SATELLITE**PRO**

TECHNOLOGY INTELLIGENCE FOR THE SATCOM MARKET

MIDDLE EAST

THE ENERGY PIPELINE
A look at how the oil and gas industry is evolving with the advent of HTS

COMMS TECH AT GITEX
A round-up of the best satellite and communications exhibitors at this year's show

THE FINAL FRONTIER

Virgin Galactic's CEO, George Whitesides, on space tourism and how technology will make satellite launches more economical

To Infinity and Beyond

The dream of the common man going into space is soon going to become a reality, with Virgin Galactic starting commercial operations early next year. Nearly 600 people that have put down a deposit for their flights, and with tickets priced at $250,000 it certainly isn't cheap. However, as the industry matures, space travel will become more economical and eventually millions of people will be able to catch a glimpse of the splendour of space.

There's talk of point-to-point travel too, where Galactic will be able to take travellers across the Atlantic in a matter of a few hours instead of the long air travel times of today, where it's not uncommon to spend a gruelling 16 hours in an aeroplane. It may seem unfathomable at the moment, but at the pace technology is moving at, it will be possible in a few years, affordable in some more, and eventually the most common form of travel, relegating air travel to the same fate that the railways face today.

Satellite launches too will eventually become much cheaper than they are today. With the imminent launch of LauncherOne, Galactic will be able to launch small satellites into orbit at a fraction of the cost of traditional rocket launch systems. As progress waves its magic wand, it might just become the norm to do this with larger payloads too.

This is just the beginning. The journey ahead will be tough, but as long as there are entrepreneurs and like-minded people working towards a common goal, space is the limit.

As always, I'd love to hear your feedback and comments on the magazine. Please send them through to me by email, or call the number in the panel to the left.

Clayton Vallabhan
Editor

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SES sets up base in the ME by opening office in Dubai

>> SES has announced that it is reaffirming its long-term commitment to the region through the opening of a Middle East office in Dubai. The Dubai office comprises an initial core team of employees in the fields of engineering, sales and business development, who in turn are supported on an international level through SES's offices around the world.

SES began operating in the Middle East in 2001, and since then has grown its investment on the ground and in space, with nine satellites serving the region's ever-increasing demand for connectivity. In addition to a growing local presence, in 2014 SES launched the inaugural SES Technical Academy in Dubai, a platform for knowledge transfer bringing the latest industry developments from the United States and

The SES team that will set up base at the Dubai office.

Europe to customers in the Middle East.

"Across many areas of the Middle East, satellite remains one of the most reliable forms of connectivity – and demand for data connectivity continues to grow. The opening of an office in Dubai reaffirms our long-term commitment to the region, enabling us to be closer

physically and to respond instantly to our customers' needs," said Hussein Oteifa, General Manager Middle East at SES. "Additionally, our customers can leverage our global fleet of 54 satellites as well as our extensive product and services portfolio to significantly enhance their presence beyond the region."

+ www.ses.com

THALES TO SUPPLY MILITARY SATCOM TO QATAR

Thales has been awarded a contract to supply Qatar Armed Forces with a military satellite communication system. The ground segment supplied by Thales will provide Qatari ground and naval forces with long-range communications capability to enhance national security and protect vital interests.

Satellite communication systems are an important component of a military force's voice and data communications capability in the theatre of operations. The military satcom network complements existing military radio communications systems. As a consequence, Thales will supply the systems needed to transmit and receive communications via satellite, and to process data on the ground.

The solution is built around Thales's high-performance System 21 technology to provide secure, high-data-rate transmissions. The Network Operations Centre, also provided by Thales, will be used for planning and managing the complete system , which will be operated by the Qatari armed forces.

+ www.thalesgroup.com

FAILED ABS BEAM COULD DRAW INSURANCE CLAIM OF $214 M

It has emerged that the failure of a Russian-directed satellite beam from ABS-2 may result in an insurance claim of nearly $214 million.

According to sources the beam is being affected to varying degrees, and has suffered an unexplainable anomaly. The Russian beam is partially owned by GT Satellite, which signed a booking of a large section of the Russian beam at $125 million in 2011.

ABS-2 operates at 75 degrees East. There have been no official comments on the status of proceedings.

+ www.absatellite.net

YAHSAT OFFERS YAHCLICK PROMOTION IN UGANDA

Yahsat has announced its YahClick satellite broadband internet promotional offer in Uganda for a period of two months. Yahsat is offering a free satellite modem and dish for new YahClick subscribers to selected service plans. as part of its commitment to deliver affordable, reliable, high-speed internet connectivity in Uganda. The offer is available via local YahClick service providers Simbanet and TrulT.

Running until stocks last, this promotion offers subscribers significant savings on equipment costs when signing up to selected YahClick Business or Home service plans in Uganda via YahClick Service Partners.

As part of the promotion, new YahClick subscribers can get a free satellite modem and dish for Business subscription plans for speeds ranging from 3Mbps or higher, or enjoy a $450 discount on equipment for 2Mbps or lower plans. Subscribers to Home 3 Mbps plans or higher will only pay the discounted equipment charge of $269.

+ www.yahsat.ae

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Du achieves 98.9% success rate in transferring home services customers

>> Du has announced a success rate of 98.9% in transferring thousands of existing home services customers onto its new GPON network.

Gigabit Passive Optical Network (GPON) technology enhances du's existing network, making it more efficient and more sustainable with higher bandwidth. The benefit for customers is more bandwidth to meet increasing connectivity requirements, paving the way for faster broadband connectivity and an enhanced customer experience as Dubai's Smart City vision progresses.

To date, du has converted more than 18,000 homes across several areas in Dubai to GPON. In addition to the conversions, du has provided GPON services to 22,000 totally new units. The conversion is conducted with minimum disturbance to customers; on average, apartments will require one visit of no more than one hour, while villas may require one to four visits depending on the readiness of the area.

Saleem AlBlooshi, Executive Vice President – Network Development and Operations, du, said: "We are committed to providing an enhanced customer experience that will allow our customers to reap the most benefits

Saleem AlBlooshi, Executive VP - Network Development and Operations, du.

from Dubai's Smart City future. Seamless, faster broadband will be an essential component of home life, providing essential connectivity to empower customers with the Smart technology that will bring more convenience and happiness into every aspect of life."

+ www.du.ae

EIAST COMPLETES ALL MODULES OF KHALIFASAT'S DESIGN

EIAST has announced the completion of KhalifaSat's design, the first satellite that will be designed and built by Emirati engineers in the UAE. During a meeting of the internal review board, which comprised system engineers, managers and consultants, EIAST's engineers presented their designs on the different modules and sub-systems of KhalifaSat and discussed the different aspects of the satellite's design, concluding the first phase of the project.

EIAST has plans to develop several new technologies to achieve the expectations of the satellite. It further revealed at the meeting that the full engineering model of the satellite and a mock-up mechanical model are expected to be manufactured in the next phase of designs. The manufacturing of the actual flight model of the satellite will follow.

+ www.eiast.ae

IRG EDUCATES STUDENTS ABOUT CAREERS IN THE SATELLITE INDUSTRY

The Satellite Interference Reduction Group (IRG) went back to school to support a project by the Science, Technology, Engineering and Mathematics Network (STEMNET), which creates opportunities to inspire young people in science, technology, engineering and mathematics (STEM), working with thousands of schools, colleges and STEM employers across the UK.

IRG's Executive Director visited the Grange School in Dorset to motivate the pupils about the satellite industry and demonstrate the wealth of career opportunities available.

"It was a great experience to be able to speak to and impassion youngsters about the work we do, especially as they were for the most

Martin Coleman, the Executive Director of IRG.

part unaware of the wealth of opportunities within the satellite industry," commented Martin Coleman, Executive Director of the Satellite Interference Reduction Group.

"Reaching out to young people is extremely important for the satellite industry as a whole and something I am proud to be a part of."

"We are pleased to have Martin on board as one of our STEM Ambassadors," said Jan Peters, Director of Katalytik, who organised the event for STEM Wiltshire and Dorset, part of the STEMNET network.

"Connecting young people with professionals opens their eyes to the options beyond education – it's vitally important and helps to ensure they are better informed about the choices they have."

IRG intends to strengthen its relationship with STEMNET and educational programmes across the globe that help connect the educational dots in the Aerospace domain.

+ www.satirg.org

SkyStream
ADVANCING CONNECTIVITY

Today Sky Stream has established itself as a leading provider of managed and turnkey VSAT solutions across the Middle East, North Africa and South-West Asia for customers engaged in the Marine, Military and Oil and Gas sectors. Sky Stream provides flexible solutions to meet the ever changing demands of its customers, including the design, build and operation of networks. Its state-of-the-art control centre and hubs are complemented by a highly qualified and experienced team of engineers, project managers and customer service personnel.

Extreme conditions call for exceptional connections

Boeing completes testing of airline antenna for Yahsat

Boeing has completed environmental and performance qualification testing on the aircraft satellite communications antenna system it is developing for multipurpose satellite operator Yahsat of the United Arab Emirates. The system has passed customer-witnessed acceptance testing, and its required data transfer rate has been validated in over-the-air satellite tests.

