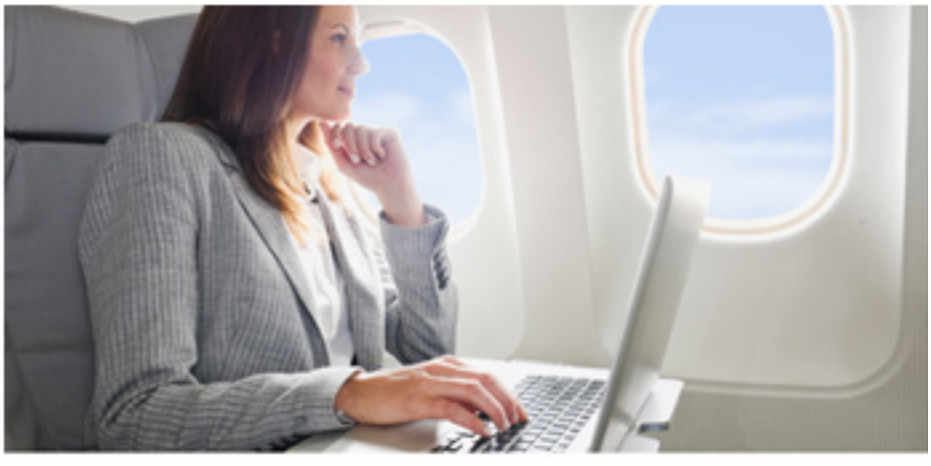
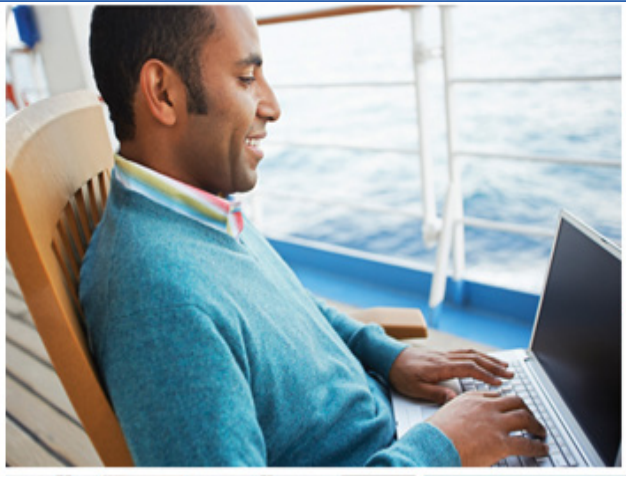
March 2022

SATELLITE Markets & Research

MARKET Briefs

Executive Summaries of Market Trends and Opportunities in Key Market Segments and Regions Worldwide





Advanced Mobility Solutions

(images courtesy of ST Engineering iDirect)

Advanced Mobility Solutions

by Elisabeth Tweedie

For many people one of the numerous frustrations of the last two years has been being "grounded". Travel was one of the hardest hit sectors during Covid. Not only did many countries close their borders, in many parts of the world local restrictions, coupled with fear of catching the virus, kept people close to home, so similarly impacting domestic and international travel. So it is hardly surprising, that as vaccinations make travel safer, and restrictions are lifted, people are starting to travel again for both business and pleasure. This is fueling a resurgence in all sectors of the travel industry.

It wasn't that long ago that travel was viewed as an opportunity "to get away from it all". Now travel is viewed as an opportunity to "take it all with you!" Whether for business or pleasure, in the air, on land or at sea, one thing all passengers have in common is the expectation that their all-important digital life will continue whilst they are on-the-move. Whether passengers want to work, stream movies, play online games, access social media or video chat there is an increasing expectation that this will not only be possible, it will also be easy and suffer no diminution of quality.

This is a pretty tall order, coming as it does during a data explosion. On the demand side of the equation, video is migrating from HD to 4K meaning that, at a minimum, four times the bandwidth is required. Users are also acquiring and using more devices. Passengers may simultaneously be doing email on a smart phone and working on a laptop, whilst at the same time watching a video on a tablet out of the corner of one eye. And in the case of airline passengers, doing all this while flying at nearly 600 mph. On the supply side, the amount of on-orbit capacity is also undergoing exponential growth, primarily fueled by the vast number of low earth orbit satellites (LEOs) currently being launched. However, medium earth orbit satellites (MEOs) and Ultra- or Very-High Throughput (U/VHTS) and software-defined geostationary satellites (GEOs) are also adding to the growth.

New Ground for Service Providers

For the last few years, we've heard a lot about "new space," but it's only very recently that we're hearing about "new ground," and yet the former would not be possible without the latter. No matter how much satellite capacity is available, if the ground infrastructure isn't sophisticated enough to handle the multiple handovers between beams, satellites, frequencies and orbits, required by the GEO and non-geostationary (NGSO) satellites alike; new space would be dead space!

Challenging as these requirements are, they are magnified when it comes to supporting the travel industry. Not only does the infrastructure need to support beams and satellites that are constantly moving and changing, the ship or vessel's location is also changing; and as already mentioned in the case of airline passengers, changing very rapidly.

While there may be specific pieces of equipment for the different markets – the modem for the aeronautical market will be different to that used for maritime for example - underlying this is a common set of requirements that service providers must meet, so that the shipping company or airline can respond to the increasing demands and expectations of these passengers.

