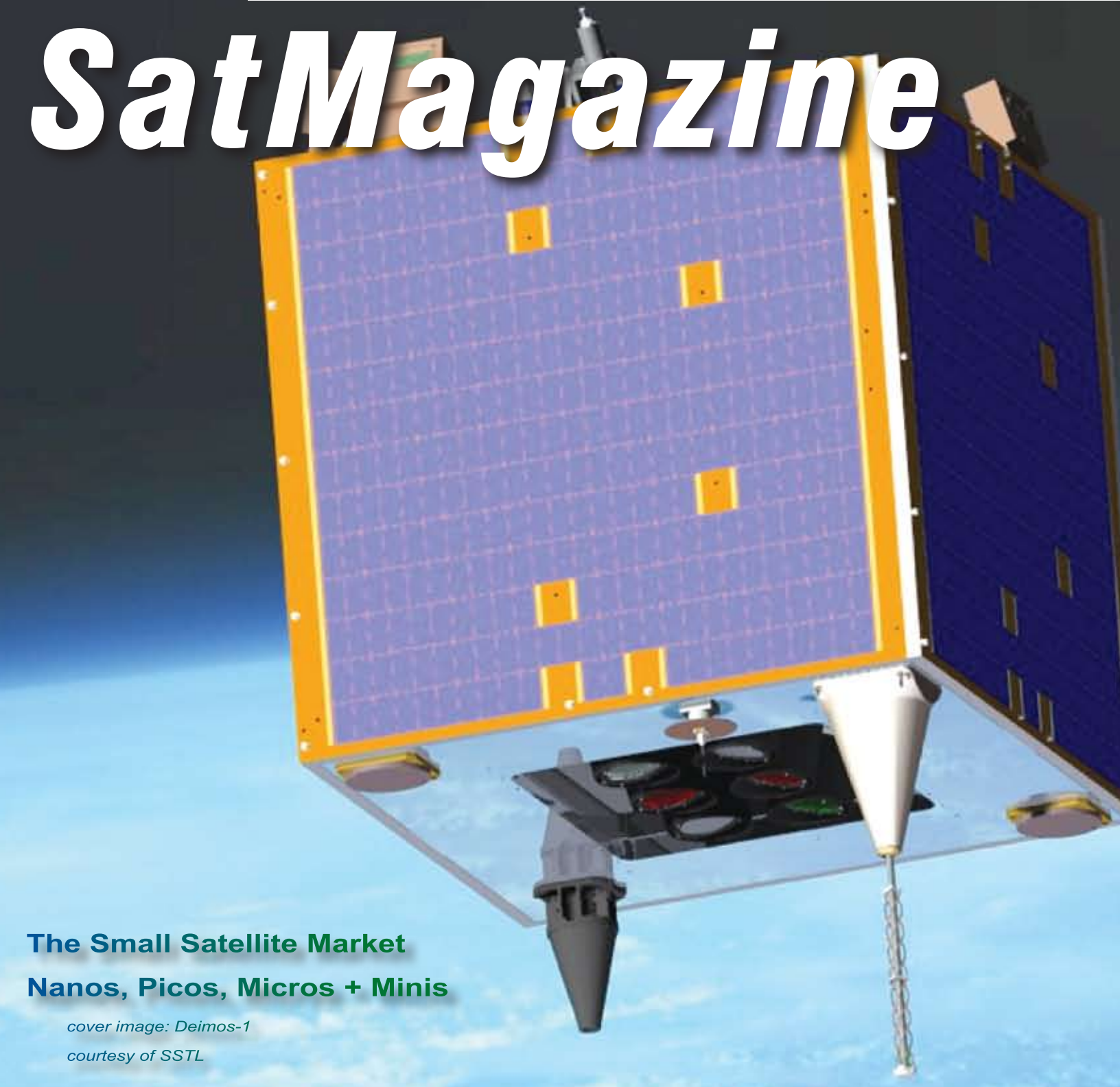
Worldwide Satellite Magazine January 2011

SatMagazine



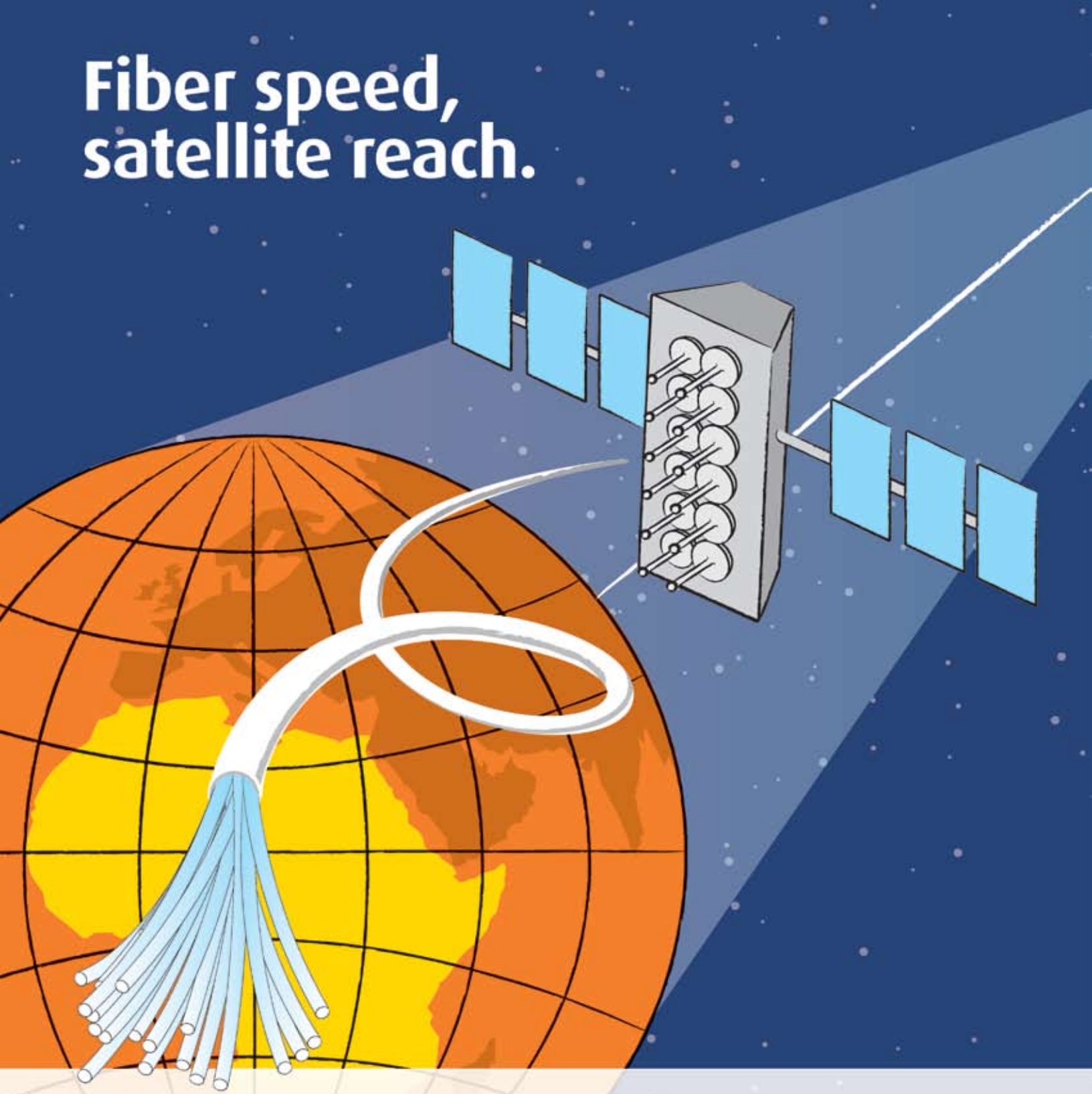
The Small Satellite Market

Nanos, Picos, Micros + Minis

cover image: Deimos-1

courtesy of SSTL

Fiber speed, satellite reach.



Satellite technology connects you to the most remote locations of the world. Our next-generation MEO satellite constellation will deliver the highest combination of bandwidth, speed, low latency, coverage and availability. Bringing the internet closer to you.

O3b, the satellite company closer to you.

Visit our website at **www.o3bnetworks.com**
or email us at **getconnected@o3bnetworks.com**
to join the bandwidth revolution.

O3b Networks

Executive Spotlight

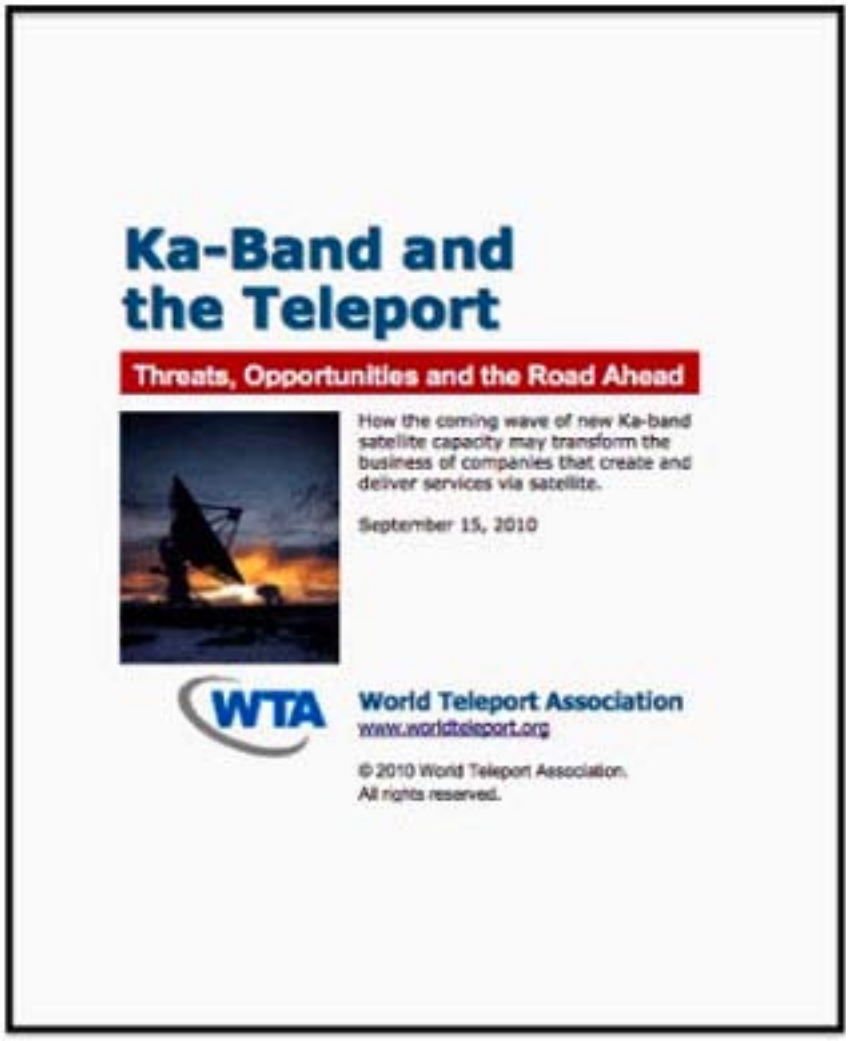
Robert Bell, Executive Director World Teleport Association

The World Teleport Association recently published a research report, "Ka-Band and the Teleport," about the impact this new satellite band may have on the established ecosystem of service providers. This month, Executive Director Robert Bell discussed the report with SatMagazine, which he researched and wrote for the association.

SatMagazine

The new Ka-band platforms being launched now are designed for consumer and SOHO broadband. That's not a market where teleport operators play. What led WTA to do this report?

Ka-Band and the Teleport



Robert Bell

It was a conversation with Tom Moore, one of the founders of WildBlue, who now heads the WildBlue division and the ViaSat-1 Ka-band project for ViaSat. He's a brilliant guy, and I found his vision of the Ka-band future compelling. Then I began thinking about the impact that cheap, nearly ubiquitous access to megabits of satellite capacity could have on the teleport business. Like the entire satellite industry, the business of the teleport is based on scarcity.

We are viable today because we deliver bandwidth and the high-value services riding on that bandwidth to places where bandwidth is scarce, at least at the volume and reliability the application demands. Everything from Internet and mobile traffic for remote regions to TV distribution, where terrestrial bandwidth may always be too scarce to replicate the cost advantage of satellite. But what happens if there is another way to do the same thing — and it doesn't necessarily include teleports or even the conventional satellite operators?

SatMagazine

Okay, nice set-up, Robert — what happens?

Robert Bell

To find out, I interviewed senior executives at the new wave of Ka-band operators to get their view of the future, then did the same for teleport operators in the Americas, Europe and Asia. I wanted to see how well their views lined up and where the gaps might be. I found

that a lot of teleport operators are not yet paying attention to Ka-band, because they don't see a near-term opportunity in it. But I was pleased to see that a lot are also watching the technology develop and evaluating both its opportunities and its threats.

SatMagazine

What exactly are those opportunities and threats you mention?

Robert Bell

Both are baked into the architecture of the Ka-band systems, which is drastically different from traditional satellite network architecture. With Ka-band, it's all spot beams, hundreds of them, and the satellite aggressively re-uses frequencies among the beams. That, coupled with the higher throughput possible at higher radio frequencies, lets Ka-band birds deliver real two-way IP bandwidth to millions of individual users at a remarkably low cost. We're talking about a 100-times gain in capacity at a cost-per-bit six to 10 times lower than the next best alternative. That should make satellite truly competitive as a broadband platform for the first time.

However, there's a catch — at least for established service providers. Getting that throughput requires the network be tightly engineered and integrated. For each Ka-band satellite, there will be a small number of ground stations accessing the satellite, and that's it.

The model of providing an open platform and inviting teleports to point antennas at it — the model that has been so successful for half a century — does not apply. According to the Ka-band operators, the only role for existing teleports is to bid to become one of the limited number of ground stations and bring their own capital to build it out. One of WTA's members, Europe Media Port, just announced a deal to become a ground station for O3b. That's the new model, as far as the Ka-band operators are concerned.

SatMagazine

If teleports are not in the business of delivering last-mile Internet today, what is the big problem in your opinion?

Executive Spotlight

Robert Bell

Good question. Is it a problem? The answer I got from the interviews is: It depends. If the market develops as all of the Ka-band providers expect, the worst outcome will be that most teleports and traditional FSS satellites miss out on a new source of revenues. Not a threat, just a missed opportunity.

Will the market develop the way the Ka-band providers expect? There is more than $5 billion worth of new Ka-band spacecraft going into orbit through 2014, including satellites from ViaSat, Hughes, Avanti, Eutelsat, Arabsat and now 03B, which just completed its financing. That's hundreds of gigabits of new capacity coming onto the market in a very short window.

One of the things I learned in the dotcom crash was that, when everybody has the same business plan, no matter how brilliant it is, there may be trouble ahead. If consumer and SOHO Internet isn't able to absorb all that capacity, the providers will naturally go looking for other markets.

SatMagazine

What other markets might they target?

Robert Bell

The teleport operators I interviewed are already experimenting with, or using, Ka-band for video contribution. It's a good match, because the circuit is point-to-point. Others are looking at it as a way to deliver DTH service to small markets, which could be served by a single spotbeam. Again, the economics could make it very attractive.

But how about VSAT? If O3b succeeds in providing IP bandwidth to the other three billion, if ViaSat1 and Hughes Jupiter put 200 Gigabits of IP capacity over North America, will the VSAT business continue in its current form? Will VSAT technology, a core competency of teleport operators, still be relevant?

SatMagazine

How likely are these scenarios?

Robert Bell

In truth, it is hard to tell. We have more questions than answers. But in the WTA report, we offer recommendations to teleport operators on steps they can take today to get ready for the possible futures, whether they offer opportunities or threats.

One of the people I interviewed put it this way. Not too long ago, there were multiple discrete networks entering your home: Separate lines for voice, video and Internet data. Today, in more and more homes, it all flows over one line, because the economics of IP make that line so inexpensive and powerful. If Ka-band offers the same kind of economics in the sky, what is to stop a similar transformation in the world's satellite markets?

Robert Bell is the Executive Director of the World Teleport Association, a nonprofit trade group that focuses on the business of satellite communications from the ground up. WTA is dedicated to advocating for the interests of teleport operators, and promoting excellence in business, operations and technology. The "Ka-Band and the Teleport" report is available at www.worldteleport.org. You can reach Robert at or +1 212-825-0218 x101.

SAY WHEN

ASI IS HERE. IP IS COMING. IT'S YOUR MOVE.

AZIMUTH SERIES

If you are in contribution, distribution or DSNG, choosing between ASI and IP will no longer be the issue. Very soon, you'll want both: to remain competitive, to grow your business, to become and remain a broadcasting partner of choice.

Newtec's exclusive DualFlow solution is today's easiest and most reliable way to combine ASI and IP technology in your broadcasting activities and prepare your migration to IP.

DualFlow guarantees future-proof flexibility. And you get to say when.

ASI + IP DUALFLOW

www.saywhen.tv

Newtec

SHAPING THE FUTURE OF SATELLITE COMMUNICATIONS

Belgium | USA | Singapore | Dubai | China | Brazil www.newtec.eu

Challenging Times For Nilesat

author: Chris Forrester, Editorial Director, RapidTV

Nilesat is going through something of a challenging period, with recent actions described by some critics as 'dictatorial' and heavy-handed. On the positive side it is very easy to tell a story that's all good news. Revenues are good, and in October it started commercializing its latest satellite, Nilesat 201, launched on August 4th.

Nilesat farm

Moreover, **Nilesat** is reporting more than 572 channels are now transmitting from its **7 degrees West** position, making it the hottest of 'hot spots' for Arab viewers. It is also seeing — at long last — a steady stream of HDTV channels flowing onto its satellites, currently numbering 24 and targeting around 35 by the spring of 2011. Even better, perhaps, is the 7 degrees West spot that has won back the 'Orbit' portion of the now merged Orbit Showtime (pay-TV) Network back. (Nilesat always carried the Showtime pay-channels).

In early November, the Company began migrating channels from its first satellite (***Nilesat 101***) onto the new bird, and a batch of new HD channels went live. Nilesat's own facility is a hive of new buildings, first for the tracking and control of the new satellite, but also the expansion of its ground control segment to handle fresh uplinking contracts, new channel launches and the like. A new

management building is also under construction, which will provide office space for broadcasters themselves — but not studios. Studios are firmly under the control of Cairo's giant — and very busy — *Media Production City* a few miles away and within sight of the famous Giza pyramids.

The growth in HDTV is meaningful. Two transponders are already used by **Abu Dhabi Sports** for their HD transmissions, and another three are allocated to **Orbit Showtime Network** (**OSN**). More will follow, says Nilesat's chief engineer, *Salah Hamza*. "Other HD players are coming. Everyone is transmitting using MPEG4, but there's a standards problem. For example, Abu Dhabi is using DVB-S2 for its transmissions, but OSN is using DVB-S. DVB-S2 is more efficient but unfortunately there is a shortage of DVB-S2 receiver boxes in the market, but they will come and the market will then converge."

Nilesat, at least with ***201*** launched, is now soaking up all its allocated frequencies from 7 degrees West. That could change, suggests *Hamza*.

"It is a challenge to plan and launch a new satellite. A Nilesat 202 would be mainly a back-up to 201, but HDTV needs extra capacity, so perhaps a new orbital slot will be needed for our expansion.

"In our region, people watch on the same dish from 7 degrees West to 26 degrees East. There are no limits to placing dishes on our homes, so a new slot is quite feasible. It costs just $20 to install a dish and LNB. Finding another orbital slot is needed. We have filings, but they are not yet co-coordinated. Or, perhaps, we can co-operate with another operator who has suitable rights. But all our studies tell us that within two years we will have fully filled our frequencies."

So far, so good. But on the debit side of the balance sheet there have been more than a few challenges, not the least of which is a slew of satellite jamming problems that are a real nuisance and a technical pain in the neck. There have also been highly controversial problems with contentious services, resulting in channels being removed from Nilesat. Currently, more than a dozen channels are affected.

The jamming problems during July's **FIFA World Cup** transmissions from **Al Jazeera Sport** included signal jamming during the competition's crucial final event. The consequences have been severe, with diplomatic relations stretched to the limit between Qatar, Jordan (allegedly the source of the jamming), and Egypt — more on this subject in a moment.

Similar problems have occurred for **Arabsat** at an 'official' level, with the Ethiopian government being accused of interfering with signals from an opposition political movement in Ethiopia. **Eutelsat** transmissions have also been affected over the region (and Europe), with targeted signal jamming of **BBC Persian** services.

- ***Nilesat 201***
- ***Built by Thales Alenia (Spacebus 4000B2)***
- ***Launched August 4, 2010***
- ***Launcher: Ariane 5 ECA***
- ***Manifest: 28 Ku-band, 4 Ka-band***
- ***Replaces 101, and backs up 102***

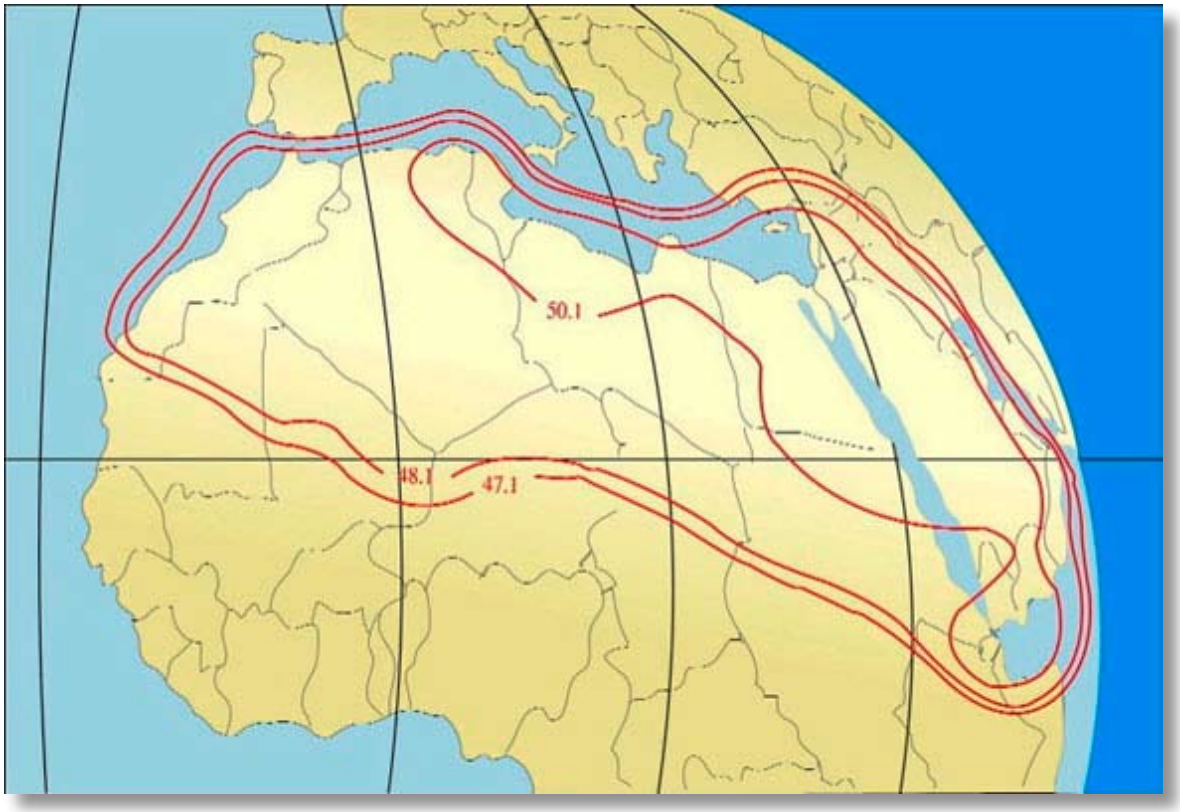
Nilesat also has the interesting task of finding a new role for ***Nilesat 101***, its first craft. Still, with a year or two of optimal life left, *Hamza* says it could sell or lease the craft, and is studying its various options. "One of the options is to sell, but the craft could be our own insurance policy in case of problems." *Hamza* explained that from 7 degrees West, life was now "extremely crowded" — developing new markets from that orbital slot has been firmly ruled out due to co-ordination problems. "We could move it to another place," he said. "Nilesat does not have other orbital positions. But if we sell or lease it to another operator, then we can happily move 101 to that new position."

