ST Engineering

A HIGHER PLANE

Boarding the Next Journey for In-Flight Connectivity

iDirect

The Shift from Passenger Wi-Fi to the Connected Aircraft

To say that passenger expectations for in-flight connectivity have increased would be an understatement. No longer content with cheap, wired headphones, today's passengers consider in-flight connectivity a must-have, and it increasingly guides their decision on which airline to fly.

According to a recent SITA Airline IT Trends Survey, 98 percent of airline passengers now board a flight with a portable electronic device while traveling, and 70 percent of passengers carry on at least two devices, depending on the purpose of their travel.

Yet, uptake has been slow for paid service due to several contributing factors. For example, data rates in the sky don't match rates on the ground. However, many passengers believe that internet service is a basic right and should also be offered for free — just like in hotels and cafes. This situation has airlines looking for ways to secure business value from their networks and rethinking the financial formula for in-flight connectivity.

Today, airlines are also moving beyond an exclusive focus on customer entertainment, and they're working on connecting the entire aircraft to enable digital applications and connect to operations on the ground.

"Fully connected" now means cockpits with electronic flight bags (EFBs) to improve aircraft operations. It means increasing communication between the crew, cockpit, and ground maintenance teams to allow for better predictive aircraft management and repairs. It means equipping cabin crews with the latest mobile technology to improve customer care, increase onboard credit card transactions, and offer real-time authentication to help reduce fraud, all of which lead to increased revenue. And of course, it means high-speed connectivity and premium entertainment content, such as live television and sporting events, to satisfy passenger demands.

The new vision of the "connected aircraft" presents an even greater network challenge for airlines. It's similar to managing a global wireless network in the sky that serves a much broader suite of applications and end users, all of which are vying for constrained bandwidth. Now is the time for airlines to begin innovating.

Creating the Business Case for In-Flight Connectivity

When determining the most efficient communications solution, airlines need to consider their long-term plans for a broad range of applications across their fleet and service territory.

Passenger Connectivity

The growing popularity of smart phones and tablet devices is creating an environment where passengers want to use their own technology to stay connected for either work or social reasons; this includes streaming video, voice connectivity and other online activities like emailing and checking social media.

Crew Solutions

With onboard connectivity, airline crews can take customer service to new heights. Crew members can check on the status of connecting flights or checked baggage before landing, or provide hotel bookings for passengers that experience travel delays. Even allowing passengers to select meal preferences electronically can enhance the travel experience.