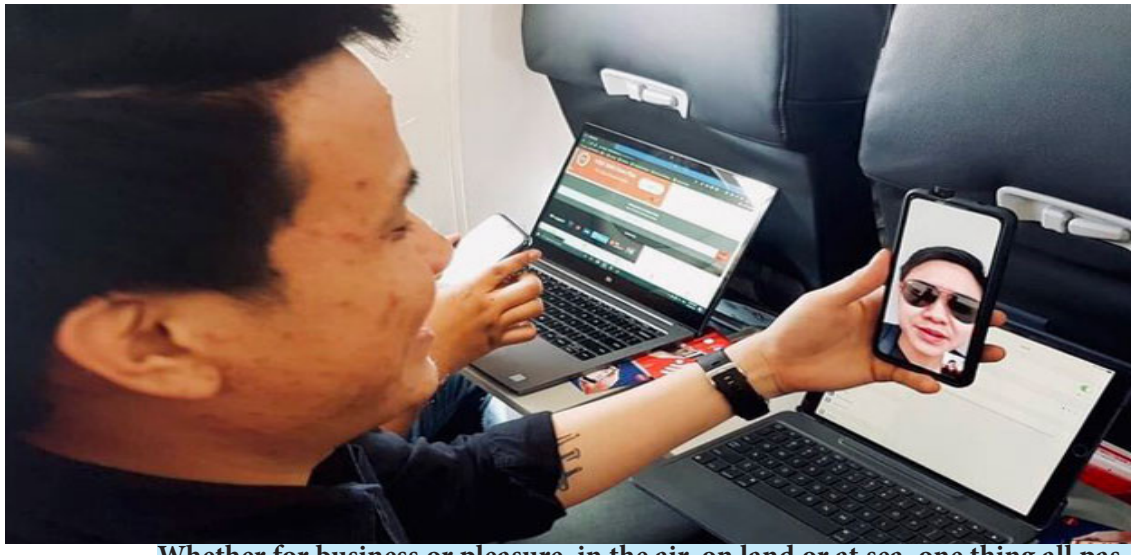
In order to help their customers, service providers need equipment and software that will enable them to:

- Successfully manage an aggregate bandwidth pool from many beams from multiple satellites.
- Grow and expand the service cost effectively, with minimum disruption as new customers and satellites come into service.
- Deliver enterprise-grade availability and resiliency.
- Comply with all local regulations, which change as passengers cross through or over different countries and territorial waters.
- Avoid interference, which can be more of an issue in mobility where size, weight and power (SWaP) limitations dictate the need for smaller antennas.
- Integrate seamlessly with terrestrial networks.
- Keep the total cost of ownership (TCO) low.

Behind the Scenes of Advanced Mobility to Deliver the Best Passenger Experience

From the passengers' point of view, there is only one requirement for their "on-the-move" digital experience: it must be indistinguishable from digital experience at home or in the office. What appears to be a seam-

less experience for the passenger, is actually the result of a remarkable and sophisticated set of network and physical technologies, namely, bandwidth management, network management, regulatory compliance, physical beam switching, waveform innovation, and equipment. The final necessity for mobility service provision is scale, the ability to grow incrementally and on demand while still conducive to the bottom line.



Whether for business or pleasure, in the air, on land or at sea, one thing all passengers have in common is the expectation that their all-important digital life will continue while they are on-the-move. Whether passengers want to work, stream movies, play online games, access social media or video chat there is an increasing expectation that this will not only be possible, it will also be easy and suffer no diminution of quality. (Image courtesy of Air Asia).

Bandwidth Management

Global bandwidth management is a key element in service provision. Service providers select and aggregate satellite bandwidth from multiple operators, satellites and spot beams, orbits and frequencies into a single bandwidth pool. This capacity pool is dynamically shared between customers and between customers' vehicles according to their Service Level Agreements (SLAs) which delineate priorities, applications and device types. Bandwidth management incorporates a myriad of SLA factors including features such as Load Balancing, Service Scheduling, Geoscope and Fair Access Policy (FAP), in order to manage congestion and optimize fill rates.

Maximizing the value of a shared bandwidth pool requires advanced Quality of Service (QoS) for traffic prioritization and bandwidth management. An airline, for example, can establish distinct QoS settings by modem, bandwidth groups and applications. As bandwidth demands fluctuate across a fleet of aircraft and among passengers onboard – all of whom are sharing a common pool of bandwidth – SLAs can be configured and prioritized in highly flexible ways unlike conventional QoS. Global bandwidth management is important now and will become even more so in the future as more and more LEOs and MEOs come on stream.

Network Management

As the epicenter of a very complex set of operations, sound network management is increasingly becoming the measure of an operator's success. A robust network management system manages large-scale deployments, monitors network activity, measures profitability and determines customer satisfaction. Network-level bandwidth management ensures overall quality of service across a customers' fleet, guarantees individual vehicle SLAs, and maximizes use of capacity. It also ensures that fluctuating demand, different antennas and customer specific Quality of Service (QoS) and Service Level Agreements (SLAs) can all be handled. A global network management system allows tracking to ensure a consistent connection as modems pass from network to network around the world. In turn, this allows service providers the capability to monitor and manage each modem. As vessels and planes traverse the globe, these modems will connect to many different hubs, but each will be uniquely identified by a fixed global IP address.