"These milestones complete the qualification efforts for our most advanced aeronautical antenna, leveraging expertise from across Boeing in designing and integrating antenna systems for customer aircraft," said Paul Geery, Vice President for Command, Control and Communications Solutions. "The result is a low-profile SATCOM solution that provides en-route broadband connectivity for many types of aircraft."

Boeing's system offers a solution to military and commercial customers who require an aircraft-qualified, low-profile, low-drag, easily installed antenna to send and receive data between airborne and ground terminals. The system employs steerable phased array technology, meaning the antenna uses electronics rather than mechanical components to track a satellite, even when mounted on moving aircraft.

The Yahsat contract calls for Boeing to deliver the first of eight low-profile antenna systems later this year for installation on various aircraft.

Boeing designed and qualified the antenna system in Kent, Washington. Final assembly and testing will be performed at the company's El Paso, Texas site. The system will be offered to additional customers whose aircraft require low-profile, low-drag, agile satellite antenna systems.

+ **www.yahsat.ae**

+ **www.boeing.com**

EUTELSAT AND ORANGE SIGN MULTI-YEAR CAPACITY DEAL

Eutelsat and Orange have concluded a multi-year agreement for C-band capacity on the EUTELSAT 3B satellite, broadening Orange's satellite capabilities across Africa.

The capacity will support a fast response to enterprises by Orange Business Services for communications anytime, anywhere, as well as serve Orange's own internal requirements.

The new resources complement C-band transponders already leased by Orange Business Services on the EUTELSAT 5 West A and EUTELSAT 10A satellites. The additional capacity will notably benefit enterprises operating in Africa who need reliable VSAT connectivity between geographically dispersed offices, including offshore sites.

+ **www.eutelsat.com**

INMARSAT'S L-TAC ENABLES MILITARY COMMUNICATIONS

Inmarsat is expanding the availability of mobile tactical Beyond-Line-of-Sight (BLOS) communications to actively deployed US and coalition forces through the capabilities of its Inmarsat-4 satellite constellation. The company's innovative L-band Tactical Satellite (L-TAC) service delivers a highly resilient "Ultra High Frequency [UHF]-like" tactical satellite capability to existing military and commercial radios used by the US government.

L-TAC has been used in the Middle East, Europe and Africa. It uses the spectrum resources of the Inmarsat-4 constellation to seamlessly augment UHF capacity on military satellites, and fully enables interoperable SATCOM using existing radios, waveforms and cryptography.

Besides adding much needed channels where UHF SATCOM is restricted, degraded or unavailable, L-TAC can also be used with very small antennas. This allows the service to support secure BLOS Push-to-Talk voice and data networks for both encrypted and non-encrypted terminals, whether man-portable or installed in vehicles, helicopters, ships or other mobile platforms.

+ **www.inmarsat.com**

ELCOME IMPLEMENTS MICROSOFT DYNAMICS CRM 2013

Elcome International, one of the world's leading turnkey marine solutions provider for navigation, communication, electrical and safety systems, has implemented Microsoft Dynamics CRM 2013 Online. Elcome International is one of the first customers to adopt Dynamics CRM Online in the region.

The new Microsoft Dynamics CRM solution will automate the sales process, customer service and key performance indicators (KPI) to make a great impact in the workforce.

The project, implemented by Metadata Technologies using Microsoft Dynamics CRM 2013, aims to bring in best practices across sales and customer service. This in turn will allow the Elcome team to streamline their workflow, resulting in improved customer service, faster turnaround times and greater visibility of their business pipeline.

CRM solutions are gaining momentum in the region, with more and more organisations seeking ways to implement profitable customer retention and prospect conversion strategies.

+ **elcome.com**

Extend Your Reach
Around The Globe.

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for the Middle East, Asia and Africa.

HorizonSat is recognized as a key provider of satellite communications services in the Middle East, Asia and Africa. Supporting institutional clients in the fields of Telecommunications, Broadband, Corporate Internet and Broadcasting, HorizonSat attributes its success to its dedication in implementing solutions that leverage the latest satellite technologies and support through its 24/7 NOC.

To serve our clients more effectively, we have enhanced our service through our state-of-the-art teleport, Horizon Teleports, strategically located in Munich, Germany covering a look angle from 55 degrees West to 78 degrees East.

Horizon will continue to work closely with its customers, focusing on their objectives and creating solutions that ensure continued success in their mission critical applications.

At the time of going to press, we learnt of the tragic crash of Virgin Galactic's SpaceShipTwo.

Virgin Galactic's partner Scaled Composites conducted a powered test flight of SpaceShipTwo on October 31. During the test, the vehicle suffered a serious anomaly resulting in the loss of the vehicle and the death of one of the pilots.

In a press statement released by Virgin Galactic, George Whitesides, CEO of the company said: "Our primary thoughts at this moment are with the crew and family, and we're doing everything we can for them now. I'd like to recognise the work of the first responders who we work with in the Antelope Valley for their efforts on behalf of the team. We're also thinking of the team members that we have at the companies that have been working on this programme.

"Space is hard and today was a tough day… The future rests in many ways on hard days like this, but we believe we owe it to the team that has been working so hard on this endeavour, to understand this and to move forward."

This story also pays tribute to all the lives lost in the endeavour to make space flights a reality for mankind.

The Final

Frontier

With space tourism rapidly garnering quite a fan base, *Clayton Vallabhan* speaks with George Whitesides, CEO of Virgin Galactic, on how the company will take the first visitors into space and what this means for the future of space tourism, point-to-point transportation and more economical small satellite launches

As a generation that grew up watching the iconic Star Trek, where Captain Kirk and Commander Spock commandeered the USS Enterprise into strange worlds light years away from our own, it is only natural for us to want that to someday become a reality. Fortunately, not only did the chunky tablets they used become the iPads of today, but Virgin Galactic has made that dream of being on the Starship Enterprise into a reality in our lifetime. The company intends to begin commercial operations within a few months, the first to take the common man on a trip to space. The very first space tourists, if you will. With this stellar first step, the future indeed seems limitless.

George Whitesides, President and CEO of Virgin Galactic, says he has always been interested in space and had a burning desire to go there. This is probably why he pursued a career with NASA, where he eventually became Chief of Staff. Whitesides first became aware of Galactic during its early beginnings, when his wife put down a deposit on two tickets to become some of the first customers to fly into space with them. Little did he know that life would take him on to head that very company.

"I always felt, and I still do now, that if there's anyone that can pull this off it has to be Richard Branson and also Aabar Investments of Abu Dhabi, UAE. The combination of those two is a very formidable team. They have the resources, the brand experience, the marketing expertise and the operational know-how of Virgin Group. Moreover just the idea that this is a hard thing to do, and knowing this will be the team that can do it, made me decide to come over," says Whitesides.

He anticipates that Virgin Galactic will go into space around the end of the year, and then go into commercial operations as soon as it can after that. "We are still in testing and the primary concern is safety; and if that means we need to check something or fix something, then we will do that before we go on to the next flight test milestone."

"We have a three-part business model. The first is to fly people into space, using our SpaceShipTwo vehicle; the second is to fly science experiments into space, again using our SpaceShipTwo vehicle; and the third is to orbit small satellites into space, using our

WhiteKnightTwo and SpaceShipTwo in flight.

LauncherOne launch vehicle. We think of these as a distinct but related market, and each a good market in itself."

Virgin Galactic is dedicated to dramatically reducing the price of getting to space. With Launcher One, the company is building and will operate a new vehicle designed to give satellite operators a radically better option for carrying their small satellites into orbit. By using much of the same infrastructure originally created to support SpaceShipTwo — in particular, the high-performance mothership, the WhiteKnightTwo — it can keep prices low while accommodating customer needs for launch availability and flexibility. It's a winning combination, and Virgin is thrilled to bring it to market.

At its heart, LauncherOne is a two-stage rocket that will be flown to an altitude of 50,000 feet with carrier aircraft. It will then

be released and ignite its rocket, taking it into space. LauncherOne is designed for the small satellite segment, on the order of 250kg.

Whitesides says: "We really think that the movement to smaller and more compact form factors, while still having substantial capability, will be a big trend over the next ten years in the world of satellite. Whether it's communications, remote sensing, weather and all other different applications. LauncherOne will be really well suited to that application and we think it's going to become a very big part of our overall business base.

"What we've done so far is sign letters of intent with deposits with various entities. They are great companies that have expressed a strong desire to fly with us, and we're now starting to talk to them about contracts, because we are hoping to do our first commercial launch in 2016."

Sir Richard Branson "high tens" with SpaceShipTwo test pilot Mark "Forger" Stucky following the successful first powered flight of SpaceShipTwo.

SpaceShipTwo is designed to hold eight people – two pilots and six passengers. Whitesides says different customers can choose different seating loads or different seating arrangements. SpaceShipTwo is built with an all carbon-composite air-frame that uses a rocket motor to blast off into space. The vehicle is 60 feet long with a 90-inch diameter cabin, similar in size to a Falcon 900 executive jet, albeit with no floor dissecting the cabin, thus allowing maximum room for space tourists to float in zero gravity. Each passenger also gets two dedicated large windows – one side window and one overhead.