Hamza admitted that, one of these days, his team would need to start thinking about Nilesat 202, even though 201 provides full redundancy for the fleet as it exists today, as well as adding some new frequencies. "Our board of directors are naturally reluctant to spend money when there's little prospect of revenues, and 202 would be, itself, an in-orbit back-up for 201. But it is necessary as we have no back-up in orbit at the end-of-life of 102. 202 should start its build around 2012-13, for launch shortly after. So it is in our thoughts."

The successful launch and healthy state of ***201*** is one load off ***Hamza***'s mind, as it would be for any operator. His other problems are pesky in comparison, but troublesome and potentially a very real diplomatic and commercial challenge.

Last month Nilesat took down four so-called "religious channels", and the news later emerged that more than a dozen others were warned to get their acts together or risk being removed from their massive potential audience of some 40m viewing homes.

"We have no formal regulator covering satellite transmission. There is no Ofcom, no FCC, and no CSA. We had always hoped that the market, perhaps with a little help from us, would regulate itself," said *Hamza*. "A poor channel or a channel with bad ideas would close. It has been said that some channels have powerful and wealthy backers, but I can tell you that the channels we have removed are all profitable channels. They are making very



Nilesat 201's attractive pan-Arab footprint

good revenues. Unfortunately some of their material is very naïve." He explained that, in the main, the channels were broadcasting "medical" remedies, usually with little or no foundation as to any practical benefit, and frequently based on plant extracts. "They would promote these plant remedies and say they would cure this or that disease or problem, or boost someone's sexual performance. All our advice is that the claims are quite untrue." Further adding to the complications is the fact that in some Middle East countries the products being sold are reportedly licensed as medications, but not in others!

"Then there are other channels which claim to have this or that religious expert on the air, and frequently giving out thoughts and ideas that are plainly wrong. The problem is they are appealing for funds, and seemingly receiving them. We are happy to carry religious channels, from any persuasion, but the people on air must be qualified," says *Hamza*. Hamza said that some channels had received warnings from the countries where the uplink licenses had been issued, so were fairly easy to deal with. He added that other channels were exploiting the more vulnerable viewer, with near-gambling elements. "The games were quite stupid, asking viewers to say what number comes between 4 and 6, and saying they could win $10,000 if they got it right, and depending on premium-rate telephone calls to make their returns.

"Worse, we understand they weren't even selecting a 'winner'," he said. "We would love to have an OFCOM to put a stop to this stupidity, but we don't, so we have to take action ourselves. The one channel quickly became two, then three, and more as people realized how easily money could be made. We have not stopped a single channel because of religion but have only stopped these quite stupid channels from exploiting viewers. We are aware of our responsibilities in this region. The whole region is conservative, and some parts are extremely conservative, especially those areas that do not have cinemas or theatres. We have a responsibility to ensure that broadcasters remember these sensitivities."

Hamza said that letters were sent to the channels concerned ahead of the suspension, and that Nilesat considers the stoppages to be temporary — provided the channels modify their ways. "We have more than these 12 channels [broadcasting], but these were the worst. We now hope that the others, who are borderline, will now modify their content," he added.

Nilesat's decision has been highly controversial locally. "The stoppages are, I am sure, temporary and it is just 12 channels out of 572. It is a warning to everyone. To be honest, a greater problem would be the impact it has on our reputation. We are trying very hard to be fair. One very encouraging sign is the response we have had from other branches of the media, which understand our dilemma and support our action. We all understand why, other than in an emergency, a cardiologist shouldn't be treating patients with a brain tumor. Each has his specialties. But it seems in religion everyone and anyone can be

Salah Hamza
Nilesat's chief engineer

an expert. We recently saw the owner of a music channel decide to move to religious broadcasting because it made more money — and it did!"

As if all this is not enough there is the problem of deliberate signal jamming. Nilesat is most reluctant to comment on the World Cup jamming earlier this year. The general consensus is that the signal jamming came from Jordan, but *Hamza* insists that there can be no criticism of the Jordanian authorities. "It is wrong to blame Jordan, when it could easily have been people from over a border entering the country," he says. "The industry needs a code of ethics and one that will see all countries honor that code. At Nilesat we will not accept a channel that broadcasts against a legitimate government. We need to conclude this code of ethics, and this should include satellite operators and the channels."

Hamza reported some good news in that demand is such that transponder bandwidth prices are holding up robustly. Nilesat has turned in consistently good numbers these past years, and even though net profit for 2009 was a little softer (at about $37m on revenues of $116m, and where 2008's numbers were $39.7m on revenues of about $100m), *Hamza* remains extremely optimistic about future prospects. "Nilesat 201 is a little more powerful, and we now reach to the south of Sudan." He explained that Nilesat's 201 orientation is a little further south than 101 and 102 and this is directly related to programming rights — leaving Europe out of the footprint makes it easier for his broadcasting clients.

"The market will see corrections from time to time, with some channels closing and others opening. But we see a steady demand for new channels, and of course there's the trend towards HDTV. We already have Abu Dhabi using HDTV, and we know there are other major channels coming. We hope to see more than 30 high-def channels on air by early 2011."

Two full transponders have been contracted for an all-IPTV service, which will take a portfolio of Nilesat channels, adding a pay-per-view service, and beaming the result into residential compounds, and gated communities in the region. By taking an IPTV-based service the operator can more easily supply the programming directly into his customers.

Nilesat 201 also has 4 Ka-band transponders on board, and will be kept for wholesale clients as well as backhaul and Occasional Use clients. Hamza says Nilesat will not be itself subsidizing receiving units for broadband by satellite. [*This is different to the likely business model being applied by the upcoming YahSat from Abu Dhabi/Ed*].

In other words, pretty much all in Nilesat's garden is looking in good shape. There's solid business in hand with a robust backlog of long-term contracts, and the prospects of adding HD simulcasts of a large number of existing SD channels exists. Indeed, it will take years before the standard definition versions vanish, which can only be a plus to Nilesat's revenues for some time to come.

About the author

Chris Forrester is a well-known broadcasting journalist and industry consultant. He reports on all aspects of broadcasting with special emphasis on content, the business of television and emerging applications. He founded *Rapid TV News* and has edited *Interspace* and its successor *Inside Satellite TV* since 1996. He also files for *Advanced-Television.com*.

Advantech Wireless

VSAT Hubs

DVB-RCS VSAT Hubs

DVB-SCPC Hub

- DVB-S/S2 Outbound
- SCPC Inbound
- 10's to 100's of remotes

Micro DVB-RCS Hub

- DVB-S/S2 DVB-RCS
- DVB-SCPC
- Mesh Sub networks
- Full Featured
- 18Mbps aggregate throughput
- Up to 100 remotes

Mini (Plus) DVB-RCS Hub

- DVB-S/S2 DVB-RCS
- DVB-SCPC
- Mesh Sub networks
- Full Featured
- 55 Mbps aggregate throughput
- Up to 500 (1500) remotes
- Scalable

Max DVB-RCS Hub

- DVB-S/S2 DVB-RCS
- DVB-SCPC
- Mesh Sub networks
- Full Featured
- 155 Mbps aggregate throughput
- Up to 3000 remotes
- Scalable
- Custom Networks

On The Move? Checkout the Advantech Wireless DVB-RCS Transportable Hub

Key Features:
> Shock-mounted
> 135 Mbps DVB-S2 ACM forward link
> 24 Mbps DVB-RCS return link
> Available support for up to 10 Mbps DVB-S2 SCPC return link
> Up to 100 terminals supported
> Star and Mesh operation
> Easily connected to transportable antennas to create deployable gateway
> TCP Acceleration Incl.
> Built-in QoS
> Fully Managed Solution

Advantech Wireless' Hubs and Terminals are highly flexible; several different network architectures are possible.

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

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

Advantech Wireless | Tel: +1 514-420-0045 | sales@advantechwireless.com | www.advantechwireless.com

From Micro- To Nano... Seeking The Business Sweet-Spot

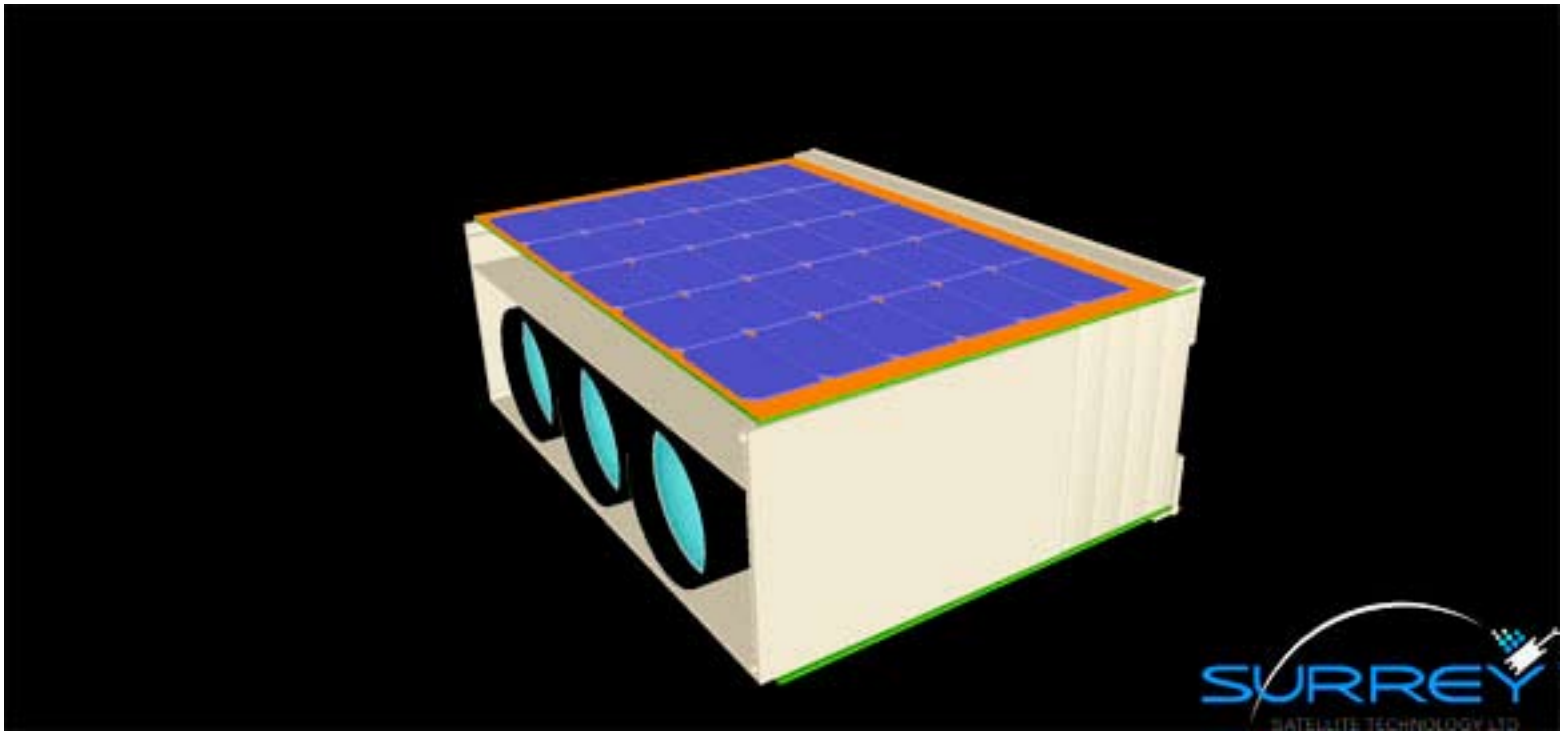
author: Shaun Kenyon, Mission Concepts, SSTL

For the last quarter century Surrey Satellite Technologies Ltd. has been manufacturing micro-satellites for paying customers. But with a flurry of activity at the nano-satellite end of the market, a new company project studies how small operational satellites might get while still performing useful tasks. SSTL project lead Shaun Kenyon explains...

Like the first amoebas crawling out of the ocean onto land, the early satellites started out small — though soon made up for it. "You could have picked up the early Explorers in one hand, and indeed even Sputnik was quite small," noted Sir *Martin Sweeting*, founder of UK-based **Surrey Satellite Technology Ltd.** (**SSTL**), addressing last year's *Appleton Memorial Lecture* in London.

Their compact nature was set by the limited nature of early rockets, Sir Martin recounted, "But as the launcher capacity grew so the satellites got fatter, and they carried multiple payloads. Alongside that however, the cost started to escalate, and the timescales for going from concept into orbit started to get very long, sometimes decades long. And as the satellites got more expensive so the ground infrastructure required to support them became correspondingly complex."

There are very good reasons for this gargantuan tendency: Ensuring reliable operations in the unforgiving environment of space is far from easy, and onsite repair is seldom an option. But Sir Martin built up his world-beating company by acting upon an alternative vision — over the last quarter century,



SSTL has launched more than 30 'micro-satellites' within the 100kg class. These are minnows indeed in industry standard terms — with anything under one ton officially classed as a small satellite — but these missions, nevertheless, offer valuable communications and Earth observation services to paying customers. The flagships of the SSTL fleet are the washing-machine-sized spacecraft of the ***Disaster Monitoring Constellation***, which operate together to provide Landsat-compatible surface coverage with an unbeatable revisit rate of just a few days.

Small equals successful in evolutionary terms, with the humble insect far outnumbering more conspicuous competitors such as dinosaurs in the past and human beings today. Sir Martin argues for a similar dynamic in the evolution of space missions.

Smaller satellites are quicker to build and cheaper to launch — giving the option of flying multiple small satellites for the price of a single standard unit. They also open up the possibility of employing the latest *commercial-off-the-shelf* (**COTS**) hardware instead of more costly, less advanced space-qualified items.

A lower price tag per satellite means that an increased level of risk becomes acceptable in return for accessing all the latest achievements of the terrestrial electronics industry, substantially boosting a mission's capabilities.

Small Changes

The satellite industry keeps evolving: SSTL's favored micro-satellites appear massive themselves next to the nanosatellites currently being built and flown by research institutions and universities worldwide. A new research project led by SSTL's *Mission Concepts* team is examining what might be learnt from these miniature new entrants. How much smaller might a satellite be manufactured in the future while still remaining capable of doing a commercially useful job?

The company has made previous forays down to the nano-sat scale. In 2000, SSTL flew the 6.5 kg ***SNAP-1*** (*Surrey Nanosatellite Applications Platform*), which demonstrated the potential of nanosats for observing larger space vehicles, successfully imaging the larger satellite that shared its flight to orbit. The

Working on the SNAP-1 nanosatellite at SSTL

mission was not followed up, though some of the hardware demonstrated during it ended up in larger SSTL missions.

In the meantime, SSTL's academic counterpart, the **Surrey Space Centre**, prepared designs for '***PalmSats***' — no bigger than a soda can — as well as a '***PCB-Sat***', with a wafer-biscuit sized satellite based around a single printed circuit board. More recently, the Surrey Space Centre has been busy developing multiple CubeSat missions.

The CubeSat open standard has come to dominate the nano-sat domain. Developed by **California Polytechnic State** and **Stanford** universities, this standard is based on a standard satellite shape of 10 cubic cm. For any institution contemplating its own satellite, Cubesats take away the 'where do I start?' problem. Parts can either be manufactured in-house or bought in from a growing base of university spin-out suppliers, while the standard also incorporates design and manufacturing best practice. Low-cost rides are available using specially-designed dispenser mechanisms to piggy-back on existing launches.

Within these constraints all kinds of highly-innovative missions can be flown, with larger payloads supported by combining two or three Cubesats together.

Cubesats are not about to sweep away the rest of the industry, however. Their main uses are for education or experimentation, with their capabilities and working lifetime severely limited by their size. While this class of satellite might have a useful supporting role when it comes to in-orbit examination or even maintenance of larger missions, the SSTL Mission Concepts team are most interested in seeking out any potential 'sweet spot' in size between micro-satellites on the one side and current nano-sats at the other.

The laws of physics limit how far a Disaster Monitoring Constellation-type imaging mission could be shrunk down in practice. The payload is the real sticking point. A camera must maintain a minimum size of aperture to deliver the sought-after spatial resolution. The remaining area of investigation is to push down the volume and mass of spacecraft subsystems such as power generation, onboard data handling and attitude and orbit control.

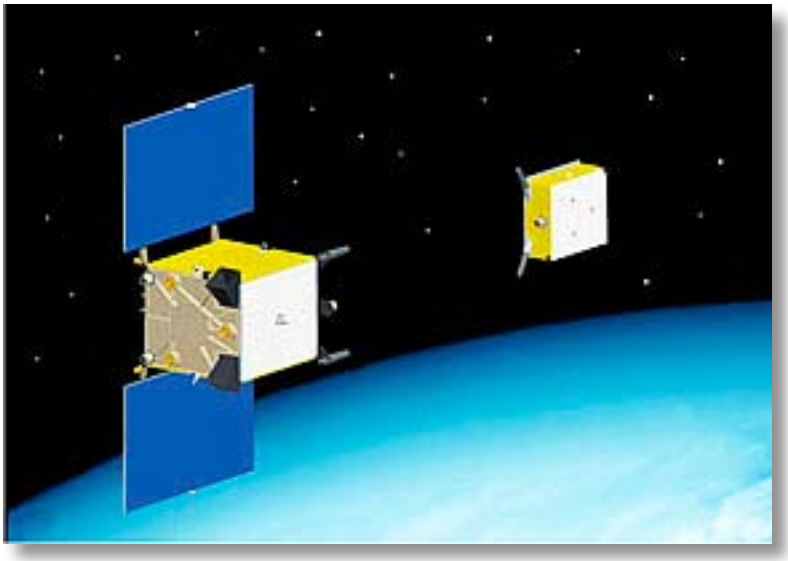
Spinning-in New Technologies

The Mission Concepts team plans to attempt this in the traditional SSTL manner: By spinning-in the latest tried and tested terrestrial technologies as much as they can.

Disaster Monitoring Constellation (DMC), image courtesy of SSTL

The latest solar cells have reached 30 percent efficiency, for instance, which means more power generation for a decreased surface area. Shrink a satellite and its maximum solar array size goes down — to rule out deployable mechanisms that would be bulky and potentially trouble-prone — but the overall power budget needed is likely to shrink, too, in a broadly scalable way. The current generation of **ARM** or **Intel PC** chips need much less power (and by extension much less thermal management of their waste heat) than just two years ago.

Another innovation seized upon by the terrestrial industry is *Micro-Electro-Mechanical systems* (**MEMS**) technology. These complete devices on a chip are mass-produced in their millions, their applications



PRISMA double microsatellites

ranging from anti-lock braking systems to inkjet printer heads. MEMS devices have already made it to orbit: Sweden's ***PRISMA*** double-satellite formation flying mission includes a MEMS-based cold-gas micro-thruster with less than milli-Newton range precision that is reported to be responding as expected despite some concerns about gas leakage in August.

PRISMA is also notable for employing a non-toxic high-energy alternative to hydrazine in its main thruster system. Known as **HPGP** (*High Propulsion Green Propellant*) it could turn out to be as an important enabler for smaller satellites — current SSTL satellites also use non-toxic propellents, such as butane, xenon, and even water. They are, however, lower energy than HPGP.

Propellant tanks are less capable of being miniaturized, of course, although as satellite mass decreases, less propellant will be required throughout its operational lifetime. The main issue here is compliance with orbital debris regulations — will a smaller satellite with less propellant still be capable of de-orbiting at the end of its working lifetime? Such satellites could therefore fly in lower orbits — as with most Cubesats at the moment — so they are naturally swept out of orbit by upper atmospheric drag. Or to increase their operational reach, they could be fitted with so-called '*terminator sails*', being worked on by the SSC among other several institutions, which deploy to increase their overall area and hasten their orbital decline.

Among other promising technologies, **RF** (*radio-frequency*) systems on a chip offer a means of shrinking the communications subsystem but also enhanced attitude ability via GPS navigation, and wireless inter-satellite links for putting multiple satellites to work in formation.

Operating such a cluster of satellites might be a way of getting around one of the main limitations of smaller satellites — maintaining adequate communications with Earth. A shrunken platform means a lower diameter antenna, and lower bandwidth downlinking. For the amount of imagery produced by a medium-resolution multispectral imager of the DMC type, data bottlenecking could prevent end-users getting timely hold of the latest images.

Advanced data compression might be part of the answer, but there are also some promising operational techniques. The **European Space Agency** currently supports a project called ***GENSO*** (*Global Educational Network for Satellite Operations*). The GENSO project is looking at the highly-collaborative operation of multiple ground stations, each one run by a local educational institution, providing a satellite with multiple chances for downlink every orbit instead of waiting for downlink opportunities at a single ground station. A similar concept could be used in a commercial application, and with such a wealth of downlink opportunities, mission data could rain down gradually and continuously as the satellite circles the Earth.

Fractionated Satellites: One Out Of Many

In addition, a cluster of satellites could work together via inter-satellite links, sharing resources as needed. So a single satellite within the cluster might be dedicated to downlinking the data gathered by its companions. This, in essence, is the model called for by **DARPA** (*Defense Advanced Research Projects Agency*) in their ***System F6*** (*Future, Fast, Flexible, Fractionated Free-flying Spacecraft*) project.