Regulatory Compliance

Many regions and countries have unique regulations which pertain to the satcom equipment or signal as it moves between sovereign states and through territorial waters. Therefore, a Service Provider offering mobility services must ensure that these are all adhered to, including frequency use and radiated power limitations as well as no-transmit areas, all of which may change during a journey. New flat panel or electronically steered antennas primarily designated for on-the-move applications, for example, might exceed power spectral density limits which may change by location resulting in penalties. Therefore, it is important that system configurations take all regulatory factors into

account and change in response to location. A mobility network platform must have the ability to manage these regulations automatically; regulations which grow in complexity as customers grow and expand their service area.

Beam Switching Technology

As satellites pass overhead and/or the vehicle moves, the signal needs to reconnect so that the change is imperceptible to the passenger. The onboard modem needs to maintain a constant IP session as the modem crosses multiple spot beams in a short period of time. Enhancements to basic beam switching technology facilitate this. These include automatic beam switching, so no manual intervention is needed, innovations at both the hub and modem which facilitate fast beam switching and fast reacquisition should blockage occur, and beam switching Application Program Interfaces (APIs) which allow (or permit) a user to customize the beam switching algorithm logic.

Onboard & Waveform Technology

In order to provide superior two-way broadband connectivity to moving antennas, additional technology is layered onto the basic modem functionality. The main technologies that are critical include: OpenAM-IP-based protocol to facilitate the exchange of information between the airborne antenna and the satellite router; skew angle support to ensure compliance with adjacent satellite interference limits; doppler compensation to account for the change in the frequency wave perceived by the receiver; multicast overlay to support distribution of content management and spread spectrum waveform technology to significantly reduce the risk of causing adjacent satellite interference from small antennas. Additionally, specialized integrated modem boards, specifically for aero, are optimized for size, weight and power and must comply with strict standards such as DO-160G and ARINC 791. Pairing these mobility-specific functions with new waveforms for increased efficiency and throughput, can enable an instantaneous connection in networks with fast-moving remotes, similar to that achieved by a terrestrial network.

What Are the Key Drivers for the Mobility Market?

- **Increased demand for high throughputs**
- **Expectations of "landline" service availability**
- **Increased devices per account/location**
- **Focus on improving margins with automation and spectrum efficiency**

Scalability & Total Cost of Ownership

Scalability is fundamental to the success of any business. For mobility-based companies, the flexibility to build out infrastructure in-line with demand, is key to managing total cost of ownership (TCO). No service provider wants to have to redesign the system as usage grows, or when it expands its coverage to take advantage of new satellites and orbits as they come into service. Not only is it important to be able to access the new satellites, but they also have to be integrated into existing systems to deliver a single unified service. That service ideally can provide more capacity and higher speeds, without a significant increase in cost.

TCO is a major consideration for any service provider contemplating upgrading its hubs and remotes in order to take advantage of the new reality of expanding mobility markets, greater satellite capacity and new orbits. As a result of significant investment in innovative technology, ST Engineering iDirect offers modular design hubs providing a pay-as-you-grow network for its customers.

Cruise Passengers

The cruise industry was particularly badly hit by Covid-19, essentially grinding to a halt as the pandemic swept around the world. As more people are vaccinated and the industry has instigated new health protocols, it is experiencing a revival, although this statement comes with the caveat that the full long-term impact of the new variants on the industry is unknown at the time of writing Nevertheless, as we await to see what unfolds, cruise lines are ramping up operations, and for some operators, bookings for 2022 are already higher than those in pre-pandemic 2019.

As mentioned in the introduction, Covid-19 temporarily slowed or halted growth across all of the mobility sectors. However, as the world gradually opens up and learns how to cope with new variants of the virus, optimism is returning. Numbers of installations, as well as bandwidth consumption continue on their upward trajectory, after the covid hiatus. NSR is predicting that the number of VSAT broadband equipped passenger vessels will experience a 6% CAGR to 2030, whereas MSS broadband will not experience any growth. According to NSR there are currently nearly 70,000 broadband enabled vessels in total, and this is predicted to grow to over 142,000 by 2030. This of

EXECUTIVE SPOTLIGHT

Sean Yarborough, VP-Product Management, ST Engineering iDirect

Please give us a brief overview of ST Engineering iDirect's offerings for advanced mobility applications?

To begin with, we offer various waveforms in our portfolio to address a variety of use cases. Our latest innovation is Mx-DMA MRC which brings forth the full scalability of TDMA return technologies to the same SCPC-like efficiency that mobility networks require.

We offer an NMS capability specifically designed to support mobility networks. It offers the ability to manage tens of thousands of terminals that are across many different gateways, satellites, and beams. This is especially important in terms of mobility as the service provider must be able to manage dynamic traffic efficiently.

Beam switching is a key aspect that many claim, but the devil is in the details. Mobility terminals are constantly switching beams and sometimes satellites, especially in the case of aero. The amount of time it takes to switch beams is critical to the overall service offering. If the service is out for minutes at a time versus one to two seconds, it completely changes the SLA and therefore the perception of the service. Our advanced mobility technology enables very fast beam acquisition so the timeframe to re-acquire the network and to switch beams is as fast as possible.

Fast beam switching is critical, but service providers also need tools that will minimize the loss of the connection in the first place. Our advanced mobility technology maintains link robustness, dynamically maximizes transmission throughput while avoiding the creation of interference on other carriers and modems and mitigates potential satellite blockage to minimize loss of a signal and to provide a superior re-acquisition environment when it does happen.

Quality of service (QoS) is another exceptional aspect of our advanced mobility, including global QoS in some of our platforms to ensure that quality of service is maintained consistently anywhere a remote terminal travels.

