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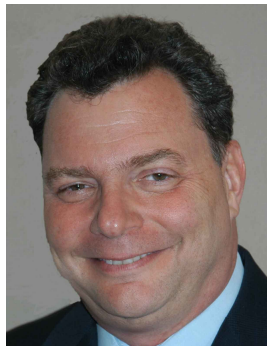New Space: "Astrocast's Unique Two-Way, L-Band IoT Solution"
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GOTTLIEB'S
SATELLITE MOBILITY WORLD

Welcome to the April 2019 issue of *Gottlieb's Satellite Mobility World*.

Flat While Panel Electronically Steered Antennas are a "hot" topic, and for our April issue, we were pleased to take advantage of on an invitation to tour Phasor's development facility in London. Escorted by Senior V.P. of Operations, Mike Warren, we learned a lot about the antenna development process - why it takes so long and is so complex. We're pleased to share our impressions and Mike Warren's insights as well as many of the photos we took at the facility.

Our next article also breaks new ground. We interviewed one of Certus' very first Beta testers and end users, Holger Boerchers, IT-Manager of German Shipping giant, Briese Schiffahrts. Find out why he's chosen to install Certus on all of the company's 125 vessels.

In our New Space Segment, we focus on Swiss CubeSat company Astrocast and in an interview with its CEO, Fabien Jordan, you'll find out how the company is exploiting L-Band spectrum to deliver a unique IoT product. This month, we're also reviewing iDirect's new iQ LTE "smart" modem - an innovative SD-WAN-like solution for satellite and LTE integration. Enjoy!

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C-Band Windfall Unlikely as Opposition Rises in Congress

Like the great Alaska Gold Rush, the C-Band "Gold Rush" is likely coming to an end. Driven by a few "pump and dump" hedge funds and some encouraging, but non-committal comments by a couple of FCC commissioners, investors have been lead to believe that the FCC will side-step their traditional auction process and instead, grant satellite operators the right to sell cellular operators a portion of their allocated C-band spectrum. Such an action would divert billions of dollars usually destined for the Treasury into the coffers of three giant mobile operators. That prospect is rapidly dissolving as opposition to such a giveaway rises in Congress.

Representative Mike Doyle (D-Pa) and Senator Dan Sullivan (R-Alaska) have recently expressed outright opposition to the plan and Senators Cory Gardner (R-Colo) and Maggie Hassan (D-NH) are working on spectrum legislation that may address the C-Band issue.

Note that Congress has acted before to block the FCC from handing out windfall profits. In 2002, Congress passed legislation originated by the late Senator John McCain that barred the FCC from doling out spectrum auction revenues to broadcasters that agreed to cede spectrum for wireless use.

As a potential July decision point looms for the FCC, expect increased Congressional opposition to the politically unsavory prospect of awarding billions of dollars to foreign operators who never paid a dime for the use of the C-Band spectrum in the first place. At most, operators only likely to receive some compensation for the cost of vacating the "band," and that isn't likely to be mega billions.

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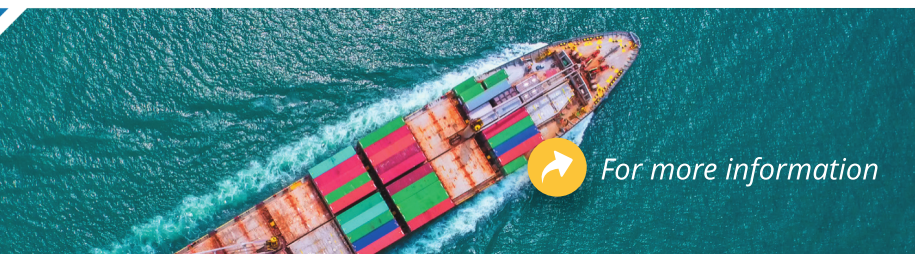
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Editorially Speaking...

Trapped in OneWeb's Web

OneWeb has just launched its first six satellites and announced an additional $1.2 billion investment, underwritten by Softbank, the Salinas Group, Qualcomm and the Government of Rwanda.

Other than the investment by the Salinas Group, an investor almost certainly secured through the efforts of former Salinas Group executive and now OneWeb CEO, Adrien Steckle, what we find interesting is that no new, outside equity investors, venture capital firms or Export Credit Agencies have participated in the second round of investment. **The story here is not who invested in OneWeb, but who didn't.**

After a search that lasted over two years, and yielded neither ECA or new equity financing, the need to secure additional funding must have been acute. Not only was OneWeb over a year late in launching its first satellites, it hadn't been able to quell doubts as to whether it would have access to the very low-cost ground terminal it needed to reach a mass market.

Oddly, only a couple of weeks prior to the recent funding announcement, Greg Wyler claimed he had solved the antenna problem. Citing a $15 array, developed by a company called Wafer, he boasted that a $300 phased array antenna could be developed - a feat that earlier was deemed unachievable by a panel of flat panel antenna developers at the VSAT Congress held in D.C. last October.

Armed with a possible, though unproven, solution to OneWeb's antenna problem and demonstration satellites in orbit, Wyler would now be able to convince the same investors to invest again.

With the clock running down, Softbank had to be the lead investor of choice. They had already committed a sizable investment to the project and more importantly, the partnerships involved and the politics of the venture made withdrawal nearly impossible.

Breaking Up is Hard to Do:

After all, an investment in OneWeb

could not be easily or quietly abandoned. Touted as an economic enabler for the Third World and covered widely in the global press, its collapse could inflict a dark stain on Softbank's reputation, tarnish its relationship with the Vision Fund, and leave its first round corporate investor/partners with a pile of losses. Like other similar ventures with an all-encompassing vision, OneWeb had become unstoppable, and Softbank has become trapped in One Web's web.

