go and I think we've gradually seen that tipping over as we've demonstrated that we can do it successfully," argues Latens CEO *Jeremy Thorp*.

Thorp says **Latens** has demonstrated that the technology works. "We can do it successfully and we can provide the cost savings that we talk about, [with] the flexibility, and the capability to offer new services very quickly."

Thorp says that software-only CA is winning approval from larger cable systems, as well as the IPTV sector. "I think the large operators will shift to over the next two or three years. The traditional security model with a smart card is fundamentally broken with what's going on from a technology point of view."

He stated that far too many card-based systems were now hacked, and the cost of swapping cards was "immense." "The hackers now completely have the dominant hand there. But also, as the operators want to offer services to more devices, not just to a traditional set top box, and I think this is one of the big trends that we have to allow for, the consumer living in a multi device environment and wanting the content to run across all of them seamlessly from their point of view. So the card base model breaks down, and obviously the card base model is broken from a cost point of view because the cost of replacing a card base solution is so massive for operators, usually they just settle with being hacked for a very long time, but that's incredibly expensive."

Latens is not alone in offering cardless security, and other vendors like **Widevine**, **Verimatrix**, and others will happily advise.

"In one-way environments, cardless solutions also have significant additional weaknesses when compared to smartcard-based systems:

- *In these systems, all the security is hosted within the STB, which is generally a commercially available piece of hardware. This makes reverse engineering significantly easier than with (good) smartcards*
- *The STB's tamper-resistance is particularly critical in a cardless environment: unlike smartcard-based systems, compromising the STB hardware not only exposes the system to control-word sharing attacks, but possibly to other types of attack, including 'perfect cloning' of STBs*
- *'Perfect cloning' represents an insurmountable challenge to cardless systems: once a device is copied, the perfect copies will follow all updates, maintain themselves, and work in a stand-alone way, with no need for a broadband connection (which is required for a control-word sharing hack to succeed). If the cloned device is detected, the clone-maker only has to provide a new identity to the 'perfect clones' and they will continue to work*
- *While smartcards can be more easily swapped, technology improvements will tend to make the cardless solution's hardware security features embedded in the STBs obsolete over time, increasing the chances of a 'perfect clone' being built*

•

"Consequently, cardless systems are arguably unable seriously to compete with the level of security offered by a (good) smartcard-based system in a one-way broadcast network," says *Farncombe*. "This is especially true of cardless systems that can be embedded in devices which are not strictly required to observe comprehensive and drastic hardware security requirements.

*The complete White Paper can be downloaded from: ***www.farncombe.eu / info@farncombe.eu***

Portable devices mean high piracy risks

'*Cloakware,*' part of the **Irdeto Group** (and **Naspers**), has also released a White Paper* that details how advanced features of the next generation of set-top boxes have created new content security challenges.

"Such new content portability developments as Home Networking in which content is pushed beyond the TV to a wide range of connected digital devices has significantly increased the complexity of security requirements. According to the White Paper, '***Security Impacts of Next-Generation Set-Top Boxes***,' set-top boxes (STB) and their associated conditional access (CA) systems and digital rights management (DRM) technologies are under increased threat from device tampering, software security breaches and hacker attacks that can significantly impact the reputation and bottom line for both STB manufacturers and service providers."

Consumer demand for media-rich home entertainment services has driven innovation and new revenue opportunities in the STB industry. Next-generation STBs will integrate video content from multiple signal sources such as broadcast television, premium video-on-demand and Internet-based services as well as provide value-added capabilities like time-shifting. They will also allow content to be distributed to a variety of viewing devices including multi-room TV networks, personal computers, portable media players and other mobile devices which are more susceptible to piracy than set-top boxes, says the **Cloakware** White Paper.

"At the same time, content owners, including movie and television studios, demand protection against the piracy of their intellectual property and require that content licensees (such as cable or satellite operators) take steps to prevent security breaches and to mitigate against damage should a breach occur as part of their distribution agreements."

"Set-top box manufacturers have rigorous compliance and robustness rules that they need to address to satisfy their customers," said *Greg McKesey*, V.P./Consumer Products for **Cloakware**. "Cloakware provides them with cost effective, drop in, easy to integrate content protection components that meet or exceed studio and operator content security requirements, allowing these set-top box manufacturers to meet those stringent regulations and get their products to market faster."

The download is available from: ***http://security.cloakware.com/whitepapers/set-top-box-security/index.php***

About the author

*London-based **Chris Forrester** is a well-known entertainment and broadcasting journalist. He reports on all aspects of the TV industry with special emphasis on content, the business of film, television and emerging technologies. This includes interactive multi-media and the growing importance of web-streamed and digitized content over all delivery platforms.*

Switching It Up: Does Putting Intelligence In Orbit Help Move Content To The Edge?

Satellites connect the world, but they generally neither connect to each other nor connect users to each other without some ground-based hub application, which adds time, complexity and cost at various levels. Every satellite link requires at least one spacecraft and two ground terminals. Some use more of one or the other but, until very recently, the only way to interconnect multiple end-users was to route signals through a complex ground network. Satellites have merely been "bent pipes" modulating and amplifying signals but not acting on the signals with any intelligence. While Iridium created a highly intelligent network ten years ago, with satellites switching signals and communicating with each other, intelligent broadband satellites, with processing, switching and routing capabilities on-board, are just coming into service, at the same time as IP-based services are becoming ubiquitous. This combination has the potential to dramatically change the way content is delivered, shared and stored adding user options and value for a range of key markets.

Despite the early demonstrations on **NASA**'s ***Advanced Communications Technology Satellite*** (**ACTS**) satellite starting in the 1970's it is only with the recent start of service of **Hughes**' ***SPACEWAY 3*** satellite that commercial broadband users have benefited from onboard digital processing and packet switching combined with spot-beam technology for direct site-to-site high-speed connectivity. At about the same time, U.S. defense users also started receiving the same benefits on the ***WGS*** satellite network.

Looking forward, other alternatives being developed to move the intelligence into the sky include the **ESA**-funded *ULtra fast Internet Satellite Switching* (**ULISS**) demonstration program for Ka-band multimedia distribution using *Radio Burst Switching*, and the *Internet Router In Space* (**IRIS**) demonstration by **Cisco**, hosted by **Intelsat General** for the DoD. But what are the advantages of having switching or routing systems on-board the satellite, vs. on the ground? Most importantly, such on-board capabilities provide technical and cost advantages to organizations operating mesh networks among widely dispersed and possibly mobile terminals for whom the key benefit is the ability to have a virtual hub in space rather than tied to a specific node on the terrestrial network. This is particularly important when the terrestrial network may be at risk of being compromised, which is the case for disaster recovery, emergency, military and extraction industry operations.

Such systems also have the potential for storing large amounts of HD content and/or varying content by region without duplicating capacity. This is a great benefit for media applications that use IP as a transport medium, including streaming of video and entertainment content, corporate data and satellite news gathering applications. IPTV in particular may be significantly enhanced by the ability to provide different content by region with a simpler, more direct delivery model that provides economic value, specifically through benefits such as reduction of capacity needed, and the potential elimination of double hops.

How Do Individual User Groups Benefit?

On-board switching/routing benefits any vertical market that requires mesh capability added to a star network or having a hub anywhere in the network. On-orbit intelligence enables the user to eliminate the need to go through central point on ground - hub or data center or gateway — and supports the desire for point-to-point interconnectivity.

On the government side military goals of achieving the net-centric *"Everything Over IP"* service is clearly dependant on this type of advanced satellite processing. In addition, in the civil government arena, first responder command and control/tactical users benefit, because for them response time is critical, thus they value the ability to bypass double-hops for routing traffic. On the enterprise side the benefits are most obvious for large networks with thousands of sites (*e.g.*, oil & gas; credit card verification), although small enterprises benefit from the reduction in backhaul links to a datacenter due to direct connections without the need for routing through a hub facility.

These mesh advantages particularly benefit broadcasters needing to get varying content to different market regions. For these users, on-board switching and/or routing can facilitate video on demand and other time-shifting applications. With the expansion of HD content offerings, broadcasters can provide more content choices and options as well as better capacity utilization at same or lower cost. This "selective connectivity" for video multicast facilitates individualized broadcasting to selected groups and subgroups. This benefits not only broadcasters, but those corporate networks with remote teleworkers or consumers, such as small companies in remote locations. In addition, on-board routing or switching enhances a range of applications such as remote monitoring, maintenance and control systems including video that need the ability to increase feed or bandwidth size on demand to investigate issues at remote facilities in industries such as extraction or construction.

Mobility applications are especially well-suited to having intelligence in the sky. In this case, an advanced

satellite with directive beams can support applications such as mobile IPTV, enabling both the mobile and on-demand access to interactive video for delivery of content to the truly moving edge. Other edge content applications include point-to-multipoint, such as satellite caching of data, imagery or other media for transport to different destinations and download as needed. These applications have value to a range of corporate and government users, such as military or first-responders needing ad-hoc visual communications, mapping, and headquarters coordination.

So Why Doesn't Everyone Do This?

While most of the technology already exists, manufacturers will need to redesign some equipment for specific purposes, in particular the ground equipment. This poses difficulties for applications with a lot of ground terminals, since the cost savings from eliminating duplicate capacity or hub networking are offset by the risks. If there's a problem with the satellite and a need to repoint to get switching through another bird; this also leads to questions about the availability and costs of backup options. There is also a need to drive power consumption down and right-size power for individual applications to keep the on-orbit technology cost-competitive with terrestrial options.

An additional requirement is for strengthened QoS to separate out video, data, voice for shared networks, and to establish or modify priorities among them, depending on the specific user requirements. This requires the network and its components be able to support customer-specified throughput consistently for a particular application, such as a business video session.

What Will Move This Forward?

As IP platforms, mobile applications and enhanced video services expand and integrate, so too will the advantages of having more intelligence on-board satellites rather than on the ground. At the same time, costs will be driven down by the continued cross-over of technology from military to commercial, broadcast to enterprise, supporting the business case for moving more investment in space to help move content closer to the edge.

Digital Terrestrial and Mobile TV But What About The Cost?

by Koen Williams

"The beginning of wisdom is to call things by their right names" a Chinese proverb states. Indeed, when it comes down to a Digital Terrestrial or a Mobile TV deployment the money-question drops in eventually. A logical first reaction by broadcasters could be to request lower equipment prices to reduce the overall investment. Fair enough. But one might question whether such a short time measure could influence costs in the long run. Looking beyond the horizon items as operational issues, performance, maintenance, satellite bandwidth and quality pop up quickly, each single one of them nicely delivered with a price tag at the expense of the broadcaster.

This article discusses the cost considerations a broadcaster could face during a deployment over satellite and explains how technologies as **DVB-S2** Multistream and regionalization can reduce the total cost picture. Some use cases will be added to illustrate an alternative approach to design **Digital Terrestrial** or **Mobile TV** installations.

Current Market Conditions

A quick browse through the newspapers nowadays confronts us with topics on financial crisis, cost reductions, inflation levels, etcetera, a bit more than we actually would like to — we do not need to understand the root causes of the economic downturn to see that the market is reacting through major bank reorganizations, company restructuring, and governments adapting their budgets.

As for the broadcast market, the financial resources obviously are not infinite. The economic slowdown may affect the media sector progressively due to the fact that financing new satellite projects could become more complicated resulting in less launches and a satellite bandwidth capacity reduction. Due to the reduced bandwidth over satellite it becomes increasingly important for new technology to get more 'bits per Hertz' over the same bandwidth. On the other hand broadcasters and governments could choose to postpone new projects in order to optimize their current networks in a cost-effective way.

Some long term projects might not be directly exposed to the current economic crisis due to the fact that they are bound to the regulatory environment

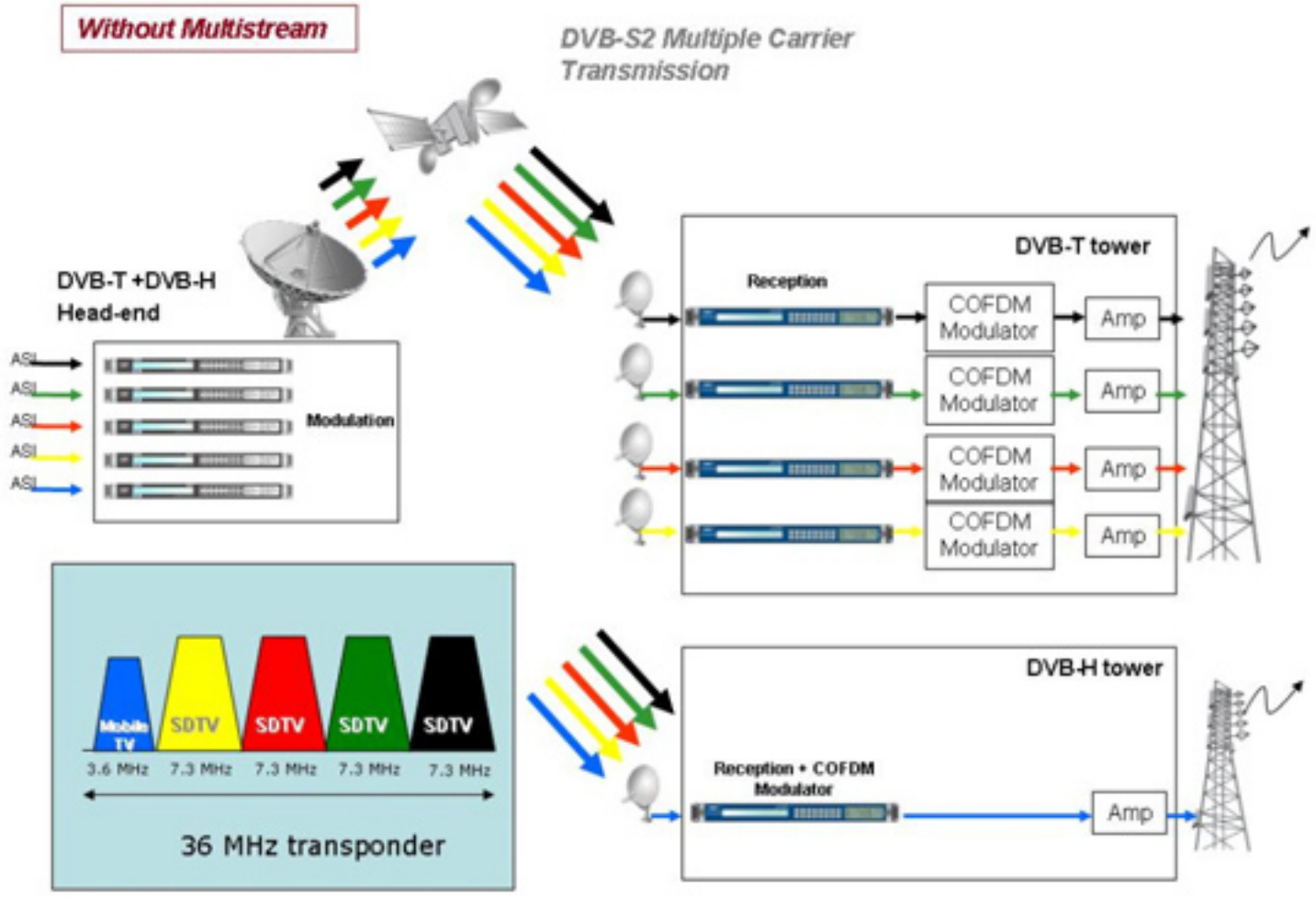

Figure 1: DVB-T/H Broadcast network with Multiple Carrier Transmission

and to government projects. One example is the Analog switch off in an increasing number of markets that needs to be in place before 2013 in Europe and North America. In times of financial crisis governments tend to start up large projects to stimulate internal economics and to ensure employment. Still there seems to be quite an interest in satellite business as the financial injection of 10 billion Euros from the EU towards ESA clearly illustrates.

Low Cost Approach

With the installation of new projects, or the review of current projects, a natural reaction is to select low-cost equipment to fit the tight budgets available to deploy broadcast networks. This reaction towards financial harder times and budget restrictions for deployments is to purchase low cost material in stead of best of breed equipment. The risk in purchasing lower cost equipment is easily identifiable but sometimes forgotten by the price tag blinding effect. Some examples are:

Quality

A first important consideration is *quality*. Broadcasters cannot afford to have downtime or to have bad picture quality because it will drive away annoyed customers (viewers) which could impact advertising revenues. Bad quality implies more service costs and more man hours to recover broken signals. As some **DTT** (*Digital Terrestrial TV*) and *Mobile TV* towers are located on remote sites service engineers need to drive up to these locations or extra investments in communication lines need to be made to enable multiple and fast remote management control.

Consistency Of Internal Parts Inside Products

Another issue with low cost equipment is the tendency to replace internal parts during the product life cycle according to the market availability and price fluctuations as for example happens in the PC market where internal parts are changes every six months. As DTT and Mobile deployments mostly are planned over longer stretches of time a broadcaster could end up with equipment that has different internal parts at the end of the ride, increasing the difficulty of maintenance. Additionally it provides headaches in terms of spare parts supply after deployment.

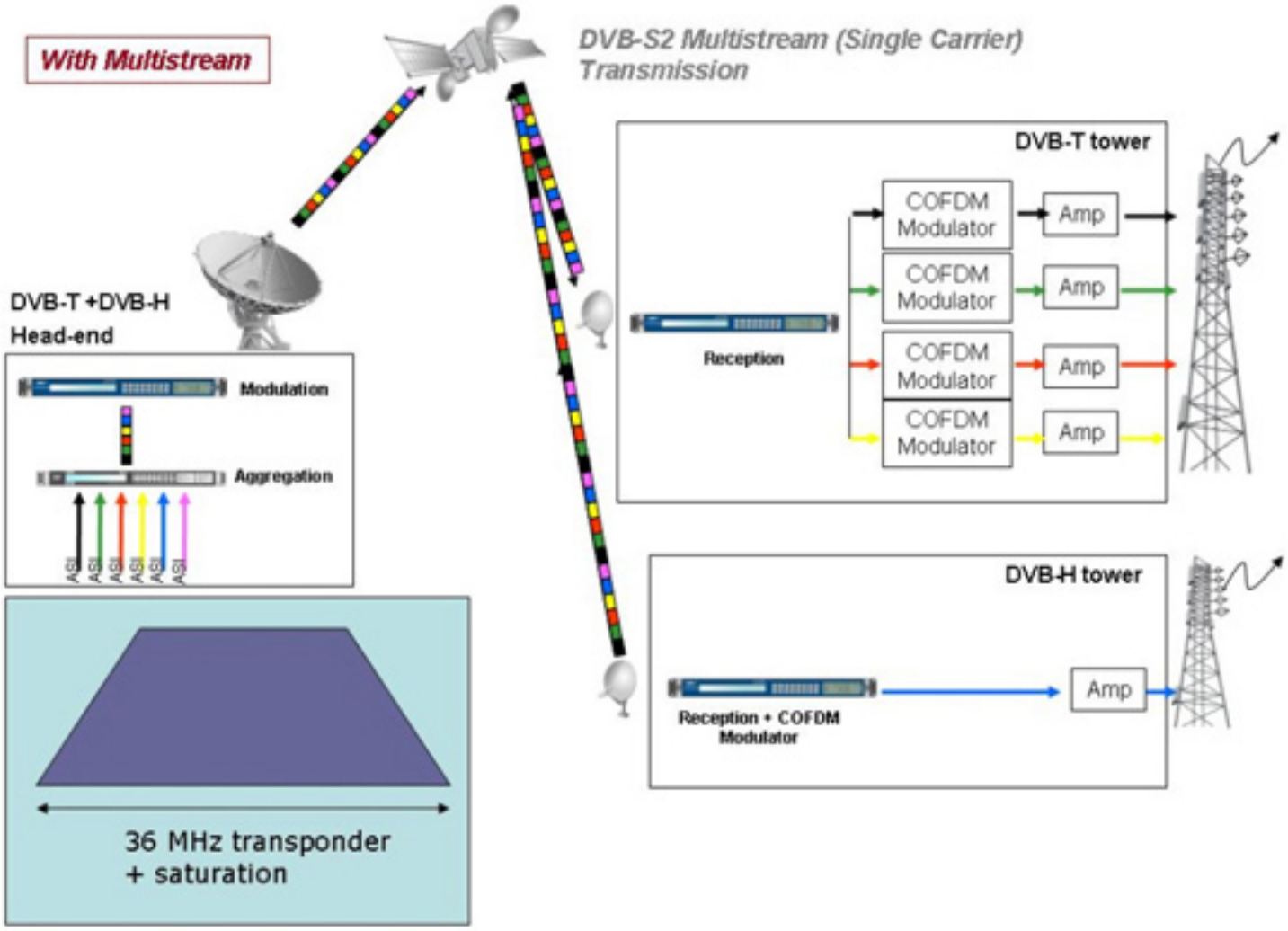

Figure 2: DVB-T/H Broadcast network with Single Carrier Transmission (Multistream)

Technology

A final consideration is that low cost equipment tends to stick with old technology whereas new technology could bring features that have a big impact on other cost lines next to equipment cost. The switch for example from **DVB-S** equipment towards **DVB-S2** already saves up 40 percent bandwidth, or 570k euros per year (market average) on a transponder.