Sean Yarborough

We're also now seeing networks that have heterogeneous user requirements such as a mix of ships and aircraft for example, which results in wide variation of terminal sizes and throughput requirements per terminal. The ability to be able to manage all of those different types of throughput and antenna performance requirements within a single network is a key differentiator for service providers.

What advantages does your advanced mobility solution package portfolio have over your competitors? What would you say are the key benefits for your customers?

I would say that it's not about calling out one feature benefit here or there. It's actually about the combination of all these offerings and how they work together to raise the level of the whole system. This is what makes our service offering so unique.

Our market presence is so significant because of some of the features we've talked about.

The fact that we offer global QoS for customers means that they can have confidence in their ability to deliver a high availability service wherever they are in the world. Our global bandwidth management or global QoS function is unique in that aspect.

We enable service providers to offer high availability networks despite rain fade or other extreme weather events. In addition to beam switching, service providers can set up redundant gateway and NMS infrastructure to keep the system always up even when disaster strikes one area.

Customization is another differentiator to our advanced mobility offering. Our platforms are API-driven meaning they allow service providers to establish new roles and new operation methodologies to create something uniquely their own to take to market. It's the same with QoS management. In some cases, our APIs allows service providers in consult with their customers to customize their beam switching algorithms.

Can you cite some examples of of implementations using your advanced mobility technology?

We work with nearly all the largest mobility network operators globally including Inmarsat's Global Xpress network, which is the largest mixed-use mobility network in the world, as well as thousands of installations on Intelsat's Flex, SES' Skala and Eutelat's Advance networks, which are managed services. Beyond pure satellite operators, we also support service provider partners including Panasonic Avionics in commercial aviation and Speedcast and Marlink across all segments of maritime. Of course, this is all in addition to large fixed segment business with most of these partners as well.

What can we expect from ST Engineering iDirect in the coming months in terms of advanced mobility solutions? What developments can you tell us about?

We will expand our platforms and solutions to become multi-orbit moving forward and we will have the ability to support ground infrastructure and dynamically allocated capacity for software defined satellites. We'll also focus on integration with the telco standards, so you'll see more 5G proof of concept work along with actually interfacing to MEF standards in the near future.

We consider network virtualization and cloud native technologies as critical enablers to this interface. Today, all of our traditional RF technology and our data processing technology is at the teleport, gateway and hub. Given the scale of NGSO networks, we can't continue to put all of that infrastructure into a single physical location. When you do that, you're not necessarily optimizing the full processing capability either. We have already centralized processing at a data center (and we're going to continue to innovate in this area). So, just like IT organizations have a data center running for all of their HR applications, their security applications, and all their other internal applications, our customers now have the ability to centralize data processing for their teleports using network virtualization. This allows them to scale their hardware needs and processing requirements up and down based on the actual demand of service growth.

We are collaborating with industry partners on the technology and standards necessary to achieve better interoperability. Specifically, we were founding members of the Digital Interface Standards (DIS) Group which consolidated with the Digital IF Interoperability Consortium (DIFI) to address the need for a standardized RF interface between modulator, modem and RF components for easier interoperability of virtualized components in the cloud. As an example, look to the aero market and consider the time it takes for all of satellite switches in a typical flight. Terminal operators and airlines are looking to minimize the amount of beam switches or satellite switch times, creating the need for multiple modems. The goal is the ability to deploy a single piece of hardware that meets the needs but may require two modems in one terminal to support various waveforms and capacity.

Another innovation in our NMS technology makes it completely virtualized to run in the public cloud. We expect that centralized data processing will still happen in the private cloud for each one of our customers but

our NMS, which is primarily doing configuration and stats retrieval, could be managed in a public cloud environment. This allows service providers to scale the NMS over time. In some cases, it allows them to invest in and deploy a solution at a lower cost. Both kinds of scenarios – centralized data processing or centralized and mass management in the public cloud – require cloud native Kubernetes technology that virtualizes our applications and makes them more accessible and scalable for our customers.

The other side of the story is at the edge. Whilst we are virtualizing the core technology, we are also innovating on the modem side. We are working on virtualizing our modems to offer the ability to run third party applications. This will give service providers the advantage of adding external processing at the edge directly on-premises, which would lower their costs and simplify ease of installation and deployment.

The bottom line is that we want to help our customers serve their customers better with excellent service and flexibility in terms of how they go to market.

What types of changes is ST Engineering iDirect preparing for in the scope of mobility? How does it plan to meet these challenges or opportunities?

It really starts with the changes in the satellites themselves. There's an expansion of orbits. Traditionally, the orbits have been primarily GEO-based. Now almost every provider is looking at a multi-orbit offering so that they can tailor their services to the unique needs of their end users. So, for example, where they need higher throughput and less delay, they might be looking at MEO or LEO constellations. If they are looking for more global coverage they will go to GEO.

A significant opportunity is primarily centered around the capability of the satellites. Software defined satellites enable service providers flexible capability to enable coverage and capacity anywhere and in real-time. Before we had constellation maps to know where static beams are, today, these beams can be adjusted in real-time to either ensure coverage for a distinct area or to ensure capacity and throughput to meet certain SLAs. This is a level of orchestration that is a brand-new requirement for most of the market, and definitely something that we as a ground infrastructure provider must start to accommodate.

"...The bottom line is that we want to help our customers serve their customers better with excellent service and flexibility in terms of how they go to market..."