Whether we are talking about OneWeb, Iridium, or Theranos, the story is always the same. In such ventures, obstacles to success never seem to be taken seriously. Critics are pushed aside, and naysayers have no voice, no matter how valid or well-supported their arguments are.

When Once is Not Enough...

No one seems to care or remember that OneWeb has already been tried. Last time, it was called O3b. It was designed to serve "The Other 3 Billion," but it ended up serving a relatively small number of high-value niche markets - cruise ships, Pacific Islands, and remote cities in the Amazon - not the global community of unconnected billions.

Unable to meet to meet its original goal, we now find it reincarnated in the form of OneWeb - a more costly and risky version than the original. Can it succeed where O3B failed? Time will tell. All we know for sure is that it will cost a lot more.

Without a clearly defined target market and facing daunting business and regulatory hurdles, competition from GEO HTS satellites and emerging fiber deployments, the risk is high, and the return is uncertain - all factors which make it easy to understand why no outside equity investors or guarantors have come forward."

-Alan Gottlieb

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Electronically Steered Antennas - From Concept to Manufacture
On Tour at Phasor: A Look Inside a Leading ESA Developer

Around the corner from St Paul's Cathedral, in one of London's bustling commercial neighborhoods, you'll find Phasor, one of the satellite industry's leading developers of flat panel electronically steered antennas.

We have followed Phasor since its inception over five years ago and now, as the company is about to transition from development to manufacturing and deliver its first antenna, *Satellite Mobility World* is here in London for an in-depth look at the company.

As we enter their Technology Center, the first thing we notice is the sheer size of the operation. Phasor doesn't look like a start-up anymore. With over 50 employees and a large, open floor plan, mixed use lab and office space, it looks like a booming business. Everywhere, there is activity and real entrepreneurial energy.

For our visit, our host is Michael Warren, Phasor's new Senior Vice President of Operations who joined the company last October. Warren brings some unique skills to the endeavor.

With stints at IBM, International Rectifier, ST Microelectronics, and 3-Com, he's a top-level executive with real-world experience in productization - precisely the kind of talent required to move a proven semi-conductor-based technology like Phasor's out of the lab and into commercial production. We sat down with Michael to find out what it was that attracted him to the company and how he plans to productize Phasor's unique technology.

SMW: As you know, there are many companies that could utilize your expertise, what is it about Phasor and its technology that attracted you to the company?

Michael Warren: Phasor is at a fascinating point in its history. The engineering teams have spent years of hard work to create a technology, and now it's ready to become a real product. From an operations point of view, this is a really attractive time to join the company.

Everything needs to be developed. This is a time when the concept goes from the R & D and engineering stage and turns into a real product. It's a time when everything transitions from a development organization to a rapidly growing

commercial organization. It's a time of commercialization and growth. That's what makes it exciting.

SMW: Going from a prototype antenna to a market-ready, commercial product suitable for several different markets must be very challenging. Can we look at the fundamental steps involved in producing an installation-ready antenna for maritime, land and aero markets?

MW: Productization can be broken down into four or five key stages.

In the first stage, we manufacture our ASICs or "chips" in a foundry. Then, we get them packaged, and combine them with other components and create the specialized circuit boards or "PCBs"which are the basic "building blocks" for all our antennas, regardless of market. This approach allows us to work with integrator partners to build product specific to each market's requirements.

In the various markets you're talking about, requirements vary considerably in terms of size and performance, and we design for the particular requirements of each market, whether we are talking about maritime, aero or land-based applications.

SMW: I can't help but notice that there are are a lot of engineers. What are they all doing?

MW: We have silicon and mechanical design teams and electrical and hardware teams. In addition, there are system architects, software design teams and, our system test teams.

As you know, designing and manufacturing a phased array antenna requires a lot of diverse talent.

SMW: Will Phasor contract manufacture its own antennas based on the input from selected re-sellers?

MW: In terms of the different markets, we are working with contract manufacturers for all the components we just described, the silicon, the boards. With this approach, we can either provide the components to a specialized integrator, as we do in aviation markets with Astronics, and they build the antennas. In markets where regulation and specification are less stringent such as maritime and land-based applications, we can manufacture completed antennas to the required specifications.

SMW: What are the most significant environmental challenges you face in customizing the antenna in each of Phasor's key target markets? Can you give us some examples

of how you deal with heat and cold, vibration, and salt air corrosion?

MW: Each market has its own challenges in terms of design for operating conditions, and we need to be able to accommodate all the environmental and test specifications. Our system is entirely solid-state and devoid of moving parts resulting in a fundamentally rugged solution highly resistant to vibration.

On aero, we have started to test our ESA under aeronautical vibration standards, and we have passed these with no issues. In shipping, to combat salt air corrosion, we seal the systems to prevent the entry of moisture and coat the boards.

SMW: What is the Phasor strategy for managing high latitude operation of its ESAs – a problem especially relevant to use with

GEO satellites in trans-oceanic cargo and aviation markets. Will you build larger antennas or build conformal or dome antennas?

MW: Our approach is to build the appropriate size ESA flat panel for the application. We have a significant advantage in that regard because our system is modular.

That means we can create a larger antenna simply by putting more panels together. Of course, the modular approach also allows us to build a conformal antenna as well, one that, for example, can wrap around the fuselage, offering further active surface area while also reducing aerodynamic drag. So, we can rely primarily on effective size (increased active area) to minimize the loss of efficiency experienced at high latitudes, in the aviation market with Geosynchronous (equatorial) satellites.