The vehicle is air-launched. A carrier aircraft, WhiteKnightTwo, which uses traditional aircraft technology, takes the vehicle up to approximately 50,000 feet, and then the vehicle is released. At this point, the rocket motor turns on and the ship goes up into space.

"We utilise direct communication between the ground and the spaceship for our telemetry and communications. We currently don't have a spaceship to space link as that's not required. What we do have is an antenna that is very similar to that which would be normally be used for communications with a satellite. We

use this antenna to communicate with the spaceship and stream telemetry while it's in space. We also use GPS and other forms of inertial navigation to guide the vehicle and to get a sense of the guidance profile and trajectory.

"A lot of what we're doing has never been done before, but we're building on technology in vehicles that have accomplished this goal. More specifically, it takes cues from SpaceShipOne, which was the first private spaceship to do a sub-orbital trajectory in 2004. It won the X-Prize award, and that vehicle was important because it demonstrated to us that a relatively small team could carry off a successful space programme. It's this same team that we contracted to execute the SpaceShipTwo programme," says Whitesides.

Scaled Composites built the first set of SpaceShipTwo vehicles for Virgin Galactic, as well as the SpaceShipOne vehicles. The company is a well-known aerospace designer and builder in the United States, owned by Northrop Grumman and based in Mojave, California.

Virgin Galactic has also set up its own manufacturing operation in Mojave, The Spaceship Company. The facility is designed

to build additional copies of the first set of vehicles delivered by Scaled Composites. According to Whitesides, the facility is half-done with building the second spaceship, and has made progress on the second carrier aircraft too, thus soon creating a fleet of two sets of vehicles.

"The challenges are, as you would imagine, properly building and testing the vehicle, designing it and designing the rocket motor properly. All of these things have not been easy, but what I think is exciting is that we're nearly at the end of the test flight programme. A lot of work has happened over the past years, but we're through a vast majority of the toughest parts now, and we're spending a lot of time trying to think about how we can deliver our commercial service."

When quizzed about how space tourism will impact the people who experience the magnificence of space and get to look down on their planet from above, Whitesides says it will change them forever.

"It has been scientifically documented that people who go into space come back with a changed perspective on the world, humanity and what they want to do with the rest of their life. Now that does not happen to every single person, but it does for a strong majority of people. This has been dubbed the 'overview effect', which is this process people experience when they go into space and have this transformative moment, where for the first time they look down on their planet from the outside. It's a profound experience, according to the astronauts who have gone through it.

"We think that, interestingly, many of the biggest problems facing humanity today are planetary in scale. That is to say they are not specific to one neighbourhood, city or even one country. They are problems that we all must face together. So we think that by having dozens, hundreds and eventually thousands of people go through that planetary shift, it will be important to the future of the world as they come back to Earth and share with their friends, and leaders in their communities. That will have a profound impact on the world. This is a very philosophical or altruistic view. I would say on another level, with a pragmatic view, the technologies that we will be demonstrating are many of the technologies that could be used for very high speed, point-to-point travel

on the Earth's surface, around the Earth. That will also have a very different but also profound impact on the world, where you can get from one side of the planet to another, within a few hours," explains Whitesides.

Challenges of Space Tourism
Whitesides says the number one challenge "is that we're putting people through a high-

"It has been scientifically documented that people who go into space, come back with a changed perspective on the world, humanity and what they want to do with the rest of their life"

GEORGE WHITESIDES, CEO of Virgin Galactic

energy trajectory and so we have to ensure that the vehicle itself is as safe as possible. Also important is that we will be putting a different kind of person through that trajectory. Historically, only astronauts and test pilots have gone through that kind of experience, and so what we're doing is taking a lot of effort with our medical staff and our training staff to make sure that the people who are going along on that experience will be able to experience space both safely and enjoyably."

Virgin Galactic has put some of its customers through a simulated space flight experience where they encounter a high-G environment in a centrifuge. Findings showed that the vast majority of people are healthy enough to go into space.

"More than 95% of people seem to be fine to go through this trajectory. Really, it's only people with really serious health problems who probably shouldn't be doing much of anything, that would have issues. The vast majority of people can do this, and do it safely. We now have a lot of evidence towards that from our testing programme," says Whitesides.

The next biggest challenge is to make sure that customers are properly prepared for the flight, and so that entails not just higher G loads, but also micro-gravity flights where they experience the pace of weightlessness. This allows customers to get a sense of what it's like and how to move around in a weightless environment.

"We also want to give them the kind of sensation of the kind of flight trajectory they will be on. We want to put them in a simulator so that they can understand how the flight goes. We also want to teach them about the vehicles so that they know basic procedures, entrance and exit, etc. Most importantly, we want them to be trained so that as they go through their space experience and when they actually are in space, they're really getting the most that they can out of it. I think that's crucial because what we want is for people to feel ready, so when they get there they are really able to soak it in, and have the most retention from their experience," adds Whitesides.

Every customer flying with Virgin Galactic will have to go through three days of training when they arrive at the spaceport in New Mexico – that's when the company will make sure that every customer has all the prerequisites for flight. They also offer optional extra training to customers before they come to the spaceport.

A flight into space on Virgin Galactic costs $250,000. A tidy sum for most people, but Whitesides explains that Virgin Galactic is actually quite economical.

"When Virgin Galactic was announced, and as is the case today, there's no other space product in a comparable price range. Our current product is $250,000 and even though

Virgin Galactic's SpaceShipTwo under rocket power.

it is a lot of money, it's a radically low price for a flight to space. The only other way to buy a flight to space is through the Russians, and currently they charge NASA about $70 million per seat on board the Soyuz vehicle to fly to space. When you think of that compared to $250,000, you're talking about a factor of almost 300. It's a huge difference. We're not just bringing down the price of space flight by a factor of two or 10, it's 300 times cheaper."

The company's maiden commercial flight will have Richard Branson on board, along with some of his family members. Whitesides describes the imminent flight as "a remarkable and historic event".

The trickiest part of returning to Earth is usually re-entry. Memories are still fresh of the disastrous burn-up of space shuttle Columbia during re-entry in 2003. How can Virgin Galactic assure its customers that they don't face a similar fate? Whitesides quells these fears by explaining how SpaceShipTwo will be nowhere near those speeds, and how it has a trick or two up its sleeve with stable aerodynamics.

"We are using a patented re-entry design that we believe dramatically de-risks re-entry, or less than what it has been in the past. First of all we're going slower, using a patented mechanism called the 'feather', in which the

rear wings of the vehicle fold up to a 60-degree angle, and what that does is it configures the vehicle in a stable aerodynamic form, so that it can only re-enter in that direction.

"If you've ever played the game of badminton, once you hit the shuttlecock it always comes downwards with the rubber ball facing down, and the feathers up. The reason for that is that it's a stable aerodynamic configuration, and this is remarkable similar to what we're talking about with the vehicle, which has stable configurations. The vehicle will always re-enter bottom-down, and it will always have a much more stable re-entry than potentially other vehicles, with a trickier trajectory," says Whitesides.

The Future
Virgin Galactic currently employs about 400 staff from all over the world. The vast majority are US citizens, but there are also personnel from Australia, the UK, New Zealand and elsewhere. Whitesides explains that Virgin Galactic relies on personnel from space agencies and the US military. It also hires staff from the civil aviation community, on both the operator and manufacturing sides. Where necessary it has also brought in experience from outside the aerospace world. Some of the people working on the seats have worked

in the automotive environment. "We've used some of the knowledge they've built up in their lives to apply to some of the challenges we are working on with the customer seats. We have a very diverse talent pool at Virgin Galactic."

Speaking about the Middle East, Whitesides says: "The region is a very important aspect for our company, most of all because of our partnership with our shareholder Aabar. Aabar has been a strong partner, not just in the shareholding sense, but also contributing good information to how we run the company, and operations. I've gotten to know Abu Dhabi and the UAE because of my frequent journeys over there, and I think we look forward to how we can some day bring the vehicles to that part of the world, which I think would be a very exciting and invigorating thing for the region."

In conclusion, Whitesides says: "I think what we have next on our plate is just to execute our current business plan, which is beginning commercial operations for SpaceShip and LauncherOne. However, once we've done that it opens up a realm of even more exciting areas, including point-to-point transportation and other possibilities, all of which we would love to do. We need to get started, and that's what we're going to do soon, then I think there'll be a universe of possibilities for the future." PRO

The Energy Pipeline

The oil and gas industry is highly reliant on satellite communications for everything from high-speed internet to video-conferencing, and even mission-critical applications like telemedicine. *SatellitePro ME* takes a look at how the industry is evolving with the advent of HTS and increasing demand for high quality connections at lower costs

Satellite is of upmost importance when it comes to the oil and gas industry. Reliable connectivity delivered via satellite is used to provide everything from high-speed broadband to real-time monitoring and video conferencing, allowing crew aboard oil and gas drilling rigs to communicate with colleagues at headquarters or friends and family back home from the middle of the North Sea.

Simon Gatty Saunt, Regional VP, Europe, Data and Mobility Services at SES, says: "Not only has satellite managed to keep crew morale high, it also enables instant access to corporate head offices, hence driving efficiencies and streamlining operations across the oil and gas industry.