The other big trend we are seeing is around the move towards integration with telco standards. We're seeing almost all of our larger customers look to some of the telco standards that many organizations have already defined to enable them to carry out orchestrated services, carrier service levels and agreements. Our customers are looking for that same level of capabilities within the satellite network so they can have more interoperability between a satellite network and terrestrial network. If you are a telco provider, with both satellite and fixed fiber offerings, you want to be able to offer your enterprise customers a common definition of service and a common Service Level Agreement (SLA), regardless of the access type. If I'm offering a service over fiber to one location, when I want to offer that service in a remote location using satellite, I will require some of the same telco capabilities in terms of configuring that service and offering the service itself. So, again, you're seeing this need to adapt, which has already have been proven to work in the telco space and by adopting this, we can achieve interoperability and improved efficiency in terms of operations because you're using interfaces and standards that are already been deployed elsewhere.

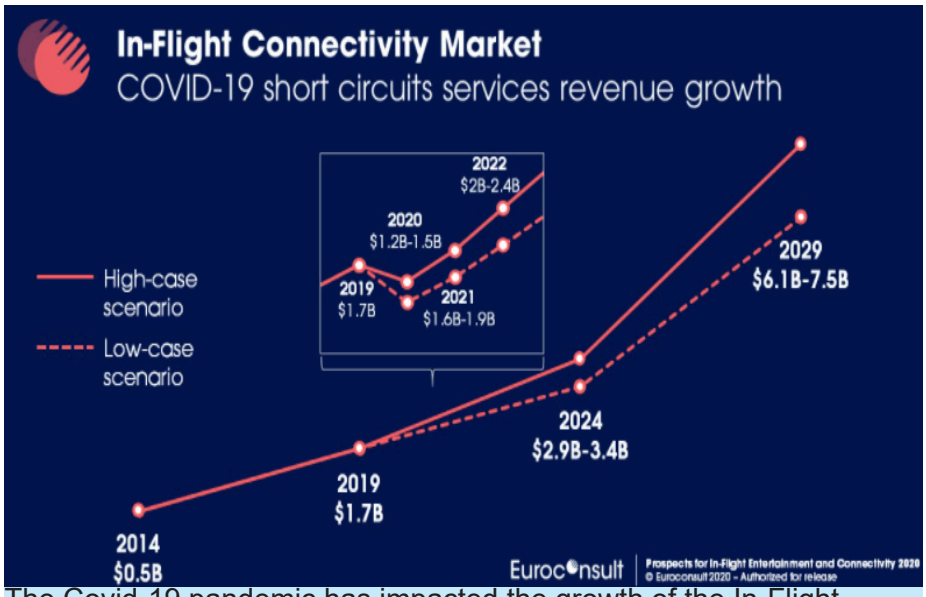
From the perspective of mobility, if you think about airplanes, ships and vehicles for example, the need to have visibility of things and people across the entire supply chain is driving that need to integrate with telco standards and to provide a consistent standard of service across them.

Then there is the shift of information to the cloud. In the maritime segment particularly, there is great demand for real-time access to information, part of what we call digitalization. Part of that digitalization is moving things into the cloud so that multiple stakeholders can access data whether it is around inventories or the operational efficiency of a vessel. Moving this data into the cloud also drives this necessity to have reliable, real-time connectivity.

course, includes commercial shipping and fishing fleets as well as passenger vessels.

Connectivity at sea was changed by HTS. Previously, the vast majority of services were limited and costly. HTS ushered in a new era of VSATs at sea, and as cruise passengers got a taste of being able to share photos or even watch video, demand for bandwidth grew. Provision of reliable broadband is giving cruise companies a competitive edge in the market for customers.

Based on two scenarios, high case and low case, the analysis forecasts that the total number of connected aircraft will reach between 16,000 and 20,000 by the end of this decade.



The Covid-19 pandemic has impacted the growth of the In-Flight Connectivity market, but the overall prospects post-pandemic still remains good. Based on two scenarios, high case and low case, Euroconsult forecasts that the total number of connected aircraft will reach between 16,000 and 20,000 by the end of this decade.

Airline Passengers

Aviation is arguably one of the most demanding of the mobility markets. As previously discussed, planes are moving at high speed, across multiple beams and satellites whilst traversing different regulatory systems.

The aeronautical market is predicted to experience even greater growth than maritime, over the same period, with NSR predicting just over an 8% CAGR in units-in-service in its low-growth scenario and nearly 11% in its high-growth scenario. At the low end this translates to a doubling of units from ~50,000 in 2020 to ~100,000 in 2030. Currently, most of this growth is coming from HTS, but the LEO constellations are clearly making a play for a piece of this market. SpaceX has recently filed with the FCC for up to 500 earth stations aboard aircraft and Elon Musk tweeted that "SpaceX is focusing on B737 and A320, as those serve the greatest number of people." OneWeb, is also targeting the IFC market, and signed an agreement with SatixFy in March to develop an aeronautical terminal. On its website it states that the antenna will significantly reduce drag and fuel consumption compared to other antennas. Telesat, already a major player in the IFC market with its GEO fleet, is now committed to its own LEO constellation.

Despite the buzz surrounding the LEO market, it is clear that service providers are wary and are not anticipating early success for the technology. IFC service provider Anuvu has recently announced its intention to supplement a possible transition to LEO with a micro-GEO constellation as well as holding the expectation that HTS GEO will always be necessary for areas of high demand.