RF Testing

SMW: The coming of LEOs is a significant event for all ESAs, especially those capable of simultaneous access to two or more satellites. What sort of modification, if any, will Phasor

need to go from GEO markets to LEO markets – software alone or hardware modification?

MW: Our core technology can be used with any type of satellite – GEO, LEO or MEO and that's good news. We have already communicated with a LEO satellite using our current design, and there is no significant re-design required to support the upcoming LEO constellations. However, there will be upgrades to the software since, in the LEO world, you are dealing with a lot more variables. Of course, ESAs will be a necessity for all earth stations operating LEOs.

SMW: Phasor's initial product is a Ku-Band Antenna. It's my understanding is the next variant would be a Ka-Band Antenna. Will it be more difficult or more-costly to produce and, if so, why?

MW: We will build a Ka-Band antenna as there is a high demand for such a product.

Because Phasor's core technology is baseband, it is agnostic to frequency. While building a Ka-Band antenna has its challenges related to the higher frequency, these challenges are not new.

We do have to scale our ASICs to a new frequency band and place them in closer proximity than with a Ku-Band antenna (due to the higher frequency) and making these changes will require some engineering effort.

SMW: What about incorporating send and receive capability on the same antenna? How important is this feature?

MW: Our initial antennas (release 1.0) will have separate send and receive modules. However, a combination send/receive antenna is on the road map because it will allow us to build smaller and lower cost antennas which I think is going to be important to everybody.

Our Release 2.0 will have simultaneous send/receive capability on the same panels, and we believe we will be launching those products in late 2020/early 2021.

Satellite applications commonly require full-duplex capability. For example, with both transmit and receive on the same panel, we can move down
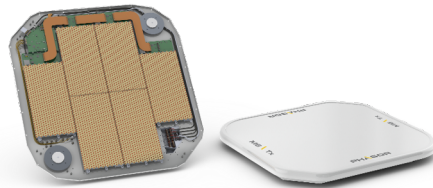
market for use on small vehicles, small aircraft, etc.

SMW: What about "true time delay." What are the advantages/disadvantages of this technique and does Phasor employ it now, or will it employ it in the future?

MW: True Time Delay refers to the method for "delaying" each of the signals from the elements in the array in order to align.

The alternative approach is to apply this delay as a phase shift (hence the term Phased Arrays). Using a Phase shift is much easier, cheaper and more efficient to implement; however, the technique starts to fail when the bandwidth of the carrier begins to get very large (i.e. greater than 125 MHz).

So today, for a more efficient system, that is cheaper and lower power, a simple phased array is the preferred solution and is how Phasor's first systems work.

We are developing a second -generation antenna to cope with higher bandwidth carriers that will enable operation on the LEOs and some of the

future HTS satellites that are coming in a few years. This antenna will use a hybrid of true time delay and phase shifting to create an efficient and capable solution.

SMW: As you know, Phasor is pursuing several vertical markets including shipping, aviation, land mobile (buses) and military. Which markets have priority, and based on your experience, when will we see the first commercially available product for each market?

MW: We are actively pursuing several vertical markets. We have several different programs running in Phasor to support each of them.

Our aim is to have products available for each of them as soon as possible, because we see strong demand in each of them.

However, our very first products will be supporting land mobile and marine applications with the aviation

prototypes following soon after. We are expecting that the first commercial products will be available in the fourth quarter of the year and the maritime and and land mobile variants will likely be the first available due to the high demand.

SMW: Thank you, Michael for the very interesting interview and tour.

About Mike Warren:

Mike Warren has over 30 years experience of fabless semiconductors, silicon assembly, PCB Assembly and Product Operations.

Prior to joining Phasor, Mike spent 12 years at Frontier Smart Technologies, where he was VP Operations.

He's held senior Operations/Supply Chain positions in organizations ranging from start-ups to large multi-nationals, and has successfully managed multi-functional, multi-site, international supply chain teams. Market sectors have included the Industrial, Automotive, Medical Device,

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Certus at Sea: An Early Adopter's Review

Finally, Iridium Certus^{tm}, Iridium's new, L-Band service has gone to sea. After eight satellite launches and billions of dollars in investment and amid much fanfare, the new service is now up and running and providing commercial service. For the first time, Inmarsat's Fleet Broadband faces a severe competitive challenge.

With initial speeds close to 352 Kbps, total global coverage, latency only a LEO constellation can deliver, an inexpensive, small terminal and lower operating cost, Certus could seriously disrupt the market.

To find out how Iridium's new service actually performs at sea , for the first time, we went direct to one of Certus' Beta testers and early users, Holger Boerchers, IT-Manager at German shipping giant Briese Schiffahrts.

SMW: Can you give us some background on Briese Schiffahrts? I understand you operate a fleet of seagoing vessels, such as heavy lift vessels and bulk carriers, as well as yachts and containers.

Holger Borcheris: Briese Schiffahrts was established in 1983 and was one of the first shipping companies established in this Northern part of Germany. At the moment, we have 125 multi-purpose vessels, containers, bulkers and heavy lifters. We also operate nine research vessels for the German government that do deep sea research and exploration near the poles and in the Pacific Ocean, the Atlantic Ocean and Baltic Sea. Ninety per-cent of our vessels are sailing world-wide, and we have smaller vessels shuttling around Europe.

SMW: Lately, you participated in the Beta testing of the new Iridium Certus service. Could you tell us about your experience? What type of ships were involved in the trial? How long did the trial last?

HB: As you know, we were a Beta tester of the new Certus service. We tested it for three months on one of our container ship feeder vessels, the Petkum which travels around smaller ports in Europe, collects containers and shuttles them to large ports, like Hamburg, where they are loaded on large, ocean going container vessels.