Price negotiations and comparison of different suppliers are natural steps in a purchasing process. This article is holding up a warning sign not to be blinded by short term price reductions but instead to look at long term impacts behind a purchase. What could be the *Return-on-Investment* behind acquiring new equipment? This aspect will be examined later in this article.

Why Satellite?

Satellite links have the advantage not to depend on any telecom infrastructure on the ground and certainly are the fast track option to deploy a digital terrestrial TV network over entire countries. With the correct technology and equipment, satellite ensures a very economical way to perform the primary distribution of TV content. The operational costs do not increase with the number of towers and repeaters in the network, and last but not least, satellite also provides very efficient methods to synchronize and manage towers remotely.

Technology To The Rescue

Considering the cost issues broadcasters are faced with new satellite network technology ideally focuses on aspects that touch the broadcaster operational issues on a daily basis. Some major cost issues include:

- *Cost of equipment: new satellite network technology should check whether it can reduce the amount of equipment that is needed to install an improved network*
- *Cost of operation: new satellite network technology should investigate on how to put multiple services on the same carrier and how to save bandwidth over a satellite link.*
- *Cost of service: new satellite network technology should be easily installed/deployed and have a good reliability/MTBF*
- *Cost of Content: new satellite network technology should protect the content of the satellite link in order to prevent piracy and (news) scoop hijacking.*

From DVB-S to DVB-S2

Nowadays, we see the transition from the DVB-S standard towards the DVB-S2 for the satellite links in the broadcasting market. **DVB-S2** (*Digital Video Broadcasting – Satellite – Second Generation*) is an enhanced specification to replace the **DVB-S** standard. DVB-S2 is closely linked to the increased demand for *High Definition Television* (**HDTV**) over satellite. HDTV typically requires three times the bandwidth required for *Standard Definition Television* (**SDTV**) signals.

From a cost perspective, DVB-S2 has a performance gain over DVB-S around 40 percent, or 570k euros, on a yearly basis (market average) on a transponder. Alternatively, up to 2.5dB less power is needed to transmit the same information in DVB-S2, which reduces the energy costs.

Multistream

Multistream is a main advantage in satellite communication for Primary Distribution of Digital Terrestrial TV and Mobile TV and is fully complaint with the DVB-S2 standard. Multistream, in short, allows users to aggregate (combine) a number of transport streams or IP streams into one satellite carrier in a fully transparent manner, maintaining the integrity of the original content.

The application of Multistream within Primary Distribution of Digital Terrestrial and Mobile TV via satellite

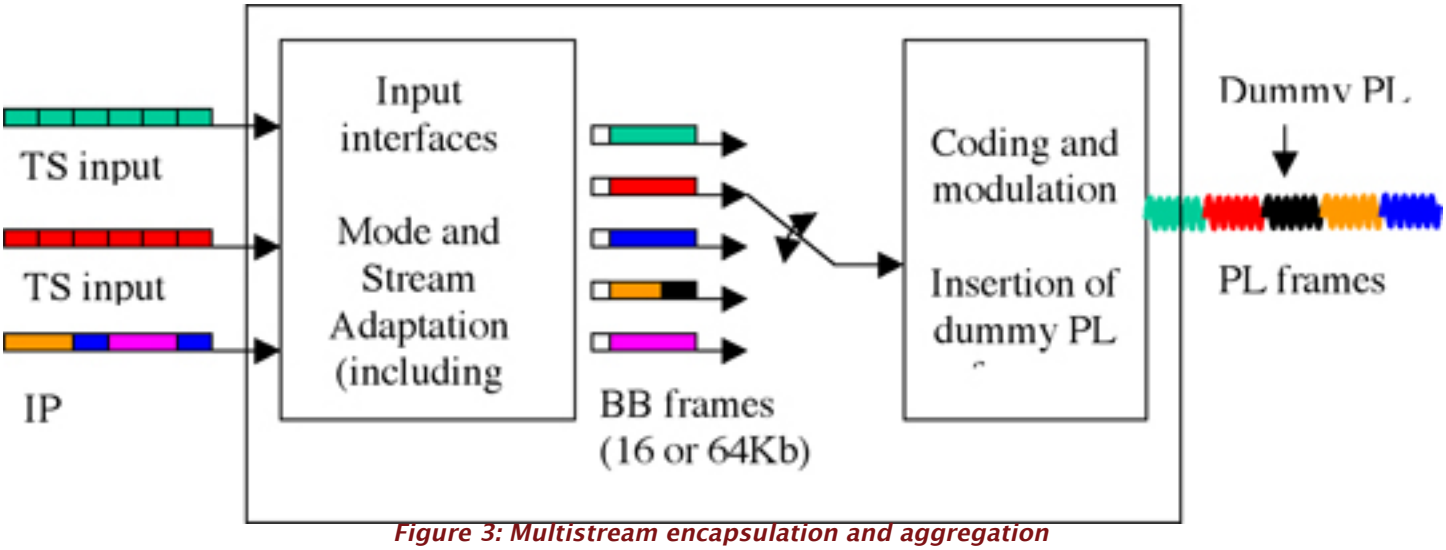

Figure 3: Multistream encapsulation and aggregation

will be displayed in the following examples. The network examples have been simplified for clarity sake.

In the first example (***Figure 1 on page 38***), a **DVB-T/H** network with multiple carriers is displayed. Each ASI input stream (can be a multiplex) is modulated separately and send in different carriers over the satellite link. At the receiver end, separate devices (IRD's or demodulators) receive a selected carrier and send it through to the **COFDM** modulator in order to be amplified and transmitted to the end-user's (mobile) TV set. Looking closer at the 36MHz transponder, five different carriers can be identified — four carriers for standard TV signals at 7.3MHz and one Mobile TV carrier at 3.6MHz. Due to the risk of inter-modulation (explained later), the satellite transponder cannot be saturated.

When compared to the previous example, some interesting differences should be noted when building a Primary Distribution Network for Digital Terrestrial and Mobile TV over satellite with Multistream (***Figure 2 on Page 39***).

First, the amount of equipment has been drastically reduced. The different ASI input streams coming from terrestrial and mobile TV bouquets are aggregated (combined) and injected into the modulator. At the receiver end, a multi ASI output satellite receiver is preferred above multiple single ASI output receiver devices (*e.g.*, IRD's). Instead of 4 IRD's, a single satellite receiver unit with multiple ASI outputs does the trick. If we multiply this tower installation over a total deployment a drastic reduction in CAPEX can be achieved. In a network with 300 towers, only 300 satellite receivers (in this example) are required in stead of 1.200 IRD's.

A second difference can be found in the transmission over satellite. Instead of sending different carriers over satellite, all the digital terrestrial and mobile TV bouquets or multiplexes are combined into one baseband stream before the modulator. A single carrier is sent over the satellite link towards the different towers. This Multistream operation allows saturation of the transponder. Additionally the compatibility with SFN operation is ensured through demodulating multiple transport streams from a single satellite carrier guaranteeing the integrity of the content.

Multistream In Detail

If we look at Multistream in a more technical sense (***Figure 3 on Page 40***), we see that transport streams (coming from encoders or multiplexers) and/or IP streams are divided into a chain of packets. The packets in transport streams and IP streams are encapsulated into **Base Band Frames** through stream aggregator equipment. These Base Band Frames consist of a header and a payload (content).

Into the header the *Input Stream Identifier* (**ISI**)-value is inserted to restore the streams' position at the receiver's end. The header also bears the *Modulation and Coding* (**MODCOD**) information for each Base

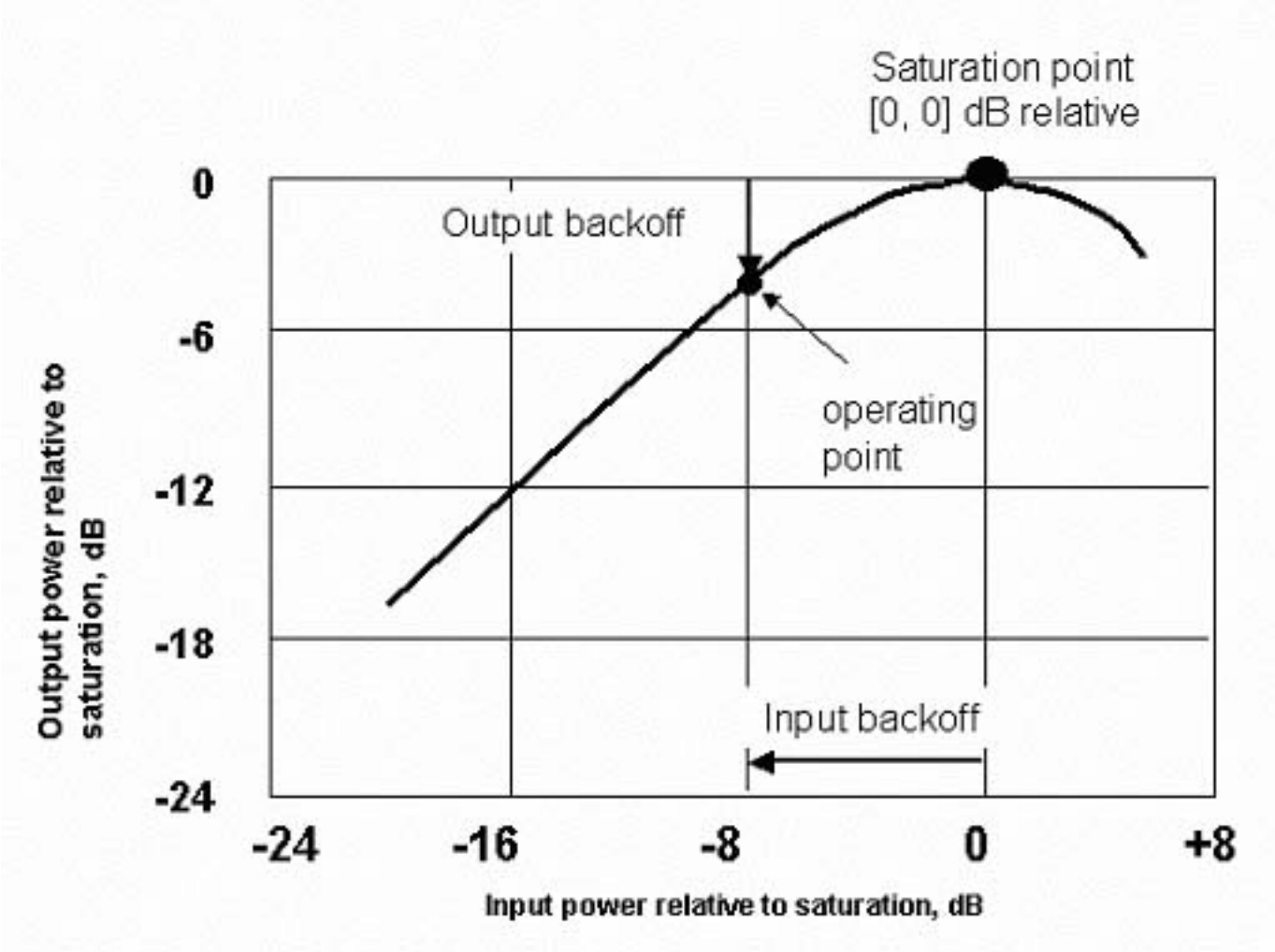

Figure 4: Transponder back-off

Band Frame. Multiple packets out of a similar initial transport stream can be stored in a Base Band Frame (16 or 64Kb). The Base Band Frames on their part will be multiplexed (combined) into a multiple input stream which is called the Multistream. The Multistream is injected into the modulator in order to be sent over the satellite link.

At the receiver end of the satellite link the Multistream is demodulated. The Base Band Frames that are required for that specific location will be taken out of the Multistream and separated again into the different *Transport & IP streams*. The modulation and coding information are checked per base Band Frame.

Once the transport streams are restored in their original ASI format, they can be inserted into the COFDM modulator and amplified in order to send through DTT and Mobile TV transmitter sites to the end-user's (mobile) TV sets. As an additional benefit, Multistream is **SFN-compliant,** which is necessary for the distribution of digital terrestrial and mobile TV content in *Single Frequency Network* mode.
Multistream in more human comprehensible terms could be described as multiple similar packets which are put into a box. Each box is labelled with a destination address, address of origin and how it should be sent. The resulting boxes containing different content are organized and put onto a means of transport that carries the payload from one location to another or to multiple locations. Arrived at destination the boxes are selected and unpacked. The packets are then put into their original state and in their original sequence.

Multistream is fully in touch with the broadcasting operational reality as several services (Terrestrial TV, Mobile TV, Direct-to-Home and IP data distribution) can be combined onto one carrier. The combination facilitates the saturation of a transponder and thus achieves a more efficient and economic use of satellite bandwidth.

Returning to the cost topic, Multistream can reduce the **OPEX** (*bandwidth cost*) by filling up a transponder to full capacity in a single carrier operation. Single carrier operation (Multistream) does not need the so-called 'back-off' and can saturate the transponder to its maximum. The 'back-off' is used in multi-carrier operations (one multiplex per carrier) in order

to reduce the risk of 'shadows' or inter-modulation between the different carriers which could compromise the quality of the received signal. Multi-carrier operations are not able to use the full output power of the transponder. When compared to (currently mostly used in the market) multi-carrier operation, Multistream saves up to 4dB resulting in more "bits per Hertz" of bandwidth (5 to 12 percent of bandwidth gain).

To avoid jitter and time lapses in the television signals at the receiver's end, DVB-S2 includes an '*Input Stream Synchronizer*' (**ISSY**) operation mode to be used with Multistream. Better implementations of Multistream do not require ISSY which is a big advantage as ISSY creates up to 2 percent overhead in the bandwidth.

SFN Requirement

Analog TV broadcasting had to face the problem of co-channel interference, prohibiting the re-use of the same channel over considerable distances. In addition, echo's (multi-path propagation) by buildings and natural obstacles resulted in receivers capturing the sum of the original signal, some delayed replicas and channel noise. To compensate this physical degradation, the traditional method was to increase the transmitting power, thereby increasing signal to noise ratio. Unfortunately, this also increases the frequency occupancy over a larger area as well as operational cost (power consumption).

New digital transmission standards make use of the so-called SFN (Single Frequency Network) technique to overcome those problems. Under certain conditions, some 'positive' echo's in a COFDM broadcast can reinforce the original signal and the negative effect of other echo's and/or channel noise can be bypassed.

Single Frequency Network operation can be obtained only if all transmitters radiate the same digital signal at any point of the service area. Therefore, each transmitter within one SFN must radiate the same data bits, on the same frequency, at the same time. SFN requirements have a direct impact on the way to set up the transmitter network and the primary distribution network. Through Multistream equipment multiple transport streams can be demodulated from

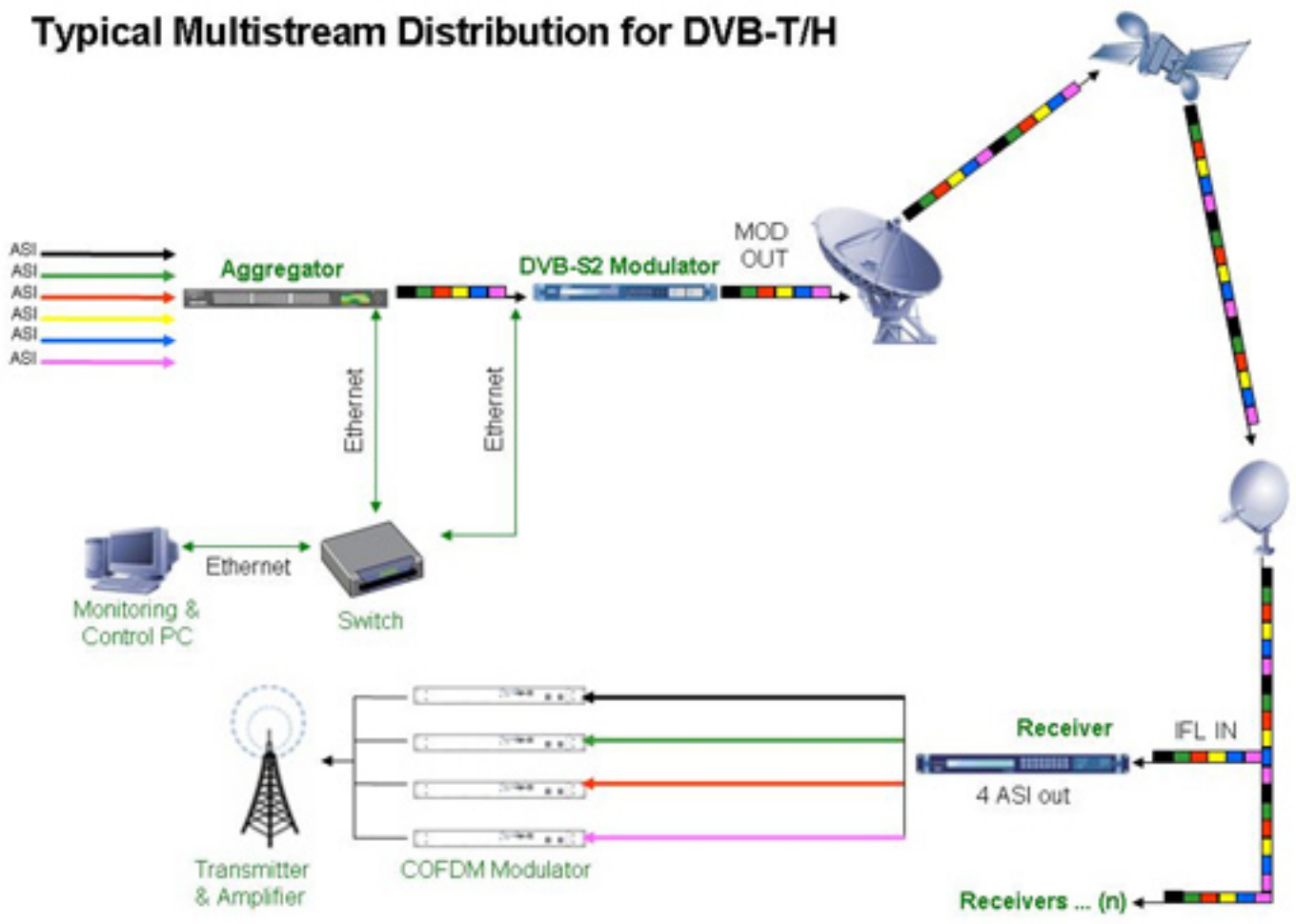

Figure 5: Multistream network equipment

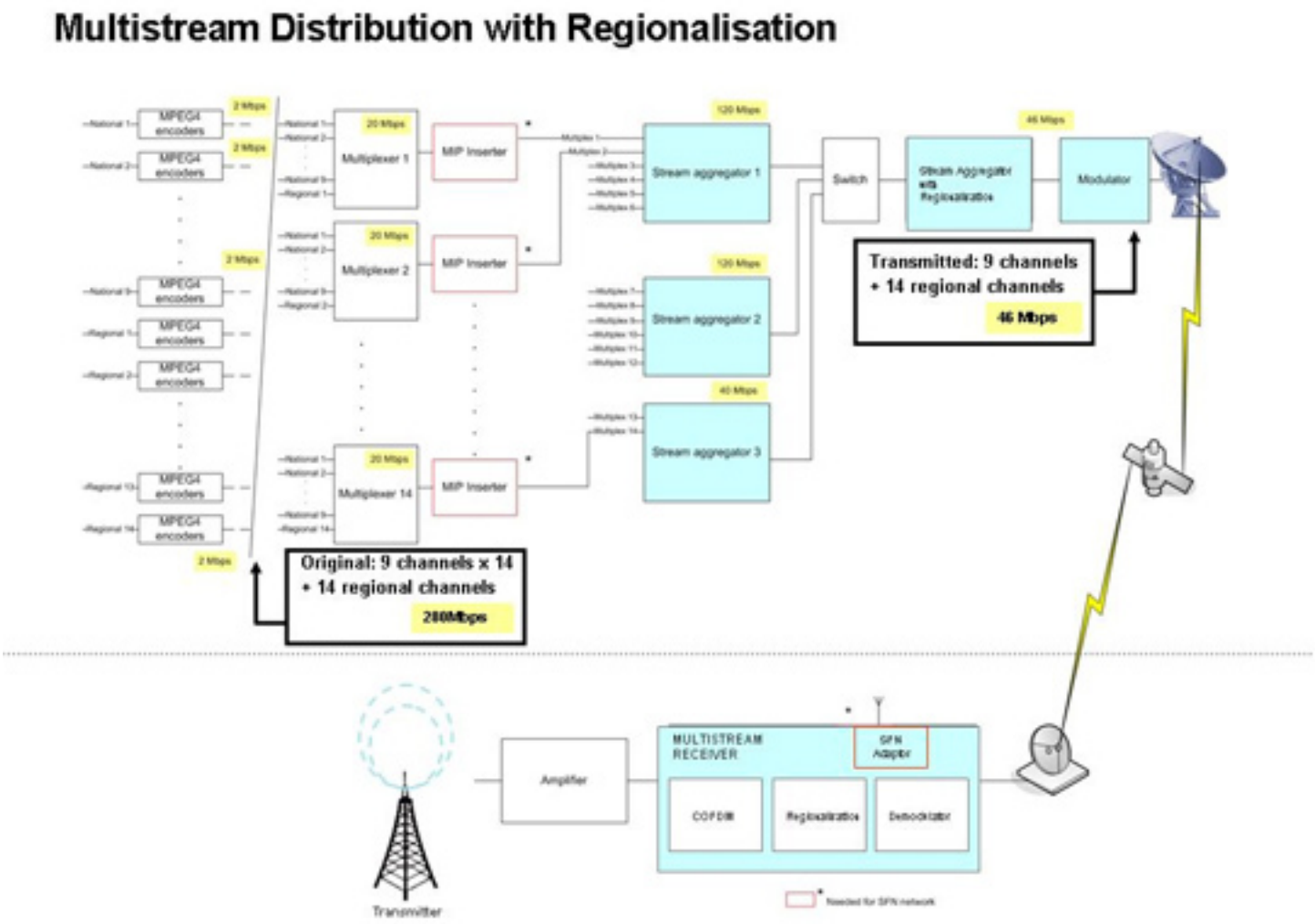

Figure 6: Multistream distribution with regionalisation in a SFN network

a single satellite carrier in a way that guarantees the integrity of the content in order to be compatible with SFN operation.