Scheduled for an initial flight demonstration in 2014, F6 aims to replicate the functionality of a standard large spacecraft with a networked cluster of micro-satellites, sharing out the separate system tasks of a typical mission. Each satellite building block could be built and launched separately, converging in orbit to form the final virtual satellite system. Such a 'fractionated satellite' will offer multiple advantages: Increased budgetary and planning flexibility, enhanced survivability and adaptability over a long time period. Any onboard failure would take out some, but not all of the system, and failed satellites within the cluster could be rapidly swapped out. The actual mission could proceed on an open-ended basis, evolving over time to target new goals.

Intriguingly, DARPA plans to proceed on an open source basis. Following the same basis as the CubeSat open standard, not to mention the DARPA-fostered Internet, the Agency will make all the interface standards and operating systems developed for F6 available to the general public. This should allow any interested party to prepare their own satellites that will be fully compatible

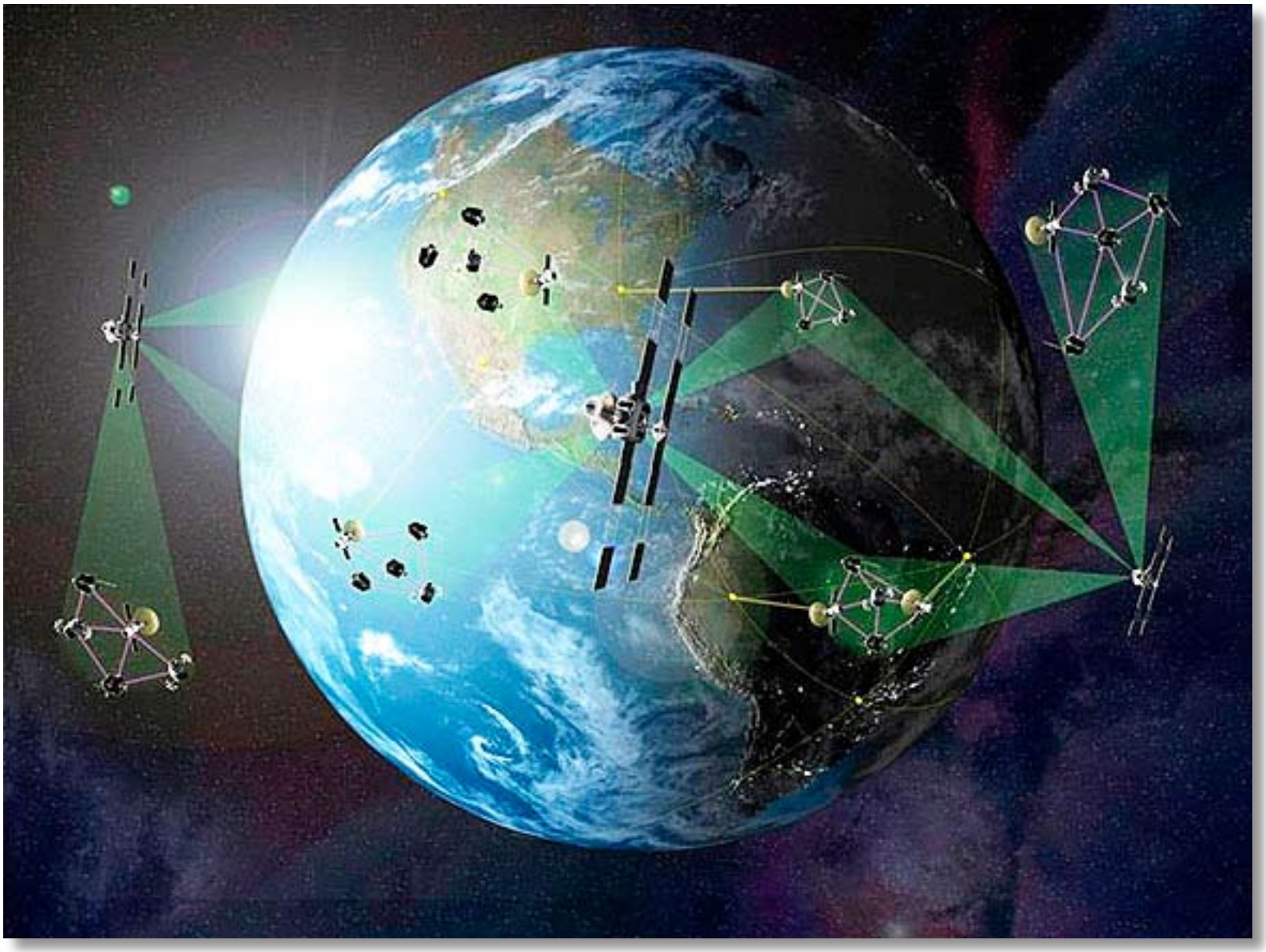


Diagram of DARPA's System F6 project, courtesy of DARPA

with the F6 network, and capable of joining and extending their cluster.

This open architecture opens the way to a collaborative approach, F6 project manager *Paul Eremenko* explained in a press release, August 2010, “An explicit program goal is to enable multiple payloads supplied by different agencies, services or even countries to share common infrastructure at multiple levels of security. It is a unique architectural approach to enhancing the adaptability, survivability and responsiveness of future space assets — and really changing the dynamics of the space industry by lowering the barrier to entry.”

Reflecting this approach, DARPA will team with other institutions and possibly international partners to develop the individual elements of their planned demonstration. The fit with Sir Martin Sweeting’s own biological metaphor is clear enough. Out of all the world’s insects, those that come together to swarm or form hives are among the most successful.

The Mission Concepts study on a new smaller platform will not use the F6 concept as a starting point, but it will be included “in the mix” of considerations, along with new terrestrial technologies, and heritage SSTL products and know-how.

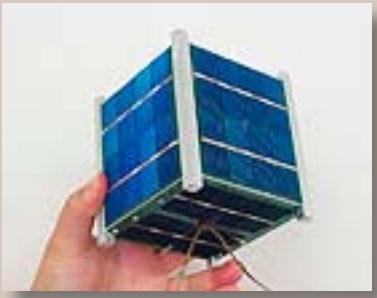
The team plan to complete their initial study by this time next year, with some prototype hardware coming out of their work in parallel — *Shaun*, along with some SSTL colleagues and a crack team at SSC are currently collaborating on a NanoSat to try out some new technologies that will feed in to the Mission Concepts study on a smaller SSTL platform.
Watch this Space.

About the author

Shaun Kenyon, Mission Concepts, SSTL

Smaller Than “Small Satellites” A Glossary Of Terms

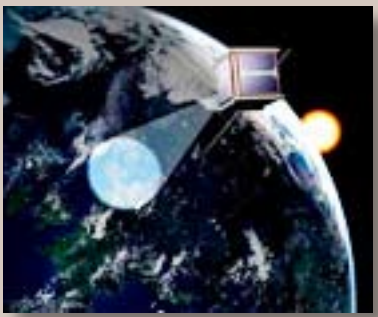
Nanosatellite
A term broadly applied to satellites between 1kg and 10kg in mass. Occasionally applied to satellites > 10kg but < than 50kg



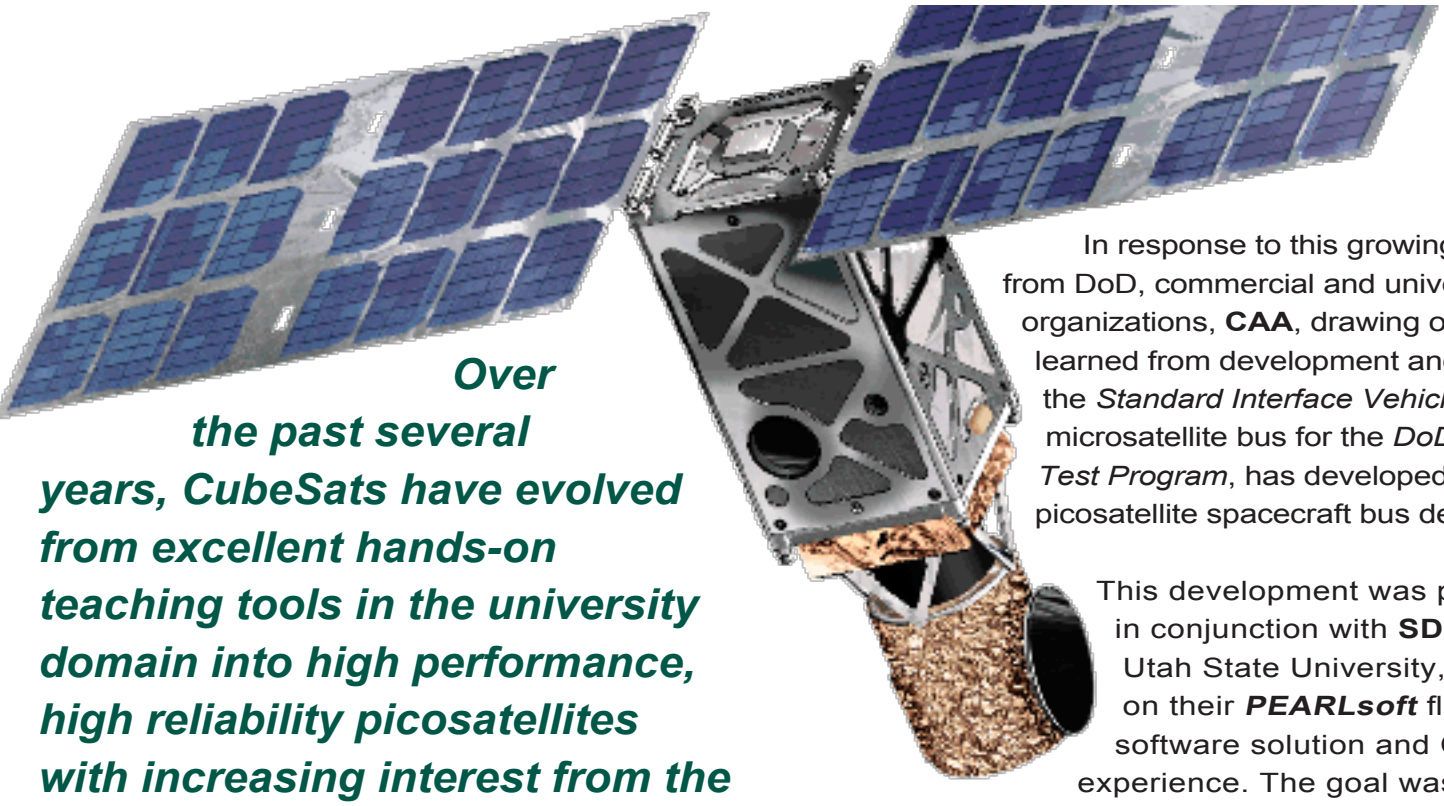
Picosatellite
A term applied to satellites < 1kg

Microsatellite
A term applied to satellites between 10kg + 100kg in mass

CubeSat
A satellite adhering to the CubeSat standard as developed by CalPoly and Stanford. One unit measures 10cm x 10cm x 10cm and weighs no more than 1.33kg. Cubesats are commonly 1U, 2U or 3U – in other words 10, 20 or 30cm in length, but 10cm high and 10cm wide



The Power Of The Picosatellite



Over the past several years, CubeSats have evolved from excellent hands-on teaching tools in the university domain into high performance, high reliability picosatellites with increasing interest from the Department of Defense (DoD) space community for experimental and operational applications. The vision for future CubeSat mission types range from technology demonstration missions to augmenting larger satellites to performing stand-alone operational missions, with dedicated payloads. Comtech AeroAstro, Inc. (CAA) and the Space Dynamics Laboratory (SDL) have teamed together to develop a high-performance CubeSat design that is able to meet the requirements of these more stringent mission types.

In response to this growing interest from DoD, commercial and university organizations, **CAA**, drawing on lessons learned from development and test of the *Standard Interface Vehicle* (SIV) microsatellite bus for the *DoD Space Test Program*, has developed the ***Coral*** picosatellite spacecraft bus design.

This development was performed in conjunction with **SDL** at Utah State University, drawing on their ***PEARLsoft*** flight software solution and CubeSat experience. The goal was to design a robust, flexible and reconfigurable CubeSat bus with sufficient performance and design margins to meet the increased performance requirements of pointing, power and volume. In addition to the three primary design objectives, the Coral bus design incorporates the following points to ensure reliability and mission success.

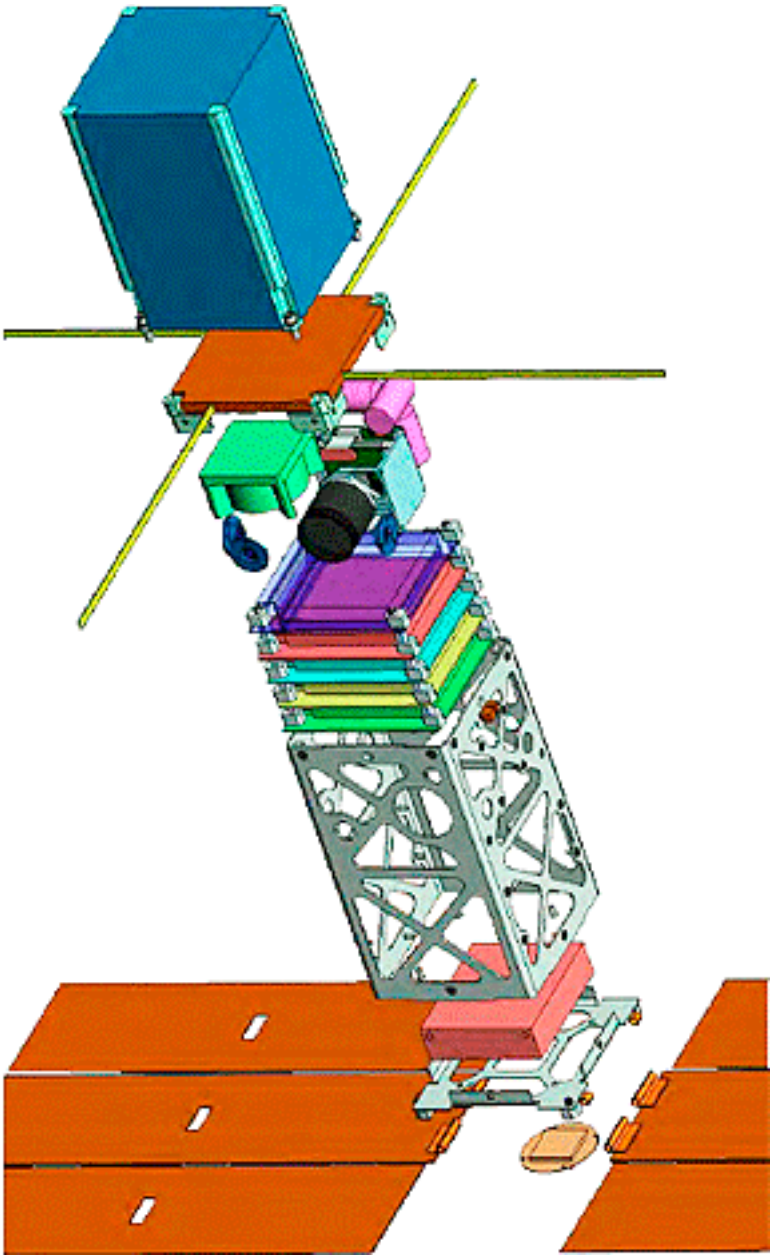
i. ***High-performance components***
ii. ***Standardized and non-proprietary interfaces***
iii. ***Proven software architectures***
iv. ***Support for a large majority of mission and payload types***
v. ***Standard quality processes and procedures***
vi. ***Spacecraft experience***

CAA has targeted these areas to increase the performance over current capabilities and rigor in traditional CubeSat designs. The combination of these enhancements has resulted in a CubeSat design targeted for a wide variety of missions, beyond just demonstration, to include operational missions.

CAA's/SDL's technical approach features a commoditized Coral bus, USING a high-performance **PCI-104** architecture (commercial, non-proprietary architecture) which offers a flexible, modular and standardized payload interface that meets or exceeds the majority of published Government and civil requirements. The Coral bus is a standard 3U design that meets all of the requirements of a CubeSat spacecraft. Additionally, the Coral bus is compatible with the ***Cal-Poly P-POD*** launcher and can, therefore, be launched on any launch vehicle designed to carry CubeSats into orbit.

To meet the stringent Coral requirements, the team performed an industry-wide search of component suppliers/vendors in all subsystem disciplines to establish a technical baseline that met the required design criteria. CAA assessed current and emerging technologies in all areas to increase subsystem performance while maintaining self imposed stringent schedules. The technical baseline includes a significant number of innovations that provide the customer greater utility for mission and payload flexibility.

- ***Simple, standard payload interface (mechanical, electrical and flight software)***
- ***High bandwidth PCI-104 architecture capable of 1 Gbps data rates***
- ***High precision ADCS design, including sun sensors for safe hold mode operations***
- ***High performance EPS subsystem design providing 45 watts of peak power***
- ***Low risk, modular, existing flight software design easily tailored for custom payload flight software integration***
- ***High data rate/link margin, ultra-high frequency radio/antenna system with AES-256 bit encryption***
- ***High performance central processing unit board based on LEON III processor operating up to 66 MHz***
- ***Payload accommodations that allow all volume above the spacecraft bus to be dedicated to the payload (except where the solar arrays stow)***
- ***Passive thermal control of the bus and payload***



Coral bus design

Coral's internal bus and payload electronics communicate over a high bandwidth PCI-104 bus interface. The PCI-104 offers excellent bandwidth performance while conforming to the Coral form factor (3U-CubeSat). The Coral design permits a dedicated payload interface card volume located on the Coral bus side to maintain a flexible, seamless protocol (RS-422, 1553, SpaceWire). The design uses a dedicated fifth row, or Row E, on the PCI-104 bus to provide substantial power and general purpose input/output to the payload.

SDL's PEARLsoft flight software provides the core C&DH software components required to operate the Coral bus and payload elements. Key components include a system monitor, communications handler, network manager, code update handler, command handler, ADCS controller and resolver, telemetry processor and payload manager. The flight software uses a multi-threaded architecture providing excellent design modularity that allows a high level of reuse and adaptability to meet a broad range of mission requirements. Separate threads for communications, attitude control and payload management allows for ease of modification, upgrade, or reconfiguration without extensive retest or recode.

The Coral bus is designed to be manufactured, assembled, integrated and tested in a production/assembly line environment. Missions that require multiple busses can be greatly benefited by this approach. The structure, at 10 percent mass fraction to the overall Coral bus mass, consists of **Aluminum 6061-T6** panels (sides and bottom) that have cutouts for ease of electrical integration between the PCI-104 avionics boards and peripheral components (star tracker, reaction wheel, torque rods, etc.).

The Coral design meets the 25-year de-orbit requirements (*NASA Safety Standard 1740.14* and *DoD Instruction 3100.12, Sec 6.4*) without the use of a dedicated de-orbit mechanism. Per Satellite Tool Kit (STK) modeling, the Coral bus is predicted to de-orbit in 21.4 years based on using a conservative drag coefficient of 2.0 and a space vehicle mass of 3.83 kg.

The CAA/SDL team offers the Coral bus implementing a technical approach that provides users with maximum payload flexibility. **Comtech AeroAstro** has optimized several key areas, pointing, power and volume within the system design and addressed critical areas lacking in the current CubeSat arena. These features allow our Coral design to accommodate the stringent pointing/slew requirements of electro-optical, or space situational awareness missions, and accommodate missions requiring higher payload power such as communications or SAR with no changes to the bus design. Mission and payload reconfiguration is simple, rapid and reliable with minimum logistics footprint, reducing overall program cost.

For more information, see us at www.aeroastro.com, or email us at info@aeroastro.com.

sspi gala

March 15, 2011
Grand Hyatt in Washington, D.C.

Don't miss the most widely attended social event in the satellite industry - a perfect mix of business and pleasure – held annually in conjunction with the SATELLITE Conference.

Tables are selling fast. Reserve your company's table – or become a corporate sponsor and get at least one free table!

Society of Satellite Professionals International
The professional development society of the global satellite industry

www.sspigala.com

Solutions—GPS Receiver Verification

author: Greg Jue, Applications Specialist, Agilent Technologies

One of the more compelling trends in the mobile phone market these days is the migration from dual-band to tri- and even quad-band designs. These complex phones must also now have the ability to handle various signals for peripheral radios such as Bluetooth®, FM, WLAN and WiMAX™ on a single integrated device.

Another key functionality expected to become pervasive in mobile phones and other consumer electronic devices is Global Positioning System (GPS), a global navigation satellite system (GNSS) that provides precise location and time information based on an unobstructed line-of-sight to four or more GPS satellites. Over the years, GPS has become increasingly common in everyday life. Today it is used in everything from automotive navigation systems and geo-tracking to a range of location-based services. While the GPS capability is a useful benefit for the consumer, it places added hardship on multi-function device manufacturers, OEM integrators and contract manufacturers who now have to determine the appropriate standard tests to verify GPS receiver performance, in addition to having to test any other supported wireless standards on their devices.

The Problem

Testing GPS functionality is a difficult enough task for the engineer, but having to test all the functionality on a multifunctional device makes it all the more complicated. First, the engineer has to determine the appropriate standard tests to verify GPS receiver performance. Then, a controlled environment facilitating precise repeatability must be found in which to conduct the verification procedure. Using actual GPS satellite signals received through an antenna typically does not fulfill this requirement because the signals presented to the receiver are highly variable and non-repeatable. Moreover, testing under specific conditions such as in remote locations or at high velocities can be both expensive and impractical.

A traditional GPS signal simulator with GPS-dedicated hardware is often used to address this issue since it produces an output signal that models the signal that would be received by the GPS receiver, which is a mix of signals from many different satellites with different time delays, Doppler shifts and power levels.

Unfortunately, these simulators do not provide signals for other wireless standards that may be in the device under test. As a result, engineers testing multifunctional devices must purchase and use multiple instruments, a costly and time-consuming proposition.

Solution

Testing multifunctional devices with GPS functionality requires a real-time GPS signal simulation solution that is capable of generating the required GPS signals for a repeatable and flexible test environment. A high-performance, general-purpose simulation solution that can also create signals for testing other wireless standards is necessary for complete verification of the multifunctional device.

In particular, to enable R&D and verification of GPS receivers, the simulator should be able to generate 12 or more satellite signals for maximum satellite visibility. It should also support multipath fading impairments, have the ability to simulate stationary and moving GPS receiver scenarios, and be able to generate scenarios for any date, time and location.