Both business and commercial aviation were hit hard during the pandemic, and both are now experiencing a resurgence. Although still down 21% from June 2019 (pre-pandemic) numbers, according to statistics from the US Bureau of Transportation, US airlines overall carried 304% more passengers in June 2021 than June 2020. This breaks down to an increase of 276% for domestic passengers and 1,450% for international passengers.

Business aviation is experiencing an even greater resurgence. This is likely attributable to both concerns about the health risks of commercial flights and the strong stock market, both of which serve to lead wealthier travelers to seek a more exclusive experience. According to Wingx Business Aviation Bulletin, in spite of regional variations due to the Omicron variant, at the end of the first week of December, globally business aviation departures were up 6% on 2019 and 48% on 2020. In the United States, at the end of the first week in December cumulative domestic business jet departures were up 3% on 2019, but this statistic conceals some very strong months. During November for example departures were up 20%.

Rail Passengers

Although lagging behind aeronautical and maritime, there are currently a few installations of communications for land-based passengers on the move. This is expected to increase as flat-panel electronically steered antennas become more readily available and affordable, and the price of bandwidth continues to fall. Elon Musk has already indicated that trains are one segment being consid-

ST Engineering iDirect: A Legacy of Advance Mobility Excellence

Consolidation among ground service providers means that there fewer players competing for this market. Comtech/UHP, Gilat, Hughes, Viasat and ST Engineering iDirect are the main players, and of these ST Engineering iDirect is highly regarded for its strength in aero and maritime markets.

Always with an eye to the future while leveraging a heritage of mobility leadership, ST Engineering iDirect has focused on developing products and technology specifically designed to meet the advanced mobility needs of service providers and their end customers.

ST Engineering iDirect has set the standard for excellence in advanced mobility for decades and shows no signs of relinquishing its leadership. Its platform and products incorporate a distinguished range of technology and innovation uniquely capable of handling the challenges inherent in high-speed mobility including automatic beam switching, global network management, group quality of service, direct sequence spread spectrum, OpenAMIP®, advanced security, multicast overlay, and aero-specific integrated modem boards.

Cruise Industry

ST Engineering iDirect is a major player in this segment, nine out of the ten largest maritime VSAT service providers use ST Engineering iDirect hubs to run their networks. Over 50% of all maritime VSAT terminals are Between them, Inmarsat, Intelsat, Marlink, SES Networks, Speedcast and Telenor Satellite account for over 50% of all maritime VSAT terminals;, all of these operators which rely on ST Engineering iDirect's equipment to power their maritime networks.

The relationship with SES is unique, as this includes O3b, SES's MEO constellation. When SES O3b mPOWER launches early next year, modems from ST Engineering iDirect will work with SES's Adaptive Resource Control (ARC) seamlessly switching between the constellation and SES-17 a GEO satellite. ST Engineering iDirect's APIs will facilitate Oo3b mPOWER's resource orchestration, the management and coordination of resources. This is a first for the industry, but the forerunner of things to come. As Frederik Simoens, CTO of ST Engineering iDirect said: "We are at the beginning of a new future for our industry. To be selected for SES O3b mPOWER is a tremendous validation of ST Engineering iDirect's technology vision and proves that ground infrastructure will play a pivotal role in SES's ambitious goal to transform satellite service delivery. SES O3b mPOWER is at the forefront of a significant movement to drive a standards-based, virtualized network approach where ground is in lockstep with space. Through our partnership, we will greatly expand the possibilities for global connectivity."

In-Flight Connectivity

ST Engineering iDirect is the major player in both commercial and business aviation, serving over 50% of the inflight connectivity market (IFC). Its advanced mobility features and ground segment technology are used on commercial and business aviation networks provided by Inmarsat, Intelsat, Panasonic and SES. It also counts Collins Aerospace, Satcom Direct, and Honeywell amongst its aero customers.

The SITA FOR AIRCRAFT deployment of the service provider's ONAIR portal over Inmarsat's GX Aviation broadband network exemplified the value of advanced mobility to passengers on 14 airlines, to SITA itself, and to the operator. Yann Cabaret, VP Customer Programs and Cabin Services, SITA FOR AIRCRAFT said:
SITA FOR AIRCRAFT, an IFC provider, has successfully deployed its ONAIR portal, on 14 airlines. This portal provides in-flight broadband and enables passengers to use their cell phones. Service is provided through Inmarsat's GX Aviation broadband network, using ST Engineering iDirect's platform. As Yann Cabaret, VP Customer Programs and Cabin Services, SITA FOR AIRCRAFT explains: "We do not believe pre-allocating satellite bandwidth at the passenger level is the optimal and efficient way to ensure the best passenger experience. We believe that our role goes beyond this and consists of prioritizing satellite bandwidth in real time depending on the passenger profile and needs. We assess passengers' real time experiences as well as each piece of the connectivity chain, so we can offer the best quality of experience possible. With the ST Engineering iDirect platform, we're able to create land-like connectivity for our airborne passengers while seeing greater network performance and savings in efficiency and cost. It's a win-win for everyone."

CASE STUDY

Jeff Sare, Vice President, Connectivity Solutions at Panasonic Avionics Corporation spoke on their partnership with ST Engineering iDirect for their In Flight Connectivity (IFC) service.

Tell us about upgrading your aero platform and leveraging the advanced mobility capabilities enables reliable operation and cohesive orchestration of your global network.