"With oil and gas explorations taking place in increasingly harsh and remote environments, effective health and safety measures supported by reliable data and voice communications have never been more important. For example, CCTVs are placed all around the oil rigs to identify and monitor the situation and crew on board."

Expanding on this, Mike Korotinsky, Director of Resources, Inmarsat, says: "Oil companies, drilling contractors and oil field services companies rely on satellite communications to improve operational efficiencies, real-time decision making, safety, security and crew welfare. From exploration to drilling to completion, reliable communications is still difficult to find at so many locations around the world, which is why satellite communications is so important to the industry."

Satellite communications supports simultaneous voice, video, machine-to-machine (M2M) and broadband data applications in some of the harshest environments around the world. Operationally, voice calling is one of the most critical applications to support, along with corporate network access, video conferencing and live streaming video to enhance real-time decision making, safety and security. Data logging, file transfer and intranet applications must also be supported, while crew calling and internet access enhance crew welfare and retention.

With the advent of high throughput satellites (HTS), things in the industry are getting ready for change. HTS are communications satellites that provide at least twice (though usually 20 times or more) the total throughput of a traditional satellite, for the same amount of allocated orbital spectrum.

According to James Collett, Director, Mobility Services Product Management at Intelsat, as communications requirements continue to increase, HTS will provide the capacity that enables new, innovative applications that increase the efficiency of site operations. "This connectivity continues to grow in importance as the amount of data being exchanged between remote sites and headquarters increases and operations have expanded to more harsh, distant and isolated areas," he says.

Another perspective on HTS comes from Fahad Kahoor, Director of Market Development for Energy, Thuraya. He says: "There is much higher bandwidth, though with additional cost and complexity. However, companies are cautious about making new investments and remain focused on cost management. The challenge is to provide satellite communications in a cost-effective way, with a pricing plan that fits their needs, either as a primary channel or a back-up. What that means for us is an opportunity to provide a cost-effective, high quality service that appeals to oil and gas companies' operational applications and crew calling, with price packages that are competitive compared to other satellite operators."

Satellite is also used to support mission critical applications. Collet says: "Satellite being used for bandwidth-hungry

> **"With oil and gas explorations taking place in increasingly harsh and remote environments, effective health and safety measures supported by reliable data and voice communications have never been more important"**
> Simon Gatty Saunt, Regional VP, Europe, Data and Mobility services at SES

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applications – such as geological data gathering, remote monitoring, data transfer to headquarters and crew safety – is helping make operations on the rig more efficient and profitable. These enhanced services require reliable broadband connectivity to deliver their return. For example, the slightest interruption could mean delays in production and suspensions in operations.

"When the average rig rents for $500,000-750,000 per day, connectivity must be reliable and ensure minimal downtime, and satellite, where 99.999% reliability is the norm, is the one technology that is able to deliver that. As we look ahead, we expect the demands of energy companies to grow in scope and sophistication. High throughput satellites such as Intelsat Epic are designed to meet the growing bandwidth demands as well as provide the support for new applications that will satisfy long-term business objectives," explains Collett.

Kortinsky says that multiple satellite technologies are integrated to provide an extra level of resilience and traffic load balancing for mission-critical applications. Ku-band or Ka-band systems are commonly integrated with L-band to provide an extra level of network availability and redundancy. Offshore, integrated C-band

> ## "Oil companies, drilling contractors and oilfield services companies rely on satellite communications to improve operational efficiencies, real-time decision making, safety, security, and crew welfare"
>
> MIKE KOROTINSKY, Director of Resources, Inmarsat

and Ka-band systems can offer high throughput and higher availability in a cost-effective package on a global scale.

Telemedicine is another mission-critical application that has benefited from the use of satellite.

"When it comes to offshore telemedicine needs, doctors need to be able to provide timely consultation and first aid support. For example, if a team member is injured and needs to be hospitalised, it is critical to get help immediately. Satellite communication can enable this, using a telemedicine solution. It allows the company to set up a call with a doctor who is thousands of miles away from to obtain medical consultation.

With the telemedicine solution, the doctor will have access to the patient's medical records. If further evaluation is needed, a decision can be made immediately," says Kahoor.

The popularity of smart phones, tablets and laptops has led to the crew's need to be connected even at the most remote location. Companies aiming to boost crew welfare deliver services such as high-speed broadband, video conferencing and video-streaming so the crew can remain connected to their friends and family back home, and to the world.

Saunt says: "As the relentless search for oil and gas reserves at the bottom of the

MISSION-CRITICAL APPLICATIONS THAT SATELLITE PROVIDES ON OIL RIGS

Fahad Kahoor, Director of Market Development for Energy, Thuraya

• **Network and service reliability regardless of location.** Service reliability is the primary requirement for successful operations. Companies today need to consider private radio, GSM and mobile satellite solutions as part of their overall communications infrastructure. MSS solutions have the resilience to act as a backup for terrestrial solutions. For geographically remote locations not served by terrestrial networks, oil and gas companies can leverage the strength and capacity of L-band networks to enjoy uninterrupted connectivity, even under adverse weather conditions.

• **Enhanced security.** Security and pipeline monitoring applications are a growing

concern in the energy sector, particularly in the Middle East. To address this, M2M applications can be leveraged for video surveillance, to prevent tampering with systems as well as monitor operations in areas which are not easily accessible. Deployment of VPN via mobile satellite solutions such as IP broadband terminals provides an additional layer of secure and reliable, end-to-end connectivity over public or private communication networks.

• **24/7 monitoring.** Real-time measurement of how operations are run 24/7 for upstream and midstream including well-head monitoring is highly critical. Oil and gas companies need to be

appraised of the status of oil production at any time to adjust production capacity where needed. In emergencies, real-time monitoring and reporting is vital in keeping operations smooth and identifying causes and factors when things go awry. This enables companies to monitor, diagnose and maintain the operation of their assets, even in the most hazardous environments.

• **Remote access enables oil and gas companies to obtain information or resolve any issues at any point in their operational supply chain, when needed.** It also helps companies streamline and automate their processes to save costs over the long term.

sea continues, exploration vessels need to remain connected even as they move from one region to another. This has led satellite operators such as SES to design specific mobility beams such as those of the SES-6 covering the shipping lanes of the North Atlantic, AMC-21 covering the Gulf of Mexico and the upcoming SES-9 covering the Indian Ocean."

Fuelled by a booming population that is set to consume even more energy, some SES customers are now exploring for oil and gas in inhospitable environments such as Greenland, the Barents Sea and Siberia, all using connectivity provided by SES satellites covering these regions, according to Saunt.

Another trend is the impact of satellite technology on the M2M market. Kahoor says: "The landscape for oil and gas companies has evolved to a point where M2M applications

are now used to optimise operations, from asset tracking, to communicating remotely with systems all over the globe, to running 24-hour monitoring schedules, while enduring both natural elements and influence from unexpected factors. The promise of efficiency driven by M2M systems combined with satellite technology is even more significant. It impacts the optimisation of processes, enables higher production capacity, enhances security and also helps establish redundancy."

So what are the challenges faced by the oil and gas industry, and how can they be resolved?

Saunt says: "Not only do the companies have to find the right equipment to withstand the harsh conditions, they find themselves having to implement environment, health and safety measures

effectively to ensure their smooth business operations. Much of the challenges can be resolved with reliable satellite connectivity, which can assist in real-time monitoring of the oil and gas platforms. In areas where automation is possible, satellite is also the key to ensuring the team works remotely to control the work process out on the platforms."

Collett thinks the most common challenge for customers is making an investment in network technology that can satisfy their communications needs today and 10 years from now, by leveraging hardware investments as long as possible.

He says: "Rapid technology advancement and new applications create a challenge for customers to maintain access to bandwidth that can flex as requirements change. As demands keep increasing, customers are facing the challenge of making network choices that will allow them to adapt and expand to meet future requirements without significant increases in capex and opex. Intelsat Epic is designed to provide value for our customers and their end users. Our open architecture approach provides great flexibility, with service providers controlling system elements. When open architecture is combined with our backwards-compatible design, oil and gas companies can incorporate high throughput capacity into their operations without having to replace existing network hardware.

"This delivers improvements in throughput and cost-per-bit while leveraging current network investments, and leads to lower total cost of ownership for the end user. As demands continue to grow, we believe the advantages of an open architecture approach will become even more apparent as operators retain the ability to adapt their networks, increasing access to incredible amounts of bandwidth while controlling cost," continues Collett.

The continued increase in throughput provided by HTS satellite capacity will enable applications to grow in scope and sophistication. This will also enable more collaboration with headquarters and even other remote locations. All of this means more efficient operations, improved return on investment and a better bottom line for the oil and gas sector. PRO

"Satellite is being used for bandwidth-hungry applications such as geological data gathering, remote monitoring, data transfer to headquarters and crew safety are helping make operations on the rig more efficient and profitable"

JAMES COLLETT, Director, Mobility Services Product Management at Intelsat

Airborne
Satellite COTM

Designing satellite airborne COTM infrastructure for the military is challenging. The end-user applications range from routine data and email through flash override VoIP, to high-definition Intelligence, Surveillance and Reconnaissance (ISR) video. These demanding, end-user applications require high bandwidths that must be supported on a fast-moving aircraft using a very small antenna

Traditional Data Applications

There are two primary sets of applications for airborne COTM. The first is what are considered traditional data applications, such as email, video conferencing and VoIP. The second is ISR video backhaul and dissemination. The military's unique demands on the transmission of these data types can greatly impact network design.