Flight Operations

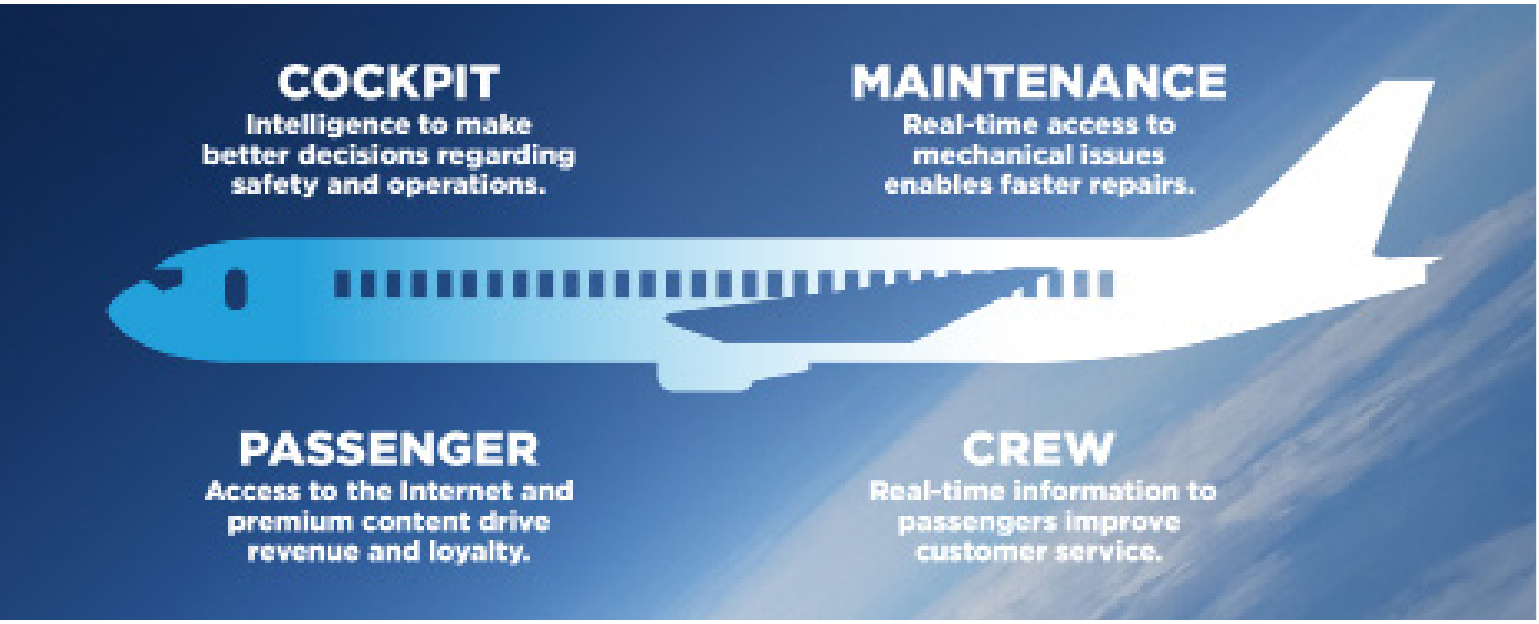
Cockpit Services EFB systems provide pilots with a suite of applications designed to provide greater insight into the performance of their flight. When connected, EFB systems can better provide real-time information, including dynamic charts, weather updates and navigation tools that provide greater insight and improve situational awareness for the pilot.

These capabilities also enable a pilot to share operational details about the plane with aircraft support personnel and technicians on the ground. Data tracking enables airlines to make decisions in real time to improve aircraft operations and reduce operating costs.

Maintenance Applications

With in-flight connectivity, sensors on board aircraft can monitor aircraft health via engine management systems or critical systems monitoring capabilities, as well as measure other parameters like speed, altitude and fuel consumption. These systems can alert ground crew of maintenance issues prior to landing to help ensure that maintenance can be addressed as soon as the plane reaches the gate for quick turnaround.

The Connected Plane



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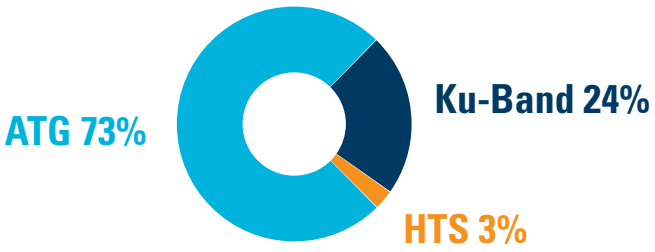
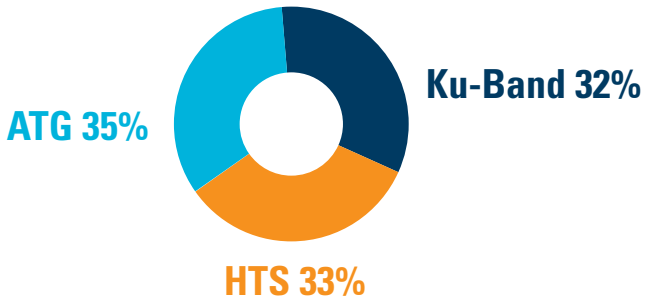
Leverage High-Speed Capacity

The biggest challenge to seamless connectivity on planes today is the need for higher throughput connectivity to the plane. High Throughput Satellites (HTS) are emerging as a solution, as they enable increased data rates to passengers and lower service providers' cost per bit, ultimately resulting in a leap forward in passenger experience.