Multistream Equipment

In order to enable Multistream in DVB-S2, some adapted equipment is required. The use of the *Stream Aggregator* is a specific **Newtec** implementation. The content received from broadcasters is encoded in **MPEG2** or **MPEG4** streams. The different channels are inserted into the aggregator. The aggregator supports multiple ASI inputs and combines the different multiplexes in one baseband stream which is inserted into the modulator. In case of large number of ASI Transport Streams, other aggregators can be placed in parallel in order to feed the modulator. The cascading of several Aggregators yields to the creation of subgroups that can be routed to different modulators. The modulator sends the signal over satellite to the required locations.

At the other end of the satellite link, the *Satellite Receiver* is capable of demodulating multiple MPEG streams in Multistream mode. The transport streams are separated again based on their DVB-S2 *Input Stream Identifier* (**ISI**).

Another strong point — Multistream can be identified as a means to reduce the CAPEX. Instead of multiple Integrated Receiver-Decoders or IRD's (typically one IRD per carrier) in the transmitter towers, one unit can receive and distribute multiple streams over ASI and IP. This saving is multiplied by the number of towers where multiple multiplexes need be delivered for transmission. If we translate these findings into numbers, we see that for a deployment of 300 transmitter towers with 4 multiplexes, as much as 45percent can be saved in hardware cost through the use of Multistream receivers with multiple outputs.

Combining multiple outputs in a receiver adds advantages that do not come to mind directly but which should equally be considered as they are delivered with a price tag at the end of the ride. If less units are used (*i.e.*, 1 Multistream Satellite Receiver instead of 4 IRDs) the consumption of electricity will be lowered, the air-conditioning only needs to consider one receiver and the rack-size can be reduced to fit in

space-limited cabinets.

Regionalization

If we are in a cost saving mode, why not go all the way? By means of an example, the case for Multistream and regionalization will show that even more bandwidth can be saved on the transponder.

The regionalization functionally, in short, allows the operator to distribute all 14 regional and nine national content undoubled on the same satellite carrier. The content of the terrestrial bouquets will be composed locally by the satellite receivers with regionalization functionality. In other words, the equipment inside the transmitter towers will pick the correct channels (nine national channels and one regional channel) out of the satellite signal that are linked to their region. The remainder of the regional channels are left disregarded.

The content will then be transferred to the COFDM modulator to be amplified and transmitted to the (mobile) TV devices. Without this feature, each local bouquet would need to be composed centrally and distributed separately, increasing the satellite bandwidth cost dramatically. Multistream with regionalization does not jeopardize the quality of signal. The integrity of the content is guaranteed. If not the SFN operation requirement would not be valid anymore.

In this real life example, nine national channels and 14 regional channels need to be distributed over satellite. In total, 280 Mbps content should be transferred simultaneously. Without considering Multistream or regionalization, three transponders would be required with a market average price of 2.5 Million euros per transponder per year.

To avoid the multiple transmitting of national content in our example, some specific regionalization technology must be used on top of the Multistream keeping SFN requirements into scope. The big cost reduction using Multistream with Regionalization is realized through the requirement of only one transponder in stead of three to send the same information over satellite. In a whisker, a broadcaster saves 5 million euros on average per year. Additionally, some other services can be added to the transponder or rented to other parties as in this example the transponder capacity is not entirely filled. Return on Investment? On the fly.

Security

No matter how hard companies and governments try to secure their networks and content, the risk that unwanted parties intrude upon the network and/or abscond with vulnerable content remains high. Is security related to cost saving? Certainly.
In the broadcaster market content is key and represents a big financial value in terms of revenue. If content is pirated or hijacked, the investment costs to recreate the stolen content will be harder to recover. Still, only a minority of the primary satellite distribution links are secured at this point.

Two different security solutions emerge: **BISS** because it is standard compliant and **AES** because a simpler, yet more powerful, propriety scheme can support the high bitrates of **DVB-T** bouquets.

An Exercise In Success

With the financial crisis hitting hard and broadcasters in search for means to complete their Digital Terrestrial TV and Mobile TV networks projects, the exercise to find the correct technology and the correct equipment becomes an essential consideration in order to fit their restricted budgets.

Broadcasters should look into reducing their initial investment as well as consider how the technology will affect their investments in the long term. The dimension beyond the price tag needs to be investigated closely. Certainly this is a priority, as broadcasters must consider new technologies such as HDTV and 3D television that are popping up above the horizon and they require additional transponder bandwidth over satellite.

The **DVB-S2 Multistream** solution has a proven Return-on-Investment track record both on CAPEX and OPEX domains. Stream aggregators and multiple ASI output demodulators help broadcasters to get more bits per Hertz over their satellite link. A first reaction for a broadcaster whenever adapting or installing a new network over satellite should be to consider best price solutions… more precisely, best price solutions in the long term.

About the author

Koen Willems started his career in 1998 with Lernout & Hauspie as a project manager in the Consulting & Services division. More recently, he joined Toshiba as a Product Marketing Manager for the Benelux and later for the European market. In six years, Koen contributes to all major Toshiba Retail IT product releases. Mr. Willems is, at present, Product Marketing Director Mobile TV and Digital Terrestrial TV Equipment for Newtec, a Belgium-based specialist in satellite communications.

Executive Spotlight On...

David Ball, Regional Vice President, Asia-Pacific, Intelsat

David Ball manages to acquire huge numbers when it comes to air miles, for as Intelsat's Regional Vice President, Asia-Pacific, his oversight includes marketing and sales offices in Beijing, Honk Kong, Mumbai, Singapore, Sydney, as well as Tokyo. David accepted his current position in July of 2006, when Intelsat acquired PanAmSat, where he held an identical post, concentrating on sales, engineering, and space systems development from 1995 to 2003.

Prior to joining **PanAmSat** in 1995, David served as a commissioned officer in the **Royal Australian Air Force**, where he specialized in communication systems management. He has a Bachelor of Science degree in Communications Engineering from the **Royal Melbourne Institute of Technology** in Australia and also has a Graduate Diploma in Business Management from Australia's **Deakin University**. He is a member of the *Council of Governors* of the ***Cable and Satellite Broadcasting Association of Asia*** (**CASBAA**) and is also a board member of the ***Asia-Pacific Satellite Communications Council*** (**APSCC**), becoming the chairman of the *CASBAA Satellite Industry Committee* in 2007.

As we are all well aware, Asia has become one of the most robust regions for satellite-enabled services. Throughout **Intelsat**'s nearly 45 year history in serving the countries of Asia-Pacific, it has introduced a variety of satellite services: the rollout of broadband infrastructures connecting island nations to mainland countries; the provision of satellite bandwidth for maritime communications; direct-to-home television platforms; and the delivery of regional and international programming, to name a few. David recently shared his views on what is driving business growth in the region. Here is what he had to say:

SatMagazine

David, would you please share with us some of your recent business highlights.

David Ball

We have had some significant business developments in recent months. I would have to say the pre-commitment contract for capacity on our ***Intelsat 18*** satellite by *Office des Postes et Telecommunications of French Polynesia* (**OPT**) was a huge testament to our excellence in delivering an infrastructure that enables a diverse grouping of applications such as DTH, VSAT and Internet delivery services; **KT Corporation** becoming a distributor for our maritime service and hosting two new **GXS Network Broadband** hubs that expand our managed services portfolio in the region; and more recently, the contract win with **ABS-CBNi** where we are expanding its DTH services in North America.

Intelsat 18 satellite (image courtesy of OSC)

SatMagazine

What is driving growth for media services in the Asia-Pacific region?

David Ball

New video channels are gaining momentum, fueled by the globalization of content. We are seeing growing demand for regional content to be delivered to North America, as well as an increased demand for Asian programming to reach viewers in Europe, Africa and the Middle East.

SatMagazine

How important is deregulation in your region to allow Intelsat to grow its business?

David Ball

Regulatory change occurring throughout Asia-Pacific is quite important for near- and long-term

satellite industry growth. Of course, we would like to see regulatory change in China, currently a closed market for us with respect to domestic services. We have had great success in distributing Chinese content globally, but with such a large land mass and minimal terrestrial infrastructure in place, satellite connectivity is becoming increasing more important for domestic delivery of not only video, but voice and data communications and we can have a robust and positive impact in China.

SatMagazine

When do you think HD going to become the headline story of Asia-Pacific?

David Ball

We are starting to see that now. Special events and sports are really driving the growth for more HD content in the region. We saw that with the Beijing Games this past summer. Viewers in Asia, like any other region, once they view programming in HD, they begin to demand it on a regular basis. Today we are seeing an increase in the pay-TV channels arena starting to expand their programming into HD. Many countries are also starting to deliver regional content in HD throughout the region. As MPEG-4 continues its rollout, we believe programmers will accelerate their HD content offerings.

SatMagazine

Which applications will drive demand for satellite-enabled services in the coming years?

David Ball

We are seeing tremendous interest for expanded video and network services throughout the region. There is strong demand across the Indian Ocean region for connectivity between Northeast Asia and Africa for telecoms services; while Southeast Asia continues to be a very strong video distribution region for us. I definitely believe Intelsat will have an enduring presence in Asia. The replacement satellites within our fleet upgrade program will bring much-needed capacity and capabilities to the region. I don't think there will be huge changes in application demands in the near term but if there are changes, we will be well-positioned to serve those growing needs for our Asian customers.

CASE WORK: GlobeCast Australia

Reaching The World

by John Graham

GlobeCast Australia's Broadcast Centre in Sydney, which is a 24/7/365 upgraded Teleport and Master Control, is a global junction that enables the connection of broadcasters and events from across the globe.

This year, **GlobeCast**'s ***Teleport*** and ***Master Control*** are receiving major enhancements and re-designs. This is being accomplished to assist increased business expansion and to offer even higher levels of service to clients. The Master Control is increasing in size by 100 percent to ensure GlobeCast Australia continues to "reach the world." In fact, GlobeCast Australia in June processed its 100,000th booking in its electronic booking system, ***ScheduALL***.

Rapid growth in global demand for high-end content distribution has seen GlobeCast Australia quadruple its annual bookings volume for occasional use services — this is in addition to the Company's full time services growth. Key bookings clients include ***BSkyB***, ***Sky New Zealand***, ***Sky News Australia***, ***FOXTEL***, ***FOX Sports***, ***Network Ten***, the ***Seven Network***, ***SBS***, ***SportsBrand***, and ***World Sports Group***.

GlobeCast Australia is the provider of choice to deliver ad hoc content to and from broadcasters throughout Australia, New Zealand, and the Pacific Islands. Clients need a reliable and cost efficient service, and the front line of this operation is a highly skilled Bookings department and a system that can be viewed by all key personnel.

GlobeCast Australia Finance Manager *Rini Chandra* worked with the bookings team, MCR operators, SNG operators, and engineers on the custom implementation of ScheduALL and said, "Prior to ScheduALL, we handled incoming bookings and project scheduling with 'job sheets', which were multi-printed and

GlobeCast Australia's Engineering Director Peter Booth and Broadcast Operations Manager Peter Doueihi in the company's 24/7/365 Master Control.

distributed to operators and engineers, then back again to bookings, then finance. In recent years, our business had outgrown these spreadsheet and paper-based processes."

Total Broadcast Solutions

From its Sydney based Teleport, GlobeCast Australia offers global customers backhaul, uplink, downlink, encoding, multiplexing, encryption, time-delay, local play-out and insertion, 24/7 monitoring, IP monitoring, transcoding to 3G phones, and SMS Services. The facility draws together an international fiber and satellite network which presents attractive solutions. GlobeCast Australia has fully protected and diverse, self-healing, bidirectional STM-1 international fibers connecting Auckland, Sydney, Los Angeles, and London — all use SDH as the standard. They are configured to carry SD and HD, ASI and SDI, and all the equipment at either end is fully redundant, with no single point of failure throughout the system. The fibers have flexible bandwidth options and GlobeCast Australia offers multiple domestic and international downlinks for injection to its international fibers. The Company also operates dozens of full time digital and analog tails to major international switches and hubs; *Sydney DVOC*, *LA Switch* and *Pac Bell Hub*, and the *BT Tower* in London. For Australia and New Zealand, the Company operates one full **FOXTEL**-ready transponder on ***Optus C1***. FOXTEL is Australia's premier pay television operator.

On the ***Optus D2*** satellite, GlobeCast operates five transponders with 52 video channels and 27 MHz of flexible, occasional use bandwidth. The channels are a mix of ethnic, sport, religion, financial, and niche programming. On the PanGlobal platform, there are an additional 29 video channels on ***Intelsat 8*** (**IS-8**), plus a range of Arabic, African, European, Asian, and niche foreign language channels.

GlobeCast Australia also caters to Asia via full-time leased and operated 9MHz C-band SCPC on ***AsiaSat 2*** for occasional use for distribution throughout Asia on the preferred Asian distribution satellite; and it has an impressive list of international downlinks in Sydney: ***AS-2***, ***AS-3***, ***AS-4***, ***IS-5***, ***IS-8***, ***IS-701*** and ***NSS-6***. In Perth, it has a facility at **Optus Lockeridge**, which can downlink ***Thaicom 5*** and ***IS-10***. That allows GlobeCast to backhaul *Direct to Home* (**DTH**) channels and occasional use SD and HD bookings on capacity from Europe, Asia, and Africa. Content is then moved via a protected **STM-1** connecting the Perth facility to the state-of-the-art, 24/7, master control teleport facility in Sydney.

DTH

Many in the media industry are aware of GlobeCast's history in transmitting and distributing ethnic and

CASE WORK: GlobeCast Australia

From left, Finance Manager Rini Chandra with Renee Bulbert and Louise Hawthorne from GlobeCast Australia Bookings.

other specific interest TV channels, such as *Vision Asia* and the *Australian Christian Channel*, both DTH and payTV platforms. With more than 120 video and audio services already delivered on a permanent basis, DTH services cater to a wide range of viewing tastes, including the multicultural communities of Australia as well as featuring major international channels, such as **NHK**.

Vision Asia, with nine channels from India, is a key client. Vision Asia General Manager *Gurudutt Satigrama* said, "We have been with GlobeCast Australia for the past eight years and they look after all our satellite and up-link needs. We have had a very fruitful and beneficial relationship built on quality service and problem solving solutions they have provided us. We look forward to strengthening our relationship in the coming years."

Optus D2 is an effective and economical satellite solution for channel operators, according to GlobeCast Australia's DTH Manager Mr. *Lobwein*.

The ***D-Series*** satellite has been developed by Optus to deliver the nexgen of digital satellite services to Australasia, with increased channel capacity and technical quality. Optus D2 is received in more than 350,000 dish-installed homes across Australia and New Zealand, and includes numerous free to air (FTA) channels.

EURO World Network operates the Croatian package on the Optus D2 platform. "We are very pleased to have signed with GlobeCast Australia. They are exactly the partner we had been looking for: efficient, reliable and open to new solutions. Thanks to them, we are able to broaden our offer to our subscribers," said EURO World's President and CEO Mr. *Chris Williams*.

In recent years, the channel distribution has become even more mainstream with the addition of the likes of global sports net **Setanta** and Australasian racing channel, **TVN**. In addition, the DTH model is becoming increasingly versatile in the content it carries and the distribution locations. For example, TVN, in addition to being distributed to **FOXTEL**, is also delivered direct to 5,000 pubs and clubs across Australia.

International Brand Channels

Transmissions over the past two years for 3G mobiles finds GlobeCast distributing international brand channels, such as *Cartoon Network*, *Sky News Australia*, *Fox Sports*, *CNN,* and *BBC* into new media's smaller screen environments. IPTV, and simultaneous broadband streaming, are an integral part of reaching audiences in 2009. The "anywhere, anytime" psyche that drives mobile and Internet distribution is clearly evident across all GlobeCast activities.

"We service many of the biggest channel providers in the world," GlobeCast Australia's Commercial Director *Andrew Nealon* says. "And, we are responsible for providing satellite and fiber capacity for crucial broadcasts on the likes of BSkyB, Sky New Zealand and FOXTEL."

GlobeCast Australia also multi channels and time-shifts in the digital environment for **ABC** and the **Seven Network**. The Company also provides significant international fiber capacity for content delivery to other leading FTA networks, including Network Ten and SBS.

New Marquee Events

The company is regularly adding new marquee sports and events to its calendar of events, including the *Indian Premier League* in 2009. Uplinking and distribution of rugby league and motocross were new in 2008, joining major sports such as V8, thoroughbred horse racing, tennis Opens and rugby union internationals, to name but a few.

"Our sporting relationships, some direct with sporting organizations, also lead us to good relations with rights companies and agencies such as IMG, SportsBrand, and World Sports Group," Mr. *Nealon* stated.

From this history of broadcast distribution, GlobeCast Australia also sees a new market developing — a more "direct to venue" than the original "direct to home". Corporate clients and venues are in detailed planning stages for the installation of digital uplink

GlobeCast Australia's 13-dish teleport sits atop the towering white MLC Centre, Sydney's second highest building.

and downlink infrastructure to assist in spreading messages to staff and to stage audio visual events in large audience environments.

In particular, another breakthrough relates to communications in the workplace and to customers. Business TV solutions are about to be delivered for major clients in the Australian financial services sector, allowing them to better communicate internally and externally, enhancing their brand and sharing critical information quickly and with maximum impact. It's an obvious, natural and bespoke response to the increasingly fragmented and niche world of communications, according to the team at GlobeCast.

Increasing Demand Drives Upgrades

As mentioned earlier, the increasing demand for channels, events, and broadcasters has led GlobeCast Australia to commit to significant upgrades of its Teleport and Master Control, according to the company's Director of Engineering *Peter Booth*.

The Teleport is positioned on the roof of one of Sydney's iconic high rise buildings, the **MLC Centre**. The Teleport upgrade in 2009 increased power, installed larger amps on **AS2** to allow for four simultaneous uplinks, and resulted in higher quality, clean carriers. Also created were three discrete uplinks to the three D2 slots, something that is supplemented with Australia's largest DSNG fleet of 10 vehicles and flyaways. The 69th floor satellite dish farm on the MLC Building is the second tallest address in Sydney and possibly the highest Teleport facility in the Southern hemisphere.

GlobeCast Australia now offers 13 satellite dishes, ranging from 4.5m to smaller 2.0m antenna, five of which are uplinkable to domestic and international destinations as far away as Cyprus in the Mediterranean and Los Angeles in the U.S. Complementing GlobeCast Australia's global fiber connectivity, this provides the bridge to key distribution markets throughout Asia, the Middle East and into Europe.