Whether traditional data applications are encrypted or not, it is important to understand how IP data is transported in a satellite network. Transmission Control Protocol (TCP) acceleration is used to ensure link efficiency when transmitting over a high latency media, such as geostationary satellite. With unencrypted data, the TCP acceleration occurs transparently in the satellite router. When the end user encrypts the data prior to transmission, the TCP headers are not available for TCP acceleration. Therefore, the acceleration has to occur prior to encryption. Introducing TCP or Wide Area Network (WAN) accelerators to a network can dramatically change the architecture, IP addressing and cost of deployment. Prioritising both voice and data traffic is imperative to the military. In the case of Multilevel Precedence and Preemption (MLPP) VoIP, multiple levels of prioritisation with strict priority queuing must be supported. This exceeds the quality of service capabilities of most commercial grade satellite products on the market today, making military grade networks necessary. TCP, WAN and MLPP capabilities are now being deployed on military aircraft executing data transfers. While the bandwidth requirements of a given mission will vary, typical data applications being utilised on an aircraft is usually on the order of a T-1 (1.544 Mb/s). Such data rates are easily obtainable in the Ku-Band using a 30cm to 45cm parabolic antenna or the equivalent aperture flat panel, using a Time Divisional Multiple Access (TDMA) return channel. Airborne COTM frequency band and return-channel architecture are particularly important to ensure secure data transmission. Due to the proximity of adjacent satellites and the need for such small diameter antennas on aircraft, the Ku-Band often necessitates using spread-spectrum technology to lower the power spectral density of the waveform.

ISR Design Considerations

The second application driving the airborne COTM market is ISR video backhaul and dissemination. High-definition video transmission from an aircraft is a daunting challenge because it requires a great deal of bandwidth. Using the appropriate Coder/Decoder (CODEC), high-definition video can be transmitted in as little as 2 Mb/s on an in-route carrier. With aircraft challenged by adjacent satellite interference and power-limited transponder transmission rates, while using very small aperture antennas, this data rate begins to push the transmission limit of an aircraft utilising TDMA in the Ku-Band.

> ## "One of the greatest airborne COTM challenges is the requirement for extremely small, equivalent aperture antennas. The practical limit for an antenna on an aircraft is between 30cm and 45cm"

ISR Requirements

There are network design decisions that can improve ISR video data rates. 14 Mb/s and greater data rates off an aircraft are possible with the right combination of technologies. Frequency band is important because the proximity of the next satellite transmitting in your frequency band determines the need for spread spectrum. While most Ku-Band satellites have another satellite in the next orbital slot, usually spaced 2 degrees, X-Band satellites are spaced at 3 degrees, allowing higher transmit power without Adjacent Satellite Interference (ASI). While it is not always practical, either, X- or Ka-Band can allow for greater data throughputs. Another important design choice when building an ISR airborne COTM network is network topology. TDMA is a very bandwidth efficient technology, but only when transporting intermittent, packetised data. A better choice for ISR transmission off an aircraft is a Single

Channel Per Carrier (SCPC) link. Video links are effectively always on, so there is no statistical sharing to leverage in TDMA. With their simplicity, SCPC carriers have much lower Layer 2 overhead and more efficient spectral efficiencies. In addition, because SCPC channels are not as dynamic as in TDMA, the demodulators often have 1 to 1.5 dB better C/N characteristics. An SCPC modem is often the simple solution for a network which supports only one ISR platform. Most networks need to support multiple platforms simultaneously. That, coupled with the fact that ISR data transmission is very asymmetric, with most of the data being transmitted off the aircraft, mean a shared out-route with SCPC return channels is the optimal network configuration.

Antenna Limitations

One of the greatest airborne COTM challenges is the requirement for extremely small, equivalent aperture antennas. The practical limit for an antenna on an aircraft is between 30cm and 45cm. There are notable exceptions of course, including the 1.2m Ku antenna mounted in a Global Hawk. However, in this paper, we will describe the requirements and limitations of approximately 45 cm equivalent aperture antennas. Antennas of this dimension severely limit the achievable link budgets of a COTM network. In addition, the pointing error and focus of such antennas often require using Spread Spectrum technology to mitigate ASI.

Spread Spectrum

Spread Spectrum is a technology used to lower the Power Spectral Density (PSD) of a given waveform. While lowering the PSD of a waveform lowers the interference with other satellites adjacent to the target satellite transmitting in the same, it comes with a price. To lower the PSD of a waveform, a Pseudo-Noise (PN) Code of the appropriate chip rate must be XORed with the transmitted data. The net result is a transmitted waveform at the same data rate that occupies a greater amount of transponder bandwidth.

The large bandwidth required for an airborne network is detrimental to the proliferation of World Wide Airborne Networks (WWANs). All Spread Spectrum

implementations on satellite routers are not alike. Spread Spectrum for satellite systems can be implemented in two broad ways. One way to implement Spread Spectrum for satellite systems is Code Division Multiple Access (CDMA). In CDMA, the network uses multiple, orthogonal PN codes to differentiate remotes in the network. The main disadvantage of using CDMA to mitigate ASI is that the power transmitted by multiple remotes on the same frequency effectively stacks. This means the chip rate required to stay below the PSD required is based on the combination of link budget, satellite band, proximity to nearest satellite transmitting in the same beam, antenna off-axis characteristics and the number of remotes in the network.

For an airborne network of any size, this would lead to an unacceptably high use of satellite bandwidth. A more cost-effective approach is using a TDMA-based direct sequence Spread Spectrum. In a TDMA-based network only one remote at a time will transmit. Therefore, the chip rate needed and the occupied bandwidth required will be independent of the number of aircraft in the network.

Two of the factors determining if Spread Spectrum is required are the satellite band being utilised and the proximity to the nearest satellite utilising the same band. As stated earlier, Ku-Band satellites are closely packed in the orbital slots, virtually guaranteeing Spread Spectrum us for Airborne COTM networks utilising this band. This is contrasted to X-Band. There are fewer XBand satellites in orbit so their spacing is much greater. In most cases, an airborne network operating on X-Band will not need to implement Spread Spectrum. The use of Spread Spectrum exacts a toll beyond the extra bandwidth it occupies. All satellite modems have a maximum transmission rate, known as the symbol rate. Since Spread Spectrum requires more occupied bandwidth for a given data rate, a satellite modem using spread spectrum may be limited by its maximum symbol rate.

Doppler Effect

The Doppler Effect has been a consideration of satellite modem manufacturers for some time. The Doppler Effect is the change

in frequency of a wave, as perceived by a receiving station, as either the transmitter or the receiver moves. Historically, the Doppler Effect in satellite transmission has been a secondary consideration arising from the satellite's motion in its station-keeping box. With high-speed COTM vehicles such as aircraft, the Doppler Effect has a great impact on the effectiveness of demodulators. The amount of Doppler Effect observed from a moving vehicle is dependent on the geometry of motion. For example, whether the aircraft is moving toward or away from the satellite (+/-), as well as the angle (θ), the velocity, and the acceleration of the vehicle, all impact the Doppler Effect. These formulas quantifyfrequency shift based on the pertinent variables.

UNIFORM VELOCITY

$$\text{Time Drift} = \frac{\pm\ v^*\cos(\theta E1)^* 10^9}{c}\ _{(ns/s)}$$

$$\text{Frequency Shift} = \frac{\pm\ V^*f_{carrier}^*\cos(\theta E1)}{c}\ _{(Hz)}$$

$$\text{Frequency Shift} = 0$$

UNIFORM ACCELERATION

$$\text{Time Drift} = \frac{\pm(v^*at)\cos(\theta E1)^* 10^9}{c}\ _{(ns/s)}$$

$$\text{Frequency Shift} = \frac{\pm\ a^*t^*f_{carrier}^*\cos(\theta E1)}{c}\ _{(Hz)}$$

$$\text{Frequency Shift} = \frac{\pm\ a^*f_{carrier}^*\cos(\theta E1)}{c}\ _{(Hz)}$$

Terrestrial and maritime vehicles travel relatively slow so the Doppler Effect does not come into play. It is, however, a major factor on airborne platforms. For comparative purposes, at Ku-Band, an aircraft travelling at 1,188km/h, and experiencing 1.7 G acceleration with a zero degree look angle, will have an uplink frequency shift of 15,950Hz. Such large frequency shifts must be compensated for. For the in-bound, in the iDirect® system, such frequency shifts have been accommodated through advances in demodulator code, primarily by adopting a multiple correlator structure.

Antenna Skew

Flat-panel antennas can cause skew angle issues. This off-axis Effective Isotropic Radiated Power (EIRP) problem must be addressed.