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The Certus Installation itself was done by Globecomm engineers, and we started the test in early October of last year and during the test, we had weekly calls with Iridium to report any issues and check out how the Beta was performing. While we expected there might be some issues initially, there were no problems. Certus worked from "scratch." What was surprising was that at the time of the test, the service was in full operation, even though the final ten Next satellites had not yet been launched.

During the trial, I tested the voice myself, and the crew and Globecomm tested Web browsing and Messenger applications and other features including file transfer, voice and fax. We experienced a speed of around 400 Kbps.

Although, we were able to use the Internet, obviously the speed is quite low compared to what someone might experience at home. This is especially true with multiple users on the system, where each user would get even less bandwidth. So, at present speeds, we can't really use the service for crew welfare.

However, it is our understanding that by next year download speeds will be 704 Kbps and ultimately will reach 1.4 Mbps, making Certus much more appropriate for Web surfing. However, even at 400 Kbps, we know we can always use Internet if we need it. For example, if the Captain needs to download something, we can prioritize his access.

SMW: What about voice quality? How does it compare with the earlier Iridium Pilot service?

HB: With Certus, voice quality, is definitely a big improvement, especially over Inmarsat's GEO- based satellite service. Reliability is also very good. Since the start of October to date, we had no drop offs and no fall back to the standard Iridium Pilot System back up. Certus was always on. Regarding latency, in calls we made with Iridium in the U.S. latency was very good.

SMW: Considering the performance of Certus during the trial, what are your plans regarding fleet wide installation?
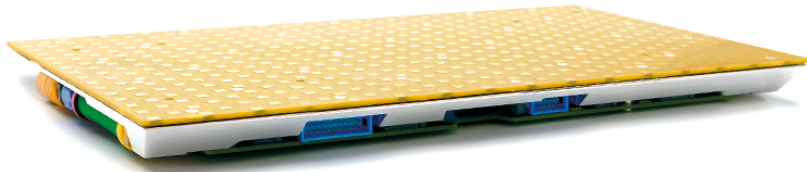
HB: We have it on two vessels now. A third installation is coming up, and we have ten more

on the schedule and then, step by step, we will replace all the Fleet Broadband terminals.

For smaller, vessels sailing within the confines of Europe, Certus will likely be the primary service, especially if the 704 Kbps service performs as well as we expect. We also might install two Certus systems, one as primary and the other as back-up, since a charter demands very high reliability. Because these vessels are frequently in port and sail near shore, crew welfare is not as important a consideration as those vessels that sail globally, and we can also use 4G to access the Internet when sailing near the coast.

Certus Antenna by Cobham

On ocean going vessels, crew welfare is obviously much more important. In those cases, we deploy VSAT and will back-up with Certus, but every combination is possible. We also can configure a vessel with a "least cost router" which gives us even more connectivity options. It depends on what the charterer wants and where the vessels are traveling. There is not a rule for the whole fleet at the moment.

SMW: Can you tell us about the installation process?

HB: We found Certus is really easy to install. The antenna is very small vs. Fleet Broadband. It's light and easy to handle, and you can install it on existing Fleet Broadband mounts or put it anywhere you like. In fact, several of our installations have been done by the crew on their own. You mount the below deck unit to a wall. Fire it up and connect the antenna cable, and you're ready to go.

SMW: How does Certus compare with Fleet Broadband in terms of installation and operational cost? What about pricing? In your opinion, in order of importance, what are the most compelling features of the Certus service?

HB: Certus is significantly less costly to install

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– Oliver Clauser
  Technical Manager, Nautic/IT
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and operate than Fleet Broadband. It's priced slightly higher than OpenPort but not very much. Pricing policies are also much easier to understand and unlike Inmarsat, Iridium doesn't change its pricing policies on a yearly basis or charge a penalty for early termination.

Of course, higher speeds are the key selling point. Today, Certus is faster than Fleet Broadband and will be even faster when it upgraded to 704 Kbps and 1.4 Mbps on the downlink, and it has much lower latency. However, there are other considerations as well.

We like the fact that with Certus we are also able to "pool" our data allowance. For example, if we buy 500 Megabytes and one ship doesn't use it all, another vessel can use what's left. It's an arrangement that is very convenient for us. We also like the fact that, unlike Inmarsat, Iridium is much more customer focused. They want to offer good prices, and they want to make it easy to upgrade. So, when you consider the differences

"We also like the fact that, unlike Inmarsat, Iridium is much more customer focused. They want to offer good prices, and they want to make it easy to upgrade. So, when you consider the differences between Fleet Broadband and Certus, it's very easy to decide in favor of Certus."

between Fleet Broadband and Certus, it's very easy to decide in favor of Certus.

SMW: There is a major trend toward the adoption of IoT in the maritime segment. What is the status of the effort at Briese Schiffahrts? Are you actively engaged in collecting and analyzing sensor data from your vessels or planning to do it in the near future?

HB: In 2019, we have nothing on our schedule in the IoT area. This is something I discussed the end of last year with our fleet management group. They are all aware of what IoT is and that ultimately, we will deploy it. With it, so much is possible. We can monitor vessels much better than we use to and use all the data to monitor and improve the performance of the vessel including reducing fuel consumption - our largest operational expense. That's a very big story.

So, we are engaged in Beta testing some systems, but still have not deployed a system on our fleet. When we do, Iridium connectivity should be

useful for IoT data transmission. Its bandwidth capacity is more than adequate for this application.

SMW: In the maritime communications market, what are the key drivers for VSAT vs. L-Band adoption and how have they evolved over time?