Transmission dishes are permanently fixed to Intelsat's ***IS-5*** and ***IS-8***, covering an area throughout the Pacific, Oceania, and South East Asia. Clients in this region enjoy world-class broadcast events on a regular basis, courtesy of GlobeCast Australia services. The *English Premier League* is a prime example and is viewed from the U.K. to Fiji with Globecast Australia providing the bridge with Intelsat.

Another satellite providing crucial operational connectivity is Asiasat's AS-2, soon to be upgraded to ***AS-5***. The latter is a more powerful satellite that will cover the same AS-2 broadcast footprint, ranging from the Eastern fringe of Europe all the way to Australasia, with downlink capability throughout all regions in its path. This means traffic, both to and from Europe, can be transmitted via the MLC Teleport. The content can then be received in Hong Kong and Singapore, Malaysia, India, Dubai, Jordan, and Cyprus. These locales are all major connectivity hubs for onward fiber pass or instantaneous satellite turnaround. Such is particularly useful for European-only satellites and is highly effective to forward live international events out of Australia to viewers on the other side of the planet.

With AsiaSat's decision to upgrade the spacecraft, Globecast Australia, as an owner of permanent capacity, undertook a calculated decision to increase uplink capability in readiness for seamless transition to AS-5 in late 2009. Globecast has increased its ability to transmit two 9MHz C-Band channels from Sydney to a total of four 9MHz C-band channels. Ex-British Telecom Satnet Satellite Operations Manager and now the Teleport Engineer at Globecast Australia, *Jonathan Garratt*, says the company also decided to use **Newtec**'s ***Azimuth*** range of modulators and combining upconverters to create a facility offering full flexibility and redundancy for any uplinking scenario that could be potentially requested.

Single, dual, triple, or quad carrier operation at 9MHz can be individually driven from a purpose-built graphical interface at the MCR operations level. Any combination of these carriers or their committed sum bandwidth on satellite can be manipulated at the touch of an onscreen button to engage single or dual carrier operation for as much as 36MHz of HD level broadcasting. DVB-S2 modulation schemes and 8PSK are a crucial part of planning at Globecast Australia.

As *Garratt* said, "From the modulators through the various stages or RF upconverting, frequency ranges can be manipulated to support interference-free combining of a multitude of carriers. Loss is kept to a minimum as is spectral regrowth, which often is the major implication when combining signals at varied amplitudes for diverse transponder loading on the same satellite. Only Newtec offer the complete system and their approach to addressing their client's needs and effectively tailoring the product base for a multitude of applications is unique to them."

Master Control Doubling In Size

The Master Control upgrade is ongoing as crucial infrastructure is carefully duplicated, transferred, and then re-integrated. The floor space is doubling in size and the number of monitoring screens is tripling. The design has created one large CAR rather than separate rooms, and created more rack space for now and for the future.

For DTH, in its Master Control, GlobeCast Australia encodes statmux, scramble, and handoff (via protected DS-3) more than 100 video and audio services to Optus Belrose for uplink onto ***D2*** and ***C1***, in all a total of six platforms. One of the platforms is running on legacy **Scientific Atlanta** equipment, three platforms are on **Thomson Vibe plus Broadmux** (one of these is for the Foxtel ready platform onto C1), and a further two platforms running on Thomson Vibe are using the very latest ***Net Processor 9030*** multiplexer. The created transport streams are passed to Belrose on ***DS3*** equipment *Network Adapter Units* (**NAU**), as supplied by **TANDBERG** (***TSP 6120***). The scrambling system employed is Irdeto Pisys.

The Master Control supplies a mixed bouquet to Hutchinson for reconstitution onto their 3G mobile phone network platform. A selection of TANDBERG and Scientific Atlanta decoders supply a **SA DCM** (*Digital Content Manager*). The multiplexed output is fed to Hutchinson via protected DVNs.

GlobeCast Australia's international fiber contribution and backhaul circuits are populated with equipment supplied by TANDBERG (Decoders/encoders), Thomson (Decoders/encoders), Scientific Atlanta (muxing), IRT and Ipitek (both for ASI over fiber delivery). The continued growth in all business areas including Contribution, DTH, and SNG services facilitates the need for more rack space and a larger Master Control, according to Broadcast Operations Manager *Peter Doueihi*.

The planned expansion will include a completely new, state of the art, control desk complemented by a video wall increasing from 10 to 24 (Plasma/LCD) screens. Recent infrastructure enhancements in preparation for this expansion are already underway with the addition of a **Chloride *120KVA UPS*** and increased capacity to the air handling. Once the build has been completed, in addition to the expanded MCR, GlobeCast Australia will have the footprint available to install an additional 30 equipment racks, already in demand from multiple clients.

The central switching matrix is a '*Probel Sirius*', while *AXON* standards converts are used to change between NTSC/PAL, and ***Playbox*** is used for ad insertion and crawlers. ***VIP MVP*** is employed for driving the monitoring displays, ***TANDBERG TT1260*** and ***TT1290*** are the decoders of choice, with ***TANDBERG 5700*** and ***5782*** for SD and HD encoding, and ***TANDBERG SM6620 Modulators*** for uplinks. **Pixelmetrix** provides ASI delay units, while **360 Systems**

image servers are used for SDI delay and a ***Thomson Sapphire*** ASI recording device is used to top/tail clips. There are ***Vertex*** upconverters for the C- and Ku-band uplinks.

Growth + Innovation

In addition to the landmark occasional use Booking #100,000 achieved in June, the upgrades come after five years of general growth and innovation. The company conducted the entire level of 2004 business in just the first five months of 2009. GlobeCast Australia's most recent establishment of infrastructure allows for seamless disaster recovery for key broadcast networks in Australasia. A secure, state of the art facility was custom built to satisfy the needs of clients. The company now also contracts for satellite tracking, as well.

GlobeCast Australia was the founding transmission platform for the Australian Christian Channel (ACC). Erstwhile ACC General Manager *Neil Elliott* said, "In the early days, broadcasting was a new venture for us. The GlobeCast Australia team came alongside us with their wealth of experience and expertise to make the dream come to reality in a very prompt and cost efficient manner. Since those early days an excellent working relationship has continued to develop and GlobeCast has become a most valued and trusted partner to our business."

About the author

John Graham is GlobeCast Australia's Commercial Manager. He joined in July 2008 after more than 20 years at five major Asia Pacific broadcasters, most recently as General Manager Production and Sales for the Australian Broadcasting Corporation until June 2008. Before he joined the ABC in 2001, Graham was Head of Programming at Optus Television, and he has also worked as a television news executive and journalist at Australia's Ten Network and Television New Zealand.

Radford Rules: Chronicles of SATCOM

Tribal History

As any veteran of the industry is fully aware, SATCOM culture emanates from a number of specific "gene-pools" scattered throughout the country. Granted, SATCOM is a global industry, but few would argue that the heritage of satellite communications has roots that can be traced to one of these epicenters in the U.S. Newcomers to the cult may be interested in learning just how these centers came to be and how they ended up in these particular, and in some cases "curious" geographic locations.

RF tagging didn't exist in the beginning, so architects of the *Chronicles* had to manually track the crusades of our nomadic pioneers, the veterans who laid the foundation of the industry we know today. To keep things simple — and to protect the identities of those few deserving of such, details are presented in the context of "tribal behavior."

Let us consult the *Chronicles* and journey back in time to see how all these tribes originated. Though these writings may be slightly inaccurate due to a few over-statements, embellishments, and exaggerations of truth, they are anchored in a frightening reality. Also, some pages were removed from the *Chronicles* and used for unmentionable things when other forms of paper were in short supply leaving some gaps in the contiguous time line.

Now — on with the story. One of the earliest and most decorated tribes, known as the *Sandpeople,* originated on the beaches of Melbourne, Florida – *Satellite Beach* to be exact. Members of this tribe passed some of the earliest and most significant milestones in SATCOM history, like sending the first transcontinental video transmission. I think it was something major, like a *Boy George* concert or Olympic mud-wrestling event, but don't quote me on that. All I know is that it triggered the end of cultural purity around the globe and launched an exciting new industry.

At around the same time, some **Georgia Tech** nerds started gathering in a local garage on the weekends where, despite neighbors' fears that a *Devo*-like rock band was beginning to form, they invented some ancient widgets that were badly needed by the fledgling new SATCOM industry.

By recruiting droves of engineers leaking from the Tech campus and unable to escape the gastronomical pull of the Varsity, the *Cabelteevees* entered the scene. They grew in ranks and ultimately formed what became a Fortune-500 SATCOM gene-pool in northeast Atlanta. Then, following the paving of Interstate — 75, the *Cabelteevees* and *Sandpeople* began to interbreed, forming a new tribe called the *LowPBTees*. After a long reign of low-margin success, the *LowPBTees* disbanded and formed numerous local sub-tribes, creating a perpetual climate of cross-pollination and tribal wars that continue to this day.

Far across the land, a couple of clever guys bought a little wooden house across the street from the **MGM Studios**. Soon, the *Ideebees* exploded on to the scene. They became a truly magnificent tribe, but after a brief skirmish, one of the elders decided to break away and head east in search of greener pastures, had a flat tire in Dallas, and soon, the *Integrates* were formed.

As the *Integrates'* tentacles spread like a patch of rabid kudzu in a field of sun-bleached cow manure, a new gene-pool was created and eventually the Europeans came with an infusion of fresh DNA, which was badly needed. Times seemed good. Though, disillusioned by SATCOM's refusal to bear the fruits of wealth and prosperity, some *Integrates* tried to escape the tribe and run to Mexico. But they ran out of gas in *Kilgore*.

Too tired to continue, they set roots and formed the *Parabolites*. At one point in time, the *Parabolites* were devoured by the *Sandpeople*, but they didn't digest well and were eventually returned to tribal self-rule, later to be consumed by warriors wearing three-horned helmets - the *TriPoints* (though it's not really clear who actually consumed who). The result was the formation of a new super-tribe called the *Geedeeites* who amassed major armies and embarked on a quest for global domination.

Other *Integrates* decided to journey back to the homeland, only to hit hard times in Phoenix. Three tribes, the *Reeds*, *Solomons* and *Viterbis* were formed where turf battles ensued for years. They tried to be unique, but governed by the laws of "open standards"; their markings were all the same.

After years of surviving the tribulations of desert life, one of them became cannibalistic and consumed the other two. War-torn and defeated in their battle for independence, those who were able to escape assimilation joined insurgent forces from *Happy Valley* and seized the opportunity to live and fight another day.

All the while, small tribes began to take shape in DC, Maryland, Virginia, and New Jersey. But there was so much in-breeding that the roots of their ancestry were diluted beyond recognition. Despite the lack of cohesive identity, they found fertile ground in the Federal Government where their combined roots became thickly intertwined.

Radford Rules: Chronicles of SATCOM

Like Jack's magic beans irrigated with nuclear waste-water, they grew into some of the SATCOM giants we know today. They rarely socialize with other tribes, but operate under a veil of secrecy and feed on a seemingly endless supply of tax dollars.

When you think about it, the tribe analogy really is appropriate. When SATCOM veterans congregate, they will inevitably gather into huddles of common ancestry. But as the industry weathers cycles of good times and bad, one tribe may experience famine while another may be enjoying a period of prosperity. This drove some tribesmen to change allegiance to another tribe that might be basking in the spoils of a major kill.

In an attempt to dissuade their subjects from seeking better hunting grounds, some of their tribal leaders attempted to force bondage in the form of non-compete treaties laden with short-term gratification or by amassing legal militia and waging frivolous battles armed with small caliber NDAs.

But with the relentless passion, dedication and stone-hard perseverance of a sled dog crossing the finish line of the Iditarod (or simply the lack of any other marketable skill) and despite attempts to thwart their escape, some tribesmen armed only with their experience, skill and ambition climbed the fences, swam the moats, crossed the desert and ultimately perpetuated the industry we know today as satellite communications.

About the thought provoker
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Increasing Brand Value In A Difficult Economy

by Patrick Boyle, Managing Partner, Longbottom Communications

Thirty years ago, when I used to run 10Ks and marathons, I did my best to follow the advice of a few friends who were much better runners than me: speed up slightly when running up the hills to pass the competition, and then run as fast as you can going down the hills, when the other runners are relaxing after the climb. I never came close to first place in these tests of endurance, but I know I did far better in the standings than if I had taken it easy going up and down the terrain of those hilly race courses.

The same advice can be applied to a company's public relations and brand management strategy: Go all out to increase market share when the economy is booming and the competition is coasting on a wave of prosperity — the easy part of the cycle — and then speed up to pass the competition when climbing out of the depths of a slow economy.

That said, why do so many company executives reach for the pruning shears to trim advertising, marketing or public relations budgets when the economy declines? There are several likely reasons:

Trimming marketing & PR budgets appears an easy way to save money in the short term. A lot of this money is spent on big ticket items, such as advertising, trade show exhibits, or agency retainer fees for strategic brand management and deliverables such as websites, e-newsletters, news media positioning and the like. An executive often can cut the marketing budget without the painful step of laying anyone off.

Reducing the marketing budget may seem justifiable in the short term. A CEO can measure bottom line results of the company's sales or business development units, but finds it much harder to quantify the value, say, of a feature article about the company in a trade publication or a new exhibit booth that more accurately reflects the firm's evolving business and key message platform.

Pulling back on branding and marketing expenditures can give the appearance of immediate bottom line gains. A CEO might reason that reducing advertising and PR activities might impact corporate identity in the short term, but that the budget can always be restored once business improves with minimal long-term impact on the company.

Eventually, however, cutbacks in activities that support a company's brand and reputation will begin to impact revenues. Notice that each of the above reasons includes the modifier "short term." This path may appear to yield immediate budget gains, but it can be illusory.

Business leaders normally don't get to the top with the words "short term" in their vocabularies, so it's often surprising to see this sort of thinking creep into decisions that can have a long term impact on a company's corporate identity and brand value, which are intertwined.

A recent study conducted by ***Text 100 Global Public Relations*** and its research arm ***Context Analytics*** found evidence that public relations may be more important than advertising to brand value, especially for companies that sell feature-rich or complicated products. The findings of the duo's ***Media Prominence Study***, which calculates brand value based on Interbrand's ***2008 Best Global Brands*** report, show that on average 27 percent of brand value is tied to how often the brand name appears in the press.

In industries that involve more research before purchases are made, public relations can account for nearly half of brand value. For example, in the computing industry, media prominence accounted for 47 percent of brand value, or 16 times that of the personal care industry.

When the economy is headed south, C-suite leaders often focus on preserving the company's tangible assets —its employees, its facilities, its products — and less on intangibles such as reputation, brand value, and corporate culture. In a recession, the activities that directly influence sales tend to take precedence over those activities that support the underlying reasons customers continue to do business with the firm.

In a September 2008 article titled ***Best Global Brands***, *Business Week* concluded, "History shows that a recession can be an auspicious time to invest in a brand. Some of the most successful brand campaigns in the past six decades began during economically challenged years. In 1974, for example, BMW introduced itself as "The Ultimate Driving Machine," a slogan that endures to this day and helped turn the German auto maker from a niche sports sedan in the minds of American drivers into a top luxury auto brand known for superior engineering in everything from roadsters to SUVs."

Here's how long-term thinking that involves maintaining — or even increasing — marketing and public relations efforts in a recession, can help a company surpass its competitors in that metaphorical marathon:

FOCUS: Longbottom Communications

Many publications have cut their editorial staffs in the face of declining advertising. This means more editors are open to — may even depend upon — good story ideas from public relations professionals they know and respect. Developing strategic corporate messages and then pitching story ideas around those messages to key editors can result in excellent publicity for a company, further enhancing its reputation. Furthermore, "earned media" generally is perceived as more credible and trusted than direct advertising and marketing messages.

A recession is a good time to reassess all marketing expenditures. Instead of slashing the budget wholesale, however, the prudent CEO dictates a line-by-line budget review to determine what spending can be the most effective, and what to eliminate. Perhaps dollars could be shifted from trade shows or advertising budgets into a more strategic and pro-active public relations campaign to support business development initiatives. Get the loudest bang for those scarce bucks!

Long-term thinking involves an analysis of the best ways to reach existing customers with targeted PR and marketing communications campaigns. This is aiming for the center of the dartboard: customers who know a company and its products are most likely to bring repeat business. These same customers can be the source of testimonials and referrals. An e-newsletter or social networking campaign may be more effective in gaining sales from existing customers than ramping up spending on another trade conference or additional ad buys to reach potential clients who know little about the company.

It may seem counter-intuitive, but the ideal time to reach out to audiences that influence the business — trade publication editors, analysts, key customers, government regulators, current and potential investors – is when budgets are tight. For important industry influencers, observing the company being proactive in a difficult economy cements confidence and builds the firm's reputation for leadership in the industry.

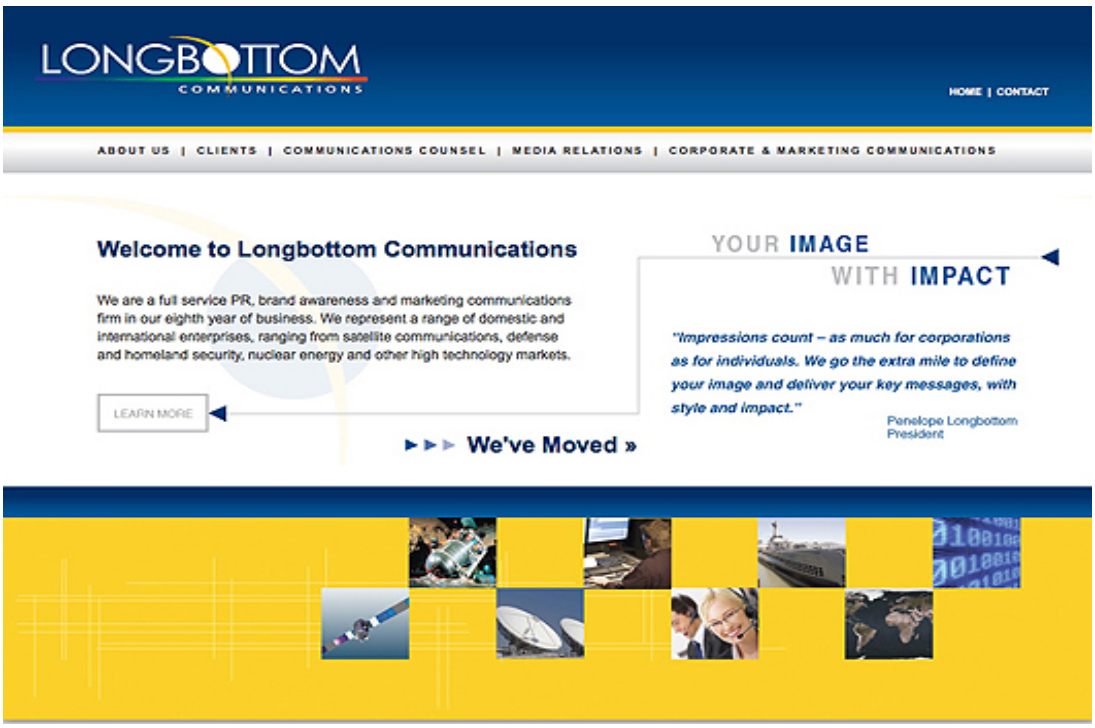
One of the primary objectives of strategic public relations is to increase perceptions of intangible assets and build the perception that the company is a leader in its market. Savvy CEOs and marketing executives are adept at this strategy. They are the ones most often quoted in the press, seen speaking on conferences panels and invited to share insights about their business at public forums.

The Media Prominence Study underscores the importance of managing and growing brand value through public relations efforts during a recession: "The more complex a product is to a buyer, the more likely they are to research the product category and to look for information they can trust — from editorial content rather than advertisements."

Patrick Boyle, Longbottom Communications

An economic downturn is when these successful companies speed up the pace of public relations and marketing communications to further cement their market and industry leadership position. That's when they pass the competition going up the hill.

For more information, visit ***www.longbottomcommunications.com*** or contact Patrick Boyle at **1-703-528-5493** or ***patrick@longbottomcommunications.com***.



Australia's Space Effort... A Stop/Start Affair

by Jos Heyman, Tiros Space Information

Australia's involvement in the so called 'space race' has been one of many false starts and has put the country in a position where it really does not play a significant role in the global exploration and commercialization of space.

How it got to this state of affairs, is a story of "been there, done that," as well as missed opportunities due to bad government decisions. With the advent of the space age, Australia was involved in four different space programs:

- *European Launcher Development Organisation*
- *British Black Arrow test program*
- *United States tracking networks*
- *Australia's own initial space effort, resulting in the launch of Wresat in 1967*

True, in the ***Wresat*** early involvement, *Australia*'s role was little more than that of a large rocket range, but it could have been the starting point of something big had the Australian governments not, deliberately, decided to move away from the space effort. What is more remarkable is that over the years Australia renewed its involvement in space several times, only to be cut short again by government decisions.