NSR predicts that HTS and Ku-band VSAT networks will overtake Air-to-Ground (ATG) systems as the dominant mode of in-flight connectivity. Of course, ATG will not be completely replaced, as it is the optimal solution for areas with higher traffic density and regional connectivity. ATG will decrease from a 73 percent market share in 2014 to 35 percent in 2024; HTS will rise from 3 percent to 33 percent market share in the same period. By 2025, NSR estimates 18,000 aircraft will be powered by HTS, adding up to $2.8 billion in potential revenue.



Air-to-Ground, Ku-Band and HTS Connectivity Market Share by In-Service Units, 2014



Air-to-Ground, Ku-Band and HTS Connectivity Market Share by In-Service Units, 2024

Source: NSR

Improve Service Levels

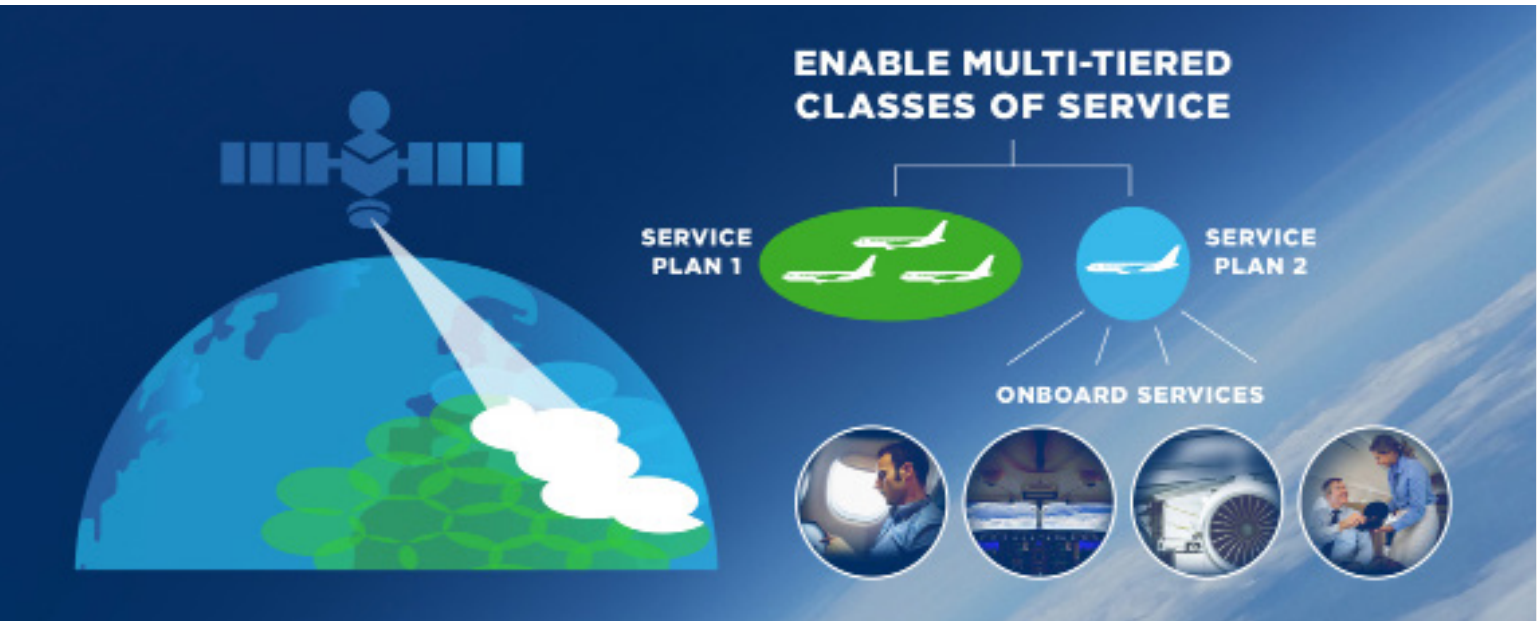
Speed, by itself, is only part of the equation. Combining HTS with mobility applications presents a major challenge when it comes to managing complex Service Level Agreements (SLAs). The increased capacity available through HTS may mean very little unless you can increase the quality of the end-user experience.