HB: In the beginning, demand for VSAT was driven by crew welfare. Now, in addition, it's used to update the electronic charts on the ECDIS system and also to send information from the Voice Data Recorders. Now, when a vessel gets an ECDIS, a VSAT is required as well. While it's true that the use of L-Band is declining as a primary means of communication, the fact that VSAT is subject to interruptions whether from rain fade or antenna failure, assures a place for services like Certus. As I mentioned previously, reliability is a paramount consideration for the mariner, and only L-Band can provide the ultimate assurance of connectivity.

About Holger Boerchers:

Holger is IT-Manager at German Shipping Company Briese Schffahrts. Based at the company's headquarters in Leer, he has managed the IT and satellite infrastructure on Briese's 125 vessel fleet since 2002.

Prior to joining Briese, he was Team Leader, Advertising Technology and Internet at Zeitungsgruppe Ostfriesland, a newspaper publisher.

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An Interview with CEO, Fabien Jordan...

Astrocast's Unique, Two-Way, L-Band IoT Solution

With potentially billions of devices to connect to the Internet, satellite companies are racing to enter the IoT market. Yet, as more and more companies emerge into the what is becoming a crowded field, one company, in particular, stands out. It's Astrocast, a Swiss based company.

Unlike its competitors, Astrocast has been able to harness the unique IoT related benefits of the L-Band frequency, produce a proprietary chip and protocol specific to the requirements of IoT data transmission and develop a constellation of inter-linked satellites capable of two-way communication - all in a low-cost CubeSat environment. This accomplishment cannot be taken lightly, and positions Astrocast as a potential market leader in IoT data transmission.

In December of last year, Astrocast launched its first demonstration satellite, and a second will follow in early April. To find out more about the company, its technology and its plans, we arranged an interview with Fabien Jordan, its CEO.

SMW: Can you give us some background on the company, its history and how it has developed into the entity it is today?

Fabien Jordan: Thank you very much for the opportunity to tell our story. I'm happy to give you some background on the company.

Our initiative actually started with the first Swiss satellite, the Swiss Cube, a CubeSat that we built and launched in 2009 and is still working today, nine years after launch. With it, we demonstrated that we can build a very reliable satellites at low-cost and operate them for long periods.

Based on what we learned in this early mission, we decided to create the first Swiss nanosatellite company. At that time, we were not sure of the niche we would occupy, but based on further research, we recognized that nanosatellites could play a major role in disrupting satellite IoT, and we became one of the very first CubeSat based companies to enter that market.

The first step was to completely design the company around the objective of connecting millions of assets everywhere on the planet using an IoT-based infrastructure. To do so, we built a team of engineers, many who worked on the original Swiss Cube project.

Later on, to round out our team, we recruited several key executives from the space industry including Kjell Karlsen, the former president of Sea Launch who is now our CFO; Bryan Eagle III who has deployed many IoT networks and knows this industry really well, and José Achache, our Chairman, the former director of the French space agency, CNES.
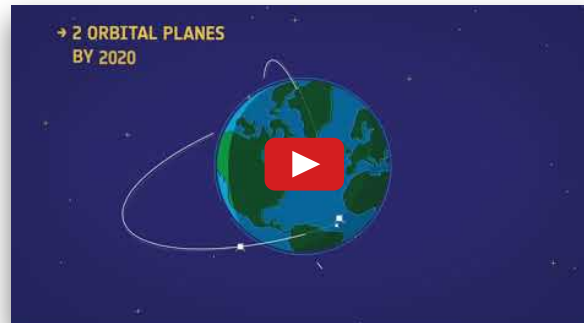
With all of the skills and expertise needed, we formally incorporated the company in 2014, and we now have around 40 employees.

To finance our efforts, so far we have raised about $12 Million - $4 Million in a "seed" round followed by grants of around $3 Million from the European Space Agency. More recently, we have opened our "A" round, and we expect to ultimately raise a total of $20-25 Million.

SMW: I understand that in December of 2018, you launched the first demo satellite, and are planning to launch a second satellite this April, followed by 20 additional satellites by the end of 2020. How have the demo satellites performed and when do you plan to launch actual commercial services?

FJ: You are correct. We have launched the first demonstration satellite in early December of last year on the SpaceFlight Industries, SpaceX mission, and the satellite is performing really well and is fully stabilized.

All of the subsystems are in nominal mode, and we are now testing the most important component of the mission, the communication payload. So far, we are extremely happy with the results.

Our second satellite has not been launched yet because it is the upcoming Indian PSLV. That rocket has been delayed to the first of April. However, the satellite is on site and loaded on

the rocket. So, we are just waiting for the launch.

These first two missions are for demonstration purposes only and are part of the "pilot" phase which is intended to fully optimize the system.

Next year, we will go commercial with the first orbital plane of 20 satellites which we expect to have fully in place by then end of 2020. We already have customers committed for testing.

The first customer is Actia Group, the world leader in telematics solutions for vehicles. They are interested integrating the Astrocast solution into mining trucks and trucks, in general.

Our second customer is Marine Instruments, a Spanish company and the leading manufacturers of marine buoys. Their goal is to integrate Astrocast technology into 40,000 to 50,000 sonar buoys per/year which are used to transmit the location of Tuna back to a fishing company.

Our third trial customer is Swiss Fresh Water, a

Tuna Locating Buoy

company that provides small water purification machines used in Africa and other remote regions. It is an inexpensive kiosk-sized device that purifies water at a cost most people can afford. So, it not only serves a vital need, but produces business opportunity for the machine owners.