Some antennas, particularly vehicle mounted antennas, have apertures that are not round. As a consequence, the beams coming from these antennas have a peculiar shape – they are elongated, with the large width of the beam along the narrow width of the antenna. Because these antennas are mounted on the tops of vehicles, the beam leaving the aircraft is wide in the vertical direction and narrow in the horizontal direction, as seen from the aircraft. For a mobile terminal, this presents some particular challenges. Antennas with wider beams hit the adjacent satellites with more power, for a given bore site power. For antennas with beams that are not round, the adjacent satellite interference will depend on the location of the antenna on the earth.

As illustrated in Figure 1, the satellite is due north of the antenna's longitude, and the wide angle of the beam is perpendicular to the geosynchronous arc. The ASI is low for a given bore site power. However, if the antenna moves to a location west of the satellite, as shown in Figure 2, then the wide part of the beam is exactly along the geosynchronous arc, and the adjacent satellites see a significant amount of radiation from the terminal. The angle between the short axis of the beam and the geosynchronous arc is the skew angle. Figure 1 illustrates 0 degrees skew, which is the best case, while Figure 2 illustrates 90 degrees skew, which is the worst case. The challenge is having an adaptive system respect the ASI limits in the bad skew case, while taking advantage of the better spectral efficiency in the good skew case.

The beam width of a terminal, combined with the appropriate regulatory ASI limits, limit the spectral power density that the terminal can radiate on the bore site. This, in turn, affects the allowable C/N and the spectral efficiency achievable.

Figure 3 illustrates how a given antenna is characterized. The X axis is the skew angle, with 0 on the left and 90 degrees on the right. The vertical axis is the allowable spectral power density allowed for a

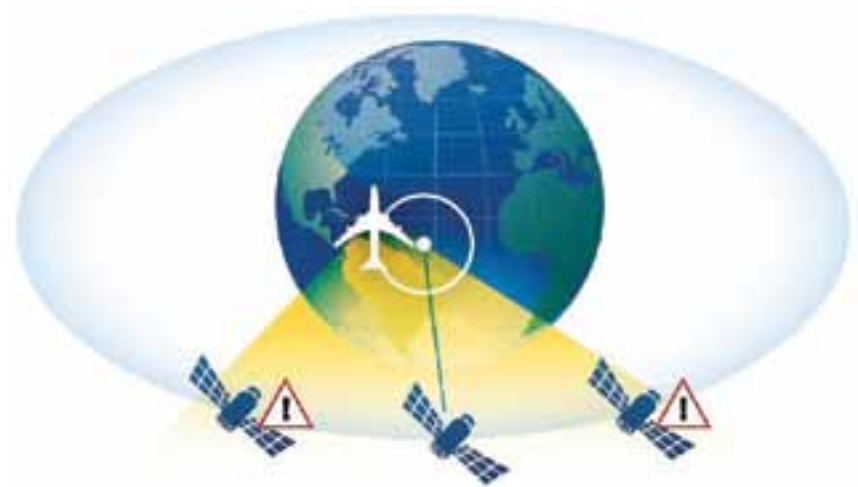Figure 1. **Flat Panel Antenna - Favourable (low) Skew**

Figure 2. **Flat Panel Antenna - Unfavourable (high) Skew**

given regulatory regime. This curve can be computed for a given antenna pattern and regulatory regime by looking at the beam pattern as sliced along different skew angles, and comparing them to the regulatory limits.

If the vehicle tilts, the skew angle is affected. For example, if the aircraft in Figure 1 banks by 45 degrees, and is flying due south, then the skew angle will be 45 degrees. Sometimes local tilt will make the skew angle worse, and sometimes better,

depending on the direction of tilt. So, given an antenna with an elongated beam, how can we maximise the spectral efficiency while guaranteeing that the off-axis regulatory requirements are met?

Terminal and Network Configurations
Terminal Configuration
The iDirect Government Technologies (iGT) system allows a terminal to be configured with a maximum operational C/N. This is controlled by a combination of an accurate

uplink power control, and only assigning TDMA bursts to a remote on carriers with a low enough C/N to respect this limit. To determine the C/N, the customer must do a link budget to translate the allowable uplink power spectral density into a C/N. This approach allows the transmitted spectral power density to be increased above the clear sky regulatory limit in the event of rain fade. This is consistent with existing regulatory standards, which assume adjacent satellites see the same rain fade as the targeted satellite.

However, the maximum C/N can change based on two factors:

1 For a given PSD, the C/N will depend on the satellite G/T for a particular spot on the earth. Hence, in spots with higher G/T values the maximum allowable C/N can be increased.

2 For different skew angles, the allowable PSD can be increased, which allows for higher C/N values.

The first case is catered to by using a map of the G/T contours, which is stored on the remote for avionic terminals.

The second factor is discussed in this paper. Ultimately the terminal will determine how much it can increase its C/N from the map and the skew considerations, and report these to the hub.

The hub will then use this information to assign slots on carriers which will respect the maximum C/N. The map that is created should be done with only the G/T contours, and without any skew angle considerations.

Determining the maximum PSD as a function of skew angle under the regulatory regime of interest should be completed first. This is usually done by the antenna manufacturer or terminal integrator. Next, a completed link budget determines the lowest C/N carrier needed to support the worst-case skew angle you wish to support. Depending on the satellite parameters, it may be possible to support skew angles to the maximum of 90 degrees. However, the carrier required may be so inefficient as to not make business sense. In this case, a smaller maximum skew can be chosen. The link budget will give an operational C/N for the worst case skew and G/T. Carriers must be included in the in-route group which will support this worst case condition. Once

the worst case (or "cut off") skew angle is determined, the maximum local tilt must be configured. A local tilt maximum value will allow the remote to stay in network during more extreme manoeuvres, but force the remote to use a less efficient carrier. This is explained in more detail in the next section.

Once the parameters have been determined, the relative C/N as a function of skew angle is entered in the Network Management System (NMS) for the antenna. In addition, the maximum local tilt is configured for the remote. Adaptive inroute groups with appropriate carriers for the different conditions are configured including low C/N carriers for the high skew cases, and higher C/N (and more efficient) carriers for the low skew cases.

Once the parameters above have been configured, then the system operates as follows:

1 When the terminal acquires, it only sends burst invitations on carriers for which the | regulatory limit is met under the worst case skew and G/T for the beam. The terminal sends the maximum configured skew angle to the antenna control unit (ACU) using OpenAMIP (Antenna Modem Interface Protocol). By utilizing OpenAMIP, any antenna could be integrated to any vendor modem.

2 If at any time the ACU determines the skew exceeds that specified in the OpenAMIP command, it ceases transmission and signals this to the remote. This is treated as a blockage.

3 Once the remote has acquired, it determines its "level flight skew" based on its geolocation and the satellite position. It adds the local tilt to this value, and computes a new current maximum skew. With this maximum skew, it does two things. First, it signals this value to the ACU over OpenAMIP. Next, it uses the configured C/N versus skew curve to compute the C/N adjustment over the worst-case skew which is allowed, and signals this to the hub. This is illustrated in Figure 4. A_a is the level flight skew, and A_e is the skew with the maximum local tilt. The increase in C/N is P_s-P_c in the diagram.

The remote also reads the increase in C/N from the local map, and signals this to the hub as well.
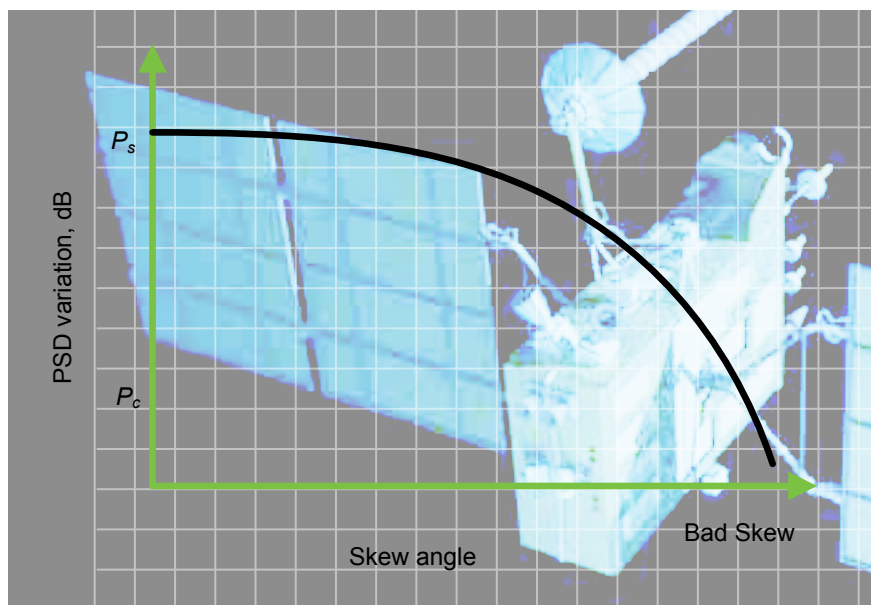

