



# ADVANCED MOBILITY FOR INFLIGHT CONNECTIVITY

## Choosing an IFC Provider, Understanding Advanced Mobility

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When an airline today chooses an inflight connectivity (IFC) service provider, they need that provider's aero network solution to deliver data rates of hundreds of Mbps to their aircraft to satiate passengers and operational applications. Airlines also seek flexibility, broader service coverage and more throughput.

Beyond meeting their passenger and operational requirements today, airlines want to know that their service provider's aero network solution will allow for better performance and scalability in the future as those requirements increase and as new technology innovations, such as new multi-orbit satellite constellations, and new terminal and software-defined modem technologies, come to fruition. From traffic engineering and shaping solutions to optimization with data analytics suitable for large-scale multi-beam operations, airlines want an IFC solution that lasts for many years.

The result is that choosing an IFC service provider is a high stakes decision that touches many aspects of the airline's business from brand loyalty to safety.

### The Airline's Special Focus: Quality of Experience

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Nestled between technical Quality of Service (QoS) and Passenger Experience, Quality of Experience (QoE) in the context of IFC goes beyond the QoS requirements to meet contractual service level agreements (SLA). QoS measures focus on delivering data to and from the aircraft, leaving aircraft and onboard users to compete for network resources.

By incorporating QoE measurements and data analysis, airlines wish to better optimize available network resources by filtering or limiting service to certain applications, or by managing the user data rate in coordination with demand. Airlines and the SATCOM industry are working together to better define these measurements proactively to achieve better results with the reality of limited capacity.

#### Quality of Service:

A networking term referring to a prioritization system to handle allocation of limited capacity; QoS is an assessment of hardware and software delivered by the vendor under the terms of a contract.

#### Quality of Experience:

All the variables of a system's performance to measure customer satisfaction; QoE references both subjective and objective factors assessed against businesses and services.

#### Passenger Experience:

The traveler's perception of their journey from end-to-end.

## Advanced Mobility Solutions

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At ST Engineering iDirect, our aero platforms are built to handle the unique challenges of high-speed connectivity as well as the overall flexibility and scale to yield the highest performance. To continue our leadership in commercial and business aviation, we are continually innovating our sophisticated set of network and physical technologies known collectively as Advanced Mobility.

## Bandwidth Management

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Service providers use capacity from many beams and satellites to provide coverage for a fleet of aircraft, posing a great challenge to service consistency across the various satellite capacities. Innovative technologies are key to managing network performance and bandwidth allocation.

Service providers rely on global bandwidth management to select and aggregate satellite bandwidth into a single pool of capacity. The pool can be dynamically shared between customers, adhering to SLAs to delineate priorities across aircraft, users and applications. Features such as automated load balancing, service scheduling and geographic scope of service allow service providers to tailor service offerings, manage congestion and optimize fill rates. Parameters can be set on various aspects of the network traffic prioritization to maximize the value of the shared bandwidth as demands fluctuate across a fleet of aircraft and among passengers onboard.

The importance of global bandwidth management will only increase as new NGSO constellations and next-generation GEO satellites come online creating a step increase in the dynamic nature for beams.

## Rapid and Assured Regulatory Compliance

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Airlines and satellite operators alike need to comply with all regulations to maintain their ability to operate. Many countries and geo-political regions have unique regulations. The challenge to adherence compounds quickly as the geographic scope of service expands from regional to global. Service providers need certainty that transmissions and frequency ranges fall within appropriate regulatory parameters. Limits on a terminal's Power Spectral Density based on its geolocation and instantaneous orientation (a factor in flat panel antenna power dissemination), or adjustments for no-transmit zones are examples of regulatory factors that the advanced mobility network will account for once configured.

## Beam Switching on the Move

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One of the most challenging aspects of satcom mobility involves switching from one beam to another. Beam switchover requires the modem to determine the timing to select the next beam to switch, and to communicate that with the antenna.

ST Engineering iDirect has developed features and partnered with antenna manufacturers to optimize this process.