By providing quality GPS signals and GPS verification functionality, this type of simulation solution is able to perform the typical tests required for receiver verification. The three tests are the following:

» ***Time To First Fix (TTFF) — TTFF is the time between "turn-on" of the GPS signal and the acquisition of a location fix by the GPS receiver. TTFF can be tested under cold, warm and hot start conditions, which refer to the state of the GPS receiver when the GPS signal is turned on.***

» ***Sensitivity — Sensitivity refers to the minimum level of signal that allows the GPS receiver to either acquire or track the GPS signal. Acquisition sensitivity is the minimum signal required to successfully obtain a location fix, and tracking sensitivity is the minimum signal required to maintain a location fix once it has been attained.***

» ***Location Accuracy — Location accuracy refers to the ability to achieve a location fix as close to the desired position as possible. Relative accuracy refers to comparisons between the location obtained from multiple tests, and absolute accuracy refers to comparisons between the calculated location and the***

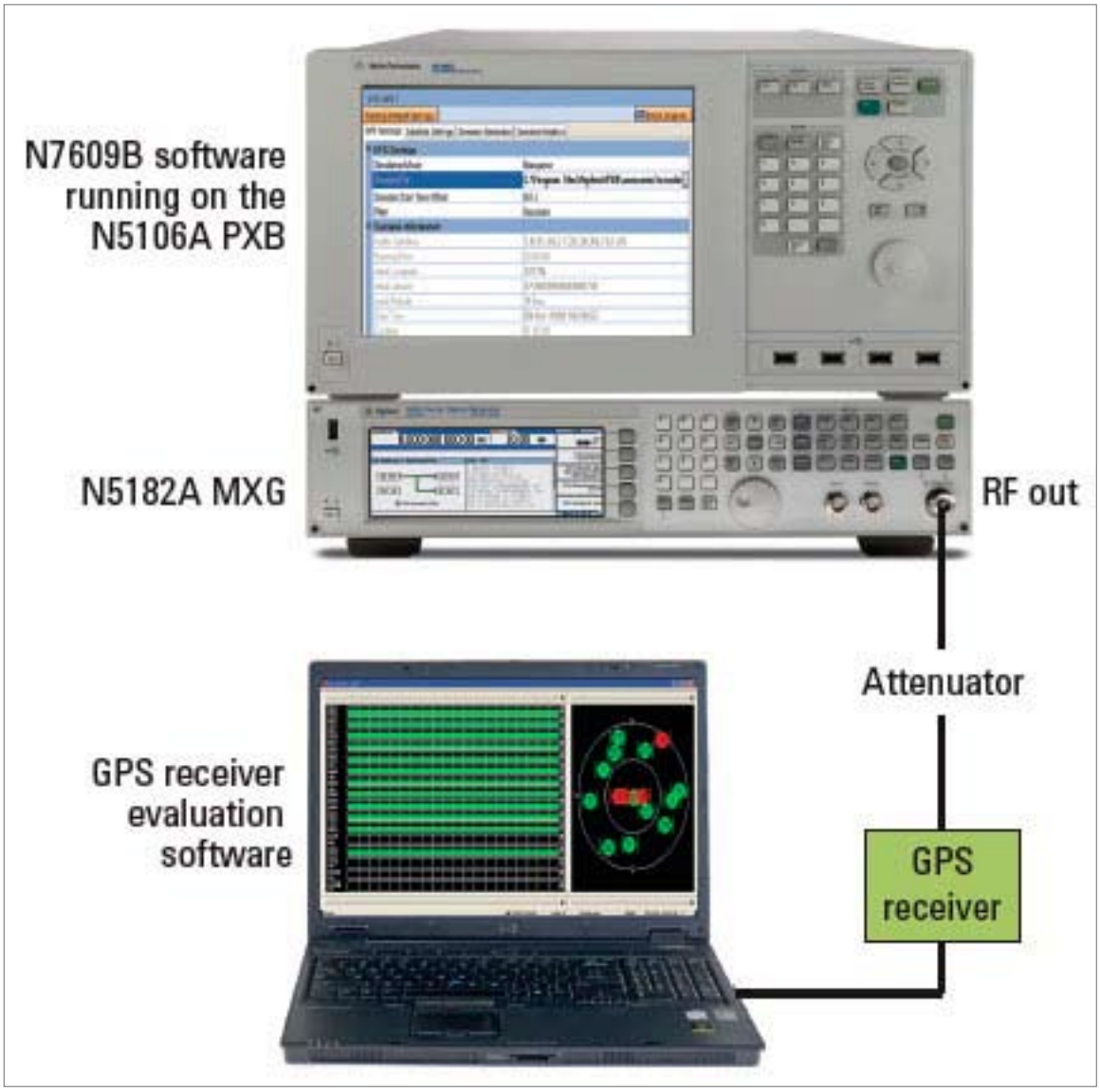


Figure 1: Shown here is a typical GPS receiver test setup with the N7609B. The baseband GPS signal is created by the N7609B running on the N5106A PXB, upconverted to RF by the MXG and sent to the GPS receiver. The GPS receiver output is then sent to evaluation software on a PC.

simulated location. Accuracy can also be measured for moving GPS receivers and individual satellite tracking capability.

The **N7609B Signal Studio for GNSS** application from **Agilent Technologies** provides the performance, flexibility and functionality required to perform the TTFF, sensitivity and location accuracy tests. Offering advanced GPS verification with impairments, it enables engineers to easily create multi-satellite GPS signals with up to 15 line-of-sight satellites. As many as 24 channels are available, allowing the addition of multipath signals using the N7609B's scenario editor. Custom scenarios (for static and moving GPS receivers) can be created, with real-time satellite power and visibility control during signal simulation.

The N7609B software runs on Agilent's **N5106A PXB** baseband generator and channel emulator platform with a vector signal generator such as the **N5182A MXG** for RF upconversion (*Figure 1 on the previous page*). As it is the only 15-satellite, 24-channel GPS signal simulator built on a high-performance, general-purpose signal source, it provides a reliable and repeatable test solution for full verification and validation of GPS receivers, as well as for most of today's wireless standards (*e.g.*, LTE, 802.11n WLAN, WiMAX, Bluetooth, WCDMA, and cdma2000).

The flexibility and expandability of the PXB/MXG platform also ensures support for future wireless standards. In addition, the N7609B solution can be combined with Agilent's **8960 Wireless Communication Test Set** and test executives to provide a system for design verification and pre-conformance testing of *Assisted-GPS* (**A-GPS**) devices.

Running the N7609B solution on the PXB/MXG platform enables the engineer to access a number of compelling features when testing multifunctional devices. The PXB provides up to 6 baseband generators (BBGs) with 512 MSa of playback memory per BBG, 8 real-time faders, the industry's widest bandwidth of 120 MHz, and supports testing and troubleshooting of 2x2, 2x4, and 4x2 MIMO (Multiple-Input Multiple-Output) systems (*Figure 2, next page*). For its part, the MXG RF vector signal generator features fast switching speed (≤ 1.2 ms in SCPI mode), industry-best ACPR (even at high power levels or over a wide range of output power levels), high power, small form factor, and simplified self-maintenance.

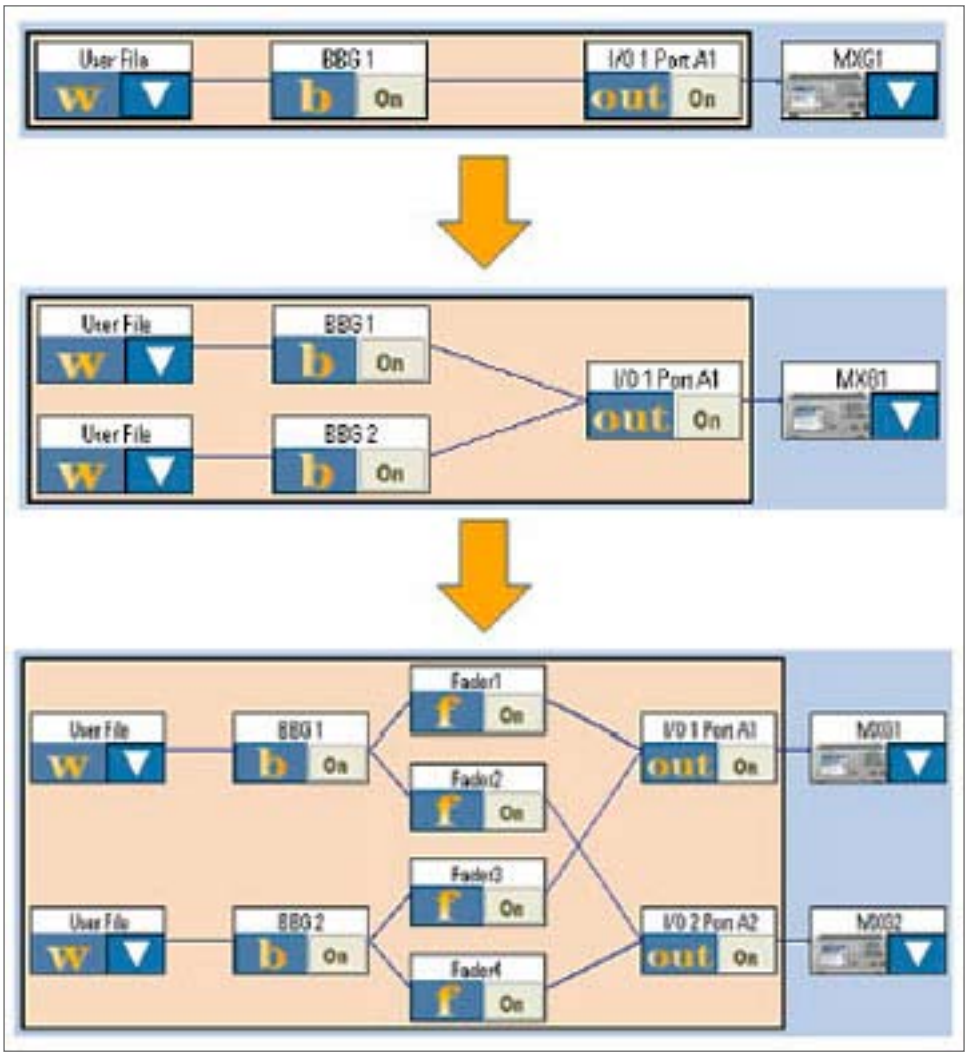


Figure 2: The PXB can be easily reconfigured in software to provide different test capabilities. This diagram shows three different possible configurations: Single-channel signal generation for creating one format such as GPS, 2-channel generate and sum for interference testing using a single RF signal generator, and 2x2 MIMO with 4 channels of fading for testing MIMO formats such as LTE and WiMAX.

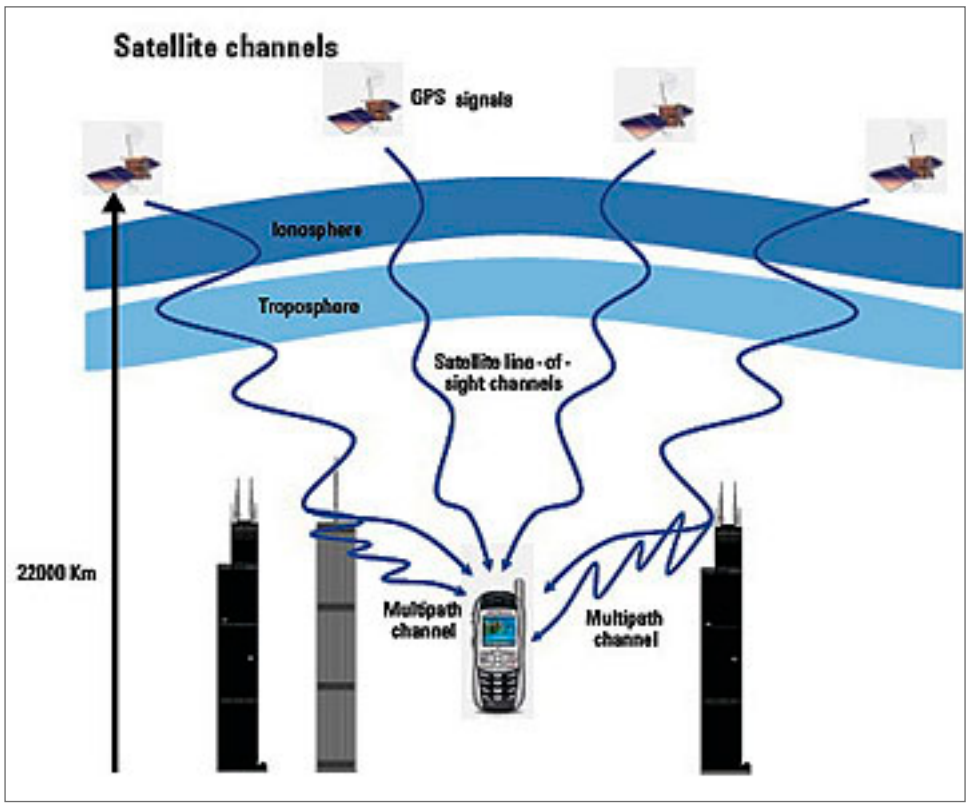


Figure 3: Multipath signals are reflected GPS signals that have different attenuation, delay and Doppler shifts when compared to the line-of-sight satellite signals.

Adding Impairments

The ability to include signal impairments such as multipath signals is critical for any GPS test solution. Multipath signals are indirect GPS signals that are received by the GPS receiver at lower power levels, with delay and different Doppler shifts than the line-of-sight signals (*Figure 3*). Typically such signals are caused by reflections from buildings, trees and other obstructions. These signals and other impairments can have an effect on GPS receiver capabilities and therefore must be taken into consideration during verification.

The N7609B solution provides support for multipath fading impairments. To access this capability, a scenario file with the ideal line-of-sight GPS satellite signals for the desired location and time is first created. The scenario editing function can then be used to add multipath versions of the line-of-sight satellite signals. To simulate other impairments, power offsets can be applied over a user-specified time interval to model attenuation or loss of a signal, as in the case of a car going through a tunnel. An elevation mask can be applied to hide satellites below a certain angle above the horizon to model obstructions such as a mountain range or surrounding buildings. The N7609B also provides modeling for ionospheric and tropospheric conditions, application of a static antenna pattern, and addition of calibrated additive white Gaussian noise (AWGN). This ability to create impairments makes the N7609B ideal for use in R&D for GPS receiver verification.

The Results

Testing GPS functionality is a challenging task, one that's made all the more difficult by the trend toward multifunctional devices. Using a simulation solution with the performance, flexibility and expandability to not only verify GPS receivers, but other wireless standards as well, is key to addressing this challenge. Agilent's N7609B Signal Studio for GNSS effectively meets these challenges by providing engineers with the ability to create GPS signals capable of fully verifying GPS receiver capabilities along with those required to test most other wireless standards. Using this solution, GPS receiver manufacturers, OEM integrators and contract manufacturers can now more quickly and cost-effectively test their multifunctional devices.

The Power Of X

The Agilent PXB baseband generator and channel emulator and MXG signal generator are key products in Agilent's comprehensive **Power of X** suite of test products. These products grant engineers the power to gain greater design insight, speed manufacturing processes, solve tough measurement problems, and get to market ahead of the competition.

Offering the best combination of speed and scalability, and created and supported by worldwide measurement experts, Agilent's X products are helping engineers bring innovative, higher-performing products to emerging markets around the globe.

To learn more about Agilent's suite of X products, please visit:
www.agilent.com/find/powerofx.

Enabling Space Access...

author: Randa Relich Milliron, CEO + Founder, Interorbital Systems

With a growing collection of small satellites from academic, government, arts, military, and corporate sectors, Interorbital Systems (IOS) is rapidly filling the manifests for the first two of its 2011 launches, and booking a series of dedicated orbital missions well into 2012.

Interorbital Systems, with headquarters, manufacturing, and test facilities based at California's **Mojave Air and Spaceport** since 1996, is building a dedicated small satellite launch vehicle, and the small satellite kits that rocket will lift. The launcher under construction is the ***NEPTUNE 45*** (**N45**), a modular rocket system, built of standard, identical modules called *Common Propulsion Modules* (**CPMs**) as they are common to the design of all IOS space launch vehicles. N45, a seven CPM-bundle rocket, will carry some 30-40 co-manifested picosats to a 310-km circular polar orbit on its 2011 maiden flight, and a lift a single 45 kg satellite on a scheduled 630-km follow-on single satellite launch for later in the year. Interorbital's totally modular rocket system can morph from a single, stand-alone CPM sounding rocket for suborbital research, into a vehicle capable of carrying a 30-kg payload to LEO (the 5-module ***NEPTUNE 30*** (**N30**), into a 37-module lunar-capable N1000 (1000kg to LEO), or into any other rocket variant built

IOS CPM TV (Common Propulsion Module Test Vehicle) during Mobile Launch System lift test

with the exact number of modules needed meet the requirements of a specific mission.

First introduced in 2009, the N30 launcher quickly sold-out it payload capacity. Due to the growing demand for payload space, Interorbital decided to enhance the launcher by adding two additional modules to create the N45 (45 kg to orbit). This transformation increased the rocket's payload capacity to 30 of IOS' cylindrical **TubeSats**, and 10 conventional **CubeSats.**

"Over a decade of internal R&D, prototyping, and testing resulted in the refinement of IOS' NEPTUNE-series rockets and the introduction the TubeSat Personal Satellite Kit. The development of these expandable modular rockets is the company's first step to LEO, and the beginning of what Interorbital has charted as a program that will encompass human space flight, the development of an Earth-Moon transportation system, and the establishment of a permanently inhabited Lunar Base," IOS President/ Chief Technology Officer *Roderick Milliron* stated.

The ***Tubesat Personal Satellite Kit***, sold to academic clients with an orbital launch included at a currently unmatched low price of $8,000, immediately captured global attention. Article author, CEO and Director of Marketing, ***Randa Milliron***, said, "It was astounding — we were updating a website, editing a rough draft that introduced the ultra low-cost TubeSat Kit and Launch concept when UK-based Space Fellowship caught sight of the page and broke the story. It went viral."

Within 24 hours, the Tubesat had erupted globally, with inquiries and orders streaming in from everywhere in the space and educational communities. "We still have not spent a dime on advertising, and the kit and launch combo has proven to be a 'must-have' item. TubeSats/Personal Satellites sell themselves---and those sales provide solid funding for our flight test and launch programs."

The current manifest for Interorbital's inaugural launch (second quarter of 2011) include CubeSats from **UC Irvine**; **EuroLuna** (2U ***Romit-1*** from Denmark's ***Google Lunar X PRIZE*** (GLXP) Team); and **Universidad de Puerto Rico** teaming with **Marcelino Canino Canino Middle School**; and TubeSats from **Morehead State University** (**Kentucky Space**); **InterAmerican University of Puerto Rico**; **University of Sydney** (Australia); **Aslan Academy** (Private Los Angeles High School); **Project Calliope** (*Space Music Project*); GLXP Teams **Stellar** and **SYNERGY MOON**; **Naval Postgraduate School** (3) (communication with live remote exercises); *Defense Science and Technology Lab* (**DSTL**,UK); **Austrian Arts Group mur.at**; **United States Military Academy at West Point** (2); **Brazilian Space Agency/ 120 Fifth Grade Students Ubatuba Elementary School**; and GLXP Part-Time Scientists/ **Fluid & Reason**.

Twenty additional projects with committed payloads are in various phases of arranging funding. These include academic, arts, private-sector, military, and corporate groups from the US, Peru, Mexico, Germany, Vietnam, Pakistan, New Zealand, the Dominican Republic, Holland, Singapore, and France

All satellites on the first launch will be placed in a 310-km self-decaying orbit for an active lifespan of between 3 weeks and 3 months, depending upon solar activity. The TubeSats will gradually deorbit, re-enter Earth's atmosphere and burn up, thus eliminating orbital debris.

Interorbital originally created the $8,000 ***Personal Satellite Kit and Launch*** to serve the academic community and the small business space entrepreneur. As an academic tool to stimulate STEM programs, TubeSats are already part of the curriculum in universities and schools (Morehead State, Aslan Academy) around the world. Perhaps the most ambitious is the Brazilian program run by Candido Osvaldo and Emerson Yaegashi which has 120 fifth-grade students creating 22 full-scale TubeSat mockups in the classroom. The students who build the best mock-up win the honor of assembling the actual orbital TubeSat.

"IOS believes in the hands-on, inspiration/ education approach to learning, and encourages philanthropists to gift a TubeSat Kit and Launch to schools or students of their choice," CEO *Milliron* suggested. "I knew I was hooked on Space when I

Spacecraft Technician Ryan Edblad and IOS President/CTO Roderick Milliron inspect the Common Propulsion Module during mobile launch system lift test at Mojave Spaceport

was five years old…I only wish I'd had the chance to build my own satellite then — it's never too soon to engage in the adventure of Science!"

Interorbital is being bombarded with requests for customized missions — largely due to its low-cost and its aggressive launch-on-demand schedule, which includes both ocean-based and land-based launches, all under US license, and all for between $8,000 (Basic TubeSat Kit and Launch) and $384,000 (for a full 45-kg payload dedicated launch).

In January, Interorbital will introduce a standard ***CubeSat Kit and Launch Package*** for the academic price of $15,000. The IOS CubeSat Kit includes the same thoroughly tested electronics hardware as the TubeSat, and a CubeSat chassis, more surface area for solar cell installation, two free sides for experimenter's use, a roomy central space plus two endplates for experiments or applications.

Two sets of milestones must be met before the first orbital launch: Conducting three low-altitude suborbital launches of a single CPM to test various systems in flight, and the completion of all regulatory requirements including launch license, export compliance requirements, ITAR issues, etc.