Woomera

After the second World War, *Great Britain* needed a test facility to experiment with its newly found (V-2) rockets, its guided missiles, and the missiles for the nuclear weapons that were all on the drawing boards. The open desert space of Australia was, from a geographical point of view, very attractive for these experiments, while Australia's sentiment and political inclinations were, in those days, very much towards the Empire and its allies. From the Australian perspective, there was also a distinct need to become involved in these advanced weapons. The lack of modern weapons during the second World War, and the failure of the Allies to supply Australia with these weapons, had created a strong desire to become independent from weapons supplied by other countries.

In 1946, a site in *South Australia* was selected. Designated *Woomera*, the site was in the desert region north of *Adelaide*, with a significant downrange across the continent, consisting of deserts. The site was also conveniently located near the port facilities of *Adelaide* as well as the former *Salisbury* munitions factory and the *Edinburgh* air force base. Australia took part in the experiments as a full partner and established a number of organizations which, in 1955, were amalgamated to form the ***Weapons Research Establishment*** (**WRE**).

Over the years, a variety of guided missiles were tested until, in the early sixties, the ***Black Knight*** experimental missiles were to be tested. For this, it was necessary to further extend the range and, in particular, it was necessary to establish a network of roads in the downrange area. These roads were drawn across the continent and several, such as the *Gunbarrel Highway*, continue to exist these days.

On the *Western Australian* coast, where the missiles were expected to impact, a large area was reserved for the planned *Talgara* township, although the town never materialized. A further impact area was 2400 km into the *Indian Ocean*, near *Christmas Island*. In those days, the island was dominated by the *Royal Australian Air Force*, which had a base there. Between September 7, 1957, and November 25, 1965, a total of 22 Black Knight flights occurred from Woomera.

Woomera was also used to launch sounding rockets in sub-orbital programs, and the *Special Anti-missile Research Tests, Australia* (**Sparta**) program was one of these. This late sixties program, in which the United States, the United Kingdom and Australia participated, studied the physical phenomena associated with the re-entry of objects at high velocity into the Earth atmosphere. A number of sub-orbital flights were conducted from Woomera using ***Redstone*** missiles provided by the United States. The flights carried various shaped re-entry bodies, which were to re-enter the atmosphere at a speed of 6 km/sec. The re-entering bodies were observed with radar equipment, cameras, photometers, and spectrometers. The basic Redstone rocket was modified with the addition of solid fuelled second and third stages which took the re-entry bodies to an altitude of 360 km. For these tests, a separate launch pad was constructed at Woomera and the Weapons Research Establishment provided support operations. Between November 26, 1966, and October 31, 1967, a total of nine flights were conducted.

Start 1: WRESAT

Towards the completion of the ***Sparta*** program, the rocket was made available to Australia. Australia's first space program had begun. Hastily, the **University of Adelaide**, in cooperation with the Weapons Research Establishment, developed, at a cost of just $250,000, a satellite which was an integral part of the third stage of the Sparta vehicle. Designated ***Weapons Research Establishment Satellite*** (**Wresat**), it was launched from the Woomera site on November 29, 1967, and placed in a 193 x 1259 km orbit with an inclination of 83.4 degrees. The 84 kg satellite studied the solar radiation

flux in wavelengths which directly influence the temperature structure at heights above 300 km, in order to understand the mechanism of the heat balance between solar and terrestrial radiation. The satellite carried three ultra-violet ion chambers, an X-ray counter, a solar aspect sensor, a magnetometer, an ozone sensor, and a *Lyman-alpha* telescope. The satellite ceased operations, as planned, after five days.

Wresat

The program managers and scientists had plans for a series of Wresat satellites for which Redstone launch vehicles would have to be purchased from the United States. But none of these plans materialized, due to a lack of government funding and interest — Australia's first space program was over.

Start 2: European Connection

The ***Europa*** series of launch vehicles was developed for the ***European Launcher Development Organisation*** (**ELDO**), which was established in 1964 to provide an independent launch vehicle for European countries. Australia was a member of ELDO. Using the facilities at Woomera, 10 launches were undertaken between June 5, 196,4 and June 12, 1970. A further flight was conducted from *Kourou* on November 5, 1971, before further development was cancelled on April 27, 1973, due to increasing technical difficulties and escalating cost. In addition to the Woomera facility, where the *Lake Hart* launch pad (originally built for ***Blue Streak*** missile use), Australia contributed a tracking station at *Gove*, in northern Australia.

In addition to its contribution to the development of the Europa launch vehicle in the form of the Blue Streak first stage, the United Kingdom developed the ***Black Arrow*** launch vehicle. The Black Arrow was an outgrowth of the Black Knight missile developed by the **British Hovercraft Corporation**. Although this was a British and not an Australian program, Australia was heavily involved, as the facilities at Woomera were used to launch four Black Arrow flights between June 28 and October 20, 1971, before further development was cancelled. As the consequence of its involvement in the ELDO program, Australia was offered membership of the ***European Space Agency***, but the offer was declined.

Oscar-5

The next all Australian effort was ***Oscar-5***, the first radio amateur satellite sponsored by the **Amsat Corporation**. Development commenced in 1966 by student radio amateurs at the **University of Melbourne** and the satellite was launched from **Vandenberg Air Force Base** in the United States as a secondary payload, on January 23, 1970, in an orbit of 1435 x 1481 km with an inclination of 102.0 degrees. This was the first ***Oscar*** to employ bar-magnet stabilization to prevent tumbling and it carried the first amateur satellite telecommand system. The satellite was mainly used for educational purposes and was designed only to transmit on the 28 MHz and 144 MHz bands for the study of ionospheric effects at a time approaching maximum sunspot activity. The 18 kg satellite remained operational for 46 days.

Oscar-5 satellite

Aussat/Optus

In 1977, a formal report to the Australian Government recommended the use of a space based communications system to provide communication facilities to the entire continent. It was correctly suggested by experts that the vastness of the Australian continent and the lack of an appropriate communications infrastructure were conditions which could only be solved using satellite technology, in order that all Australians, irrespective of their place of residence, would have access to the same telecommunications facilities. This resulted in the establishment of a task force and, following experiments with the *Canadian* ***CTS*** communications satellite in 1978, led, in 1979, to a government decision in favor of a communications satellite system.

Aussat was established in 1981 as a government body owned by the Government and Telecom, the latter also government owned, to operate the system. The first of three first generation satellites was launched on August 27, 1985.

The first generation satellites were based on the **Hughes *HS-376*** spacebus and the satellites carried 15 transponders operating in the 14/12 GHz band. Services were initially directed at remote areas in the outback.

Name	Int.Des.	Launch
Aussat-1	1985 076B	08/17/1985
Aussat-2	1985 109C	11/28/1985
Aussat-3	1987 078A	09/16/87
Optus B-1	1992 054A	08/13/1992
Optus B-2	1992 090A	12/21/1992
Optus B-3	1994 055A	08/27/1994
Optus C-1	2003 028B	06/11/2003
Optus D-1	2006 043B	10/13/2006
Optus D-2	2007 044B	10/05/2007

Table 1 : Aussat/Optus B launch dates

Plans for the next generation of satellites were made in the late eighties and the second generation of satellites were also ordered from **Hughes**. By then, ***Aussat*** had been sold to **Optus**, the second (and privately owned) communications organisation in Australia. The focus of the system had been changed to provide new customer services, such as mobile communications and pay television.

The third and fourth series of Optus satellites, ***Optus C*** and ***D,*** followed at a later date, by which time ownership of Optus had been transferred to interests in Singapore.

Start 3: The COSSA, ASO, ASC eras

In spite of the fact that Australia did not have a space program during the early seventies, scientists and engineers, against all odds, continued to operate at a below-government level and kept the candle burning with a range of projects. Some of these projects found their way to the U.S. as payloads for satellites.

Australia has a traditional expertise in astronomy. As a result of this, Australia became, in 1979, involved in the ***Starlab*** project, conducted with the United States and Canada. Starlab was to be a free flying space platform to be placed in orbit by the *Space Shuttle* for periods of six to twelve months at a time. It would have carried a camera providing high resolution imagery over a very large field of view, an ultra-large format photon counting array and a multi-purpose spectrograph for the extended study of selected astronomical sources. The first launch was planned for the 1990/91 period, but the program faltered after Canada withdrew its support.

The proposed ***Mirrabooka-1*** satellite was to have been launched in the 1986/88 period and would have been based on the ***Spartan*** spacebus. It would have carried an X-ray telescope and was to have been deployed from the *Space Shuttle*. A further development, known as ***Mirrabooka-2***, envisaged a free flying and re-usable platform to place payloads into orbit. Mirrabooka, incidentally, is an aboriginal word for Southern Cross.

To provide some coordination in the space involvement of the various divisions of the Government, the ***Commonwealth Scientific and Industrial Research Organisation*** (**CSIRO**) established the ***CSIRO Office of Space Science and Applications*** (**COSSA**) was in 1984. To build on the excellent efforts initiated by COSSA, the Government established the ***Australian Space Office*** (**ASO**) in 1987 to actively encourage the development of a local space industry and commercial space activities which were internationally competitive. The ASO was also to create an innovative environment by encouraging greater involvement of local industry in space research and development activities.

One of the ASO's first projects was the *Endeavour* payload which used the large photon counting array originally proposed for *Starlab*. The payload, which was completed by the Australian space industry in 1988, was flown on the ***STS-42*** mission of January 22, 1992, after having been delayed by the ***Challenger*** disaster.

Using two *Getaway* canisters, ***Endeavour*** provided the Australian space industry with experience and the actual scientific payload took a secondary position, which was evidenced by the fact that, while the experiments required a flight in which the payload bay would face outer space, the ***STS-42*** payload bay faced towards Earth — no scientific results were obtained. ASO was heavily criticized for allowing ***Endeavour*** to fly on that mission instead of waiting until a mission with a better flight profile became available — the decision, however, was outside Australian control. The payload was placed in storage and was reflown on ***STS-67*** on March 2, 1995, with better scientific results. Not all efforts of participation were successful. Like Starlab, Australian participation in the ***Lyman Far Ultraviolet Spectrum Explorer***, fell by the wayside due to matters beyond Australian control.

The ASO also became involved in the *Cape York Spaceport* project, which envisaged the establish-

ment of a commercial launch site for Soviet ***Zenit*** launch vehicles. This project, which was first mooted in 1980, included the development of a seaport and an airstrip and was expected to commence commercial launches in 1995 with an eventual launch rate of five per year. The project, which changed hands several times, failed to materialise as a result of a lack of financial sponsors. It was also hampered by environmental and aboriginal tribal concerns, while the general downturn in the space industry may also have been a contributing factor.

The ASO was also instrumental, and more successful, in establishing a number of ***Space Industry Development Centres*** (**SIDC**), which combined the research skills of the universities with commercial partners, establishing competitive intellectual property. Centres were established in *Adelaide* and *Brisbane* and one of these was involved in signal processing, navigation and position location technology, as well as microwave technology.

In 1988, proposals were made by **Australian Launch Vehicle Pty.** for a launch vehicle that would have had a launch capability of 500 kg into low-Earth orbit. The vehicle would have been a two-stage vehicle using solid fuel. The length would be approximately 22m, of which the first stage would have been 12m. It would have used the *Cape York* facility. Because of an excessive reliance on imported components, the project lost its commercial viability and did not materialise. Neither did a *Southern Launch Vehicle* proposal made by **British Aerospace (Australia)** get off the drawing board.

In spite of the modest successes by the **Australian Space Office**, the Government passed the *Australian Space Council Act* in 1994, establishing the Australian Space Council to replace the Australian Space Office as a move towards a more comprehensive national space program. Consisting of representatives of the industry, the scientific community, and the Government, the task of the Council was to advise the Minister and advance a rolling, five year space plan.

The first plan was published in July 1994 and recommendations included a proposal for Australia to launch two satellites. However, the Government of the day decided, in the context of the 1995/96 budget, to initiate a review of the National Space Program, which had originally been planned for 1997 forward to 1995. Funding was continued for the program during 1995/96, but funding for 1996/97 was subject to the Government's consideration of a further review. The decision to freeze funding beyond 1995/96 had a constricting effect on expenditure under the National Space Program and eventually precluded decisions on long term initiatives and the Australian Space Council concept and its National Space Program disappeared from the scene.

Start 4: FEDSAT

In spite of the fact that the Australian Space Council had been 'put to rest,' the government of the day announced a new direction for the Australian space effort on August 29, 1996. This new effort involved the launching of a satellite during the centenary of Federation in 2001. The microsatellite program, known as ***FEDSAT***, was undertaken by the ***Cooperative Research Centre for Satellite Systems*** (**CRCSS**), a branch of the CSIRO organization.

The 50 kg micro satellite, which was eventually launched on December 14, 2002, was to provide hands-on-experience in space science and technology for those involved, providing a skilled resource base for follow-on space projects whilst at the same time stimulating the development of a commercial market and maintaining the public interest. But, due to lack of funding, there was no follow-up to FEDSAT and, with the benefit of hindsight, the effort was a waste of time and resources.

As a separate and commercial effort, the ***Australian Resources Information and Environment Satellite*** (**ARIES**) was proposed. The 400 kg satellite was to carry an imaging spectrometer with visible and near-infrared and shortwave infrared capabilities. To be launched in 1999, it would have been be placed in a sun synchronous orbit of 500 km altitude and will provide users with data for mineral exploration, resource mapping and environmental monitoring.

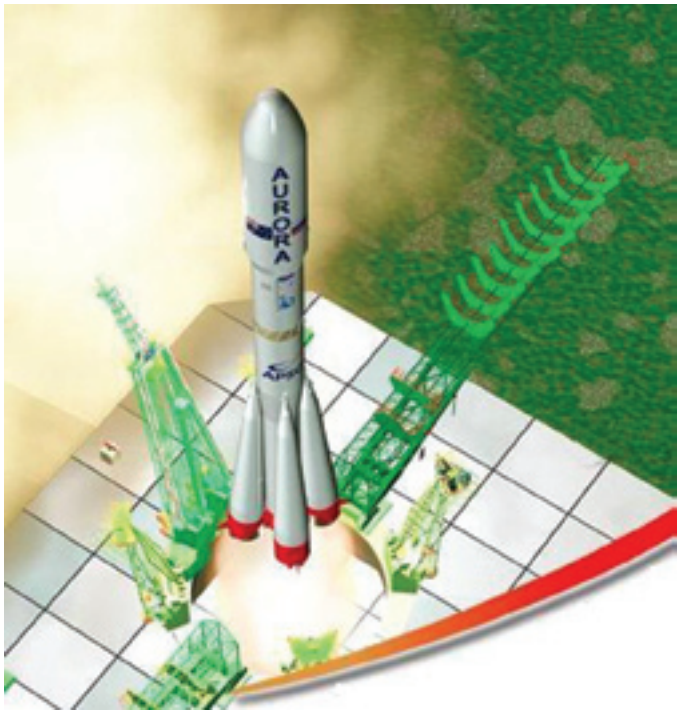
Launch Facilities

Interest in Australia as a location for one or more launch sites continued. Over the years, proposals for launch facilities at Woomera, Cape York, Darwin, Eucla in Western Australia, and Christmas Islands (Indian Ocean) have been made, but all of them lapsed due to a lack of funding. It has been suggested that some of the launch proposals failed as a result of a lack of commitment from the Australian government.

Satellite Proposals

In spite of the lack of a national space program, the scientific and educational communities continued their space efforts. A typical example that actually resulted in a satellite was ***Westpac***, a 24 kg geodetic satellite with a mass of 24 kg that was based on the Russian ***GFZ-1*** satellite and was used by the ***Western Pacific Laser Tracking Network*** (**WPLTN**). It was launched via a ***Zenit 2*** launch vehicle from *Baikonour* on July 10, 1988.

The ***Basic Low Earth orbit UNSW Educational Satellite*** (**BLUESat**) is a microsatellite project undertaken



at the **University of New South Wales**. It was first proposed in 1997 and went into a research phase in 1998, followed by the first designs in 1999. Progress remains slow, mainly due to limited funding as well as a flow-through of participants.

In 2007 Australian space scientists proposed the development of a spacecraft to learn about the sun's corona and the origin of solar winds. Designated as ***Sundiver,*** the spacecraft could be powered by Australian-made plasma thrusters to get it within three to four solar radii of the sun before it stops sending data back to Earth and burns up.

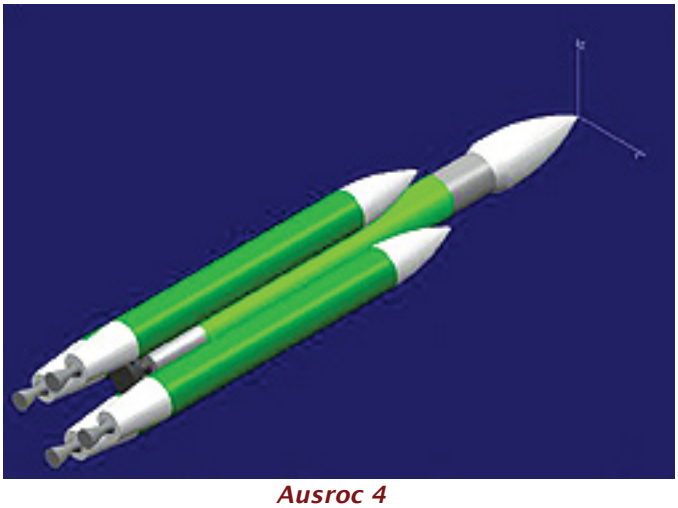
The ***Australian Space Research Institute*** (**ASRI**), a non-profit research organization run entirely by volunteers, came about in the early 1990s through a merger of the ***Australian Space Engineering Research Association*** (**ASERA**) and a group at the **Monash University** in Melbourne that was interested in developing a launch vehicle labelled as ***Ausroc***. Although run as a company limited by guarantee, ASRI does not have employees, has very limited resources, and does not offer courses that lead towards qualifications. Nevertheless, ASRI does have a close collaboration with a number of Australian educational institutions, including the **Royal Melbourne Institute of Technology**, **Queensland University of Technology**, **University of Queensland**, and the **University of Technology** in Sydney.

Its previous activities included the development of an amateur satellite designated as ***VKSat***. The satellite, based on the ***AMSAT Microsat***, was to be fitted with the Australian built *Integrated Remote Imaging System,* but the satellite never materialized. One of the other activities ASRI continues to undertake is the launching of ***Zuni*** rockets from Woomera. These rockets, originally surface to air missiles, had been donated to ASRI by the Royal Australian Air Force to be used to launch educational payloads into a sub-orbital trajectory. Launches are conducted twice a year from Woomera, South Australia.

In 1990, ASRI started the development of a very light launch vehicle under the designation ***Ausroc***. The first test, using ***Ausroc 1***, was conducted successfully on February 9, 1989, at the **Puckapanyal Army Camp** weapons firing range and the rocket achieved an altitude of 4 km in an 8 seconds flight. Ausroc 1 had a length of 2.6m and was propelled by a furfuryl alcohol/nitric acid motor which provided a thrust of 1274 N for 8 seconds.

The first test flight of the much larger ***Ausroc 2***, conducted on November 17, 1992, at Woomera, met with failure. A further flight of Ausroc 2 took place with limited success on May 26, 1995, when an altitude of 1.8 km was achieved (instead of 9 km) and a distance of 3 km (instead of 25 km). Ausroc 2 had a length of 5.6m and was fuelled by kerosene and liquid oxygen with a thrust of 9810 N for 20 seconds. An improved vehicle, designated ***Ausroc 2.5***, is scheduled for launch in mid 2010.

Ausroc 3 and ***4*** are projects currently being developed by ASRI. Ausroc 3 is a liquid fuelled sounding rocket that will be capable to place a 150 kg payload into a 500 km sub-orbital trajectory. The vehicle will have active guidance so that its trajectory can be controlled during the flight. The payload module will have a 6 minutes period of weightlessness before it will re-enter with a steerable gliding parachute recovery system. The first launch is planned for mid 2011. Ausroc 4 is a further development in which five clustered Ausroc 3 vehicles will provide an orbiting capability for a 10 kg small satellite. Four of the clustered rockets will serve as a first stage whilst the fifth rocket, in the core, will serve as the second stage.



Ausroc 4

On top of this will be a solid fuelled third stage. The first flight is planned for mid 2012. While in the first instance the ASRI activities are intended to advance education, technology and industry development, the capability and hardware being developed through the program may have commercial application.