We will help them monitor the machines remotely and make sure they are maintained correctly, an especially useful solution because the cellular network is not available or stable enough in many areas to provide the connectivity they need. Swiss Fresh Water loves our solution because they don't have to deal with many different cellular providers, even when cellular service is available.

These applications give you an idea of what we can do in the satellite IoT business. There are literally hundreds more potential opportunities, since 90% of the planet's geography is not covered by cellular networks.

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GILAT SATELLITE NETWORKS

SMW: What frequencies are being using to communicate with the satellites? What is their altitude and expected life cycle?

FJ: The satellites work with L-Band for the IoT links which is a key differentiator because we are the only IoT venture with this global access. L-Band is, by far, the best spectrum for IoT based satellite applications because, among other advantages, you can use an antenna very similar in size to a GPS antenna. Also, L-Band is not sensitive to the weather like Ku and Ka-Band, and you don't have to worry about interference in other frequencies where capacity is shared. Use of L-Band also enables us to access GPS data with the same antenna that we use to establish the link with our satellite.

> "L-Band is, by far, the best spectrum for IoT based satellite applications because, among other advantages, you can use an antenna very similar in size to a GPS antenna. Also, L-Band is not sensitive to the weather like Ku and Ka-Band, and you don't have to worry about interference in other frequencies where capacity is shared."

SMW: What about latency and the data downlink? How many ground stations do you require, and how frequently to you pass over a target area?

FJ: First of all, Astrocast has a scalable system. We will go commercial next year with three orbital planes, and we will be able to transmit a few messages per/day. So, at the beginning, we will have a relatively high latency.

However, there are many applications that don't really care about the latency. For example, Swiss Fresh Water has a once a day contact, and that is sufficient. As there are many customers with this sort of latency requirement, we will target them initially.

Of course, the more satellites we launch, the more the latency is reduced. Ultimately, we will have 64 satellites with two-way communication operating in eight planes, and the satellites in each individual plane will be inter-linked, further reducing latency and allowing us to achieve near real-time with ten ground stations, thereby broadening our market.

SMW: I note you target maritime, mining and oil and gas markets. Why have you chosen these markets? Can you give us any examples of initial applications and initial customers? Are there other markets you can target?

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FJ: As I mentioned, we are going to target remote areas, and because the earth is mostly covered by water, maritime applications are a big market for us.

Here we are talking about fishing and environmental buoys and vessels. For example, in some vessel applications, it makes more sense to go direct from a sensor to the satellite rather than go through a centralized VSAT system.

Also, when you add a new IoT application on a vessel, it is sometimes easier just to use a direct satellite link. One application in which we are engaged is the monitoring of the emissions scrubbers.

Another is the monitoring the level of compressed gas used to inflate life rafts. We have also been working on an application for life vests as well that transmits GPS position to enable rescue.

SMW: Can you tell us something about the terminal module itself?

FJ: Our terminal is a highly miniaturized module about the size of ½ a business card and because it's L-Band, the antenna is very small.

The module itself is based on an ASIC that we have developed together with Airbus and another French entity, and is basically the best technology that you can find for satellite IoT. We have exclusive access to the chip and the data protocol that goes along with it.

IoT has some unique requirements in a satellite environment. You simply cannot use existing protocols in this application. It's inefficient. What we have is a data protocol that is optimized for space-based LEO-based IoT, essentially taking into account all of the constraints related to this mode of operation - the high speeds of LEO satellites vs. the stationary nature of the object on the ground, Doppler effect, the ability to do firmware updates. Of course, it's important that the chip is low cost.

It will cost around five dollars, and a complete module will cost less than $50. While we will sell the chip itself and a complete module, ultimately, we expect integrators to buy the chip only and not the module.

SMW: What exactly is the business model? Will you go through-value added distributors or sell direct to the customer? How does Astrocast

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generate revenue, and, if you employ distributors, what is their pricing model?

FJ: Our customers will be systems integrators and, in some cases, end users. We plan to make a small margin on the hardware, but the real revenue will come from several types of usage plans. We can charge by volume, monthly or annual subscriptions.

When a value-added integrator is involved, they can make money by buying the hardware and data plans from us and then create a high margin, value-added solution for the customer.

SMW: As you know, in IoT, competition is really heating up. Sky and Space Global, Hiber and Kepler Communications are all planning to launch "store and forward" services and Iridium will provide a "real-time" service. In addition to the use of L-Band, what are the other key differentiators?

FJ: We have quite a few very distinct differentiators vs. our competition.

- Many applications require two-way
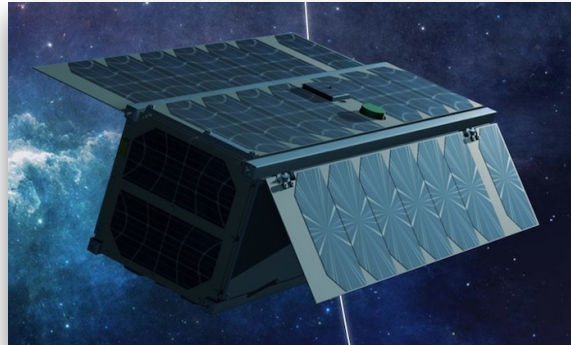
communication. We have that capability. Most of our competitors are only one-way. This is useful, if you want to update the firmware of your communications modules.

- There's low latency. Using inter-satellite links in combination with 64 satellites and ten ground stations assure the best latency possible.

- Our dedicated L-Band frequency which eliminates the threat of interference.

- High level security: when you connect millions of actors, you need a very safe solution. We have multi-level encryption with a 256 bite encryption key. So, we can address markets where security is critical.