When Panasonic Avionics first launched connectivity services for its airline customers, our focus was on building and delivering a global Ku-band satellite network that delivered wide-beam coverage across over 99% of all the world's air routes. At the time, we were using v1 of our aircraft antennae, and a modem from ST Engineering iDirect that was able to generate a bandwidth of 12-15Mbps to an aircraft.

Since that time, we've upgraded our satellite constellation, and introduced our Third Generation Network. We've done this by layering high throughput satellites (HTS) and most recently the first of several extreme throughput satellites (XTS) over high air traffic areas. We introduced a new single panel antenna that delivered dramatic improvements from the previous version, and worked closely with ST Engineering iDirect to develop a new modem for our Third Generation Network.

When we started testing the new modem platform, we forecast that it could provide 250 Mbps per plane in areas where there was sufficient capacity and HTS coverage. Today, with best-in-class satellites in our Network, we're seeing a 15+ fold improvement in throughput.

Recently, a China Eastern flight using our new Extreme Throughput Satellite (XTS) service on the highly advanced APStar 6D communications satellite saw peak speeds reaching 200 Mbps. As a result, passengers were able to enjoy services like streaming video, video conferencing, downloading large files, and high-speed web browsing, on multiple devices, all at the same time.

While the modem isn't the only reason for that massive increase in speed and bandwidth, it is a critical component in our communications infrastructure, and has contributed significantly to Panasonic Avionics' ability to enhance the connectivity experience of our airline customers and their passengers.

How important is aero platform flexibility to offer your unique portfolio of inflight services?

This level of flexibility is vital to Panasonic Avionics to ensure we can deliver seamless connectivity of a sufficient bandwidth to airlines and their passengers. It gives us the ability to support widebeam, HTS and XTS simultaneously. This flexibility is key to our ability to simultaneously deliver Internet connectivity, OTT applications and our global television service for the best possible price.

The flexibility to connect seamlessly to all the satellite types enables us to offer a highspeed connection on everyday commercial flights. As airlines have different commercial objectives, we need to offer tailored connectivity rather than 'one size fits all'. A flexible platform makes this possible, by enabling different service plans and connectivity bundles with different speeds and profiles.

Having a versatile aero platform also enables better dynamic load balancing between overlapping beams. Advanced modem technology not only saves our airline customers money, but has shortened the time between satellite beam switches by over 70%, enhancing the passenger experience. Additionally, by realizing full potential of the antenna capability, we have been able to reduce ground hardware expenditure on beams greater than 54MHz.

What has been biggest difference for your airline customers since your worldwide aircraft upgrades to your current ST Engineering iDirect aero platform?

Our airline customers have reported a number of tangible benefits as our connected fleet has been upgraded. The most prominent is the faster connectivity speeds available to passengers inflight, enabling them to continue much of their 'on the ground experience' in the air. Faster beam switches have also made a difference – particularly to passengers working while flying, and also helpful for cabin crew connectivity for activity such as in-flight retail purchases. The platform also enables us to be more responsive to satellite network requests from our customers.

How has your third gen network paired ST Engineering iDirect technology facilitated a streaming class of IFC service?

This partnership has made it possible for Panasonic Avionics to offer a reliable and competitive streaming product in-flight. Not only that, but has enabled us to offer HD streaming.

ered for Starlink. Some of the existing installations rely on cellular, however, high-speed trains can transition between cellular base stations at speeds faster than some of the terrestrial networks are able to cope with. Also, during the course of a journey, many trains will pass through areas of no cellular coverage, making a hybrid cellular/satellite solution the obvious choice for both issues

Hispasat is one of the leading providers of satellite services for rail passengers, with installations dating back to 2004. Its latest installation is for Renfe, the state-owned Spanish rail operator. This hybrid service, provided in partnership with cellular operator Telefonica, links satellite and 3G/4G for continuous connectivity and quality of service relying on fast signal reacquisition as the train travels at up to 350km/h. The service provides internet access, video-on-demand and multicast TV to passengers on 89 trains.

Looking Ahead

Despite the many advances, more evolution of the ground segment and advanced mobility is on the horizon. There are basically three concepts which service providers and their customers should be tracking: virtualization, standardization and orchestration. These are the key building blocks on which convergence and interoperability can be built. They will form the connective tissue to bring the 5G cloud-based telco-aligned reality to fruition and thus realize multi-orbit, multi-access, multi-service, multi-vertical service agility.

Virtualization, based on open source to bring forward improved scaled, performance and security will reduce operational complexities resulting in a fully digital ground segment that can integrate with terrestrial telecom networks to enable 5G. Standardization allows seamless integration between satellite and terrestrial networks for global mobile communication systems. Orchestration means end-to-end service automation to harness the full potential of high-throughput, high-efficiency networks.

"...Despite the many advances, more evolution of the ground segment and advanced mobility is on the horizon. There are basically three concepts which service providers and their customers should be tracking: virtualization, standardization and orchestration. These are the key building blocks on which convergence and interoperability can be built..."

ST Engineering iDirect is a member of the Digital IF Interoperability Consortium (DIFI) which promotes open standards between space and terrestrial interfaces with the goal of enabling virtualization of the modem infrastructure. Advances in resource orchestration through virtualization of networks and baseband functions will provide flexibility for supply and demand.

Today and into the future, Service Providers require networks with features that enable them to deliver scalable, customized, and efficient services to their end-users, thereby maximizing revenue and limiting costs.