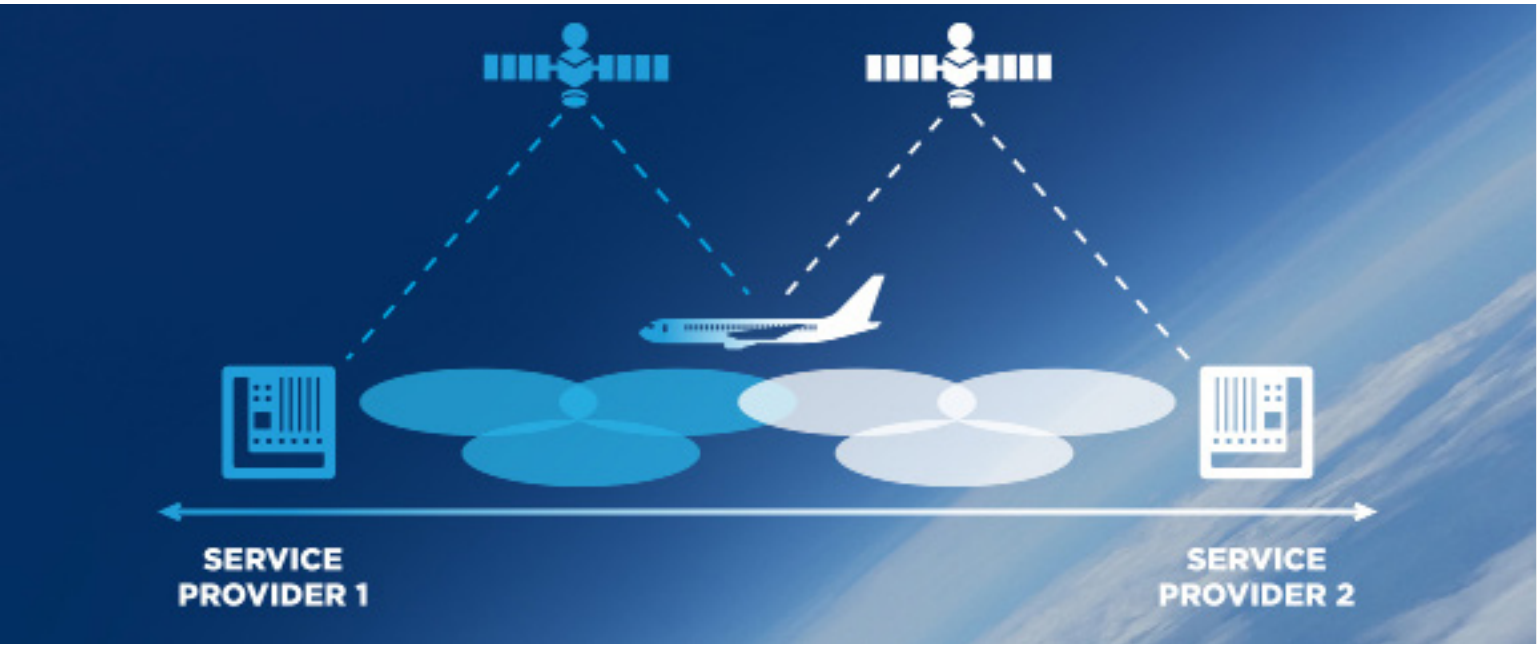
It is becoming increasingly difficult to manage bandwidth across a contended network that spans multiple beams, aircraft and end users. There is also a greater number of applications to support today, such as multicast solutions for content management and real-time broadcast TV delivery. At any given moment, there are thousands of aircraft operating around the globe, with each one needing to connect to various bandwidth levels over the course of their journey. Even with faster modem speeds, bottlenecks can occur if network traffic is not prioritized correctly.

Those operating aero VSAT networks need to expand their thinking from what data rate is being delivered on an individual airplane to how they source, integrate and manage a global pool of bandwidth. There is even discussion on how to deliver higher data rates to an individual seat for those passengers willing to pay for premium service. Aero VSAT operators need a global bandwidth and network management system that allows them to pool satellite capacity across numerous spot beams and create group service plans that can automatically allocate resources as they are needed.