- We already have a satellite compatible, IoT ASIC chip that we can manufacture in large volume which drives down cost, and we have exclusive access to the chip

and protocol because we co-developed it with Airbus.

- Finally, we have an extremely low power requirement. We consume less that ½ a watt during transmission which results in extended battery life – between 5 and ten years in most cases.

SMW: Will you provide raw data, offer any analysis or are there other ways in which you add value?

FJ: Initially, we are just a "bent pipe" that provides raw data. Later on, we want to put in place specific analytical capability for certain segments. However, there are a lot of companies that specialize in data analytics and we will work with them when required. Also, many of our initial customers will have their own capabilities in-house.

In this initial stage of development, We're really very focused on the structure of the network. We need to make it very reliable and secure and superior to what the competitors can offer.

SMW: Thank you, Fabien.

[GD_42]

[sat_06]

[sat_07]

[GD_2

About Fabien Jordan:

Fabien brings more than 15 years of technology and engineering experience to Astrocast.

He successfully raised the funds required to demonstrate the system in orbit and is now leading the company towards the deployment of a 64 satellites network to offer IoT communication services, globally, starting next year.

He is widely recognized for his work on Switzerland's first satellite, SwissCube, while serving as Systems Engineer for the Swiss

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SES | Networks

New from iDirect: a Software Defined, VSAT - LTE Hybrid Modem

As enterprise connectivity becomes more complex, software defined networks (SDNs) are emerging to offer high-efficiency connectivity, automatically routing traffic over the best performing and lowest cost networks.

Now, for the first time, with its new iQ LTE remote, iDirect is bringing the same kind of software defined networking capability to the wireless world. Based on pre-programmed parameters, iDirect's modem captures IP streams from both satellite and LTE and depending on the application, chooses the appropriate routing.

For example, in cases where LTE is relied upon as a primary means of connectivity such as remote retail, satellite can provide critical backup allowing businesses to continue operation even if LTE service is interrupted.

In a secondary, and in even more intriguing application, the satellite forward link can be used for multicast, transporting very large data or video files to thousands of locations simultaneously and achieving significant time and costs saving vs. traditional unicast.

To find out just how useful this technology can be, we asked Chris Boyd, iDirect's Senior Director of Vertical Market Solutions, to highlight some of the more interesting use cases. Here's what he had to say:
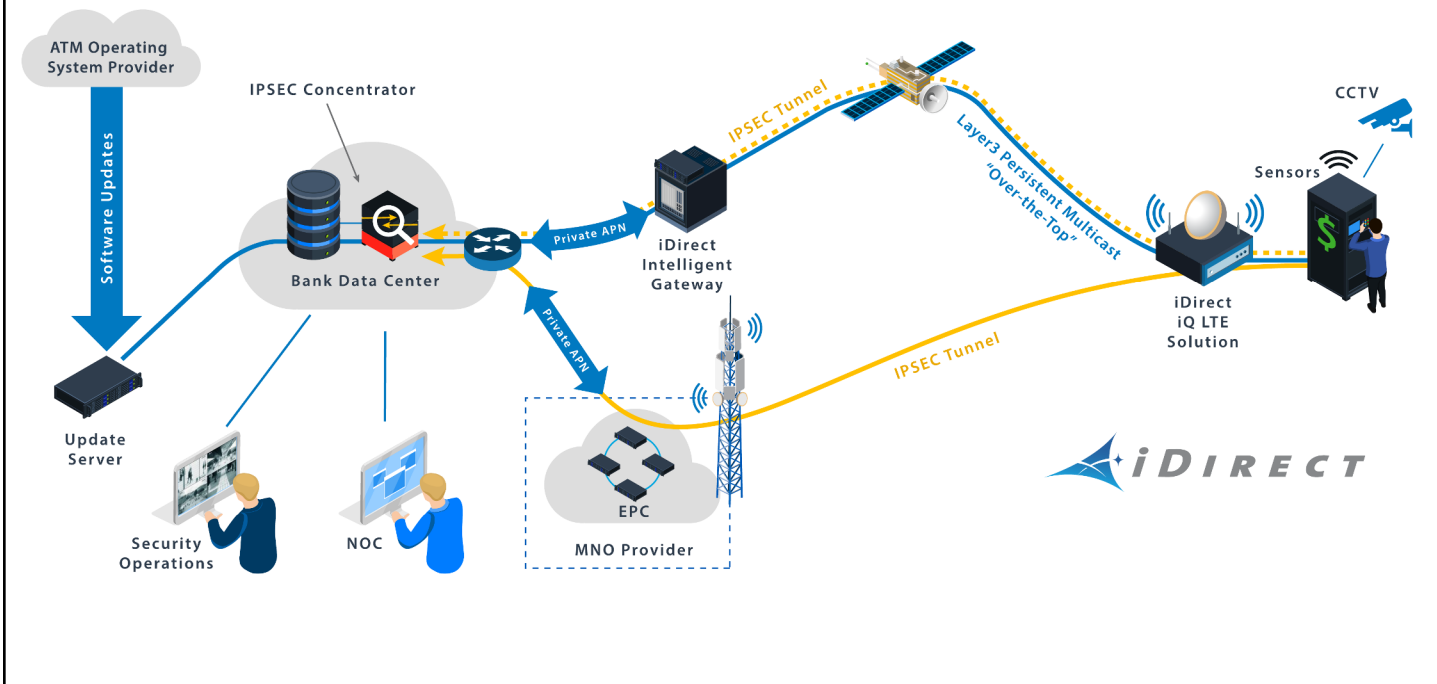
ATM Connectivity:

Chris: Developing market rural ATMs have traditonally been served by satellite, but as LTE coverage is extended out beyond the urban core,

The new iDirect iQ LTE remote combines iDirect's next-generation DVB-S2/DVB-S2X satellite remote with a cellular modem, integrating LTE and VSAT connectivity in a single rackmount form factor.

iQ LTE Use Case: ATM Resiliency

we are starting to see a transition to connectivity by LTE cellular.