ST Engineering iDirect Technology: A Fit for Any Service Provider

Service providers of all sizes are looking for a step change in capabilities. As the new NGSO constellations and advanced GEO satellites come online, the need for flexible, efficient, scalable ground systems will become even more important. With three robust platforms today—Dialog, Evolution and Velocity—and next generation capabilities under development, ST Engineering iDirect has rightly earned its reputation for remarkable advanced mobility platforms for air, land, and sea. Whether a service provider wants to adopt a new platform with high-efficiency waveforms suitable for a greater range of applications while minimizing operational complexity, maximizing statistical multiplexing, and adding further scalability or grow an already large scale maritime network with high QoS, or become an operator of managed services that require massive scale and advanced bandwidth management with very fast beam switching across hundreds of spot beams globally, ST Engineering iDirect has the innovation and technology to be relied upon for the best advanced mobility has to offer.

Elisabeth Tweedie is Associate Editor of the Satellite Executive Briefing. She has over 20 years experience at the cutting edge of new commmunications entertainment technologies. She is the founder and President of Definitive Direction (www.definitivedirection.com), a consultancy that focuses on researching and evaluating the long-term potential for new ventures, initiating their development, and identifying and developing appropriate alliances. She can be reached at: etweedie@definitivedirection.com

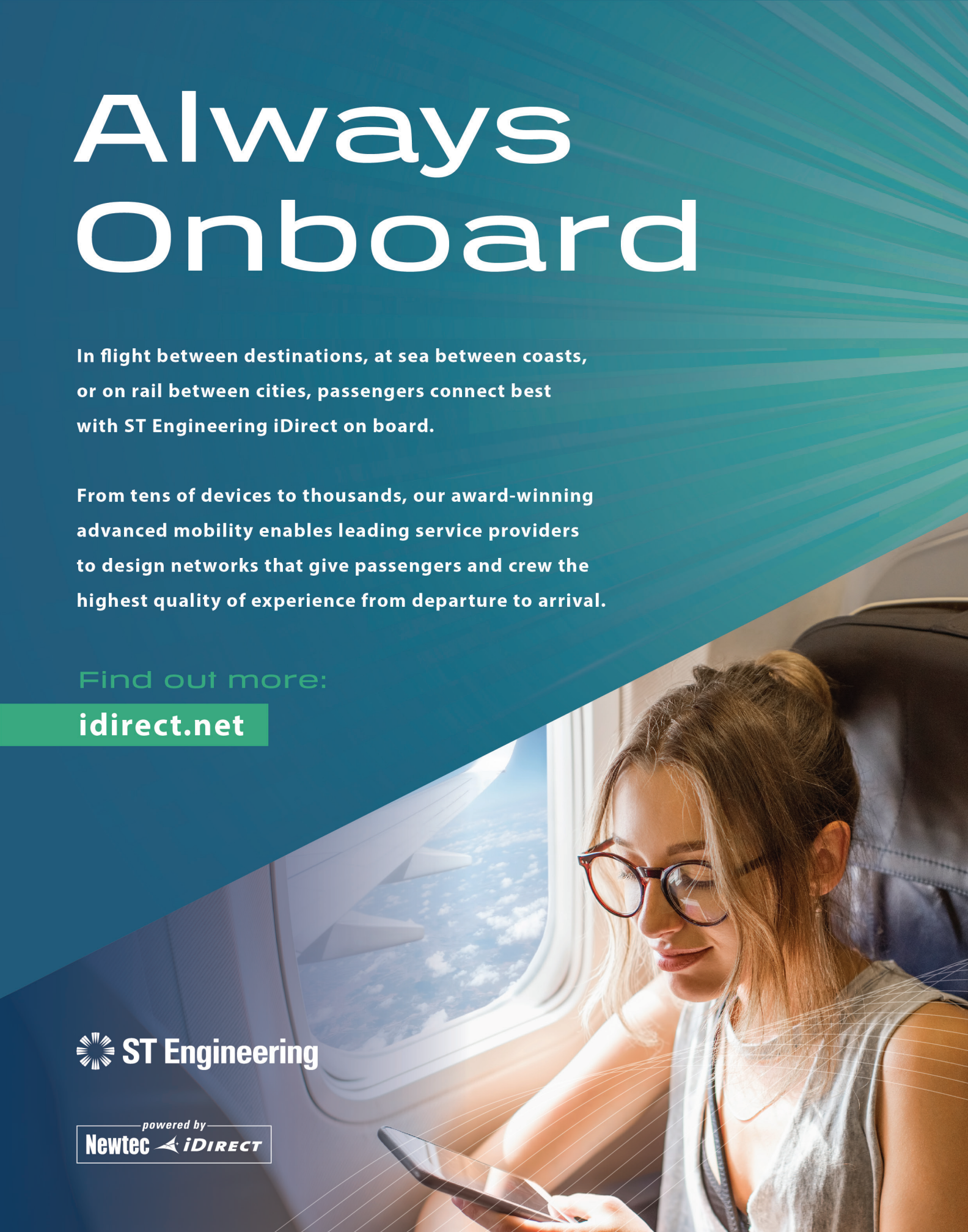
Always Onboard

In flight between destinations, at sea between coasts, or on rail between cities, passengers connect best with ST Engineering iDirect on board.

From tens of devices to thousands, our award-winning advanced mobility enables leading service providers to design networks that give passengers and crew the highest quality of experience from departure to arrival.

Find out more:

idirect.net



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