Airlines can manage the use of bandwidth across an airline's entire fleet to prioritize service levels based on multiple criteria, including bandwidth profiles for individual aircraft or even specific onboard applications. Without such a measure in place, an airline operator or service provider may need to over-allocate dedicated bandwidth to each application to ensure an acceptable quality of service.

Ensuring Quality of Service





Inter-Provider Service

High-Speed Beam Switching

Another key requirement for providing the optimal customer experience is automatic beam selection and fast beam switching. To ensure seamless connectivity, an aircraft must now be able to automatically switch between satellite beams as it moves from one geographic footprint to the next, with no manual intervention across multiple satellite footprints in a high-speed environment. Internet sessions should not be interrupted as the plane moves through several beams on a flight.

Global service operators and regional providers catering to airlines can expand service reach outside of their core networks through roaming, particularly within countries where regulatory restrictions require specific satellites and/or traffic landing in-country. Mobile operators have mature architectures that enable a customer to roam from a home network to a guest network while maintaining home service plans.

The satellite industry is developing similar capabilities whereby a satellite service provider may partner with other service providers to enable their mobility terminal to roam between autonomous networks.

Service providers adopting these business and technical models will maximize capital and operational resources. The roaming technology itself can evolve into multiple forms — roaming from a service provider's regional coverage to another, roaming from a GEO constellation into a LEO/MEO constellation, or integrating multiple connectivity solutions for a hybrid network.

Bringing Smarter Technology On Board

A major area of improvement for in-flight connectivity is onboard satellite equipment. From antennas to onboard computers to remotes, technology is now more powerful and efficient, resulting in improved bandwidth utilization and reduced weight penalties. New innovations also allow for significant reduction of traditional upgrade-related downtime, such as installation and maintenance.

Flat-Panel Antennas

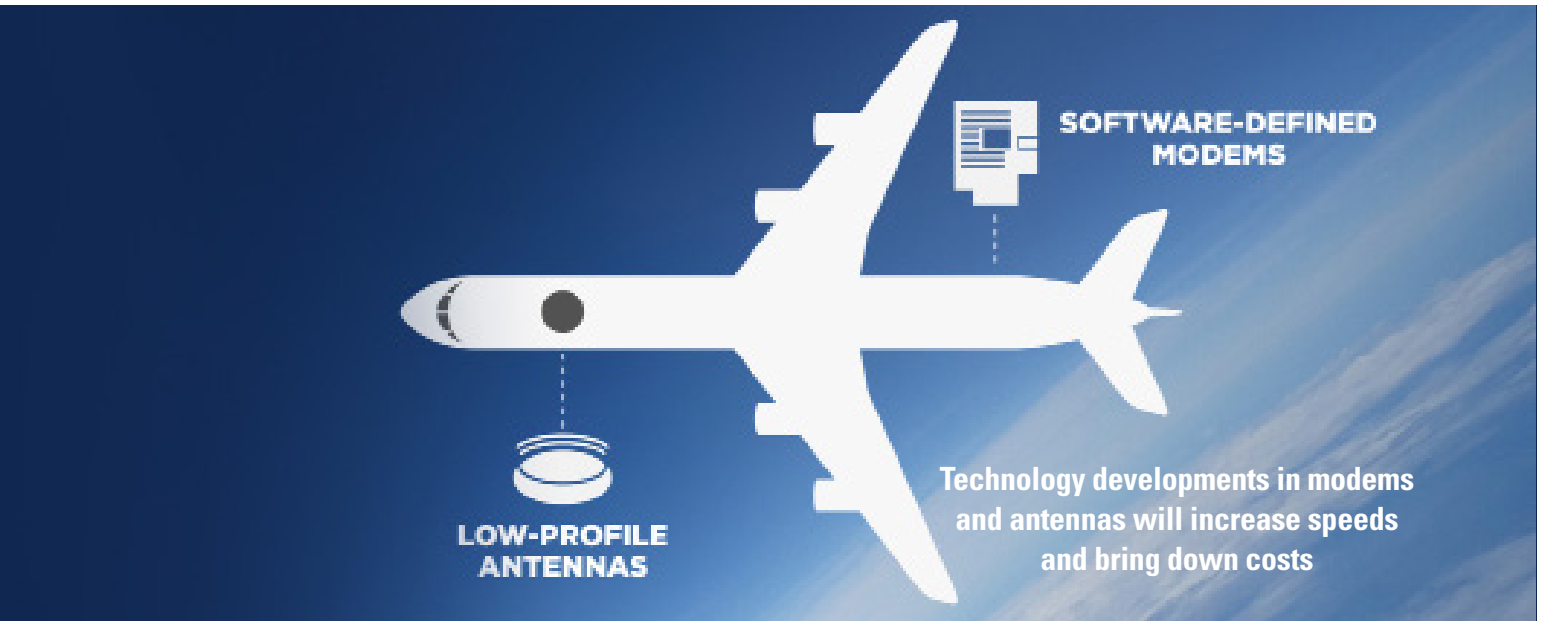
Advancements in aeronautical flat-panel antennas, along with emerging LEO and MEO constellations, can increase network speeds and potentially reduce airline operation costs. The result: antennas that are smaller, thinner and more aerodynamic, combined with greater bandwidth capacity. These antennas' electronic steering capabilities also represent a significant advancement over traditional mechanical methods to ensure constant satellite connection.