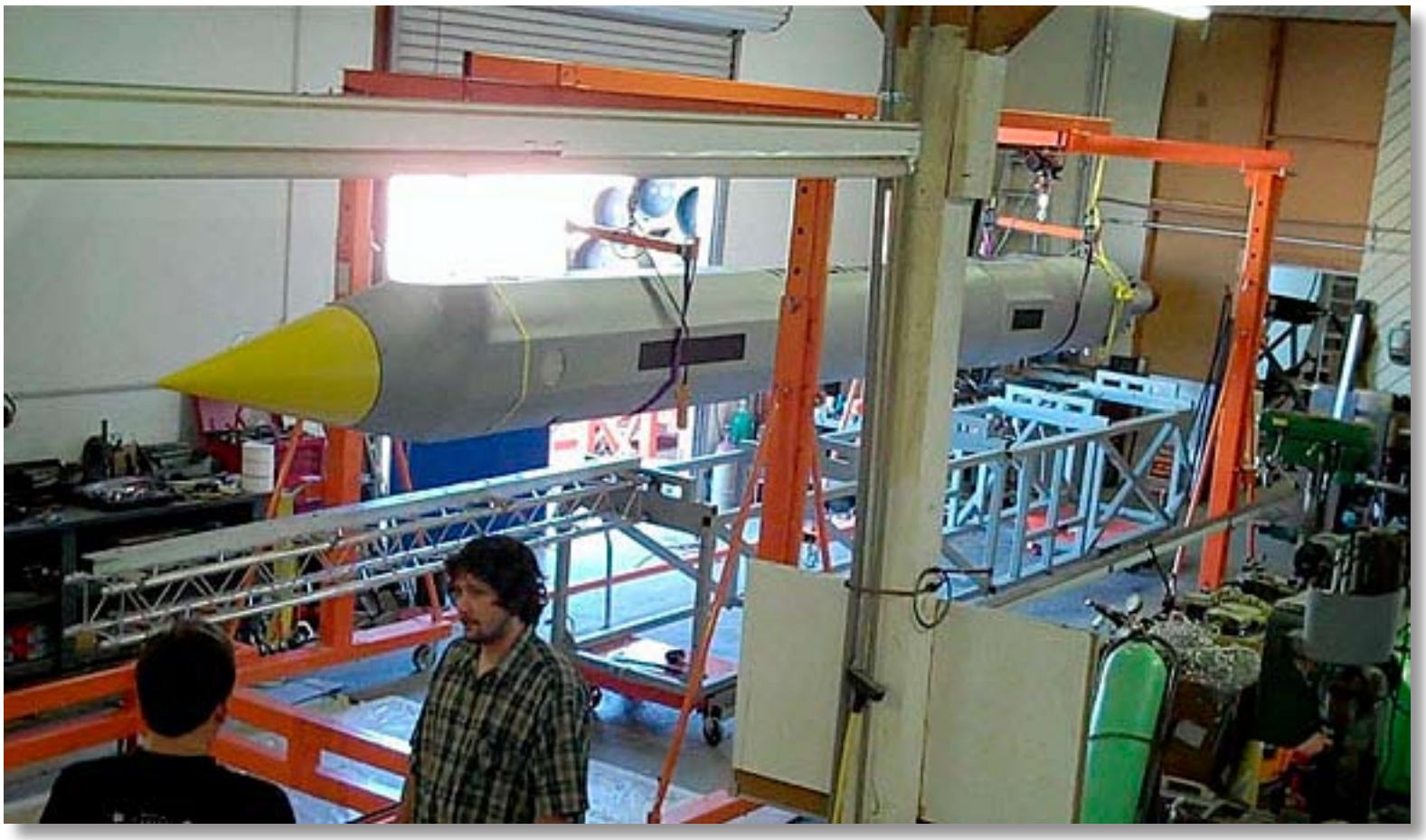
The first low-altitude (35,000-50,000-ft) flight tests will lift off from the Pacific Rocket Society launch zone at the Mojave Test Area near Koehn Dry Lake, in

California, under a *Class 3* Rocket waiver granted by the **FAA**. In preparation for the first of these flights, Interorbital's launch team recently performed a lift test with its 30-ft mobile launcher and the CPM flight test vehicle. Two groups will fly payloads on the suborbital flights — Alex Bordetsky's teams from Naval Postgraduate School and Bob Twiggs' team from Morehead State University — both testing equipment that will be used on their orbital flights.

The N45 is comprised of sevemn CPMs (NEPTUNE 45: throw weight of 45kg to a 310km Polar orbit). Each CPM is also a stand-alone sounding rockets capable of lifting 145 kg to 310km in a ballistic trajectory; price: $115,000 for rocket and launch services; exclusive of range and transportation costs.

A competitor in the $2 Million ***NASA NanoSat Challenge*** and the ***Google Lunar X PRIZE*** (GLXP) IOS will fly hardware for four GLXP teams, including its own team, SYNERGY MOON, and EuroLuna, Stellar, and Part-Time Scientists. *Wes Faler*, Chief Scientist at Fluid & Reason, LLC, of Dearborn, Michigan, and Software Development lead for Berlin-based GLXP Team Part-Time Scientists, is launching a TubeSat with Interorbital Systems to test one of several engine concepts. "Nothing motivates like a deadline, and a rocket on a launch pad is one heck of a deadline!" said Faler. "Internally, we've got three engine designs and a mini space race to bring one to flight status. The next year is going to be really exciting for us. All of our engine designs, including a tunneling-enhanced ion engine, use high fields which demand much larger than normal vacuum chambers for full scale testing. With the TubeSat platform now available, we can leverage our skills and capital right away."

Technical acumen and a novel business model are not the only ingredients for a successful launch service company; there are a myriad of regulatory requirements that must be met before a rocket is permitted to launch. Interorbital recently established operations in Washington D.C. and is actively engaged with key U.S. federal agencies to facilitate roll-out of its orbital launch program. *Kirk*



CPM under construction at Interorbital Systems' Rocket Lab

Focus

Wollert, Government Liaison/ Analyst and Head of DC Operations for IOS commented, “Interorbital intends to be the premiere launch service for the under-served research community and small satellite startups. Our dedicated nanolaunch service will dramatically reduce barriers to entry for responsible customers that need access to space.”

Recent entrants to the space launch industry tout vertical integration as a key factor in driving down costs and offsetting scarcity of supply chain options. As an operational philosophy, Interorbital has taken one step further by challenging end-to-end assumptions of rocket design and space launch operations.

IOS draws on concepts from the minimum cost design (MCD), such as minimizing use of highly skilled labor, using identical components suited for mass production (the CPMs), using a private launch range, and choosing technology which is scalable with low incremental cost, constructing and propelling its launchers with non-exotic, industrially available materials, and manufacturing all key rocket components in-house.

Roderick Milliron said, “Moving towards a simplification of systems and away from complexity while achieving performance to meet mission requirements is paramount — our approach is essentially an example of Subtractive Design ,— removing unnecessary systems and/or components, like turbopumps, and thereby increasing both ease of construction and launch vehicle reliability.”

Interorbital’s philosophy is ideally suited to the establishment of a dedicated nanolaunch service since the manufacturing and performance goals are relatively modest when compared to more demanding space missions such as flagship space probes, heavy lift, or human space flight — all of which are part of IOS’ long-term goals. These more ambitious programs will be made possible through the short-term implementation of the company’s new small sat launch service.

TubeSat With Sample Ejection Cylinder

This approach to space launch also carries over into a complementary business segment through Interorbital’s offering of the TubeSat picosatellite kit. The CubeSat, established by Professors Bob Twiggs and Jordi Puig-Suari, has been a phenomenal success, even described as a “disruptive technology”.

However, a typical CubeSat may cost close to $100K to develop, placing it out reach of small colleges, secondary schools, and for that matter, average citizens. The TubeSat, on the other hand, like the ultra low-cost launch vehicle it rides, prices out into what is essentially a bargain-basement, fully functional picosatellite. Its design is simple — it is constructed completely of circuit boards — there is no ‘shell’, other than an alternating series of aluminum strips (for thermal control) and solar cell PCBs (printed circuit boards), which form the satellite’s structure.

All kit components are commercial-of-the-shelf. Since Interorbital considers all TubeSats primary payloads, mechanical and electrical isolation requirements are greatly reduced, eliminating costly deployment hardware, and allowing passage

to orbit for more adventurous experiments that would not be permitted to ride along as secondary payloads on larger standard, more expensive, or more sensitive missions.

After many years of searching the world's existing spaceports for an affordable launch location, IOS' principals realized that the only way to provide low-cost commercial spacelift was to go outside the system and work to create a spaceport of its own.

"Private spaceports, whether land-based or sea-based, are a key component in driving down launch costs. We have always had an amphibious agenda," says CEO *Milliron*. "Our goals include establishing a spaceport in the friendly South Pacific Kingdom of Tonga that would support our orbital expedition/space tourism and lunar launch programs.

"We are applying for FAA/AST licenses to launch both from Tonga for land-based operations, and from an open-ocean site a hundred-plus miles off the coast of California. Both locations meet the requirements of being remote and having extremely low population density."

Randa and Roderick Milliron/ Founders/ Interorbital Systems

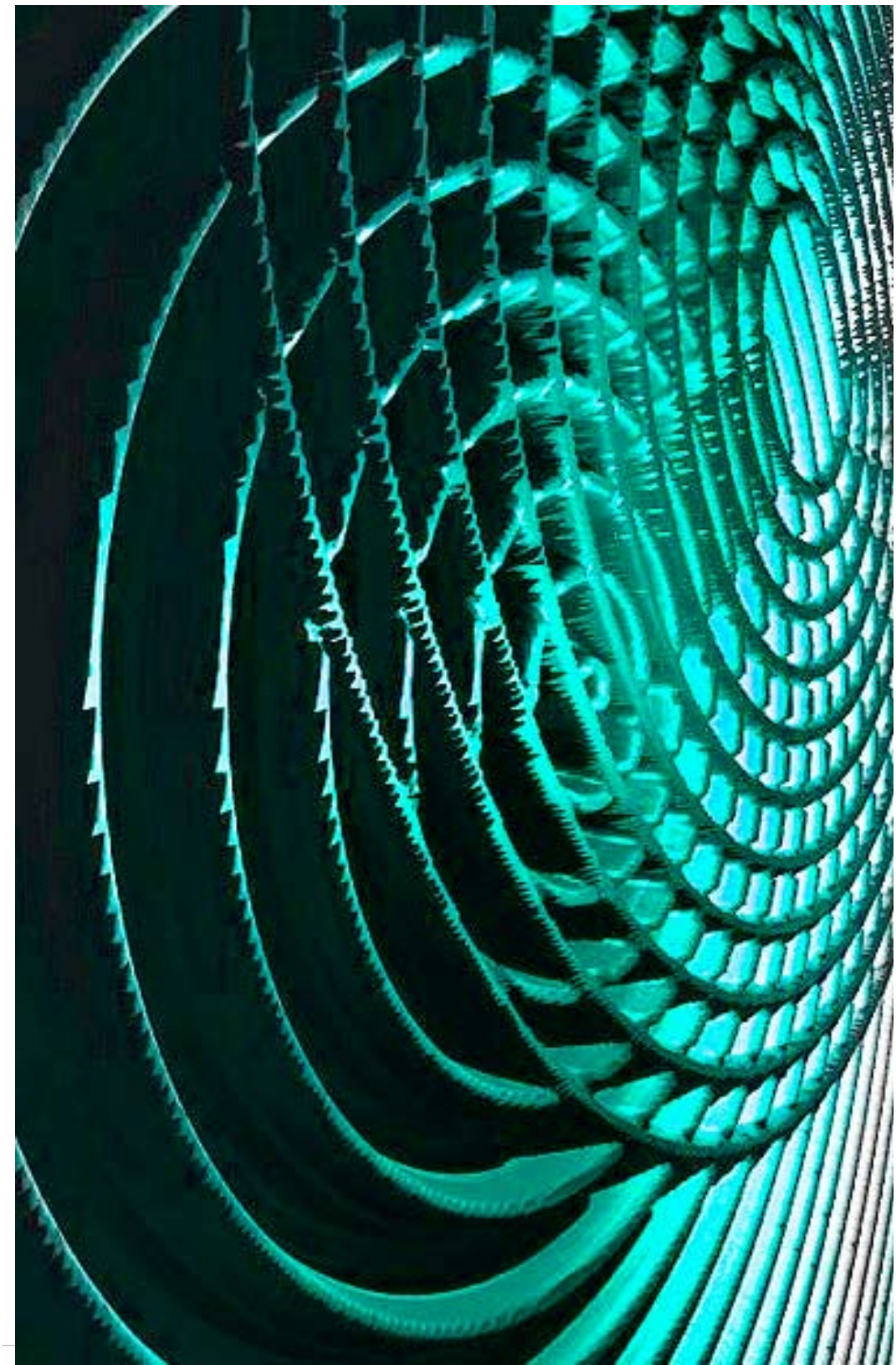
After all regulatory hurdles are cleared and flight tests have been completed, Interorbital Systems will conduct its first orbital launch from one of its private launch locations. Its current target window for launch is the end of the second quarter, 2011.

NEPTUNE Modular Series Launch Vehicles

Running Interference...

author: Martin Coleman, Director, Colem

Spotting interference when it occurs is great and helps to reduce interference, but better than reduced interference would be no interference at all.



Carrier ID + Training — What's Next?

Carrier ID and the training initiatives are, without doubt, an important step to reducing interference and, in fact, they are the first step and should become standard practice. By issuing an ID to all satellite carriers and ensuring they receive a decent level of training, interference can be stopped at source with immediate effect.

That said, with effective implementation of carrier ID throughout the transmission chain and training as an integral part of all installation and operational practises, then what?

We need to look beyond current thinking and remember that more must be done. We need to start new initiatives now, not wait until we have ID and training in place. Better than reducing interference surely would be to stop it completely, that is possible but only if we get in control.

Determining Focus

According to the ***Satellite Users Interference Reduction Group*** (**SUIRG**), as much as 80 percent of satellite interference is unintentional and short-lived

with a whole host of different factors leading to errors being made. Of course, that is natural — people make mistakes and equipment goes awry.

In a broadcast environment, for example, any operation is vulnerable — those at most risk are the SNG vehicle, Flyaway and VSAT terminals. To avoid, or warn, of impending errors is a must! Better prediction, error reporting, and automation of the RF transmit chain is mandatory.

Indeed, I often find it surprising broadcasters don't already have more tools integrated into their uplink functionality. To some extent, tools for the simplest tasks could make a difference, such as logging events and operations. Such would make it quick and easy for any operator to have an overview of all the happenings of that ground station and quickly flag up any operational errors.

Through discussions within SUIRG, ***World Broadcasting Union - International Satellite Operations Group*** (**WBU-ISOG**) and at trade shows, I have been focusing our own products on some of those areas that will help our clients. I am a strong believer in bringing together and sharing those ideas of others to get new thinking and solutions to market. In my opinion there are three areas that should be tackled immediately...

1. ***Improved systems, to allow predictive and preemptive error reporting and full monitoring and automation of the RF transmit chain;***
2. ***Cost effective add-on tools to allow automated detection and analysis of impending problems and thus avoid interference at source;***

Eutelsat Vue

3. ***The future design and capability of the satellite itself to detect problems directly from its orbit.***

Taking each area in turn…

I have, personally, always been a great advocate of automation or simplifying the operation of any transmission system, which significantly reduces both equipment and human error. For **items 1** and **2** automation, quality monitoring and reasonable control is fundamental.

To predict or preempt a problem, you must first have a reasonable monitoring system in place. Surprisingly, many broadcasters have little input from the RF Transmit chain. Without flexible ***Monitoring and Control,*** it will difficult to add tools to help operations improve their ability to get things right, every time.

Broadcasters constantly use the term *workflow* but rarely apply that philosophy to anything outside the editor's domain. Workflow should be inherent in all parts of the broadcast system.

Item 3 is something that often is discussed in closed military circles but this thinking should be applied to all future commercial satellites. We have to start thinking now, so that we may have the hope of getting new features for satellites being considered, bearing in mind a minimum time of 10 years to change.

During the SUIRG conference this year, members started to think about on-board satellite technology that could directly help trace incoming transmissions such as…

iv. On-board Predictive and Scheduled transmission planning

v. On-board geo-location

vi. The ability to optically "view" the source.

Combining this with current efforts to reach the "shop floor", rather than have discussions behind closed doors, has proved to be invaluable.

Incorporting The Colem Supremacy

The key in my mind to combating interference is to not limit our view to current efforts. It is not simply about the video group but about the other groups of SUIRG (VSAT and Data) and those within the industry introducing the latest training programs, who, equally, are taking that initial but crucial step towards the common goal of eradicating interference.

In order to do that effectively, we need to use carrier ID and training initiatives as a building block, rather than as the entire solution. These measures will reduce interference but once in place, we as an industry need to building on those. That thinking process that started at the SUIRG conference, especially regarding satellite technology, is just the start and needs work. The hope is that a working group of members in 2011 will engage and formulate such future thinking. It is imperative.

As we continue to deliver the basics, we also continue to grow our products and technology and, for once, share that information with the industry.

By enticing people to discuss and share their information and ideas is the only way to make a significant impact on solving the interference challenges, once and for all.

About the author

Martin Coleman is the Director of Colem

Executive Spotlight

Howard Teicher, Vice President
Public Sector & Satellite Markets, Expand Networks

A founder of Expand Networks, Howard Teicher is responsible for Expand's military, intelligence, civilian agency and satellite business. Mr. Teicher served in the United States government as the Senior Director, Political-Military Affairs and Director, Near East & South Asia, on the National Security Council, from 1982 to 1987, as well as serving in the Departments of State and Defense from 1977 to 1982.

Howard is the author of* Twin Pillars to Desert Storm: America's Flawed Vision in the Middle East from Nixon to Bush*, Mr. Teicher received his MA from the Johns Hopkins University School of Advanced International Studies and his BA from Boston University.

SatMagazine
Howard, what prompted your decision to work at Expand Networks?

Howard Teicher
As a national security official from 1977 - 1987, I was always committed to the development and adoption of innovative IT techniques that would enhance the development and implementation of American foreign policy. Following five years at the National Security Council as the Director for the Near East and South Asia and the Senior Director for Political-Military Affairs, I entered the private sector and set out to identify and bring to market disruptive technologies that would deliver significant benefits to the business of government.

As one of the founding employees of Expand Networks, I was responsible for the evaluation of the public sector market in the late 1990s where we rapidly uncovered significant opportunities for Wide Area Network (WAN) Optimization solutions that would increase virtual bandwidth while lowering recurring costs and improving application performance. With the Defense Information Systems Agency's (DISA) production rollout in 1999, other elements in the Department of Defence, both in battle labs and in the field, recognized and took advantage of dramatic bandwidth improvements and cost savings that Expand Network's Accelerators provided to our forces. Military users of satellite networks immediately saw the cost, capacity and performance benefits that could be achieved by inserting this technology into their environments, leading the way for Expand to deliver nearly 15,000 units to government customers in the ensuing 11 years. Government is just one industry that has reaped the benefits of Satellite Optimization though...

SatMagazine
What changes and advancements have you seen the industry undergo during your tenure with the firm, and to what do you attribute these?

Howard Teicher
From a standing start with a patent-pending algorithm in 1998, Expand has seen the dramatic expansion of the WAN Optimization market across global commerce. While increasingly ubiquitous throughout enterprise networks, commercial and government

satellite users and service providers have come to find that WAN Optimization is the most efficient (and rapid) way to lower their operating costs while improving customer satisfaction with their networks. From transportation, to mining, to infrastructure projects, to public safety, to the military, satellite demand far outstrips capacity, mandating the use of WAN Optimization to enable remote workers to do their jobs at the lowest possible costs.

WAN Optimization technologies enable low-speed satellite networks to deliver broadband services by leveraging existing resources. For example, this technology enables public safety communications, telehealth, distance learning, distributed business and other services to be delivered over satellite.

SatMagazine

Can you provide an insight into techniques for Satellite optimization in these sorts of environments, and provide some examples?

Howard Teicher

Expand's technology takes satellite optimization to a much higher level than traditional latency mitigation of PEPs. The integration between compression, byte level caching, acceleration, optimization and quality of service in a single appliance provide up to, and over, four-times the capacity of a satellite link without the effects of latency.

The Swiss based Allseas Group is a good example of advancing satellite connectivity in extreme environments. One of the largest offshore subsea construction companies in the world, it has six ships and seven offices on three continents. Accelerators were deployed on the ships and at headquarters to overcome network performance issues, as users suffered from poor connectivity and minimal capacity between ship and shore. Expand's file compression and WAN acceleration meant the company's key applications immediately ran one-third faster, and delivery of data between engineers and those back on shore became stable.

Another great example is with Christian Aid, the international charitable organization. Working in

Africa, and South America where satellite connectivity is the only option for communication, the organization was plagued with poor applications' performance so inherent in these networks. This year, we deployed across its key international locations, and the Accelerators have since successfully increased network performance, application delivery and connectivity between all of their remote branch offices. This is supporting the charity in providing urgent, practical and effective assistance to some of the world's poorest countries.

When the earthquake struck in Haiti for example, the Christian Aid office, like so much else, was completely lost. As they set-up after the disaster, they were able to simply plug in and play a new Expand Accelerator, enabling them to continue their relief work to aid the people of Haiti. Christian Aid was also able to double the number of people working from the location, but do so on the same connections, without reaching capacity or experiencing delays.

SatMagazine

Are there any new markets that you believe have significantly advanced in the last 12 months, and how do you see WAN Optimization evolving over the next decade?

Howard Teicher

Satellite is becoming more and more prevalent, and so as I said before, optimization techniques are being used cross-sector. However, the most notable advancement is the big leap forward by service providers in looking to optimize their offerings to better manage the flow of traffic over satellite links. Using optimization technology as a value-added service they can pass onto their customers, supplying improved levels of services at reduced network costs is a trend that is accelerating at pace.

The space industry is absolutely booming, and service providers are investing billions in launching new satellites in the coming years. The reason is simple — the demand is there. At Expand, we have completed projects with providers such as Thaicom, Clear Channel and Inmarsat to name a few. These alliances and deployments have seen the world's largest and most advanced commercial satellite systems providing accelerated IP services with our optimization technology, and there will be more to come.

In addition, governments around the world are pursuing various broadband initiatives. In the US, the Broadband Plan has a specific focus to deliver connectivity to underserved rural, and semi-rural areas. Here, Expand is working with service providers to help accelerate the middle mile, and deliver on these programs. For example, when looking to rapidly deploy hybrid broadband services to unserved and underserved areas, WAN Optimization can enable the delivery of broadband service based on satellite backhaul, the 'middle mile,' with WiMAX for 'the last mile,' by mitigating the debilitating effects of latency and increasing backhaul capacity to support more users on the network at more affordable prices.

For me, it's clear the future continues to be bright for WAN Optimization technology as it helps to maximize existing satellite and other wireless broadband services to ensure fast, resilient and cost-effective communications to service provider customers across all industries. What was a disruptive technology back when I started is now the mainstream. But the prospect for further advancements makes it just as exciting today as it was at the start of the decade!

Expand products

Mission accomplished!

Arabsat-5A launches a new era of 100% African coverage–and beyond

J U N E 2 0 1 0

Youngest fleet. Highest reliability. Maximum flexibility.

With the successful launch of Arabsat-5A at 30.5° East, the Arabsat world now reaches farther than ever, adding unprecedented 100% African coverage to our expanding footprint across the Middle East, Central Asia and Europe. This means even more choices, more flexibility, and more capacity for communications, broadcast, telephone, broadband, VSAT and interactive services. Join the region's largest community in the sky. Tune in to the future, today.

www.arabsat.com

عرب سات
ARABSAT
Our world. Your world.

A Case In Point

HoneyComms

Laney Honey, located in North Liberty, Indiana, has been beekeeping for almost 30 years. What started as a hobby for the Laney family in the '70s has become a full-time business for Dave, Kay, and Linda. The Laney family has grown their beekeeping business from just a few hives to 18 hives over 40 acres of land.

Laney Honey, located in North Liberty, Indiana, has been beekeeping for almost 30 years. What started as a hobby for the *Laney* family in the '70s has become a full-time business for *Dave*, *Kay*, and *Linda*. The Laney family has grown their beekeeping business from just a few hives to 18 hives over 40 acres of land.