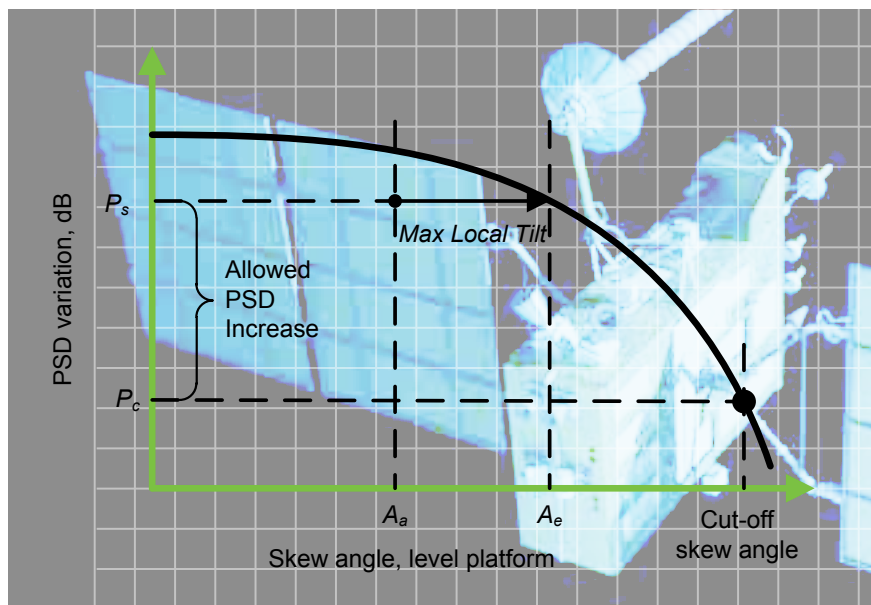Figure 3. **Maximum Allowable PSD as a Function of Skew Angle**

Figure 4. **Picking Operational Parameters**

4 The hub takes the total allowable increase in C/N, and uses this to allow more spectrally-efficient carriers to be used by the terminal.

Automatic Beam Switching

The antenna systems used on airborne platforms have become remarkably sophisticated. The strides made in improving the performance and effective aperture of flat panel antennas are very impressive. Whether the designer chooses a parabolic or flat panel antenna, the integration of the antenna with both the aircraft flight systems and the satellite router requires a great deal of development. To understand why such a level of integration is required, all the steps

necessary to seamlessly hand off an aircraft from one satellite beam to the next must be considered.

Let us consider an aircraft leaving the east coast of the United States heading for a location in Western Europe. While the aircraft is in the U.S., the antenna is locked on a particular DVB-S2 out-route carrier from a satellite and landed at a teleport on the east coast of the U.S. The satellite router's IP network is a part of a system and all IP traffic destined for the aircraft router is being sent to the east coast teleport upstream router. As the aircraft travels east, at some point over the Atlantic, the current satellite coverage ends and the transition to another, hopefully overlapping satellite beam needs to take place. The question is, where and when is the right place to make the switch and how would either the remote satellite router or the antenna control unit know when to make the switch?

The only feasible solution is to provide the satellite router and antenna control unit system with the EIRP contour maps of the available satellites. The iDirect Global Network Management System (NMS) includes global mapping which has the EIRP contour maps for most geosynchronous satellites in orbit. The challenge now becomes one of communications. The aircraft IRU has the current geographic location of the aircraft and the satellite router is in communication with the hub and can receive the appropriate EIRP maps. Utilizing the OpenAMIP protocol, different devices in the network can communicate with each other. Therefore, the IRU can provide the geo coordinates to the remote, and the remote can command the antenna ACU. Internet Protocol networking requirements present the next set of challenges faced by anyone designing a World Wide Airborne network.

Global Network Management
Fast moving and long distance airborne terminals will need to be handed from one beam to another and from one teleport to another. This mobility poses a number of challenges for IP networks and network management systems. Basic IP network design assumes core network devices like routers and switches will remain at a fixed location even if host devices come in

and out of the network. Dynamic routing protocols like OSPF, RIP v2, ISIS, BGP and others are designed to accommodate subnets being added to and deleted from a network and for interconnecting links to come in and out based on backhoes and power outages. The new mobility in the satellite market allows for IP routers, built into remote terminals, to move from beam to beam and roam from teleport to teleport and from continent to continent. COTM requires a new approach to the design and management of mobile networks. To address this challenge iDirect has developed a global NMS, within which a single COTM remote may have multiple

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> ## "There is one aspect of TRANSEC, however, that may prove beneficial in a commercial network. The more mobile and dynamic a network is, the more vulnerable it becomes to rogue remote terminals gaining access"

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instances in teleports around the globe. The flexibility of iDirect's global NMS allows IP addresses to remain fixed while allowing for configuration differences across beams, including varying out-route and in-route sizes, as well as different QoS profiles.

Security
COTM and itinerant terminals pose new challenges from a security perspective. The need for advanced encryption over the satellite link is obvious. As a remote moves from location to location and beam to beam, one never knows who may be listening to the link. Satellite service providers will need to offer strong encryption, such as 256-bit keyed AES. For government users, FIPS 140-2 certified encryption will be required.

TRANSEC
iDirect has developed Transmission Security (TRANSEC) for TDMA-based COTM systems to meet very high security requirements.

TRANSEC has a number of components, including the ability to obfuscate any traffic volume or remote terminal activity information, which may allow an adversary to infer useful information based on activity levels.

It is doubtful any commercial applications will require the level of security TRANSEC provides. There is one aspect of TRANSEC, however, that may prove beneficial in a commercial network. The more mobile and dynamic a network is, the more vulnerable it becomes to rogue remote terminals gaining access to the network. Most satellite NMS systems authenticate a remote terminal by verifying a physical hardware address in the remote terminal, similar to a MAC address in Ethernet. It is theoretically possible for an adversary to change the hardware address of a remote. Once a remote's hardware address has been changed, it could be acquired into a restricted network.

There is a component of TRANSEC for TDMA VSAT systems known as X.509 certificates which could be employed in both commercial and military networks to stop such intrusions. X.509 certificates are a standard RFC 2459, and are simply a digital certificate issued by a Certificate Authority (CA). The X.509 certificate uses the Public Key Infrastructure and leverages RSA public key encryption. In this way, a remote can be authenticated to a teleport and a teleport to a remote. By employing X.509 certificates, a network operator can be assured all remotes acquiring into the network are authorized and that remotes in the field will not acquire into an adversary's network. The iDirect NMS has the capability to accept third party certificates or to generate its own.

The advent of airborne COTM technology will be very beneficial for MoD operations, if implemented correctly. However, COTM presents a number of physics, operations and security challenges. A holistic approach to COTM network design is needed, taking into account satellite frequency bands, antenna sizes, integration of a satellite remote with a global key distribution for seamless beam switching between secure networks and an antenna control unit for uninterrupted communication. **PRO**

Whitepaper by iDirect. www.idirect.net

The Best of
Comms tech at GITEX

This year's exhibition that ran from October 12-17, drew more than 142,000 industry professionals from over 150 countries. We round up some of the best companies at the show

Talia showcases satellite internet services at GITEX

Talia showcased a host of internet services and satellite communications technology at GITEX Technology Week. The company is a provider of internet, voice and video services throughout the Middle East, Africa and Europe with expertise in satellite, voice, video and broadcast communications. Talia also provides global network coverage, enabling companies, PTTs, mobile carriers and broadcasters to connect to the largest global meet me rooms, and linking the major regional telecoms hubs around the world.

Ali Kalamchi, Technical Sales Engineer at Talia, said: "We provide internet services to rural areas over satellite, where internet through fibre or ADSL is nearly impossible to reach. That's where we do our business. We are currently a partner with Thuraya and Newtec for internet services. We also partner with Thuraya for satellite phones. The show has been great for us so far, and we've made a few new partnerships and closed deals."

With headquarters in the UK, Talia operates its own teleport facility in Germany and has support and sales offices in the US, the UAE, Nigeria, South Sudan and Iraq.

Inmarsat brings range of solutions to GITEX

Inmarsat showcased its entire range of products and services at GITEX Technology Week in Dubai, all designed to deliver the most powerful, portable and flexible connectivity services on a global scale.

For the first time in the Middle East, Inmarsat provided live demonstrations of its innovative, recently launched IsatHub service, which brings globally available 3G smart device connectivity to a new generation of users.

The company also demonstrated the latest addition to its satellite phone portfolio, the robust and reliable IsatPhone 2. Specifically for government customers, Inmarsat presented the recently launched, civilian version of its L-TAC, beyond-line-of-sight (BLOS) service, providing military-grade connectivity to the civilian emergency services.

Additionally, Inmarsat presented the latest developments in the world's first global, mobile high-speed broadband service, Global Xpress (GX). The first of three GX satellites entered commercial service in July 2014 and is now being deployed by customers.

Real Presence is the highlight at Polycom

Polycom showcased its RealPresence Immersive Studio at GITEX Technology Week 2014. RealPresence Immersive Studio is the next generation of immersive collaboration environments and is ideal for the meetings that matter the most, including creative brainstorms and crisis management sessions.

The flexible configuration lets users see content on any of the large displays in the studio, and support for BYOD allows users to share content from mobile devices like tablets and laptops. The solution also features the added capability of Polycom VisualBoard, the virtual whiteboard that permits users to engage in interactive note-taking on critical content such as business documents, CAD drawings, blueprints or maps.