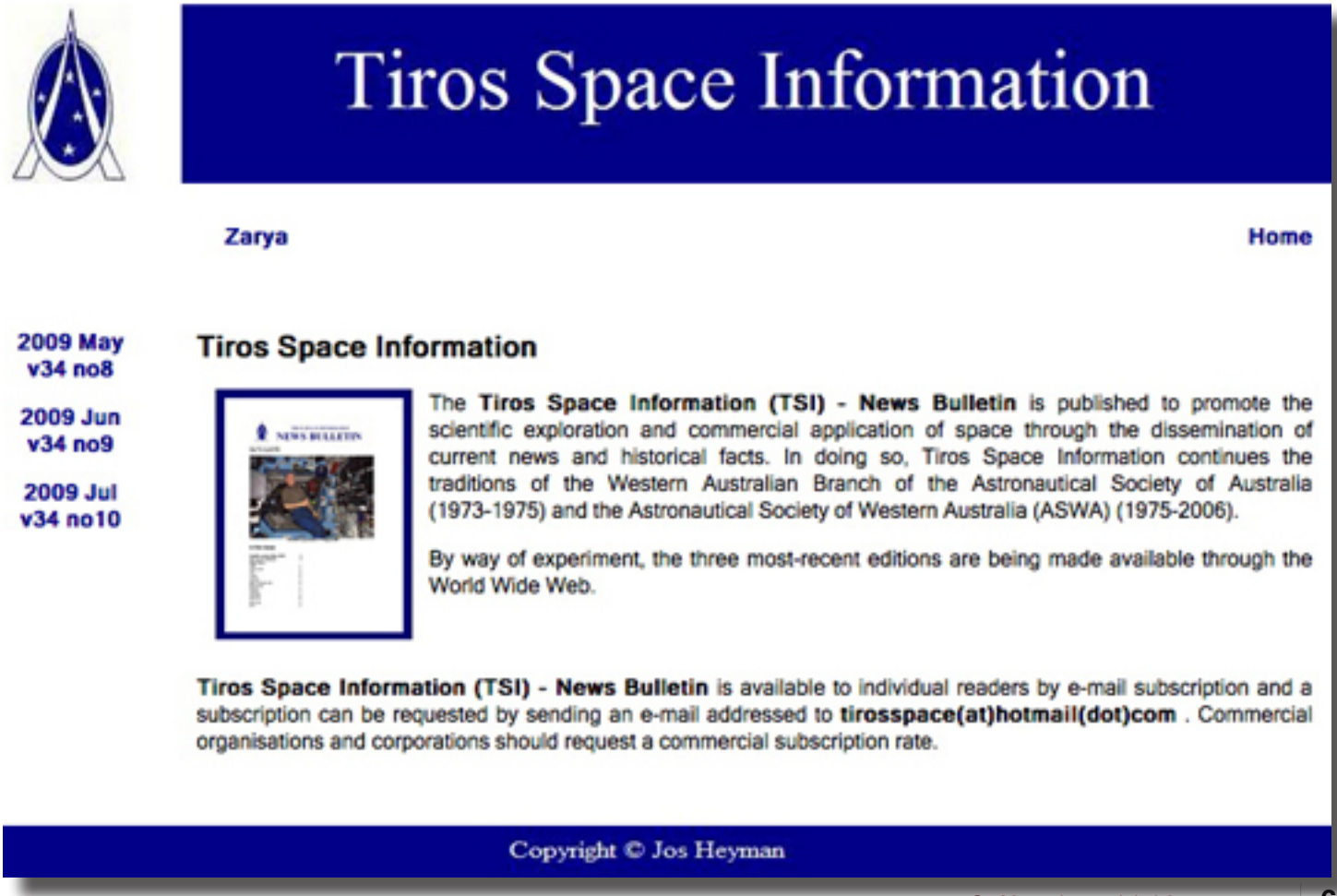
Start 5: The Future

It is unlikely that the future of the Australian space effort will be a spectacular one. In the Asia Pacific region, Australia now faces strong and real competition in the space effort from its Asian neighbors, countries where the governments actively support the emerging space industry. A parliamentary enquiry conducted in 2008 recommend a step-by-step approach towards re-establishing an Australian space agency. But to what extent the recommendation will eventually result in a space agency remains an outstanding question. As far as is known, the recommendation does not yet have government endorsement. And if the government endorses it and decides to take positive action, there are many points on the path of progress where the government can cop out for whatever reason they deem suitable.

The report does not recommend a time frame and it could be years before we can see the establishment of an Australian Space Agency. Others have suggested that Australia does not require a primary space industry, but rather a secondary space industry which comprises the involvement in multi-national consortiums to build spacecraft components, marketing our expertise in remote sensing, and so on. Whatever direction is taken, such will require the involvement of government at a higher degree than current commitments. This would be needed to ensure such efforts are sustained by government funding and do not become further 'dead ends.' As government involvement is, as a rule, driven by public perception, it is also essential that an active space awareness program be successfully conducted.

About the author

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



MSS And Financing — Weathering The Oncoming Storm

by Claude Rousseau, NSR

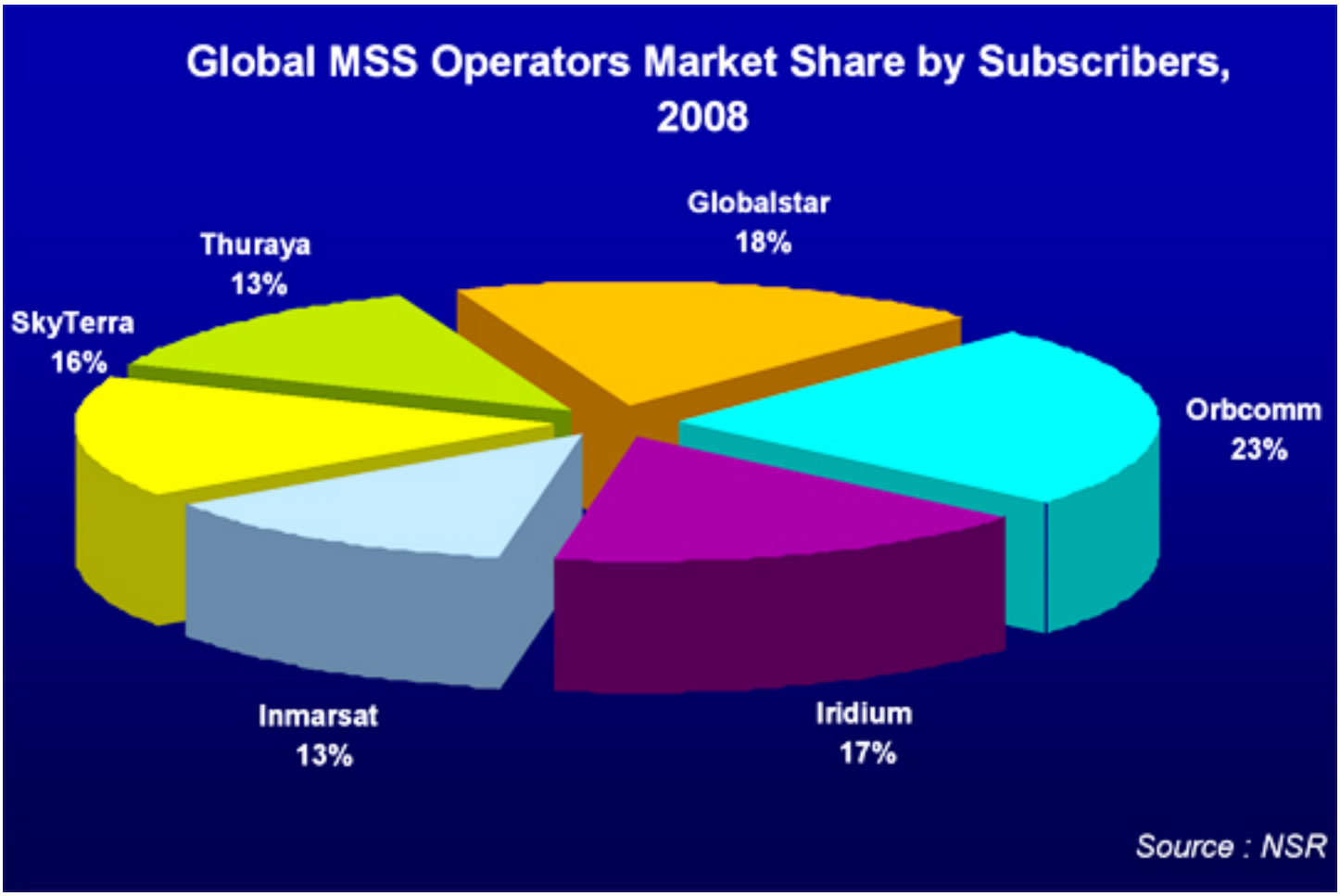
As we hear more and more that the global economic crisis could drag on various industrial segments in general and the satellite industry in particular, it is worth looking at how the mobile satellite services operators have faired over the last 12 months and what lies ahead for them in terms of settling their high capital expenses. Most of the operators have released results from the last year with different levels of success and the admission by all is that they have been hit but much less so than what was expected.

With less than two million subscribers, the six main MSS players are holding their own for the most part, as three constellations totaling 128 satellites in Low Earth Orbit and another 23 satellites in MEO and GEO could be launched in the next six years. This is a lot of capacity for what many believe is too many operators vying for the same business, in a market that is very small compared to the telecom industry, where giants today battle for hundred of millions of new subscribers every years.

Furthermore, two other operators, namely **ICO Global Communications** and **Terrestar Networks,** will enter the market and have satellites whose power and transmission capabilities dwarf current satellites in orbit, such that the game is likely to get tougher in the corners. Nonetheless, the market has seen the total number of subscribers grow by 21 percent in one year, to reach above 1.9 million subscribers at the end of December 2008.

The riskiest part in the life of a these operators, the launch of its satellites, will peak for the entire industry in 2010-2011, with an estimated 82 birds set to lift off aboard a variety of rockets, some with multiple satellites launched at the same time. This represents a significant element of hazard for businesses, but it is part and parcel of what makes the satellite communications industry unique, and is a well-known parameter in providing the benefits of ubiquitous or extended reach from well above the Earth.

As far as revenues goes, the six operators combined for revenues of $1.25 billion last year, a 12.5 percent increase over the previous year. Over the last three years, the *compound annual growth rate* (**CAGR**) of this group of operators is a very respectable 9.5 percent, a performance to be taken in the context of dwindling revenues for **Globalstar** (minus 20 percent



over the same period) and increased competition and expansion from wireless operators. At 23 percent CAGR, it is **Iridium** that is showing the highest revenues growth rate, driven in large part by defection from Globalstar voice users to its service and a booming data modem business.

But is the past a measure of future success? Not necessarily. Simply because more satellites will be up in space will the market demand equation strongly tilt towards the supply side and this causes more issues for the operator that are sometimes independent of its market position.

A Wave of Satellites

When Inmarsat completed its new fleet of satellite it started launching in 2007 with a launch of its ***I4-F3*** spacecraft on August 19, 2008. This reaffirmed its lead in the MSS market, with this first set of new generation satellites providing very wide coverage across the planet in the coming decade. The repositioning of its fleet in early 2009 settled the U.K.-based company's operations for the next fifteen years, unlocking access to a new family of broadband L-band products for land-mobile, maritime and aeronautical markets with ***BGAN***, ***Fleet Broadband*** and ***Swift Broadband*** respectively. The operator success has continued when it received partial funding from the **European Space Agency** to build and launch an L-band satellite called ***Alphasat***, to extend spectrum and capacity for BGAN over Europe, the Middle-East, and parts of Africa.

More good news for the operator came from the **European Commission,** which decided to give 15 MHz of bandwidth in the 2 GHz band of spectrum over Europe to Inmarsat. However, this also means that it will need to find new money to build and launch an S-band satellite by the end of 2011 but it is well-positioned to find avenues for this new venture.

In the Middle-East, the competition was not sitting idle. Earlier in 2008, **Thuraya Satellite Telecommunications** also launched a satellite that is positioned over Asia, a new region of interest to them and the market as a whole. This was the enabler to increase handset service revenues and tap into the broadband and maritime markets so as to make a dent in the Inmarsat BGAN user base with an IP-based solution, the ***ThurayaIP***, delivering standard Internet services to an A5-size portable form factor at 444 kbps.

On the other side of the world, **ICO Global Communications** launched its ***G-1*** spacecraft in April

2008, a next-generation spot beam S-band satellite. However, to this date, it is still in the demonstrating phase, putting through tests the virtues of the satellite network in the Las Vegas and Raleigh region and it has yet to generate revenues. ICO recently ran into financial problems with its North American division and is running the risk of not delivering its highly-touted multimedia service to vehicles if its funding problems continue. If it can settle issues with spectrum in Europe where it lost the S-band decision, fight an appeal from its manufacturer over ten satellites, and find a suitable launch service provider, ICO could finally deploy in the next few years a medium Earth orbit (MEO) constellation designed to provide MSS globally.

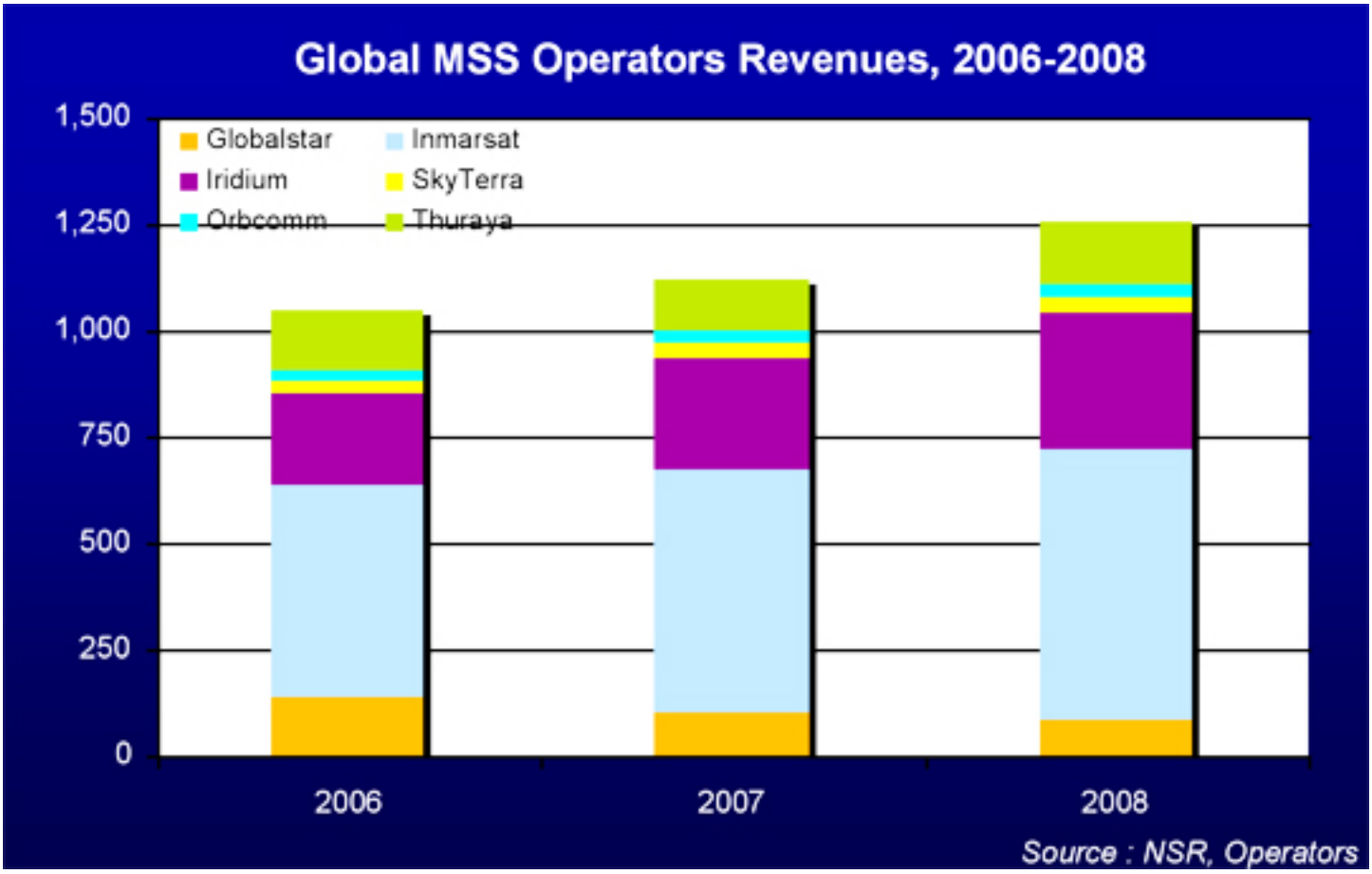
A low Earth orbit (LEO) operator that has been around for a long time, **Orbcomm Inc**., based in Fort Lee, New Jersey, launched six satellites in June 2008 to augment is current constellation. They offer narrow band, two-way messaging, data communications, and geo-positioning services, globally. It now has 29 satellites in orbit and ordered in early 2008 another 18 satellites from **Sierra Nevada Corporation** for $117 millions (excluding launch and insurance), with an option for another 30 satellites to replace the current constellation. The new satellites should be launched between 2010 and 2011.

Finally, **Solaris Mobile**, a joint venture of FSS operators **Eutelsat** and **SES Astra,** is the newest player in the game, having launched in March this year an S-band payload onboard a geosynchronous orbiting satellite built for Eutelsat for European customers. The company has signed up various suppliers such as **DibCom** and **Alcatel Lucent** and is in the process of recruiting national mobile operators, broadcasters, and equipment manufacturers to develop an ecosystem which will sell products and services that will us its capacity for mobile TV, in-car entertainment, and data services. The S-band payload has, however, experienced problems that could delay the service roll-out. Furthermore, the European Commission decided in May 2009 to allocate frequency on a continent-wide basis in the 2 GHz part of the spectrum to Solaris, which may be in jeopardy if the company is unable to recover its payload.

The High-Pressure Front

All counted, it is five GEO spacecrafts, one GEO payload, and six LEO satellites that the industry launched in the last three years. This is just the beginning of a whirlwind of launches for the industry, with a swell of large and powerful satellites to loft in the next few years.

Terrestar Networks is to lift ***Terrestar-1***, a huge 6,700 kg. spacecraft in geosynchronous orbit over North America this summer, and one more in 2010. It will be the largest commercial satellite ever built,



outfitted with 500 S-band spot beams to link hand-held and PDA users in a roaming fashion over it satellite/terrestrial network. At the time of this writing, the company had delayed the launch to verify the **Harris Corporation**-built S-band antenna, which developed similar problems on the ***Solaris Mobile*** payload that lifted off in early March 2009. Its roaming agreement with **AT&T** is the principal route to market for them as no proprietary ground infrastructure has been set-up to enable the ancillary terrestrial component of its network to provide service. They are the third operator in line authorized to fly with an **MSS-ATC** authorization from the **Federal Communications Commission** (for a satellite-terrestrial hybrid network) as ICO and Globalstar are already in orbit but both have yet to deliver any service commercially through this authorization.

Iridium will launch its ***NEXT*** constellation much later, starting in 2014, and will elect a supplier in the 3rd quarter of this year for the manufacturing of the 66 spacecrafts. It plans to have a little more than four years to build and launch what should be the most powerful LEO constellation ever built. As the current specifications stands, end-users will be able to get reserved capacity in the downlink direction of up to 2 mbps.

The company is still reaping the benefits of its arch-rival Globalstar, which continued to have problems with its voice service over the last two years. This situation has given almost a monopoly situation to Iridium in many satellite handset markets and there should be no stopping them in the next 12 to 24 months as Globalstar replenishes its constellation and Inmarsat delays its entry into the handheld market until mid-2010.

Through its bent-pipe satellites, offering CDMA-type connectivity, Globalstar is on track to roll-out its new services in late 2010 at the earliest, and delivering 256 kbps downlink to the handset. In the meantime, it has retained many of its customers by offering large discounts on phones and services packages, while at the same time signing up new ones with simplex data hardware and a new critically-acclaimed consumer-oriented location-based messaging device called ***SPOT***. Its main shareholder, **Thermo Capital Partners,** also infused a healthy does of goodwill by changing debt into equity to lessen the dire financial situation of the operator.

Lastly, **SkyTerra L.P.**, formerly **MSV**, has continued the roll-out of its successful push-to-talk solution with government and state emergency responders in

the U.S. It is actively preparing to launch two high-power spacecraft to a hybrid network upgrade that will include a terrestrial component and higher capability handsets in 2010 and 2011.