Powerful Software-Defined Modems

Swapping out onboard equipment is a considerable logistical and regulatory challenge. It can take several years for a regulatory body to approve new hardware to be installed inside an airplane, and even longer if it requires installation of new antennas or anything mounted to the frame structure of the airplane.

Today, airlines can adopt a remote solution that's engineered with a high degree of flexibility to adapt to changing requirements while only paying for the capabilities that they actually need at any given time. Through software-defined architectures, this next generation of modems can be continually upgraded over the air to increase network capabilities and throughput levels while dramatically extending the deployment life in the air.

Innovations in Onboard Technology



A Platform for the Future

Today's in-flight connectivity challenge is about meeting rising customer expectations while allocating a broader pool of bandwidth to feed connected aircraft applications. Airlines that can best leverage in-flight connectivity will gain a clear business advantage in terms of customer loyalty, crew productivity and company profitability.

The ST Engineering iDirect Mobility Solution

ST Engineering iDirect is the leading ground infrastructure provider to the aeronautical industry with 46% market share according to Comsys. Our Velocity platform is designed to handle unique high-speed mobility challenges along with high-performance VSAT router boards designed specifically for integration on board the aircraft. The platform is further distinguished by a comprehensive range of advanced integrated mobility technologies.

- **iQ 800 Integrated Modem Board** supports DVB-S2 waveforms and is DVB-S2X ready with three receivers for throughput in excess of 500 Mbps on Velocity.
- **Automatic Beam Switching** to connect a modem on an aircraft to automatically cross multiple spot beams within a short period of time without manual intervention, maintaining a constant IP session.
- **Global Bandwidth Management (GBWM)** enables service providers to manage a single bandwidth pool across a large coverage area spanning multiple spot beams. By partitioning the bandwidth into service tiers across the entire payload, prioritizing service levels based on multiple criteria and individual profiles service providers can better manage contention among the fleet or different airlines.
- **Advanced Mobility Features** including Doppler compensation, fast reacquisition after blockage, fast beam-switching and skew angle support to allow a terminal to take advantage of high skew situations while ensuring compliance with adjacent satellite interference limits.
- **Direct Sequence Spread Spectrum** to mitigate satellite interference common with ultra-small antennas or phased-array antennas, while maintaining a reliable and efficient link.
- **OpenAMIP®**, an open-source IP based protocol, to facilitate the exchange of information between the airborne antenna and the satellite router.
- **Advanced Security** to support critical information security risk management principles, such as those reflected in the ISO 27001 standard and the NIST Cybersecurity Framework.

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