"Important business meetings need to be as life-like and interactive as possible. With Polycom RealPresence Immersive Studio, we deliver next-generation collaboration experiences, making video accessible through all environments and adding vital collaboration tools to deliver a lifelike user experience," said Ramy Alam, Regional Sales Director, Gulf, Polycom. "Much more than mere telepresence, this immersive meeting room gives an environment that eliminates the barriers of distance with a no-compromise experience. Participants can be seen and heard from any corner of the room, and the system allows you to move around, eliminating the need to be pinned down to your chairs as in the traditional video conferencing systems."

Du and Google announce partnership for home services at GITEX

Bringing the best in innovation to its home service customers across the UAE, du has partnered with Google for the launch of Family Bundles, in collaboration with Google's premier partner, Cloudypedia.

Two types of Google bundles will be available from du in the UAE, giving customers the chance to be among the first in the region to own the tech giant's new products and tools. The collaboration will also give du's customers a prime opportunity to enhance their home services experience with customised bundles, designed specifically by du with the communication needs of the UAE community in mind.

Ahmed Mokhles, Executive Vice President, Consumer Business, du, said: "We are continuously seeking ways to enhance our customers' experience, to empower them in the UAE's emerging Smart City environment. Convenience is a major component of Smart City life, and we are proud to partner with Google to offer our customers the ultimate in entertainment convenience across all screens, powered by our home services connectivity and Google's tech innovations."

Home service customers can choose from two pre-defined Google bundles, which will include a Chromebook and at least one Chromecast, combined with Google Apps Suite with multiple accounts. These will connect family members over the cloud and help them enjoy Google Apps, unlimited storage, mobile device management, unique sharing capabilities and more.

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STC launches STC Advanced Solutions at GITEX

STC once again returned to GITEX Technology Week this year, announcing the launch of STC Advanced Solutions at the show.

This new initiative is part of STC's ongoing commitment to transforming itself into a leading regional ICT player. STC values the importance of providing integrated advanced information and communication technology and services to meet its clients' needs. STC Advanced Solutions, a subsidiary of STC, will accelerate STC's enterprise segment growth strategy by providing a wide range of information and communications technology, as well as services beyond the traditional telco offerings.

"As a market leader, STC assures the business community reliable and affordable services by providing an array of ICT services and solutions. We continue to strive for excellence and innovation. STC Advanced Solutions will bring to the market new products and services with industry focus to help enable the knowledge-based economy," commented Dr Khaled Biyari, STC Senior Vice President for Technology and Operations and Chairman of the Board of STC Advanced Solutions.

Dr Sultan Binsaeed, CEO of STC Advanced Solutions, outlined key services. "We have set out to reintegrate Awal IT Services into the overall STC B2B strategy by re-launching the brand under a new identity, STC Advanced Solutions. Our strength lies in the turnkey solutions we bring to clients. STC Advanced Solutions is the one-stop-shop for ICT services in the Kingdom; its service offering includes cloud computing services, managed services, systems integration and M2M services. STC Advanced Solutions will address the market with focus on industries including healthcare, education, oil and gas, financial service, transportation and other critical government infrastructure sectors."

Alcatel Lucent partners with Reddington Gulf

Alcatel Lucent Enterprise showcased a variety of solutions at GITEX Technology Week this year, as well as future technology. The company also announced Reddington Gulf as an additional regional distributor.

Moreno Ciboldi, Senior Vice President, South Europe, said: "GITEX is an important event for the Middle East. We are a recognised vendor in the region. We just celebrated an event commemorating more than 20 years together with our business partner, Al Futtaim in Dubai. We have also announced Reddington as an additional distributor for our products in the region. Through this partnership we see an opportunity to grow in the SMB market, where we are growing successfully.

"At GITEX, we are presenting our strategies around cloud solutions for unified communication and unified access approach. Another area where we want to grow is through investing more in vertical solutions. One of the verticals we are very focused on is hospitality. Here at the show, we are showing how hotels can start a new revenue stream from their customers by using our applications. This helps improve the quality of service provided to the guest."

Alcatel Lucent Enterprise also demonstrated applications under development. These are ways it is constantly improving its offerings and looking at the future of technology.
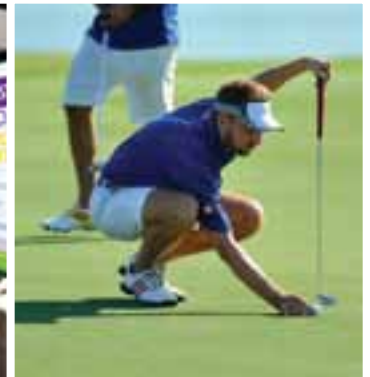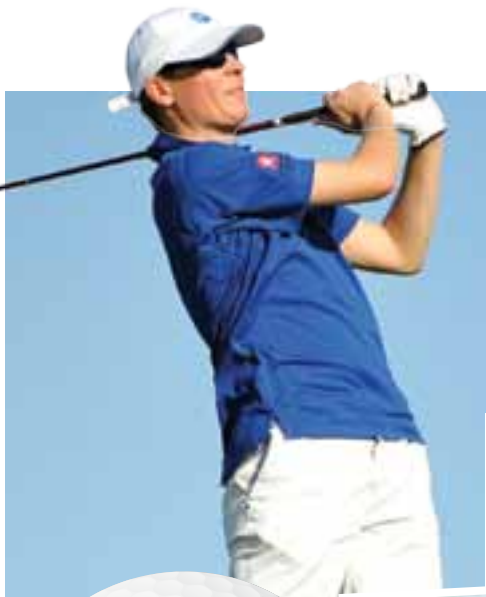
> **"A fantastic opportunity to network,** we had a great game. BroadcastPro should host these more often"
>
> Hassan Ghoul,
> Grass Valley

BroadcastPro
Masters Cup 2014

On October 23rd, the inaugural *BroadcastPro* Master's Cup, at The Address Montgomerie, welcomed a host of industry heavyweights who spent a good half of the afternoon teeing off on the greens, followed by dinner and refreshments later on

> **"It was a fantastic opportunity to meet and connect with those from the industry** who share either a passion for golf or simply spending a day in the sun! A big thank you to the organisers!"
>
> Zain Mirza, Glocom

Military Interference

The military is one of the biggest users of satellite; however, the issue of interference has not really taken centre stage. Carrier ID for military commercial services could be a start

When it comes to satellite interference, the military has for a long time featured in the discussion. As one of the biggest users of satellite technology, it is a vitally important user area if we are to gain real traction with solving satellite interference. However, we are only now beginning to see them get involved with the various initiatives and there is a lot still to be done.

The lack of involvement is not through a lack of interest, but it is a complicated arena. Of course, the biggest barrier by far is the need for caution when exchanging information. Look at Carrier ID, for example; mention to military personnel that you want them to put an ID on all their satellite transmissions, and understandably they refuse. This year, IRG has reached out to the various organisations covering the military arena, some being IRG members. From informal conversation and formal meetings we have found a procedure that meets the needs of both commercial and military processes and thus makes Carrier ID workable for these military commercial services, simply by separating commercial IDs from military IDs held in their own protected environment. If we have an unidentified interference when compared against the commercial database, we simply pass it through a secure connection to the military operations centres. They handle the rest and cooperate with commercial entities through the normal channels.

Of course, it is important to remember that the CID database will only contain a unique identifier and the name of the satellite operator to which that ID belongs. No other information is necessary, as in the commercial world even that is sensitive and can only be accessed by satellite operators. So despite concerns, the information is limited and the

"From informal conversation and formal meetings we have found a procedure that meets the needs of both commercial and military processes and thus makes Carrier ID workable for these military commercial services, simply by separating commercial IDs from military IDs held in their own protected environment"

MARTIN COLEMAN, Executive Director, the Satellite Interference Reduction Group (IRG)

database has a high level of security to ensure protection. Bear in mind that CID is currently being implemented across the globe, with a number of measures in place to ensure widespread implementation. If the military is the only user which doesn't adopt CID, then surely it will stand out much more than if it used CID.

That said, even if we get every single user on board with Carrier ID, according to Mark Steel of Inmarsat at our recent workshop, that will only account for around 20% of interference problems. By far the largest cause (50% of all instances), according to Mark, is poor quality equipment. For the military this is naturally a concern, as they mainly use VSAT and comms-on-the-move terminals, which are more often that not auto-deploy. For manufacturers to produce these products so as not to cause satellite interference, especially as they will be often moving during operation, is by no means simple. With more and more products in the marketplace and manufacturers facing stiff competition, that challenge is becoming all the more apparent.

The Global VSAT Forum (GVF) has a system of type approvals for VSAT systems, meaning that if all users ensure that new equipment has been type approved, the amount of interference will instantly be reduced.

According to Mark Steel, the remaining 30% is down to lack of training. GVF, speaking at our workshop, talked about a planned delivery of auto-deploy training to militaries. We also had an in-depth discussion about other options around training; there are a number of suppliers doing some great training courses, many specifically targeted at the military. If anyone would like further details of those, they can get in touch via press@satirg.org. **PRO**

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