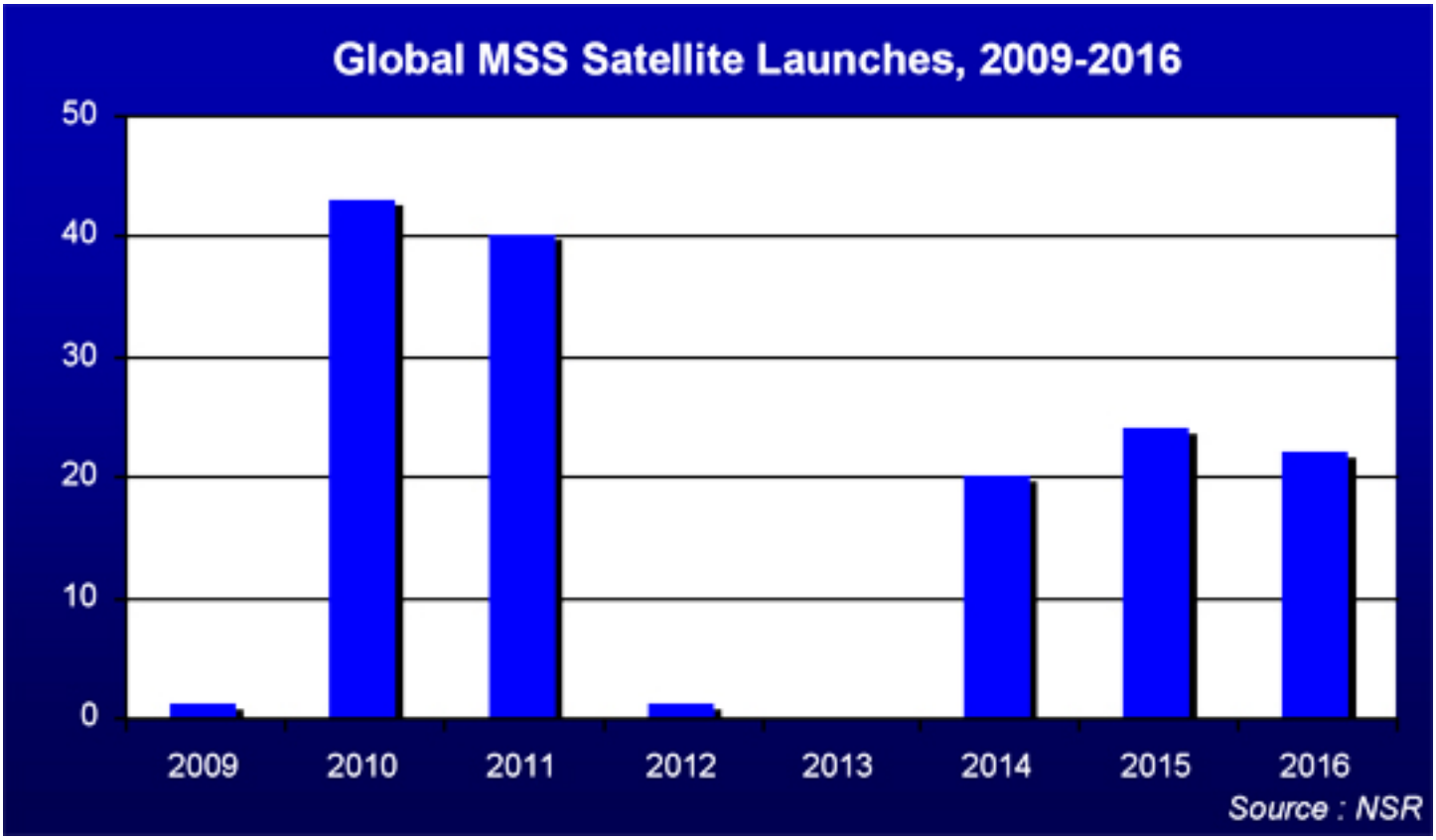
Of interest is also the continued key metric offered by **OrbComm**, the machine-to-machine and asset tracking specialist in the VHF part of the spectrum, which has increased its subscribers base (or as it calls them 'billable customers') to 460,000 last year, but has seen a decrease of more than 30 percent in equipment sales. Its revenues from service were up 34 percent, which is a shift that reflects their efforts to hone in on service revenue and less on hardware. They believe that what best suits the application decides the hardware, and in doing such, that they are helping manufacturers develop new hardware to meet the new needs of the market. They also were struggling with board-level disputes recently that were settled, but lost much expected revenue when a key order from its largest customer in the transportation industry last year (over 200,000 units) was withdrawn. This news requires them to go after greater diversification of income in the coming years, perhaps shifting to the maritime and government segments in the face of weak transportation sales.

Finding Public Shelter

All these satellites come at a time where economics may trump business plans and dry up future streams to make good on large capital infrastructures payments. The expected launches shows the cyclical nature of the MSS market: most satellite are ordered, built, and launched within a five years time window, and sometimes less, which is a feat in itself when considering the increased complexity, range of capabilities, performance, and sheer number of satellites in production, small or large. If these are placed into orbit at a time of general economic distress, equipment sales and associated airtime revenues will eventually suffer, even if the wholesale model and the industrial customer base of the majority of operators continues to communicate, albeit at a slower pace.

In the case of **Terrestar**, as mentioned before, they have forfeited the build-out of their terrestrial networks putting on hold a $76 million contract with **Bechtel Communications**. Perhaps this was due to stringent and mounting requirements on financial obligations, which are why the operator may start needing new money by early 2010. Terrestar is faced with huge contractual obligations totaling $2.4 billion. In the meantime, it has extended its development of a PDA form factor with Elektrobit and hopes to promote and roll it out through AT&T's sales channels. The PDA, the first for the industry's next-generation satellites, will be made in Malaysia by mobile electronics manufacturer Flextronics.

In April of this year, one year after launching its MSS-ATC satellite, **ICO** filed a **Security Exchange Commission** document that contained a 'going concern' assessment from its auditors, meaning that the company would be hard pressed to meet repayment commitments on loans and notes if it did not have



fresh financing. In May, its North American subsidiary, whose name was changed to **DBSD,** was placed under Chapter 11 protection to restructure under a mountain of debt.

All this begs the question: *who is going to pay for all this*? The answer certainly does not lie in too many directions and at a time when banks and institutional investors are leery of anything that is new and unknown with a high risk factor, it is not a sure bet that going to the market will be an easy task.

It is perhaps time to think in more pragmatic terms and consider that the public domain, as a whole, is benefitting from jobs in high-tech, high-speed global mobile satellite communications, and may be the only funding source 'game enough' to absorb high-risk ventures such as mobile satellites.

Globalstar, which stole the show at the *Satellite 2009* conference by announcing a $586 million credit arrangement brokered by the French government's export credit agency **COFACE**, has understood that its 48 satellites currently under construction in France were providing jobs to the French aerospace industry. Before crumbling under mountains of debts, and thus forcing the layoffs of hundreds of jobs, it rightly used public institutions help to shape a deal that still puts the onus on the company to deliver but handed them a needed hand at 'crossing the bridge' to its next-generation satellites.

The advantage is clear for the operator: increased reliability of its faltering system and the completion over an 18 months period of a brand new, high-speed, IP-based satellite network. It users will be able to continue using their current handsets, but also a Hughes-built, MSS-ATC, dual mode chipset that will be placed into each device in hopes such will get subscribers back with the constellation all the while gaining new ones. Time is of the essence for Globalstar, once seen as a dying 'star,' which will need to put pressure the equipment manufacturer to deliver on its promise so it can meet FCC requirements for two-way MSS-ATC service by July 1, 2011, to keep its authorization. Furthermore, through its partnership with wireless rural operator **OpenRange**, this service has to include WiMAX (TDD) air interface protocols to retain its FCC authorization.

On the pure financing side, the backers of Globalstar changed the paradigm with increased governmental-funding of the satellite manufacturing side of a commercial industry. This is a change that, in this day and age, should benefit other operators such as **Iridium** that have a stronger bottom line to show for their long-term financing needs. Iridium will certainly be well-advised to try and get public money to stay the course over the next few years. For that, it may seek the same sources of export credit. But to complement this, it will probably host payloads on its polar-orbiting constellation that are likely to come from government agencies or military users, especially for surveillance or Earth Observation missions. Add to this the continued critical support that it provides in Iraq and Afghanistan through its contract with the U.S. Department of Defense, which continued to grow last year, and one has a strong case for using dollars from the public as a basis to spread risks.

As for the other newcomers in the next-generation game, **Terrestar** and **ICO**, their onus, given their weak position, will be finding a telecom or wireless operator that wants S-band spectrum to either use it as is, or re-purpose it (with a little help from the FCC). They stated their aim is to address government and homeland security markets from the get-go, but this is not likely to be enough to generate revenues to pay down debt.

Terrestar still has a card in hand, however, in its majority owner **Harbinger Capital Partners**, which has a solid hold and many hedge positions on spectrum across the MSS-ATC and wireless allocations in the US.: they own a large stake in ***SkyTerra*** and about 29 percent of **Inmarsat** plus a good portion of **Leap Wireless**. When coupled with the impending merger of Inmarsat and SkyTerra, Harbinger could certainly combine Terrestar or leave it as is, while supporting it long enough to cash-in its chips by selling both S- and L-band spectrum received by its subsidiaries for MSS-ATC services. As for ICO, other than a 'spectrum clearance sale,' only a clear signal of support from its majority owner, **Eagle River Investments, LLC** (owned by telecom mogul *Craig McCaw*) can bring much needed cash to convert the company into a multimedia service operator.

As there are more satellites flying above to offer mobile services at ever greater speed to more devices than ever before, one of the main obstacles and yet the one item that will accelerate MSS operators to success (and help them stay above the flotation line) is access to cash to pay down the large capital outlay that builds the satellites mentioned above. There are a few companies that can look for their short- to mid-term needs at deep-pocketed financiers, such as Harbinger. However, there is more than just a lump in the road ahead, and as **NSR** has stated in the past, it is perhaps easier for the MSS industry to seek money from the government investment arms — those have backed far more troubled industries lately — until the horizon clears up. This will help the MSS companies weather the storm and come out of the trenches with a healthier outlook when the economy does rebound.

About the author

Claude Rousseau is the Senior Analyst for Satellite Communications at NSR with 15+ years of experience in the space sector, including business and program management, consulting, research, administration, and communications. Mr. Rousseau started his career as Special Assistant for space and science in the Office of the Minister of Industry, Science and Technology of Canada. He then joined the Canadian Space Agency in 1992 in Montreal, Canada where he was Assistant to the President, then successively Analyst for Industrial and Regional Development, Administrator for the RADARSAT program and Manager for Strategic Planning in the Long Term Space Plan Task Force.

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Linking The World's Communications

When you think of it, despite our having almost instantaneous communications, the world remains a huge place. On Earth as well as in space, the key to survival and success for humans has always been, and will remain, communications. From the oldest methods of fire and smoke messaging, to the telegraph lines strung across continents, to satellite fleets navigating above the Earth in geo-stationary orbits — the propagation of messages, communications, and missives has been the role of the all-important carriers, operators, and distributors.

The future of the teleport is evolving. No longer are teleports simply conduits through which content is moved from one place to another — rather, they are becoming Gateways. These Gateways are akin to value added routers or connectors. They insert smart additions to enhance the value of the content passing through them. They offer a plethora of new services to help clients to improve their services. As the world goes digital, add-ons and extra services offered by Gateways take on even further economic importance as they generate new revenue streams and add to their importance in the broadcast value chain.

The Middle East is considered by many to be the center of the world — this according to Christian, Judaic and Islam beliefs. These traditions accord Jerusalem the title of epicenter or *Umbilicus Mundi* (*Latin: Navel of the World*). Today, as we link the world together and create communications' networks, the Middle East has retained its significance as a focal point in linking signals to and from Europe, Africa, and Asia.

With communications methods advancing, a smartly run teleport business operating to ensure and enhance communications holds a natural competitive advantage. For instance, as immigration grows and ethnic groups move from their original homes to new regions, there is an increasing need for the broadcast of channels into those regions, or for insertions into existing channels to reach these new audiences. The role of the teleport will only improve as broadcasters and advertisers seek to reach and embrace these consumers.

The experience of **SatLink Communications** in linking the world together supports this thesis. With an antenna forest of more than 80 antennas, the global satellite communications services provider has developed its geographically strategic located facilities in the Judean Hills outside of Jerusalem to offer services and platforms to channels, broadcasters, IP providers, satellite operators, governments, and others. Sitting atop a ridge in the Holy Land, overlooking both Jerusalem and Tel Aviv, the company is a leading provider of tailor made transmission solutions for Global Content Distribution with advanced Gateway facilities and its own fiber networks to enhance the global presence of its clients' brands as well as its own.

"SatLink's model is to operate as a Gateway," states SatLink CEO *David Hochner*. "We are not only moving communications, but also adding value to our customers whether satellite operators, channels, networks, or telecoms."

Recognized as one of the ***Top 20 Independent Teleports*** by the **World Teleport Association** in 2009, the company provides access to a worldwide network covering five continents and supplies clients with flexible transmission solutions over multiple satellite platforms, fiber and IP. Its services include uplink, downlink and turn around, channel management, production, SNG & Flyaway, hub hosting, video monitoring, IPTV and Telemetry, Tracking, and Control (TT&C).

SatLink Communications offers full support for **Irdeto**, **Viaccess** encryption solutions, or for a broadcasters own encryption system. SatLink's Gateway uplinks the signal to its full transponders for contribution to cable head-ends, re-broadcasters, and distribution for direct to home (DTH) viewers around the world.

Started in the early 90's, Satlink's business strategy and technical acumen has garnered acknowledgement from some of the world's leading satellite operators and brands such as **SES NewSkies**, **AsiaSat,** and **Hellas Sat**, all of whom have designated the company as their official Middle East Port of choice for carrying content between Europe, the Middle East, Africa, and Asia.

The company weaves together complementary ground services based upon top-level technologies with the creation of a space presence in the form of various **MCPCs** (*Multiple Channels Per Carrier*) platforms. By

linking its ground station to leading satellites around the globe as well as a world-wide fiber network, the company is able to offer full service solutions, especially for HD and SD broadcasters, networks, operators and telecoms seeking to connect far-flung audiences or to open new markets.

SatLink operates a range of premier MCPC platforms for global content distribution on ***AsiaSat 2***, ***HotBird 8***, ***Galaxy 19***, ***Sirius 4A*** (***Astra 4***), ***Eutelsat W2***, ***Hellas Sat***, ***Amos,*** and more. Its far-flung fiber network reaches from New Zealand and Australia to Hong Kong and Singapore to Europe and the Mediterranean and to North, Latin and South America.

In a rich media content generating area such as the Middle East, SatLink is also the communications provider of choice for international broadcast services, networks, and news agencies seeking to maximize coverage from this region and beyond. It is never a dull day as *Reuters* and *APTN*, two of the world's leading providers of news and entertainment broadcast materials, employ the company for contribution and distribution of their materials around the world on a daily basis.

Mr. *Hochner* smiles at SatLink's fortune. "SatLink sits in a strategic location and we are routinely busy around the clock, serving our long standing permanent customers as well as occasional use clients. Because of our 24/7 capabilities, we have developed a team efficiency rating that enables us to handle breaking news as regularly as permanent services."

The most recent upgrade engineered by the company has been the augmentation of its High Definition (HD) capabilities. Company management has moved forward aggressively to expand its ground station's HD transmission capabilities to as many as 12 simultaneous streams including encoding, decoding, and multiplexing the feeds — and the first operator in the region to possess complete end-to-end HD teleport facilities with those feeds. The new HD systems add a new layer of technologically advanced services, making the teleport a major gateway for sports, news, and special occasional events, as well as for HD permanent channels with HD Playout services provided through a nearby partner. The systems also enable the insertion of different languages into the streams prior to re-transmission and distribution, as well as down conversion of HD to SD and vice versa. Such enables the company to meet its partners' growing needs for HD entertainment programming such as

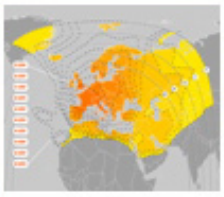
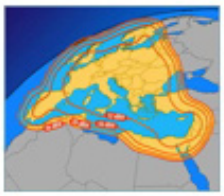
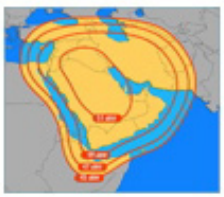
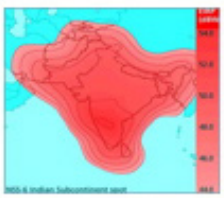
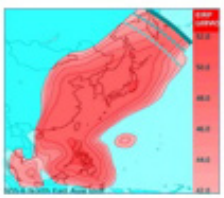
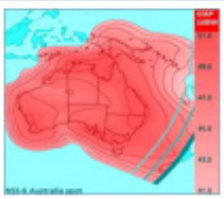
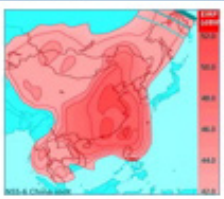
sports, nature, and films with the encoding, encrypting and multiplexing of multiple HD feeds.

According to Mr. *Hochner*, "HD will soon go from being a single digit percentage of revenues into a double digit earner. SatLink is already positioning itself to meet this need and its incumbent challenges."

The satellite communications industry is also choosing the Company to undertake sophisticated technical projects. A case in point is SatLink's TT&C and E.I.R.P. services to satellite operators and satellite owners. Based on its technical expertise and transmission facilities, SatLink offers satellite engineering services that include satellite beam measurements and performance; satellite tracking and command; satellite maneuvering, E.I.R.P. spectrum and multiple carrier analysis with remote access at client's end; and traffic management multi-beams measurements and hub hosting.

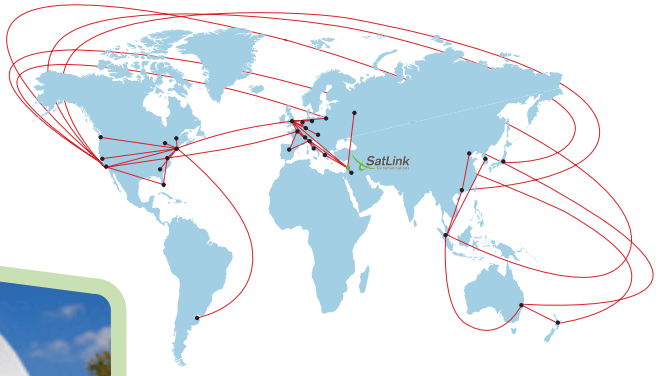
Mr. *Hochner* is proud of the company's accomplishments. "Anchoring SatLink's continued business growth is our commitment to providing superior service, customized solutions and robust technical capabilities. In a dynamic business world, we are a global content distribution provider positioned perfectly at the intersection of the fast growing markets in Africa and the developed markets in Europe, North America and Asia.

"Despite the current economic turmoil, we are optimistic about the market's rebound. In 2009, we brought forth additional HD capabilities, supplemented our highly qualified and vigorous technical team and enlarged our MCPC platforms. Consummating new deals in Asia, Europe, North America, and Africa have confirmed our abilities to provide the right solutions with the highest service level in a global market," states *Hochner*.

Satellite	Technical Information	Footprint
AsiaSat 2	Beam: Number of platforms: 1	
HotBird 8	Beam: Number of platforms: 1	
HellasSat	Beam: Europe Number of platforms: 1	
HellasSat	Beam: Middle East Number of platforms: 1	
NSS 6	Beam: Indian Beam Number of platforms: 1	
NSS 6	Beam: North East Asia Number of platforms: 1	
NSS 6	Beam: Australia Beam Number of platforms: 3	
NSS 6	Beam: China Beam Number of platforms: 1	
Astra 4A / Sirius 4	Beam: Ku band Africa Number of platforms: 1	

SatLink's existing digital platforms

SatLink Brings Your Channels Into Asia



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Global Content Distribution

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SatLink Communications

FOCUS: Optus

Optus is currently preparing for the launch of its latest communication satellite, Optus D3. Optus has been a leading provider of satellite services across Australia and New Zealand for nearly 30 years, having successfully launched and operated a total of eight satellites since 1985, with the ninth, Optus D3, to follow in the early second half of this year.