Laney Honey is unpasteurized, unfiltered, and minimally processed to preserve the distinctive flavors, trace minerals, vitamins, and pollen grains found in the honey. The Laney family produces, packages, and distributes their honey to over 300 grocery stores across the country. With 12 distinctive flavors including Blueberry Blossom, Clover, Wild Raspberry, and Orange Blossom, the Laney family needed a fast way to connect with customers and distributors.

To stay connected, Laney Honey turned to ***HughesNe***t®,a service that does not rely on cable or phone wires to deliver affordable broadband service to consumers and small businesses everywhere in the U.S., regardless of geography, at speeds comparable to DSL. The compact antenna needs only to have a clear view of the southern sky.

Sticky Situation

The Internet has changed how all businesses operate, large and small alike. For Laney Honey, processing orders online quickly and efficiently became a key competitive requirement. Linda knew that meant she would need a high-speed Internet connection.

As with many farmers, access to cable or DSL was not an option, since the farm is in a remote location and covers such a large land area. For years, Laney Honey

"If a customer called wanting tracking information for their order, I would have to put them on hold for several minutes while loading the Web site. This was just not a productive way to conduct business."

relied on a slow dial-up connection to conduct business on the farm. "If a customer called and wanted tracking information for their order, I would have to put them on hold for several minutes while loading the web site," said *Linda*. "This was just not a productive way to conduct business." Dial-up slowed down the Laney's honey business.

To avoid using dial-up, Linda would often update the company web site from home, where high-speed access was readily available. "No one ever likes to bring work home, but we really had no option as it was very difficult to update the Web site through the dial-up connection," said *Linda*.

Sweet Satisfaction

"We hadn't heard of satellite Internet until one of our customers — an orchard, also in rural Indiana — mentioned HughesNet to us," said *Linda*. "I can't believe we spent so long on dial-up."

Now that the farm has a high-speed Internet connection — using a compact satellite dish antenna on the roof of a barn — Linda and her family can regularly update their web site with new flavors and photos, maintain shipping information for customers, and capitalize on Internet marketing tactics, such as Google Ad words and Yahoo Engine Optimization.

"It's great to see how modern technology can enhance something as rustic as beekeeping," said Linda. "The possibilities for expansion are endless now that we don't have to waste time waiting for the Internet to load."

The Honey Comb Grows

Laney Honey continues to introduce new flavors of honey every couple of weeks, depending on what's in bloom. Now that the farm is connected through HughesNet, the Laney family doesn't need to worry about bringing work home, as they can conduct all of their daily business right there on the farm. "I am excited about being able to provide my customers with top-notch service and provide them with the honey they love," said *Linda*. "Doing business was a hassle when dealing with the slower connection. This definitely gives us the opportunity to expand our business into new territories, which was not an option on dial-up."

Honey Straws

Honey Varieties

Laney Honey

Giftsets

"It's great to see how a modern technology can enhance something as rustic as beekeeping. The possibilities for expansion are endless now that we don't have to waste time waiting for the Internet to load."

HughesNet offers a full suite of services designed to help businesses such as Laney Honey adapt to the ever-changing marketplace and provides broadband satellite networks and services for large enterprises, governments, small businesses, and consumers.

HughesNet

From The Back Of The Closet To The Convenience Of Your Hip

Similar to satellite TV and satellite radio, mobile satellite communications will soon allow Americans nationwide to enjoy the reach and breadth of satellite services. Although satellite phones have provided an important service to government, enterprise, and some consumer users for years, the recently introduced TerreStar™ GENUS™, (currently available through AT&T) offers a feature-rich approach to satellite communications of the mobile kind.

The ***GENUS*** is an innovative dual-mode smartphone device with cellular wireless capability as the primary default mode and satellite access capability as a secondary option for voice, data and messaging. With just one phone number and one contact list, all on the one device, users with a line of sight to the southern sky where **TerreStar**'s satellite is located, can gain access to expanded voice and data roaming coverage in the United States, Puerto Rico, U.S. Virgin Islands and in territorial waters. The GENUS runs on the *Windows Mobile 6.5* operating system to provide rich features and functionality, including a touch screen, Wi-Fi, Bluetooth®, camera and GPS.

Was bringing satellite to the masses TerreStar's primary objective?

According to *Dennis Matheson*, chief technology officer at TerreStar Networks, the answer is no. "Our primary objective was to provide public safety agencies, first responders and disaster recovery groups with integrated cellular-satellite backup communications capabilities; yet the consumer interest we've seen since the GENUS launch in September 2010 has been a great bonus."

TerreStar's intention was to partner with traditional

wireless operators to bring its mobile satellite service competencies to government, energy, utility, transportation and maritime users, by enabling these audiences to access the TerreStar satellite network when cellular coverage became unavailable. The opportunity to extend the satellite-cellular service beyond this niche group became more relevant when rural-based consumers, outdoor adventure types and general consumer interest in satellite as an 'insurance' policy became a reality.

"The GENUS is the smartest smartphone we've seen in satellite communications, as the device pushes the envelope and satellite communications in new directions across the wireless ecosystem," said *Daniel Longfield*, senior analyst at **Frost & Sullivan**, a research consultancy. "It's lightweight, has the same look-and-feel as a traditional smartphone, is small enough to fit in your pocket, yet offers the combined innovation of satellite and cellular communications – something no other satellite communications company has figured out yet." ***However, is the mass market truly ready for 'the genius of GENUS?'***

Frost & Sullivan believes so. Research conducted within the past few years showed a high interest in 'everywhere' wireless services achieved by adding satellite connectivity into traditional mobile devices. The study explored user interest in a ubiquitous wireless service across a range of prices above a user's existing cellular subscription.

Frost & Sullivan found that for an incremental monthly fee over their current post-paid voice and data plans, 24 percent of the addressable consumer market was interested in an integrated satellite-cellular mobile service. When looking at usage intentions, consumers reported they would most likely use a ubiquitous wireless service on road trips (64 percent) followed by using this service when traveling to remote locations for hiking or other outdoor activities (59 percent).

Insight

"As our society becomes more inter-dependent on mobile devices, having an 'always on,' reliable connection source will be paramount in a user's future mobile service and device purchasing decision," *Longfield* continued. "And although operators continue to build-out more towers to augment current cellular networks, their wireless footprints still do not offer the same level of ubiquitous coverage, failsafe features or capacity management as satellite networks. In fact, cellular network limitations have become satellites, and in particular, TerreStar Networks' opportunities."

Matheson commented further saying, "We have come to an era where the infamous 'dead zone' is nearly non-existent in the U.S. From the most desolate sections of the Grand Canyon and the heart of the black hills of South Dakota to the uppermost regions of Maine to 200 miles off the U.S. coastline, we can deliver wireless communications. Consumers — especially outdoor adventure enthusiasts — are seeing our vision, service and GENUS as the best way to connect during any potential situation. For these cases, the benefit of having a sleek, small cellular-satellite device on their hip remains the reassurance they need to feel connected no matter where they are in the U.S."

TerreStar expects to offer its service to consumers by the end of the year. The **AT&T Satellite Augmented Mobile service** and the **TerreStar GENUS** are available today to Enterprise, Government, and Small Business customers and require standard AT&T cellular voice and smartphone data rate plans, as well as a monthly satellite subscription feature. Usage of the satellite network for voice, data and messaging is not included in the monthly feature charge and is billed as per-minute, per-message or per-megabyte roaming charges.

Mr. Dennis Matheson is responsible for TerreStar's corporate planning and drives the technical direction and delivery for development of the satellite and network systems and handset technologies for TerreStar Networks.

Back on October 19th of 2010, TerreStar Corporation announced that its majority-owned subsidiary TerreStar Networks Inc. and certain other affiliates, had filed voluntary petitions for reorganization under chapter 11 of the U.S. Bankruptcy Code. This was part of a strategic plan to strengthen financial positions and achieve long-term success in the mobile satellite services market. Through the restructuring, TerreStar Networks will lessen its debt obligations in order to place greater focus on delivering the future of 'always available' mobile communications through its recent launch of the world's first integrated satellite-cellular smartphone.

Jeffrey W. Epstein, president and chief executive officer, TerreStar, said, "After careful consideration of all available alternatives, we determined filing chapter 11 was a necessary and prudent step to strengthen our balance sheet and gain financial flexibility in order to access liquidity and position TerreStar Networks as a stronger, healthier company. As part of this initiative, and as a result of receiving our debtor-in-possession financing facility, we will be able to conduct business-as-usual with customers and partners, and ensure the highest customer service is provided throughout the reorganization."

Concurrently with its chapter 11 filing, TerreStar Networks entered into an agreement with EchoStar Corporation, its largest secured creditor, to provide the Company with a $75 million debtor-in-possession financing facility. TerreStar Networks will use the debtor-in-possession financing to maintain business-as-usual operations during the restructuring process. The Company believes its current and anticipated cash resources will be suitable to pay its expenses and maintain its business operations during chapter 11.

In addition to the debtor-in-possession financing facility, TerreStar Networks has also entered into a Restructuring Support Agreement with EchoStar Corporation, under which EchoStar has agreed to support a restructuring premised on a debt for equity conversion by the Debtors' secured noteholders, and backstop a $100 million rights offering that will provide the funding for TerreStar Networks' exit from chapter 11. TerreStar Networks believes that the Restructuring Support Agreement will provide the foundation for an expeditious emergence from chapter 11. All is operating as "business as usual".

27TH NATIONAL SPACE SYMPOSIUM

SPACE FOUNDATION

The Premier Gathering of the Global Space Community

TIME IS RUNNING OUT for SUPER SAVINGS—REGISTER TODAY!

Save up to $500
with Super Early Bird Discount
Special ends January 14, 2011

Featured Panel: CEOs on the Issues

Moderator

Mr. Pacome Revillon
Chief Executive Officer and Managing Director, Euroconsult

Panelists include:

Mr. Matthew J. Desch
Chief Executive Officer
Iridium Communications, Inc.

Mr. David McGlade
Chief Executive Officer
Intelsat

Mr. Jean-Yves Le Gall
Chairman and Chief Executive Officer, Arianespace, Inc.

Mr. Andrew Sukawaty
Chairman and Chief Executive Officer, Inmarsat

"This was an extraordinary event from start to finish."
– 26th National Space Symposium Attendee

April 11 - 14, 2011

The Broadmoor Hotel
Colorado Springs, Colorado

www.NationalSpaceSymposium.org/psm2

Stay Connected

Register Now!

The Importance of Channel Simulation

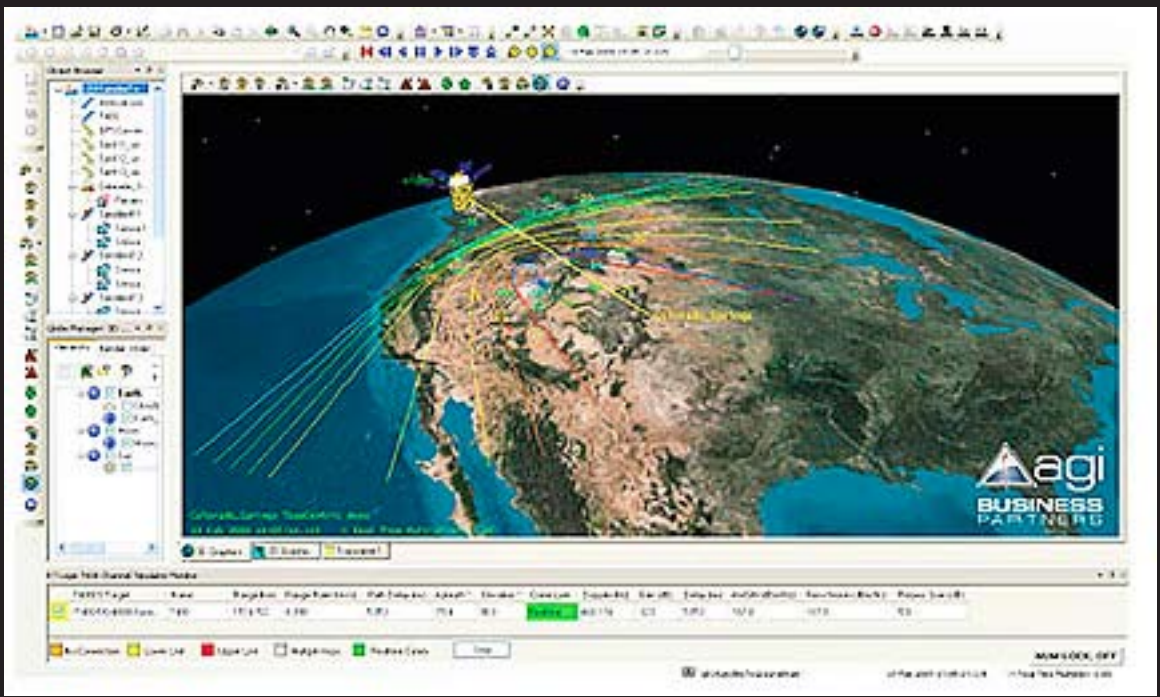
author: Steve Williams, Business Area Manager, RT Logic

Satellite communications (SATCOM), manned and unmanned military and aerial surveillance systems, and strategic and tactical military communications all play critical roles in ensuring our economic and national security. Each of these relies heavily on radio communication links for control, data uplink, data crosslink and data downlink. As such, our skies are jam-packed with radio signals, each of which is increasingly compromised by natural, accidental and intentional interference. This interference threatens the integrity and quality of these links, and therefore the very missions they support.

As a result, we have seen rapid development and deployment of systems that continuously monitor space, atmospheric and terrestrial communication links for signs of interference or channel abuse. These monitoring systems have moved well beyond spectrum analyzers running simple spectral masks that define nominal frequency and amplitude characteristics. Instead, modern interference detection systems employ sophisticated *digital signal processing* (**DSP**) techniques to detect and characterize even the smallest and most transient anomalies. They log results and instantly notify appropriate personnel when unauthorized signals appear, and when critical signal parameters such as **EIRP**, **C/No**, **Es/No**, center frequency, occupied bandwidth and many others are violated.

Above: RT Logic TELEMETRIX 400 Channel Simulator (T400CS)

Below: T400CS client/server software architecture facilitates a wide range of local and remote control options. Local control is provided by an easy-to-use RT Logic Graphical User Interface (GUI).



Often employing multiple remote sensors, today's interference detection systems combine signal data from geographically dispersed fixed and moving locations for enhanced overall situational awareness. Further development of such systems is proceeding rapidly, with key focus on faster detection of a broader range of interference types in wider frequency segments. Reductions in system size, complexity and price are anticipated, along with improved ease-of-use. Tighter integration with related automatic functions such as interference mitigation, traffic re-routing and signal geolocation are also expected.

Addressing the continual need for economic efficiency, many interference detection systems are multi-purposed, and are applicable toward a broad range of operational, training and test requirements. This is achieved in part with integrated hardware channel simulators capable of injecting physics-compliant target and/or interference signals indistinguishable from their real-world counterparts.

As interference detection system capabilities advance, and as automatic avoidance techniques are developed, the physical size of interference detection systems will decrease. This will spawn "built-in" interference detection and mitigation capabilities, rendering communication system receivers, for example, self-aware of interference and capable of taking evasive action without user intervention.

The hardware channel simulator holds a key position, not only within multi-purposed interference detection systems, but specifically in the underlying R&D and test that enables advancements in interference detection and mitigation in the first place. In fact, since channel simulators facilitate comprehensive and accurate RF, IF, digital, firmware and software development and test, they are rapidly becoming commonplace in R&D labs and product manufacturing and test facilities.

Channel simulators create real-world signals in the laboratory by adding dynamic interference to signals, along with nominal and/or worst-case carrier and signal Doppler shift, delay, loss, noise, non-linearity, oscillator drift and phase noise. Multi-path simulation, Ricean and Rayleigh statistical fading, and others are

also considered with full attention to related physics. This results in signals that are precise duplications and predictions of real-world signals. These instruments can add such effects to existing test signals or they can create test signals themselves.

Channel simulators are specifically designed for precise physics modeling of RF signals and channels. As a result, they produce more realistic signals and are less expensive to learn, use and maintain than an assemblage of non-specialized test and measurement equipment controlled by user written, tested and supported software. When channel simulators are coupled with accurate flight dynamics models, antenna radiation patterns, flight vehicle and ground station body masking, terrain and weather, to name a few, testing can assure solid communication system operations even under substantial interference situations.

With channel simulators, designers, testers, students and trainees can work with signals that exactly match those that will be encountered in an actual mission.

Designers can verify receiver interference rejection techniques, tolerance of frequency and data rate changes and the receiver's ability to compensate for large and fast swings in received signal strength.

Test personnel can use channel simulators to present devices with a wide variety of complex and difficult-to-duplicate signals, assuring functionality and performance under the worst of conditions.

Training personnel can use channel simulators to inject signals into operational communication, monitoring and command and control systems, thereby training operators for rapid diagnosis and recognition of interference effects, types and sources. Training continues as operators take appropriate corrective action to maintain viable communication links.

Advances in interference detection and mitigation are vitally important as the dependence on radio communication links increases. The integration of channel simulators into RF interference detection mitigation systems will provide civil government, the military and commercial communications providers with the ability to better predict and react to the effects of interference. In addition, these instruments will play key roles in R&D, test and training activities for all types of communications equipment.

Steve Williams is an RT Logic Business Area Manger, responsible for R&D and business development activities for RT Logic's RF Channel Simulator, Range Test System, UAV/ Target/Missile Test Systems, Spectral Warrior Interference Detection System, and high-rate digitizers. He is a frequent presenter and author on these and related subjects. His 29-year digital and RF instrumentation career has included R&D, management and business positions at RT Logic, Hewlett-Packard, Agilent Technologies and precisionWave Corporation which he co-founded. Steve holds a BSEE from the University of Illinois.

The global leader in consulting & analysis for the satellite industry

With offices in Paris – Montreal – Washington DC

Providing comprehensive research reports, forecasts, and analysis

17th Satellite Communications & Broadcasting Markets Survey

Forecasts to 2019

Preparing for a Showdown

- Analysis of all FSS applications
- Strategic review of satellite operators' business models
- Exclusive forecasts for transponder supply & demand
- Twelve regional profiles

13th Satellites to be Built and Launched by 2019

World Market Survey

- Exclusive 10-year forecasts including breakdown by customer and by orbit
- Review of strategic issues from both supply and demand perspectives
- Analysis of leading actors' performance

Maritime Telecom Solutions by Satellite

NEW TITLE

Global Market Analysis & Forecasts

- Strategic issues & forecasts
- Market dynamics & value chain
- Analysis of addressable maritime market (MSS & VSAT breakdown)

3rd Satellite-Based Earth Observation

Market Prospects to 2019

- Data usage: breakdown by type, demand by sector, forecasts
- Applications: drivers & risks
- Data demand: 10-year regional forecasts
- Current launches & forecasts through 2019

Mobile Satellite Communications Markets Survey

Prospects to 2018

- Strategic issues & forecasts
- Operators & value chain
- Applications & markets
- Market segments: Maritime, Land, Aeronautical

Earth Observation: Defense & Security

NEW TITLE

World Prospects to 2019

- Strategic issues & forecasts
- Supply-side analysis (manufacturing & data)
- Data demand & procurement analysis

For additional reports or more information visit:
www.euroconsult-ec.com or contact **reports@euroconsult-ec.com**

A Case In Point

AtollComms

author: Katia Gryadunova, Marketing + Public Relations, Pactel International

Teletok is the exclusive telecommunications provider in Tokelau. The territory of Tokelau itself is spread among three remotely located atolls, Fakaofo, Nukunonu and Atafu, making the delivery of telecommunications solutions to its residents quite a challenge.

Teletok's communications requirement was to create a redundant Internet path that would allow services to continue despite network outages or major repairs on their existing infrastructure.

Project Brief

In 2010, Teletok appointed Pactel International to design a solution that was capable of delivering high quality data services into all locations of the region. The new platform also had to interconnect to the existing one in the islands to serve as a back-up solution in case of outages or system failures. The system also had to be cost-effective, while being robust enough to withstand the extreme weather conditions and harsh environment of the islands. Voice was added in September 2010 on Fakaofo.

Solution

Pactel International proposed to deliver a complete turnkey solution to Teletok, based on the Ku-band Star Topology VSAT network, using its U.S. backbone to provide dynamic allocation of bandwidth between the three atolls.

Atafu Atoll, Tokelau, Southern Pacific Ocean

Fakaofo atoll

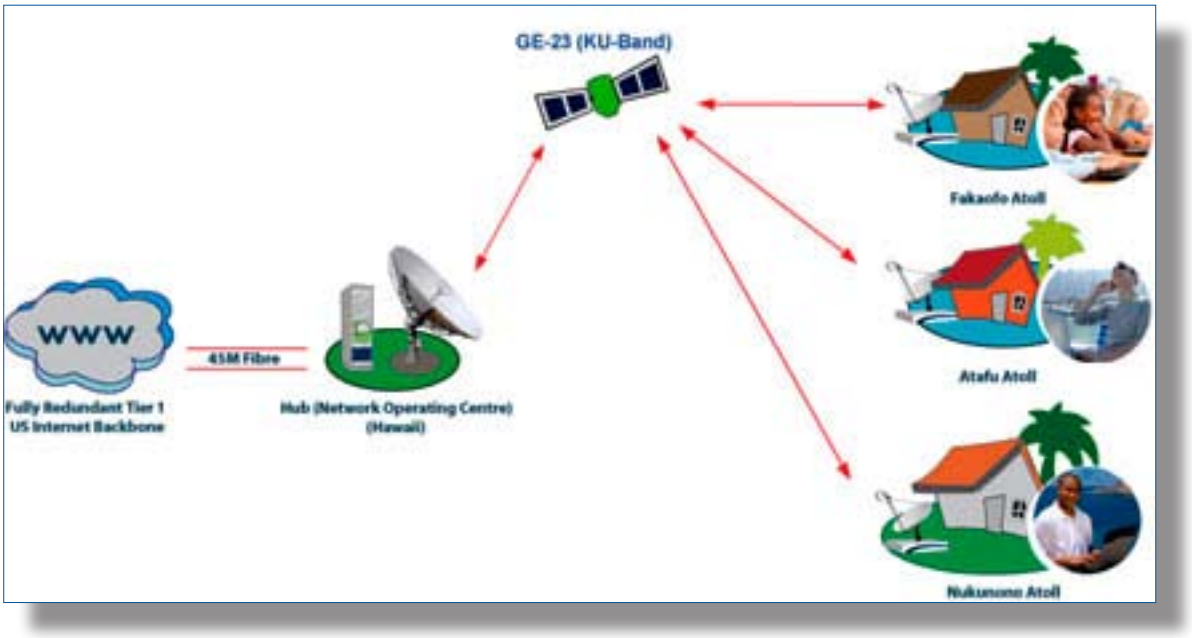
Nukunonu atoll

Benefits the islands' new Ku-band VSAT platform offers:

- ***Size-efficiency (antennas measuring only 1.8M), making it faster to install and easier to deliver***
- ***Low power consumption***
- ***Increased reliability and throughput***
- ***Dynamic allocation of 1024/512 kbits bandwidth between the sites***
- ***Ruggedized design to suit the extreme weather conditions and harsh environment of Tokelau Islands***
- ***24/7 remote network monitoring, thus bringing network outages close to zero***

A Case In Point

- ***Total flexibility of system layout, with the options of placing more terminals and increasing bandwidth in the future***



Pactel's VSAT Ku-band system is directly connected to the U.S. backbone via ***GE-23*** (**172 degrees East**) in Hawaii and provides unprecedented performance and low latency. The system is based on the cutting edge **SHIRON** DVB-S2 ACM ***Intersky*** platform, using the latest modulation techniques to ensure reliability, availability, and throughput. Although mainly targeted at telecommunication providers, Pactel's VSAT system can be customized to suit schools/universities, medical institutions, Internet cafes, home offices and individuals.