The problem is that sometimes the ATMs connected by LTE go off-line, and the bank doesn't know whether the LTE has gone down, the modem has gone bad, the machine has been stolen or if the ATM has been destroyed.

So, our customers are telling us that they would like to have an alternative to LTE. We ask "Why choose one vs. the other. We think it should actually be both - a hybrid option." The problem can actually be solved by integrating an IP satellite modem and an LTE cellular modem. We are doing this with our new iQ LTE Remote, partnering with LTE connectivity leader, Cradlepoint, to create a hybrid cellular solution.

Essentially, we replace the existing LTE modem with the iQ LTE thereby enabling both a cellular and satellite connection.

What is interesting is that this solution provides more than just an alternate connectivity path: it also opens the door for a multicasting solution that enables the download of massive security and system updates to thousands of ATMs simultaneously - an approach far more cost efficient than unicasting.

For example, the download is usually a 1-2 Gigabyte file and doing it for four thousand ATMs over LTE via unicast takes days. Alternatively, when the Microsoft update server uses multicast over satellite to distribute the file, it can be delivered to all 4,000 ATMs in 30 minutes.

Digital Signage:

Another use case is Digital Signage. Here, again, the satellite backup link can be used for multicast distribution of digital signage such as the advertising videos you see on a gas pump.

Disaster Recovery:

In the case of a hurricane, first responders typically rely on a combination of cellular LTE and satellite.

Vehicles are typically equipped with auto-acquiring satellite antennas that are deployed at the final destination and cellular is used en route and at the final site, if it's available.

As cellular is the least cost alternative, first responders would prefer to use it, but at any time, might have to switch to satellite. In the past, switching between networks was complex.

With our iQ LTE modem, it's all done automatically. VSAT and LTE IP streams are consolidated under a single IP network, and no user intervention is required, allowing emergency responders to stay in constant contact using VoIP and Wi-Fi. Of course, satellite multicast can be deployed here as well for mass distribution of graphical data.

Pleasure Boats:

For larger pleasure boats already equipped with VSAT, the iQ LTE is especially useful. When near shore, boats can use low-cost LTE, but as they venture further out, they can automatically switch to satellite.

Offshore Service Vessels:

As you may be aware, the Gulf of Mexico and North Sea, two major oil areas, are covered with cellular. OSV's must continually navigate through areas where sometimes cellular may not be available. Because our modem has the ability to seamlessly switch between networks, uninterrupted connectivity can be assured.

Rail:

Passenger Rail is another good example of how the iQ LTE can be used to advantage. In addition to providing seamless switching from one network to another, the multicasting capability can be used to onboard caches of entertainment content, lowering connectivity costs and improving the user experience.

These are only a few examples that demonstrate the

significant market potential for the product."

Enhanced Opportunities for Service Providers:

There are other advantages as well. Using the iQ LTE, service providers can add value to their managed service offerings and offer a service that consolidates all network services under one bill. The result is extended service capability and a win-win for everyone.

For more information: www.iDirect.net

About Chris Boyd:

Chris Boyd, Senior Director Vertical Market Solutions, Product Management, VT iDirect, is responsible for driving the overall product and solution strategy across VT iDirect's core vertical markets – maritime, aero, telco/enterprise, IoT and defense.

Previously, Boyd focused on next-gen advanced mobility solutions. This work, leveraging 4G/5G network solutions using 3GPP mobility standards, brings significant expansion of

Upcoming and Recommended Satellite Mobility Events

There are many mobility related satellite industry events and unless you have an unlimited budget, here are the "must attends" and others that may be of interest. Note that the "hot" sectors are Cruise, Aero and Yachts. Satellite Mobility World attends those events highlighted in blue.

Upcoming Conferences:

*****Satellite 2019: May 6-9: Washington D.C. We consider this one of the two most important Satellite shows and conferences in the industry, the other being the World Satellite Business Week in Paris, held the second week of September.

****Cellular Backhaul 2019: June 13: London.

Click here for further information:

*****Global Connected Aircraft Summit: June 10-13: San Diego, CA . This is the premier conference for those interested in broadband connectivity on commercial aircraft.

****CommunicAsia: Singapore June 18-20: This is the premier satellite industry event in Asia. Not to be missed.

*******Small Satellite Conference: Logan, Utah, August 8th-12th 2019. While a bit out of the way, this is the primer conference in the industry. With most of the innovation in satellite coming from this segment,

it's a must to attend. Last year, over 3,000 attendees from all over the globe attended - far more than any other conference focused on the topic.

***Nor Shipping: Oslo: June 4-7: Important exhibition for those following the Scandinavian shipping industry and the maritime VSAT Market.

******World Satellite Business Week: Paris, France: Typically, the 2nd week of September (dates to be announced) For those seeking the opportunity to meet and easily network with top executives of the satellite industry, this is the premier conference of the year.

***Monaco Yacht Show: 25-28 September: Monaco: For those interested in the use of VSAT on yachts, this is a key event.

*Other Conferences/Shows of Interest:

***Digital Ship *CIO Forum/Cyber Resilience* Forum: Held in numerous locations around the world, these events are notable for their focus mainly on IT related issues including cyber security, IoT and M2M. Sponsored globally by Marlink, they are held nearly everywhere.

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