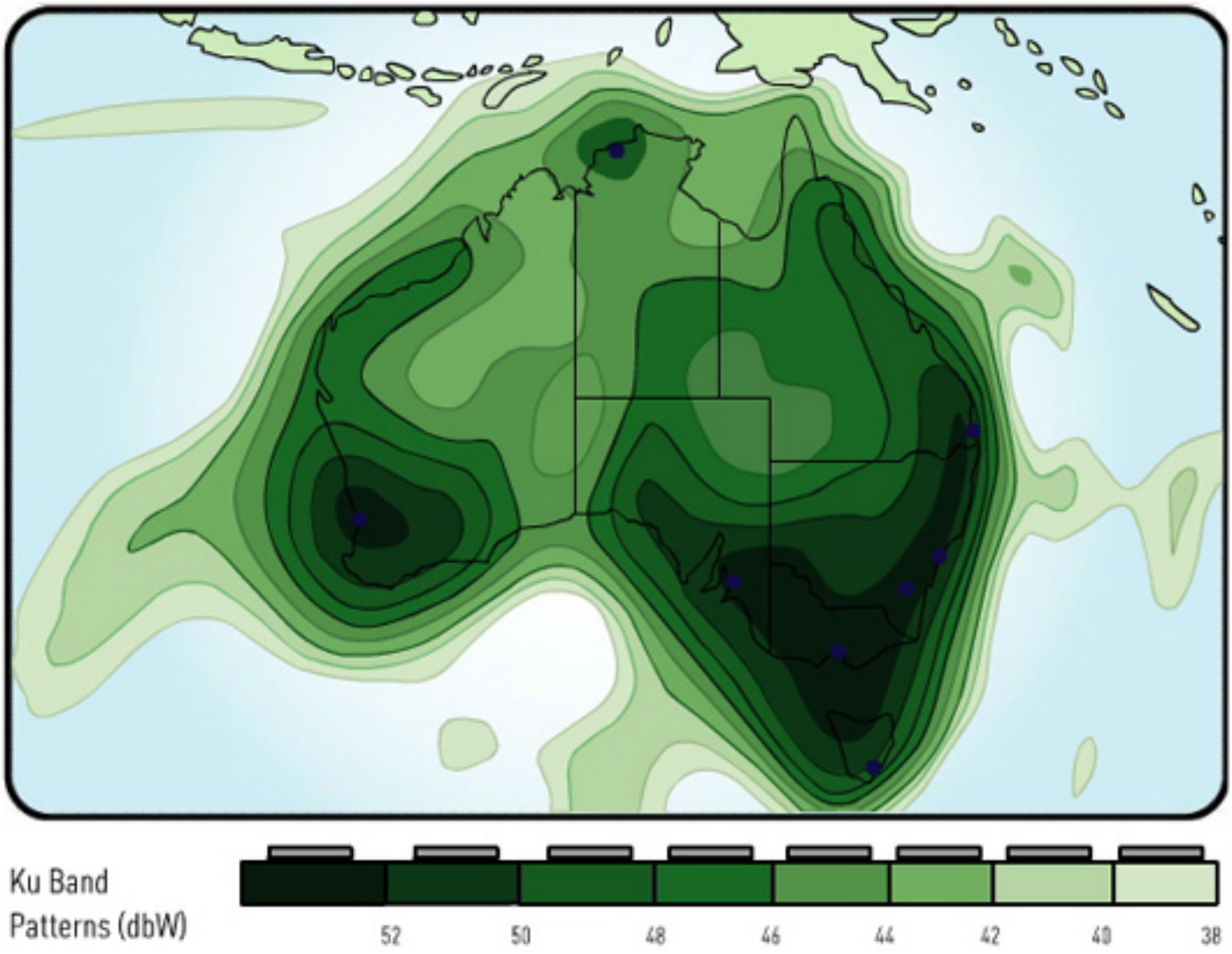
The successful deployment of the ***Optus D3*** satellite will expand **Optus**' satellite fleet's capacity by more than 30 percent, provide an in-orbit redundancy capability, and mark the first use of the *Broadcast Satellite Spectrum* (**BSS**) band in Australia.

To support this new frequency band, Optus has constructed a new Earth station in the *Canberra* suburb of *Hume*, which will act as the primary means of access to the Optus D3 satellite and also provide additional backup capabilities to Optus' existing Earth stations in Sydney and Perth. The award-winning *Canberra Technical Facility* is also used by Optus to support other communication services including mobile, Internet and fixed telephony.

Brett Finch, General Manager, Optus Satellite Engineering, said, "The construction of our new facility in Hume is the latest example of Optus' ability to adapt to the ever-evolving conditions of the satellite market. When we first built our major Earth stations in the early 1980s, they were distributed throughout Australia and were primarily used to support analogue TV distribution, with customer connections most commonly provided via local microwave links. To a large degree these were turn-key facilities with almost all of the equipment carrying the same brand. "Fast forward 20 years to today and we see satellite technologies that have advanced to a remarkable new level. Satellite has evolved into a mainstream service delivery medium, fully integrated with the access and transport layers of Optus' full telecommunications network. We now use our satellites to provide a diverse range of services including digital TV, corporate data applications, consumer broadband internet,

Optus D3 satellite Australian coverage

Effective Isotropic Radiated Power (EIRP)



mobile telephony, cellular backhaul and distance education," Mr. *Finch* said.

Optus currently operates three major Earth stations across Australia in *Perth*, *Sydney,* and *Canberra*. These Earth stations allow Optus to provide the associated ground support for a variety of customers using Optus satellites, ranging from major TV broadcasters to broadband Internet consumers. The Sydney and Perth facilities also house the equipment and the specialist operators who manage the command and control of the Optus satellites, as well as the service assurance function for commercial traffic.

"When people think about satellite services, it is usually the satellites that attract most of the attention; however the ground segment is also a critical element in end-to-end service delivery. The provision of efficient and reliable Earth stations is essential for successful business outcomes for satellite operators and our customers," said Finch. "Rapid changes in technologies and services coupled with the current economic climate will continue to present challenges for operators. To ensure future business growth can be supported through use of these emerging technologies, operators need to adopt different procurement philosophies to years past. To be successful, operators must maintain the capability to integrate products from multiple vendors without sacrificing reliability or quality of service for customers.

"As a result of this evolution, as well as changes in customer demands and other commercial factors, Optus now operates fewer, but larger, Earth station facilities. While aggregation of our traffic through fewer ground-based facilities is a commercial reality, many of our major customers are quite rightly focussed on mitigating risks of service loss for business continuity purposes. For Optus, this means we are committed to careful management of satellite capacity, and to investment in the provision of geographically diverse backup ground access for key commercial services.

"Improved satellite sensitivities and power capabilities mean we don't always need large scale Earth stations — some services can be supported through more modest facilities. Environmental issues, planning regulations, and increasing competition means there are still significant benefits in using experienced and well established operators." Mr. *Finch* said.

Riding The Rails With The Internet... At 200 MPH!

by Roland Schaller

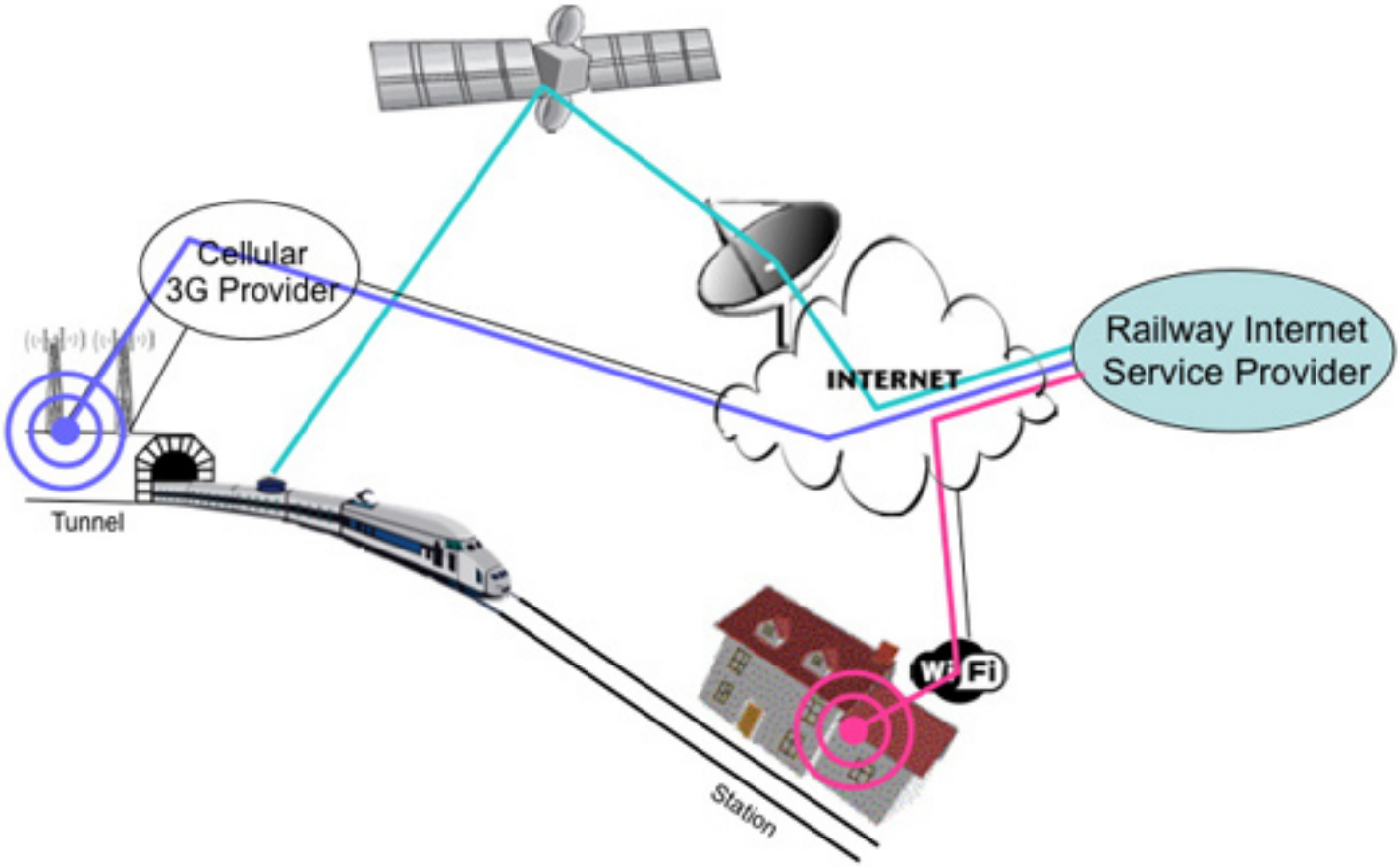
We have experienced it all, as far as Internet access is concerned — hotels, airports, train stations, cars with cellular modems, even in planes — Internet access has become a crucial commodity. We cannot live without the Internet anymore, even for just a few hours. For business professionals, travelling without online access is simply unacceptable.

A last challenge for Internet access was obtaining connectivity in a high-speed train running at 200 Miles per Hour — just for informational purposes, that's 320 km/h, which is a common cruising speed for "bullet" trains in Europe these days. Such posed unique technical challenges. Enabling Internet access to train users offered the following options:

Cellular Wireless high-speed Internet access via 3G or CDMA technologies — this technology is mostly available in countries where high-speed trains are deployed. However, the amount of work required to cover hundreds of kilometers of railway networks, often located in remote rural areas where Internet access is not much needed, does not make it economically feasible for the cellular providers to invest in such infrastructure. Bandwidth obtained using this technology is poor and as unsuitable as a backbone for the hundreds of users in a train attempting to access the Internet. Furthermore the high travel speeds pose some severe constraints on cellular infrastructure in terms of Doppler Effect and Cell Handover. Another commercial problem for cellular access is that data subscriptions are usually quite expensive when used outside of the home operator's coverage, such as when crossing borders, which is very frequent in Europe where a train can easily travel through as many as three or four countries during the course of its journey.

Wi-Fi access is potentially interesting. Experiments are underway to cover lengthy track segments with dedicated Wi-Fi access, leaky cable technology (designed to radiate a portion of a signal along its entire length — the longer the cable, the less uniform the connection due to signal dispersal), and also WiMAX. These technologies are too immature for robust, daily service and use. Additionally, Wi-Fi does not behave well at high speeds.

Of course, satellite access has the major advantage of providing high bitrates (up to a few Mbit/s per train) while being relatively immune to the high speed of the train, but does require a clear view of the sky.



Combining these three technologies enables seamless access to the Internet and takes advantage of the strengths of each technology:

- *Satellite access when satellite is visible, i.e., no tunnels or buildings blocking the link*
- *Wi-Fi access when the train is approaching, standing in, or leaving the train station*
- *Cellular access while in dense urban environments or in tunnels*

Using these technologies means there must be some intelligence on the train that will manage the switch between any of these access technologies, depending on the condition of each link, managed by priorities:

Wi-Fi access will always be favored over everything else — when Wi-Fi is not available, satellite Internet will be used — when satellite access is not available, the system will fall back on cellular access. For cell access, there are multiple modems installed, with subscriptions from providers in the different countries traveled through in order to access the best available data tariff for each country.

The diagram on the previous page illustrates the communication principles:

All seems quite obvious from a principle point of view. However, there are some serious implementation challenges that need to be solved:

- *When switching from one technology to the other, the IP addressing space changes, as other operators are brought into the mix*
- *There can be a short interruptions in traffic flow*
- *Open data connections will reset due to changed IP addressing*
- *Different links have very different characteristics in terms of bandwidth, delay, packet loss, and so on*
- *The number of simultaneous users per train, when high enough, can saturate the link with the total user traffic*
- *Some users will attempt to consume more bandwidth, either consciously (watching video, downloading, peer-to-peer, etc), or unconsciously (viruses, Trojans and other Malware)*

UDcast, partnering with major system integrators, has provided the technology to overcome the aforementioned problems. The core technology of UDcast, known as the ***UDgateway®*** product line, was implemented with extreme data compression, protocol enhancement, Quality of Service and security.

First, the extreme data compression, named ***WANcompress***®, is used to reduce the amount of data sent over the data link, independently of which link is currently in use. WANcompress stores all IP data streams at the sending and receiving end, while at the sending end, the data is indexed and searched in real-time. This allows data to be found that has been already transmitted between a particular train and the "ground" (and vice-versa) to prevent retransmission — a pointer to the data is sent instead. This particular technology offers a bandwidth savings of 30 to 40 percent.

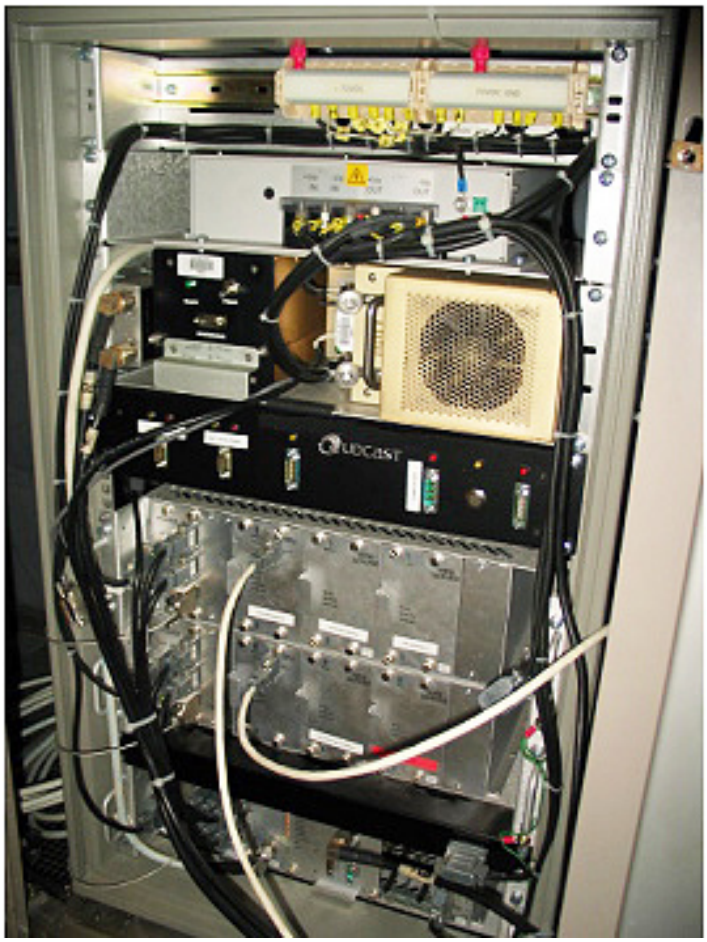
Protocol and application enhancements such as TCP acceleration, HTTP Caching and Prefetching, DNS caching, further enhance the user experience and decrease data volume. For example, UDcast's ***TCP ACK*** suppression technology reduces the bandwidth on the return channel, allowing the use of freed up bandwidth for more valuable data.

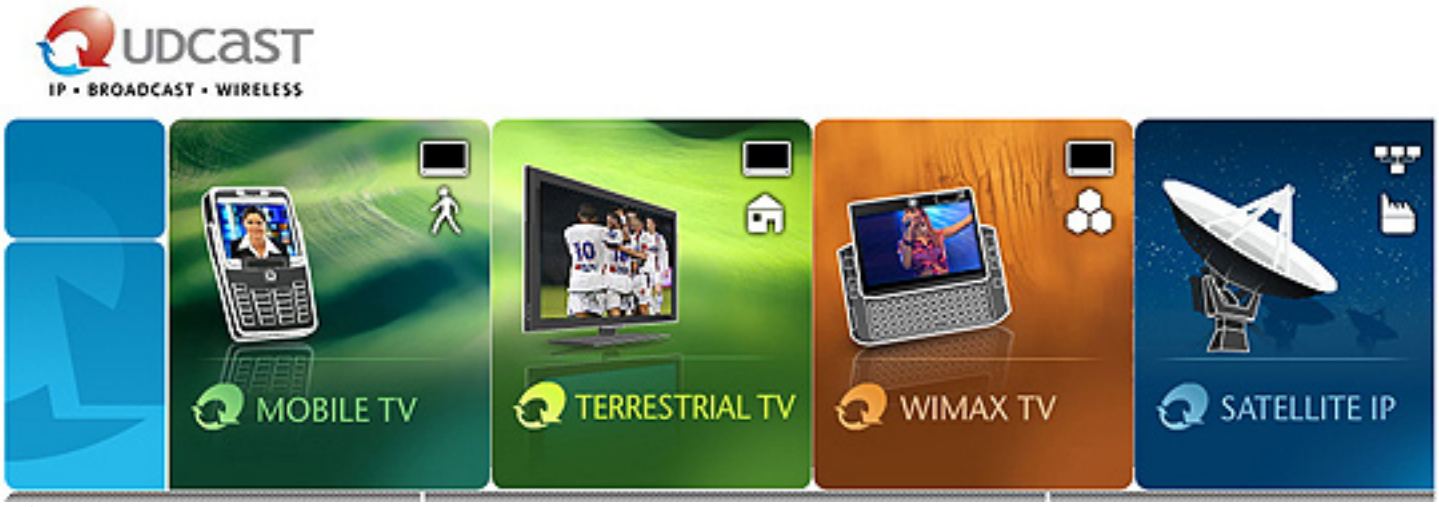
The UDcast *Virtual Private Network* (**VPN**) function performs two functions in this train context:

- *It secures and authenticates the connection between train and ground center*
- *More importantly, it overlays the private IP addressing scheme of the train Internet Service provider over whatever addressing scheme that is used for the link*

UDcast's implementation makes certain that no data is lost between the clients and the Internet when switching links or during short interruptions in the link that is currently being used. The Quality of Service function is very important to ensure real-time applications, such as web surfing, receives a higher priority than file downloading. Furthermore, a fair access policy is enforced, attempting to give all users on the train the same capacity, even under circumstances where a link becomes congested.

In a train environment, like any other vehicular environment, there are specific environmental concerns such as temperature, shocks and vibrations, as well as regulatory and safety constraints, which have an impact on the hardware that can be used in the train. The UDcast software has been ported on an existing train-qualified hardware with the required Railway Certifications, and it could as well be easily integrated on any other hardware on different form factors for marine, road, or aeronautical transport use.





Further advantages of the UDcast open service platform are modular, meaning that specific features can be implemented to accommodate user needs. In example, hardware with very limited processing power. The UDcast technology can also be extended with additional features that could include, but are not limited to, GPS fleet tracking, video surveillance, telemetry, remote maintenance, least-cost routing, and so on.

The photo on the previous page illustrates the complete equipment rack, mounted in one of the wagons, and feeding the entire train, allowing Wi-Fi coverage through all of the wagons.

Internet access in trains is currently deployed on some routes where there is a long travel time, typically a few hours — the technology is gradually being extended to shorter routes and commuter trains.

In addition to the service for the railway passenger, the railway operators themselves are starting to use the same Internet access for their internal use. This would include non-vital train communication, on-board passenger information, video surveillance, and digital signage systems, just to name a few.

All these technologies make Internet access truly mobile and covers one of the few last "white spots," much to the enjoyment of the traveller, or to the sadness of the business traveller who sees there is no excuse anymore for being unproductive on a train — if you are on an Internet-enabled train right now, get back to work and stop gazing through the window to watch the cows watching you zip by at 200 Miles per Hour.

About the author

Roland Schaller drives global product strategy and communications activities of UDcast. He also leads the Technical Sales Support team of UDcast. He is a Senior Engineer in telecommunications, IP and Mobile technologies. Prior to his role as Vice President Product Management, Schaller managed the Presales Team and built the training programs. Before joining UDcast, Roland lead the Operations Support group at the Lucent Technologies European Technical Support Center.

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