Challenges Faced

The design and testing of a new platform proceeded according to schedule — however, as anticipated a number of challenges surfaced, including:

» ***Power**: Power consumption had to be kept as low as possible to reduce power costs, which are naturally high for remote areas such as Tokelau.*

» ***Physical**: The new technology had to cope with extreme weather conditions such as high temperatures, high humidity, and heavy rains.*

» ***Design**: The equipment had to be designed to be simple enough to be installed and operated by a non-technical staff, thereby reducing installation and operation costs.*

Results

Despite the challenges faced, Pactel International has successfully implemented a new rural VSAT system, which is now able to deliver high quality data services on a low-power, cost-efficient platform.

Pactel's expertise assisted in producing a system designed to survive in remote locations under harsh weather conditions. The installed, new technology delivers reliable, weather proof, cost and bandwidth efficient communications, empowering any operator to deliver their services at the highest quality.

"Apart from their reliable and error-free performance, Pactel's terminals are perfectly compatible with our existing system and provide outstanding back-up support during our existing equipment failure or power crisis incidents", said *Tino Vitale*, General Manager of Teletok.

Pactel's equipment is designed to use only one-third as much power as other suppliers. Centralized administration allows for effective network monitoring of the VSAT terminals directly from the Company's Network Operations Centre (NOC). As a result, residents of Tokelau atolls now have access to a low-cost VSAT system, which provides all standard data services, including Internet browsing, telephony and fax over IP, File Transfer Protocol (FTP), Instant Messaging, content filtering and online billing procedures, allowing users to manage their own usage and subscription levels.

"We are planning to expand our relationship with Pactel further to include video conferencing and voice services on the new platform in the near future. We are confident that Pactel will attend to our growing demands in a reliable, timely and cost-efficient manner," Mr. *Vitale* added.

Company website: http://www.pactelint.com/

FREEDOM TO FLOURISH

ISLAND OF INNOVATION

www.

SPACEISLE.COM

THE ISLE OF MAN IN SPACE

Accounting Services · Financial Services · Legal Services · Corporate Services · Satellite Services · Technical Services

Space Data Association · Space Manufacturing · Media Services · Telecoms Services · Orbital Filings · Institute of Space Commerce

Executive Spotlight

Mike Antonovich, Managing Director
Media Solutions, Global Crossing Genesis Solutions

Mike Antonovich is responsible for serving the high-performance, rich-media, video-based needs of the world's major broadcasters, programmers, producers and aggregators of the world's global television and media business. He was named managing director in November of 2010, when the company acquired Genesis Networks, where he had served as the company's president and CEO. Mr. Antonovich brings more than 30 years of broadcast and satellite industry sales, marketing, operations and executive experience to his position.

Global Crossing Data Center

SatMagazine

Mike, would you afford our readers a look into your history in this industry, considering your wealth of experience in the broadcast and satellite environments?

Mike Antonovich

Well, I've been in this business since I was a wet-nosed puppy — that's more than 30 years, working for some of the best people and companies across the whole broadcast and media spectrum. I began as a cameraman at ESPN, moved into master control, audio, TD and most every other production job. The great part about ESPN was you might do all these jobs during the same Sports Center!! What a blast!! I then spent eight years at Group W Satellite doing everything from Earth station operations and microwave maintenance. I even cleared more than my share of seagull poop out of antennas! That was a little less exciting.

At PanAmSat, I did everything from bookings through sales and marketing and played a small part in what was, without a doubt, the most successful satellite company ever. I'm now working in the video fiber business where the great thing is I'm still dealing every day with my customers and friends who I've gotten to know over the past 30 years. Increasingly, more and more of what they need is best delivered inside our fiber network.

SatMagazine

How was Genesis Networks conceived and what role did you play with the Company?

Mike Antonovich

Most of the credit for the launch of Genesis Networks truly belongs to Paul Dujardin and the rest of the Parente/Dujardin team. These guys took it from a simple concept into a truly global 70-city network. Me, I just came along at the right time to help them grow and mature our services and solutions to an even broader set of customers. The really great news is that the core team that built this company is still in place and is as eager as ever to meet the needs of our customers.

SatMagazine

What brought Genesis Networks to the attention of Global Crossing? What prompted the acquisition and what will the merging of technologies and talents bring to Global Crossing?

Mike Antonovich

The purchase of Genesis Networks supports Global Crossing's strategy of investing in emerging areas, deepening penetration into vertical markets, furthering the differentiation of solutions and services, expanding customer relationships, and leveraging the company's global assets to seize new opportunities. Global Crossing was looking for a catalyst for their growth in their managed services businesses like the media and broadcast marketplaces. The acquisition provides Global Crossing opportunities to attract new customers and expand service offerings into vertical markets that require high-performance, rich-media, video-based delivery, such as health care, cinema, music, gaming, government and distance learning.

Genesis had already built the key technologies and relationships with many of the world's leading media companies and was essentially operating at a "retail" level in a business that truly requires a global scope and scale. That's where Global Crossing comes in. We were able to leverage their 700-city network that operates in its essence as an IP backbone that can truly offer a soup to nuts product suite of just about every conceivable service a broadcaster could want: Dedicated point-to-point fiber, managed video services, hosting, store-and-forward applications, etc. We see this powerful combination as a real launching pad for new products and services targeted directly at our television customers.

And let's not forget, the market for these services is growing. Industry research firm Infonetics Research forecasts that worldwide revenue for video services, including IPTV, cable video and satellite video services, will top $250 billion in 2014. In addition, according to the Visual Networking Index (VNI), an industry benchmark report produced by Cisco, 3D and HD Internet video will comprise 46 percent of consumer Internet video traffic by 2014.

SatMagazine

How do you see the future of satellite broadcasting, given the impetus of IPTV, increasing fiber installations, the increasing use of mobile entertainment, and the decrease of cable viewership?

Executive Spotlight

Global Crossing's London Docklands Network Operations Center (NOC)

Mike Antonovich

You're going to see a lot more targeted and niche distribution of content across satellite and the other platforms. Long gone are the days of a single "world feed" of the same content to everybody. Increasingly, what is going to feed these satellite DTH platforms around the world are unique customized streams which may be "central cast" from half-way across the world and delivered on our global fiber network. The truth is, we've been doing this for almost five years now. And the trend is for continued growth.

Mike Antonovich

I think it's premature to call the death of any distribution platform with hundreds of millions of subscribers around the world. I don't think there's going to be less satellite and cable television, simply more and more niche and targeted outlets for programming available on every appliance; available to anyone, anywhere. Who's to say that in five years you don't carry a chip with you that allows you to watch the game in the living room and then to instantly display the same game on the refrigerator when you get up for a beer? Think of the possibilities! The future we see, though, is all based on IP-enabled content to serve as the medium that delivers this content to all these devices and appliances. Global Crossing Genesis Solutions is today one of the only truly global IP video delivery networks and we expect to help listen to and lead this industry to where it's going next.

SatMagazine

What technologies do you see being implemented over the next year or so as far as the primary and secondary businesses are concerned within the satellite broadcasting industry?

SatMagazine

The capacity needs of HDTV are enormous. How will compression technologies play their role in delivering product to consumers without the need of various steps at the DTH end of the link?

Mike Antonovich

Given the bandwidth constraints of all satellite platforms, the evolution of digital video compression has been the single biggest driver of DTH platform growth. Platforms that once could have only carried 24 analog TV channels nowadays carry hundreds of channels in every format from standard definition, high definition and even 3D TV. Advances in compression will soon allow for "4K"-type of truly cinema-quality television to be received directly to DTH subscribers' homes. We've not yet seen the best that satellite TV has to offer.

SatMagazine

Mike, what role will satellite broadcasting play within the 3DTV environment; within the digital cinema market segment?

Mike Antonovich

3D TV is still a niche "experiment." And the jury's still out on just how big a market this will be. Digital cinema is even more complicated and confused at the moment and it may naturally — due to its own bandwidth demands — ultimately require capacity from fiber networks. But for the foreseeable future, a hybrid fiber-satellite model may be what gets the job done.

SatMagazine

What can the industry do to accommodate the future... in other words, how do we entice younger students to consider careers within our industry to ensure companies such as Global Crossing have the talented folk needed in the future for continued growth?

Mike Antonovich

As media platforms continue to develop in ways we hadn't thought about even 10 years ago, what will clearly drive the success of these platforms will be unique and creative content developed especially for the end-user appliance. That is going to require lots of young minds with new ideas who tap into the unquenchable thirst for customized, personalized media experiences. So, we need to give students challenges and opportunities to turn bent-pipe satellite and fiber networking into creative playgrounds of their own. Who knows where the next YouTube or Facebook will come from. We'd like to think that Global Crossing will have the network and the relationships with content and distribution partners to create some of that next-generation media landscape where these kids will want to play.

For more information on Global Crossing, head to...
http://www.globalcrossing.com/

Army Satellite Success With SpaceX

The U.S. Army's first satellite in more than 50 years piggybacked into low Earth orbit Wednesday as part of SpaceX's launch of its two-stage Falcon 9 booster rocket and prototype reusable space capsule, Dragon. About 45 minutes after the 8:43 a.m. CST liftoff, the Army SMDC-ONE (Space and Missile Defense Command - Operational Nanosatellite Effect) nanosatellite deployed from the second stage of the rocket, which also carried other payloads. Ground stations at the Space and Missile Defense Command/ Army Forces Strategic Command headquarters on Redstone Arsenal and at Colorado Springs, Colorado, quickly began receiving data from the satellite about the health of its systems.

"The launch and deployment of the first SMDC-ONE nanosatellites is intended to demonstrate the concept of sending and receiving data from unattended ground sensors using small, low-cost, low Earth orbit satellites," said Lt. Gen. Kevin T. Campbell, commanding general, Army Space and Missile Defense Command. The nanosatellites would be constantly overhead, collecting data from ground sensors and relaying it over the horizon to commanders, according to John London, program manager in the SMDC Technical Center. The nanosatellites can also be used for communications and, if the concept proves feasible, could quickly be configured for other specific missions.

The ultimate goal is to have satellites that cost around $300,000 each and are either secondary payloads aboard other rockets — as in Wednesday's SpaceX launch — or that could be put in orbit virtually on demand by a new class of smaller boosters, the Multipurpose NanoMissile System. Dynetics in Huntsville is already working on MNMS, which has a goal of putting a nanosat in orbit for about $1 million. The team hopes to have a sub-orbital flight test, complete with satellite, in 2011, and an orbital test in 2012.

This is the Army's first satellite development program since the 1960 Courier 1B communications satellite. The SMDC-ONE satellites each weigh less than 10 pounds and are about 14 inches long. In April 2009, SMDC took delivery of eight of the four-kilogram satellites at the end of a one-year contract effort led by Miltec of Huntsville, Pericle Communications Company, of Colorado Springs, Colorado, and Clyde Space Limited of Glasgow, Scotland. Two more of the SMDC-ONE satellites are scheduled for a launch in late 2011. ⓘ

SpaceX Falcon 9 on launch pad at Cape Canaveral AFP, with SMDC-ONE and others aboard

SpaceX Dragon Launches Mystery Payload (Cheese In Space!)

While SpaceX was planning the first civilian launch from the Cape yesterday, rumors were flying about the 'secret' payload on board the Dragon. Twenty-four hours later, the launch was successful — the Dragon cycled twice at speeds of up to 17,000 miles per hour all the while carrying a large round mystery payload that turned out to be — cheese — in a tribute to Monty Python!

Top photo
"Top Secret" payload, bolted to the floor of the Dragon spacecraft.

Bottom photo
The payload — revealed.

Photo Credits:
Chris Thompson, SpaceX

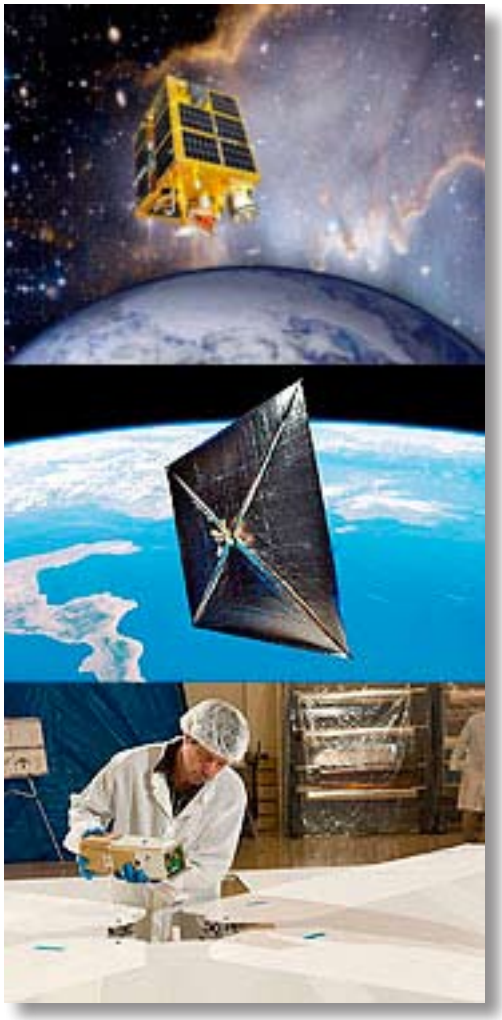
Upon landing successfully in the Pacific Ocean, the Dragon was recovered and... the cheese wheel was found to be in fine condition. Imagine the cheers that went up as the seal was broken and the payload inspected. Guess that's why when they were smiling for the press they said, "Cheese!" No one said space stuff had to be boring... perhaps there were some crackers handed out to the recovery team to go with the cheese? ⓘ

Sail Ho!

On December 6th at 1:31 a.m. EST, NASA, for the first time, successfully ejected a nanosatellite from a free-flying microsatellite. NanoSail-D was successfully ejected from the Fast, Affordable, Science and Technology Satellite, FASTSAT, demonstrating the capability to deploy a small cubesat payload from an autonomous microsatellite in space.

Nanosatellites, or cubesats, are typically launched and deployed from a mechanism called a Poly-PicoSatellite Orbital Deployer (P-POD) that's mounted directly on a launch vehicle. This is the first time NASA has mounted a P-POD on a microsatellite to eject a cubesat. FASTSAT, equipped with six science and technology demonstration payloads, including NanoSail-D, launched Friday, November19th at 8:25 p.m. EST from Kodiak Island, Alaska. During launch, the NanoSail-D flight unit, about the size of a loaf of bread, was stowed inside FASTSAT in a P-POD.

The NanoSail-D flight results will help to mature this technology so it could be used on future large spacecraft missions to aid in de-orbiting space debris created by decommissioned satellites without using valuable mission propellants. After ejection, a timer within NanoSail-D will begin a three day countdown as the satellite orbits the Earth. Once the timer reaches zero, four booms will quickly deploy and the NanoSail-D sail will start to unfold to a 100 square foot polymer sail. Within five seconds the sail fully unfurls. If the deployment is successful, NanoSail-D will stay in low-Earth orbit between 70 and 120 days, depending on atmospheric conditions. NanoSail-D is designed to demonstrate deployment of a compact solar sail boom system that could lead to further development of this alternative solar sail propulsion technology and FASTSAT's ability to eject a nanosatellite from a microsatellite — while avoiding re-contact with the FASTSAT satellite bus.



Top photo
FASTSAT

Middle photo
NanoSail-D cubesat. Image courtesy of NASA

Bottom photo
Doug Huie, research technician at the University of Alabama in Huntsville, carefully sets the NanoSail-D satellite on a specially constructed surface designed for deployment testing. The spacecraft measures 4 inches wide, 4 inches deep and 13 inches long, roughly the size of a loaf of bread, and weighing about 9 pounds.

Photo credit:
NASA/MSFC/D. Higginbotham

NanoSail-D was designed and built by engineers in Huntsville and managed at the Marshall Center with technical and hardware support from NASA's Ames Research Center in Moffett Field, Calif. This experiment is a combined effort between the Space and Missile Defense Command, Von Braun Center for Science and Innovation, both located in Huntsville, Alabama. And NASA's FASTSAT launched on the STP-S26 mission, a joint activity between NASA and the U.S. Department of Defense Space Test Program. The satellite was designed, developed and tested at the Marshall Center in partnership with the Von Braun Center for Science & Innovation and Dynetics Inc. of Huntsville. Dynetics provided key engineering, manufacturing and ground operations support for the new microsatellite — Thirteen Huntsville-area firms, as well as the University of Alabama in Huntsville, were also part of the project team. ⓘ

How To Pack With Aplomb

The Organism/Organic Exposure to Orbital Stresses, or O/OREOS, nanosatellite managed by NASA's Ames Research Center, successfully launched at 5:25 p.m. PST on Friday, November 19th, 2010, from Alaska Aerospace Corporation's Kodiak Launch Complex on Kodiak Island, Alaska.

The O/OREOS chemistry cube contains 24 sample compartments and a spectrometer, all packed into a 10-cm^3 box.

Photo credit
Charlie Friedericks/NASA

O/OREOS rode into orbit aboard a four-stage Air Force Minotaur IV rocket. Also aboard were the Air Force Research Laboratory's Space Test ProgramSat-2 (STPSat-2), NASA's Fast, Affordable, Science and Technology Satellite, or FASTSAT, payload bus which carried the NanoSail-Demonstration (see story in BEAM), NASA's first solar sail, as well as other satellites developed by universities and industry. The goal of the O/OREOS mission is to demonstrate the capability to conduct low-cost astrobiology science experiments on autonomous nanosatellites in space.

Scientists will apply the knowledge they gain from O/OREOS to plan future experiments in the space environment to study how exposure to space changes organic molecules and biology. These experiments will help answer astrobiology's fundamental questions about the origin, evolution and distribution of life in the universe. Approximately 19 minutes after launch, O/OREOS separated from the Minotaur IV rocket and entered low Earth orbit at an altitude of approximately 400 miles. About three hours after launch, amateur radio operator, Marco Bruno, in Torino, Italy received the first signals from O/OREOS.

After a spacecraft checkout period, O/OREOS autonomously initiated the first of two experiments, which will last approximately six months and transmit data for as long as a year. The second experiment will start on Friday, November 26, 2010. Now that O/OREOS is activated and has begun transmitting radio signals to ground control stations at Santa Clara University, the nanosatellite will send mission data to the NASA Mission Management and science teams at Ames for analysis.

The STPSat-2 launch was the STP's 26th small launch vehicle mission. The Air Force Space Command's Space and Missile Systems Center's Space Development and Test Wing at Kirtland AFB, New Mexico, has overall management of the STPSat-2 mission. The Small Spacecraft Division at Ames manages the O/OREOS payload and mission operations with the professional support of staff and students from Santa Clara University, Santa Clara, California, in support of the Astrobiology Small Payloads program under the Planetary Science Division of the Science Mission Directorate at NASA's Headquarters in Washington. ⓘ

Falcon 9 — A Window To The Future

The first Falcon 9 demonstration package launched successfully from Cape Canaveral Air Force Station, Florida, on December 8th at 10:43 a.m., EST, with the Dragon capsule now in orbit. There is true cause for celebration at SpaceX with this successful event, as the first private, commercial space company has launched their product from the Cape. At 8:01 PST, the Dragon capsule separated from its second stage and trunk and performed two Earth orbits, as controllers put the spacecraft through several maneuvers. Dragon then re-entered the atmosphere for a Pacific Ocean splashdown, approximately 500 miles west of the Mexican coast. (*Also see the "Army Satellite Success" and the "Cheese In Space" news item earlier in this news section of SatMagazine.*) ⓘ

Polishing Up The Project

The first flight mirror segment for NASA's James Webb Space Telescope's (JWST) primary mirror has completed its final polishing process, the first of 18 segments that comprise the Observatory's 21 ft. primary mirror.

Northrop Grumman Corporation is leading the design and development effort for the space agency's Goddard Space Flight Center. Performed at Tinsley Laboratories Inc. in Richmond, Calif., the optical fabrication process is one of the longest and most rigorous steps in mirror manufacturing. Each of the 18 primary mirror segments undergoes high precision grinding, aspheric polishing and testing to tolerances as tight as 20 nanometers, or less than a millionth of an inch. Each mirror segment is polished and tested at least 30 times. After each polishing cycle, the mirror segment is cooled to 80K (-315 deg. F) in a liquid nitrogen chamber to test the polishing process, which ensures that when the mirror segment reaches cryogenic temperatures, it will change its shape into the exact optical prescription needed for the mission.

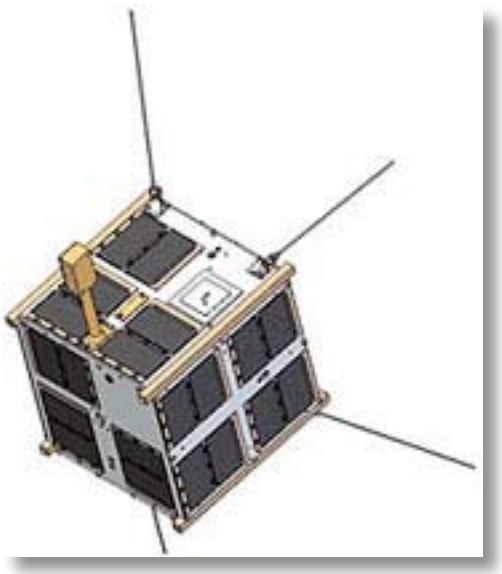
The mirror segment will next be sent to Quantum Coatings, Inc. in Moorestown, N.J., where a thin coat of gold is deposited on the mirror's optical surface

to increase its reflective properties. The layer of gold measures 120 nanometers, a thickness of about a millionth of an inch or 200 times thinner than a human hair. The segment will next be shipped to Ball Aerospace where actuators will be added, and then on to NASA's Marshall Space Flight Center in Huntsville, Ala., for a cryotest at minus 400 degrees Fahrenheit (near absolute zero). The first mirror segment will be closely followed by the remaining 17 segments.