Automatic beam switching can be based on logic built into the modem or it can be based on customer-provided logic. Using built-in logic results in faster implementation and less investment time in development. The use of customized beam switching involves an API on the network to fetch and combine data, switching beams based on a customer's specific business logic.

ST Engineering iDirect's modem technology is antenna agnostic and uses the OpenAMIP protocol to work with all major stabilized VSAT antenna manufacturers to ensure compatibility between the modem and mounted antenna. OpenAMIP and our commissioning solution enable a seamless installation process to terminal integrators.

## Satellite Signal Acquisition and Blockage Mitigation

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Satellite connectivity, whether dedicated for maximized geographic coverage or shared for carrying simultaneous user traffic, must be continuously updated to manage limited beam resources.

There are several methods of satellite beam acquisition depending on circumstances and urgency. A nearly instantaneous network connection inflight requires each terminal to select the correct satellite and beams, and a network and satellite signal acquisition scheme that is fast and reliable.

Traffic interruption may occur when a terminal needs to switch to a different beam or satellite, or when there is blockage between the antenna and the satellite. A combination of carefully implemented strategies is necessary to eliminate some of these interruptions or to keep them below perceptible limits. By creating blockage tolerance and recovery protocol, terminals can stay in the network through blockage and momentary outage.

To re-acquire the satellite and establish connectivity in seconds provides the seamless user experience.

## Return Waveforms for Mobility

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ST Engineering iDirect is leading the way in waveform innovation to support the most efficient use of satellite bandwidth. Today's service providers are looking for how to stretch their networks and services further to meet more user requirements.

Efficient inbound waveforms for shared capacity can support bursty, low to medium data rates mobility users on a single pool of bandwidth for traffic where sharing, and even overbooking, are possible. These waveforms offer better flexibility for fluctuating, mixed traffic. They are scalable from very low to high-end mobility applications.

## Aero Modems Fit for Purpose

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ST Engineering iDirect is proud of its heritage of leadership in installed aero modems across business and commercial aviation sectors. Our modems are specifically optimized for aero requirements in form factor, environments, performance and reliability. Due to the rigorous supplemental type certificate (STC) process to modify the airplane after its original design, the choice of modem vendor by the integrator or service provider represents a critical decision in the lifecycle of the airline's IFC strategy. The ST Engineering iDirect aero modems enjoy the widest support and the most complete ecosystem among aero terminal integrators, providing network operators, service providers and airlines the maximum choice and the shortest time to deployment.

In addition, the ST Engineering iDirect aero modems and platforms allow network operators and service providers to cohesively orchestrate their capacity while wrapping their own sophisticated tools and management around our flexible system to enable a unique portfolio of services.



## The Future of Advanced Mobility Through Innovation

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A significant amount of capacity will become available in the next few years bringing the cost of aero IFC services down. Passengers want uninterrupted broadband connectivity; that demand is driving technical innovation.

Always-on terrestrial-like experience from gate-to-gate will necessitate a broader technical solution. Passenger devices will connect to several access technologies throughout the course of a journey to enable constant connectivity for communications, entertainment and operations. Next-generation satcom aero services will be part of a standardized system for end-to-end networks in the 5G era.

Satellite capacity to the aircraft will be orchestrated and dynamically allocated. Everything from ground stations and waveform technology to beam shapes, hopping or switching sequences will be dynamically instantiated. Services will be provisioned based on real-time factors such as availability, user demand and flight routes.

Cloud-based hub innovation will be necessary for NGSO and GEO capacity. Software-defined networks will adapt to accommodate a fully orchestrated system for multi-orbit.

## Trusted Mobility Experience

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The ST Engineering iDirect aero platform accounts for 45% of installed commercial tails and 55% of backlog. With our modems onboard over 4000 aircraft, we are in lockstep with global and regional network operators and service providers for both commercial and business aviation. Our efforts toward collaboration and standardization are empowering innovative aero solutions. We are active in industry associations including the Airline Passenger Experience Association (APEX), the Seamless Air Alliance, and ARINC. We are part of a robust ecosystem to develop advanced mobility antennas, modman technology and over-the-top technology for inflight entertainment. We understand that a principle of partnership will deliver the best outcome to airlines and their passengers.