The James Webb Space Telescope is the world's nexgen space observatory and successor to the Hubble Space Telescope. The most powerful space telescope ever built, Webb will observe the most distant objects in the universe, provide images of the very first galaxies ever formed and see unexplored planets around distant stars. The Webb Telescope is a joint project of NASA, the European Space Agency and the Canadian Space Agency. ⓘ

A Brilliant Project

Austria will launch its first satellites into space next year. The satellites will be used to measure variations in the brilliance of stars, a project leader from the Technical University (TU) of Graz announced last week.The two cube-shaped satellites, each measuring 20 centimetres (eight inches) per side and weighing seven kilograms (15 pounds), are part of a joint project with Canada and Poland entitled "BRITE" (Bright Target Explorer).



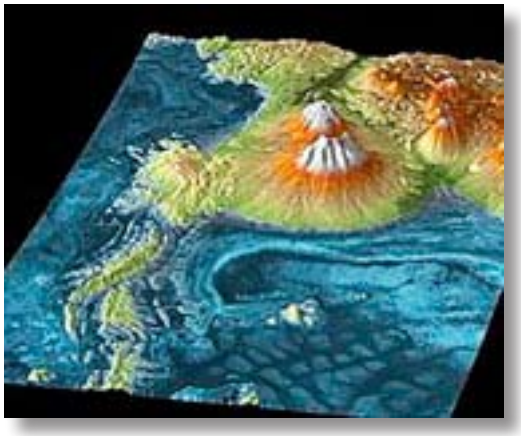
Developed by TU Graz and the Technical University of Vienna, in collaboration with the University of Toronto in Canada, the two mini-satellites will measure the light intensity of stars with more precision than was possible until now. This could help explain how stars are formed and reveal further clues about the history of the universe, he explained. The Austrian satellites will be launched aboard an Indian rocket in late July, although a clear date as not yet been set. Four further satellites — two from Poland and two from Canada — will follow in 2012. Ground control stations in Graz and Vienna, as well as compatible stations in Poland and Canada, will download data from the satellites. The satellites' life expectancy is estimated at two years, but they could survive longer, as well. ⓘ

TanDEM-X' Milestone

TanDEM-X passed another important milestone: the radar mission's test phase has concluded in less than six months according to plan, paving the way for routine operations - the collection of elevation data - in 2011.

The TanDEM-X mission was developed by the German Aerospace Center in collaboration with Astrium, and is operated from DLR Oberpfaffenhofen. The objective of the mission is to create a highly accurate three-dimensional elevation model of Earth's entire surface.

Immediately after it was launched to its 514-kilometre high orbit on 21 June 2010, the satellite was operating nominally, and sent back its first high resolution images after just three and a half days. TanDEM-X was thoroughly tested and calibrated over the following months.



This TanDEM-X image shows Salar de Uyuni, the largest salt flats in the world covering 10,000 square kilometres, located next to the volcanic region of the Atacama Desert. The blue to dark blue areas show the lowest lying parts of the salt flats. A trained eye can see the boundaries of rock deposits in the three-dimensional model. This information about landscape features helps us draw important conclusions about the origins and development of the area. Credit: DLR.

This included the first close formation flight with TerraSAR-X, launched in 2007, during which the two radar satellites flew at a distance of just a few hundred metres from each other. This formation flight made it possible to take simultaneous images of Earth's surface from two different points of view - crucial to the three-dimensional mapping of the entire globe. ⓘ

Double Delivery

Globalstar, Inc. (Nasdaq:GSAT) has taken delivery of two new second-generation satellites from manufacturer Thales Alenia Space.

Globalstar expects to take delivery of four additional satellites in early 2011 and all six satellites will then be shipped to the Baikonur Cosmodrome in Kazakhstan. There, they will undergo preparations and testing for launch using the highly reliable Soyuz launch vehicle. In October, Globalstar successfully launched six new second-generation satellites using the Soyuz.

Globalstar signed a contract with satellite manufacturer Thales Alenia Space in late 2006 for the design, manufacture, and delivery of its 2G constellation satellites. In 2007, Globalstar contracted with launch services provider Arianespace for a total of four launches of six satellites each using the Soyuz. Globalstar plans to integrate the 24 new second-generation satellites with the eight first-generation satellites that were launched in 2007, to form a 32 satellite constellation. The new satellites are designed to support Globalstar's current lineup of voice, Duplex and Simplex data products and services including the Company's lineup of SPOT retail consumer products. ⓘ

Crucial Canberra Communications

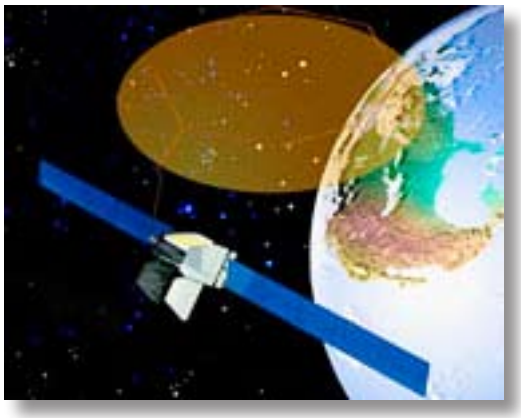
NASA has taken the next step toward a new generation of Deep Space Network antennas.

A $40.7 million contract with General Dynamics SATCOM Technologies, San Jose, California, covers implementation of two additional 34-meter (112-foot) antennas at Canberra, Australia. This is part of Phase I of a plan to eventually retire the network's aging 70-meter-wide (230-foot-wide) antennas. The Deep Space Network (DSN) consists of three communications complexes: in Goldstone, Calif.; Madrid, Spain; and Canberra, Australia.

The 70-meter antennas are more than 40 years old and are showing signs of surface deterioration from constant use. Additional 34-meter antennas are being installed in Canberra in the first phase; subsequent phases will install additional 34-meter antennas in Goldstone and Madrid. The 34-meter beam waveguide antennas are essential to keep communications flowing smoothly as NASA's fleet of spacecraft continues to expand. In addition, the waveguide design of the antennas provides easier access for maintenance and future upgrades, because sensitive electronics are housed in a below-the-ground pedestal equipment room, instead of in the center of the dish. ⓘ

A Delightful Deployment

Boeing has reported that the 22m L-band reflector on the SkyTerra 1 satellite has been successfully deployed. (*link to the SatNews' original news item* regarding



antenna deployment difficulties. All deployment indicators are nominal and Boeing will continue a series of on-orbit check-out procedures over the next several months prior to handing SkyTerra 1 — and the first Space Based Network — over to its LightSquared customer. ⓘ

Payload Signed Up

Thales Alenia Space has signed a contract with Empresa Argentina de Soluciones Satelitales SA, ARSAT, to supply the payload for the second Argentine geostationary telecom satellite ARSAT-2, a part of the SSGAT program (Sistema Satelital Geoestacionario Argentino de Telecomunicaciones).

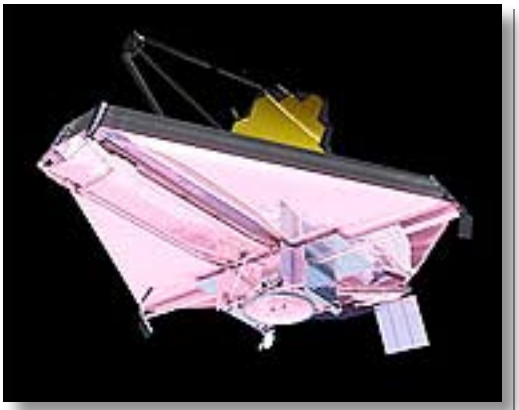
INVAP, the Rio Negro Province high-tech powerhouse located in San Carlos de Bariloche, already involved in the manufacturing of observation satellites, was selected by ARSAT as prime contractor for ARSAT-2. To be fully compatible with the tight schedule of the program, the payload provided by Thales Alenia Space will be integrated, assembled and tested in INVAP facilities before being mated with their platform. ARSAT-2 follows the ARSAT-1 contract signed in September 2009: the Nahuel-1 satellite was already built by Thales Alenia Space.

ARSAT-2 is slated to enter service in 2013, and will be positioned at 81 degrees West. It will provide data, telephone and television transmission services for South and North America. Weighing about 3 tons at launch, it will offer a design life of 15 years. The payload will be fitted with 4 C- and 16 Ku-band transponders and will use 3.4 kW of power. ⓘ

Webb Work

The first completely finished primary mirror segment for NASA's James Webb Space Telescope has passed its final cryotest in the X-ray & Cryogenic Facility at NASA's Marshall Space Flight Center in Huntsville, Alabama.

This last successful cryotest demonstrates that the mirror segment, an engineering development unit and flight spare, has fully demonstrated its ability to meet the needs of the Webb Telescope program. Northrop Grumman Corporation (NYSE:NOC) is leading the Webb Telescope design and development effort for the space agency's Goddard Space Flight Center. Ball Aerospace, Boulder, Colorado, is the principal optical subcontractor for the Webb Telescope program, responsible for developing the telescope optics.



James Webb Space Telescope, image courtesy of Northrop Grumman

The mirror segment was recently coated to maximize its reflectivity in the infrared part of the spectrum. During the final cryotest, the mirror segment is chilled to -415 degrees F and telescope engineers take extremely detailed measurements of how the mirror's shape changes as it cools. Cryotesting verifies that the mirror will change shape into the exact optical prescription needed to accurately image distant stars and galaxies. The primary mirror engineering development unit will be closely followed by 18 primary mirror flight segments. ⓘ

Ahead Of GPS Schedule

The 2nd Space Operations Squadron at Schriever AFB, Colorado, has completed its sustainment software release for the GPS operational control segment ground system ahead of schedule.

The software release, which was scheduled to be complete in early January 2011, was accomplished ahead of schedule on December 8th, thanks to the dedication and teamwork by the Space and Missile Center's GPS Directorate and the 2nd Space Operations Squadron. "The sustainment initiative was transparent to GPS users worldwide," said Col. Harold Martin, chief, Positioning, Navigation and Timing Division, Air Force Space Command Directorate of Requirements.

This sustainment release is part of a larger on-going effort by the Air Force to improve and maintain the current GPS ground system before the next generation GPS control segment is deployed in 2015," added Colonel Martin. "The GPS constellation remains healthy, stable and robust with 31 operational satellites on-orbit providing precise positioning, navigation and timing worldwide, free of direct charges to users." ⓘ

A Proper Grounding

GMV has announced a contract with Orbital Sciences Corporation to provide the ground system for the Azerspace/Africasat-1a satellite.

The Republic of Azerbaijan selected Orbital to build the nation's first commercial communications satellite. GMV will integrate the entire ground system for the Azerspace/Africasat-1a GEO satellite, including the satellite

Azerspace/Africasat-1a satellite, courtesy of Orbital

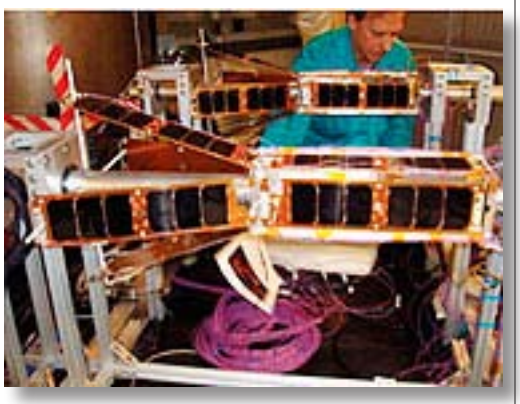
telemetry and telecommand system based upon GMV's product hifly, the flight dynamics system based upon GMV's product focussuite, the payload management systems based upon smartHz, as well as the ground equipment monitoring and control.

GMV will provide two antenna ground stations with satellite control centers in Azerbaijan and one satellite control center in Cyberjaya, Malaysia. With an expected launch in 2012, GMV plans to install the ground system in 2012. ⓘ

Naval Nanos

Launched from Cape Canaveral Air Force Station, December 8, 2010, as secondary payloads on a Space Exploration (SpaceX) Technologies, Inc., Falcon 9 launch vehicle, two NRL Naval Center for Space Technology designed and built nano-satellites have been deployed to evaluate nano-satellites as a platform for experimentation and technology development.

Known as the CubeSat Experiment (QbX), the two 3U (30x10x10 cm) CubeSat buses were built by Pumpkin, Inc., San Francisco, Calif., and provided to the NRL by the National Reconnaissance Office's (NRO's) Colony Program Office. This is the first flight of the Pumpkin-built Colony I spacecraft bus and is being used to evaluate the performance of the vehicle as a platform for experimentation.



Two QbX CubeSats being prepared for TVAC testing at NRL's Spacecraft Checkout Facility.
Credit: U.S. Naval Research Laboratory

Two QbX CubeSats being prepared for TVAC testing at NRL's Spacecraft Checkout Facility. Credit: U.S. Naval Research Laboratory (2010)
Engineers from the NRL Spacecraft Engineering Department are in the checkout phase of the 3U CubeSats, the NRL developed tracking, telemetry and command (TTC) radio is fully functional, providing reliable two-way data transfers and the flight software, ported from previous and ongoing NRL programs to the Pumpkin Colony I processor, is providing an onboard scheduler for routine vehicle control and operation.

The Falcon 9 rocket launches at 10:43 a.m. EST from Cape Canaveral's Complex 40 on the first test flight of NASA's Commercial Orbital Transportation Services project with the Dragon capsule. Credit: SpaceX/Chris Thompson

Spacecraft attitude is controlled by, and operates in, a novel "Space Dart" mode. Due to the low orbit (300km) atmospheric drag provides a stabilization torque that, used with reaction wheels and torque coils, provides stable pointing to within five degrees of Nadir throughout the orbit. The system has been verified on both vehicles and is providing a stable platform for continued experimentation.

The primary payload launched aboard the SpaceX Falcon 9 was the Dragon Module. Developed by SpaceX and sponsored by NASA's Commercial Orbital Transportation Services (COTS) program, the Dragon Module is an initiative to develop private spacecraft to ferry cargo to and from the International Space Station. Flight software, antennas, and the TTC radio were built and integrated by the NRL, as was the developmental communications payload. Environmental testing of the completed package was also performed at NRL. Ground stations on the east and west coasts provide coverage for command loads and data collection. ⓘ

SATELLITE MENA

www.satellitemena.com

YOUR PREMIER SATELLITE PLATFORM

8 - 10 February 2011

Dubai International Convention and Exhibition Centre, UAE

Firmly established as the definitive satellite event for the MENASA region, Satellite MENA continues to expand its reach, both geographically and in terms of the sectors it covers. Satellite MENA encompasses broadcast, telecoms, oil and gas, NGOs and military applications, and features a vast array of leading global companies supplying technology and services to these sectors.

As the pivotal event for the satellite industry in the Middle East, Satellite MENA is the natural choice for any company wishing to target end-users of this technology.

SAVE THE DATE AND BOOK YOUR SPACE NOW!

For more information, please contact us: **Satellite MENA Team**
Dubai World Trade Centre LLC, PO Box 9292, Dubai, UAE
Tel: +971 4 3086077 / 6282 • Fax: +971 4 318 8607 • Email: satellite@dwtc.com • www.satellitemena.com

Organised by

مركز دبي التجاري العالمي
DUBAI WORLD TRADE CENTRE

SATELLITE MENA supported by

Asia Pacific Satellite Communications Council

Global VSAT Forum

Society of Satellite Professionals International

World Trade Association

In conjunction with

CABSAT MENA
www.cabsat.com

Adieu, My Fair Maiden

author: Tony Radford, Vice President of Sales and Marketing at Paradise Datacom

Close your eyes and picture yourself in a tropical paradise taking a leisurely morning stroll along a beautiful stretch of deserted beach. You're immersed in the pristine ambiance of brilliant flora, the soothing warmth of the sun and soft caress of a gentle ocean breeze when all of a sudden you detect the faint whisper of a distant song.

You walk amidst a flock of seagulls fighting over a breakfast buffet of minnows trapped in shallow pools created by the receding tide, but even their noisy chatter can't compete with the serene, but penetrating melody riding gracefully on the air like a colorful bird, stirring your curiosity, beckoning you to come

Your senses afire, you continue your trek as you seek the origin of this aural delight when up ahead in the distance, a mysterious silhouette partially obscured by the mist from the crashing waves begins to take shape.

Soaking wet from the cloud of salty spray, you cautiously make your way along the rocky shore as the enchanting melody aimed directly at your very soul draws you ever closer to the answer you seek, an answer that seems more elusive with every step you take — then as the veil of mist begins to clear, you see her — the embodiment of the best the sea has to offer.

You stand in speechless amazement, gazing upon the epitome of grace, beauty and an appearance so striking that you can't help but be mesmerized, hopelessly imprisoned in the fear that what you see is merely a figment of your imagination.

That which you behold is a sight and sound that has captivated the attention of seafaring mariners for as long as captains have sailed the vast seas in search of that yet known — a captivation so strong that the ocean floor is littered with the shattered remains of vessels that failed to avoid the perils of a jagged shore, instead choosing to focus on nothing more than locating the source of these mystical lyrics sung in such an alluringly angelic tone.

For centuries, the very word "Mermaid" has struck a primal chord in the minds of everyone who possesses an imagination. Countless stories, books, movies and plays based upon this mythical creature have passed from generation to generation showing no signs of diminished popularity.

When I washed up on the Paradise Datacom beach six years ago, the "sea creatures" theme had already been adopted by the new management and thanks to the artistic skills of KC Murphy, a successful ad campaign was well under way. "Success" was proven by statistics pulled directly from the metrics used by mainstream advertisers to convert buyers' behavior into a tangible form — a clear indication that new heights had been reached in capturing the interest of the viewing audience. No surprise, it was a sensible theme. After all, any anecdotal reference needed to propel a SATCOM product into the market like speed, agility, intelligence and flexibility, could easily be analogized with a well-known ocean dweller.

From the fearsomely aggressive power of a Great White Shark, the blinding speed of a dolphin or the majestic aura of a Killer Whale to the strikingly vivid colors of a school of angelfish, attributes aplenty bode so well on the printed page. And since the spectrum of sea-life spans the smallest to the largest of Earth's creatures, the list of available images is as endless as the imagination of the engineers who architect the very products that make all of this necessary.

After working within this theme for several years and having full appreciation for the success our company was receiving, I challenged myself to find a new sea creature, a transcendental image that could push our message into uncharted territory. I wanted an enhancement to our theme that would introduce an even more vibrant tone to the benignly stoic field of satellite communications. But with a legacy of such success, how does one raise the bar even further?

Well hey, no epiphany required here. Anyone who's been alive for more than a week knows that there is but one sea creature that "exists" (albeit in a proverbial sense) that would stand a chance at fulfilling such a mission. Yes, a mermaid. And not just any mermaid, but one that would embody without compromise the very traits that define the enchantress — beauty, grace, agility and form. But how would the market react to a campaign based upon such a genre?

Being a veteran member of the industry, I thought it likely that my own perspective would be shared by my peers who comprise the SATCOM family. If modern day architects of SATCOM systems who must constantly navigate the long list of available products in search of the perfect solution were cut from the same cloth as the ancient mariners who navigated the high seas in search of spices, the fountain of youth

or whatever else would cause you to spend your life living on a wind-powered wooden boat, how could the result be anything other than success?

But in the interest of cultural sensitivity, multi-gender, multi-national focus groups were formed and subjected to the imagery for reaction prior to launch. All feedback was positive.

My second challenge was the internal sell. I would soon learn that espousing such a concept would garner little more than expressions of belief that I had completely disassociated myself from reality, probably appropriate as reality was no place to look for a mermaid. And that brings me to my third challenge. Where does one find a mermaid on 21st century Earth? As a kid growing up in central Florida, my folks used to take me to an attraction in Weeki Wachee famous for the live mermaid shows performed inside a huge aquarium theater. But when I visited their website, I was quick to learn that the mermaids pictured were likely the same ones that performed when I was a pre-teen. Decades of sub-aquatic performances had not done them justice. Scarred from some of the images I witnessed, I pressed on, though my lack of instantaneous luck combined with an incredibly short attention span drove me to toss the challenge to KC.

Months would pass before I would learn that KC had achieved success in his search that ended in a small coastal town of eastern Australia. Still faced with internal resistance, I asked him to create an ad for our satellite modems based on a picture selected from the portfolio we had recently received. It was a gamble that the impact of the ad alone would be sufficient to sway my naysayers from a stance of opposition to one of acceptance. KC in his characteristic style succeeded in bringing to life a mental image that seemed at the time to be shared only by me. The results of his efforts were profound.

“Calling from Paradise” set in the scene of a beautiful mermaid resting on a Bali beach was the first of a series of ads designed to promote modems and amplifiers manufactured by Paradise Datacom. What started as an enhancement of a years’ running campaign became an iconic symbol that would become well recognized through countless ads, banners, booth graphics, posters and even the front covers of two industry magazines. For the next couple of years, “Hannah” would be a treasured member of the Paradise team even if only in JPEG form.

I will return SATCOM to the place it once stood — stark, unimaginative and void of flair. But unlike the many mythical creatures that fade from the spotlight, our mermaid will always hold a position of notoriety at Paradise. The SATCOM community will never forget her thanks to the vast array of images that brandish books, magazines and electronic media, not to mention the hundreds of “Hannah” mouse pads that grace the desks of SATCOM professionals around the world.

So Hannah, I bid farewell and thanks for an act that will be impossible to follow.

Intelsat / GVF Type Approved

- Original designer of patented rolled edge reflector
- Production capacity(≧ 1 Million units per month)
- High performance
- Highly accurate reflector surface(RMS≦0.1mm)
- State of art test equipments and facilities

VSAT Antenna System
DTH Antenna System
Fly Away, Movable Antenna

AZURE•SHINE

AZURE SHINE INTERNATIONAL INC.

No. 1000, Gwang Fu Road, Pa Teh City, Taoyuan, 33455, Taiwan R.O.C.
Http://www.azureshine.com.tw/ E-mail: azure.shine@azureshine.com.tw
Tel: 886-3-3611393 Fax: 886-3-3615877

SatMagazine
Vol. 3, No. 11 — January 2011

Silvano Payne, Publisher + Author
Hartley G. Lesser, Editorial Director
Pattie Lesser, Editor
P.J. Waldt, Associate Editor
J Durfee, Sales Director, Editorial Assistant
Donald McGee, Production Manager
Simon Payne, Development Manager
Chris Forrester, Associate Editor
Richard Dutchik, Contributing Editor
Michael Fleck, Contributing Editor
Alan Gottlieb, Contributing Editor

Authors
Martin Coleman
Chris Forrester
Katia Gryadunova
Greg Jue
Shaun Kenyon
Hartley Lesser
Pattie Lesser
Dennis Matheson
Randa Rellich Milliron
Steve Williams

Published monthly by
Satnews Publishers
800 Siesta Way
Sonoma, CA 95476 USA
Phone: (707) 939-9306
Fax: (707) 838-9235

Advertiser Index