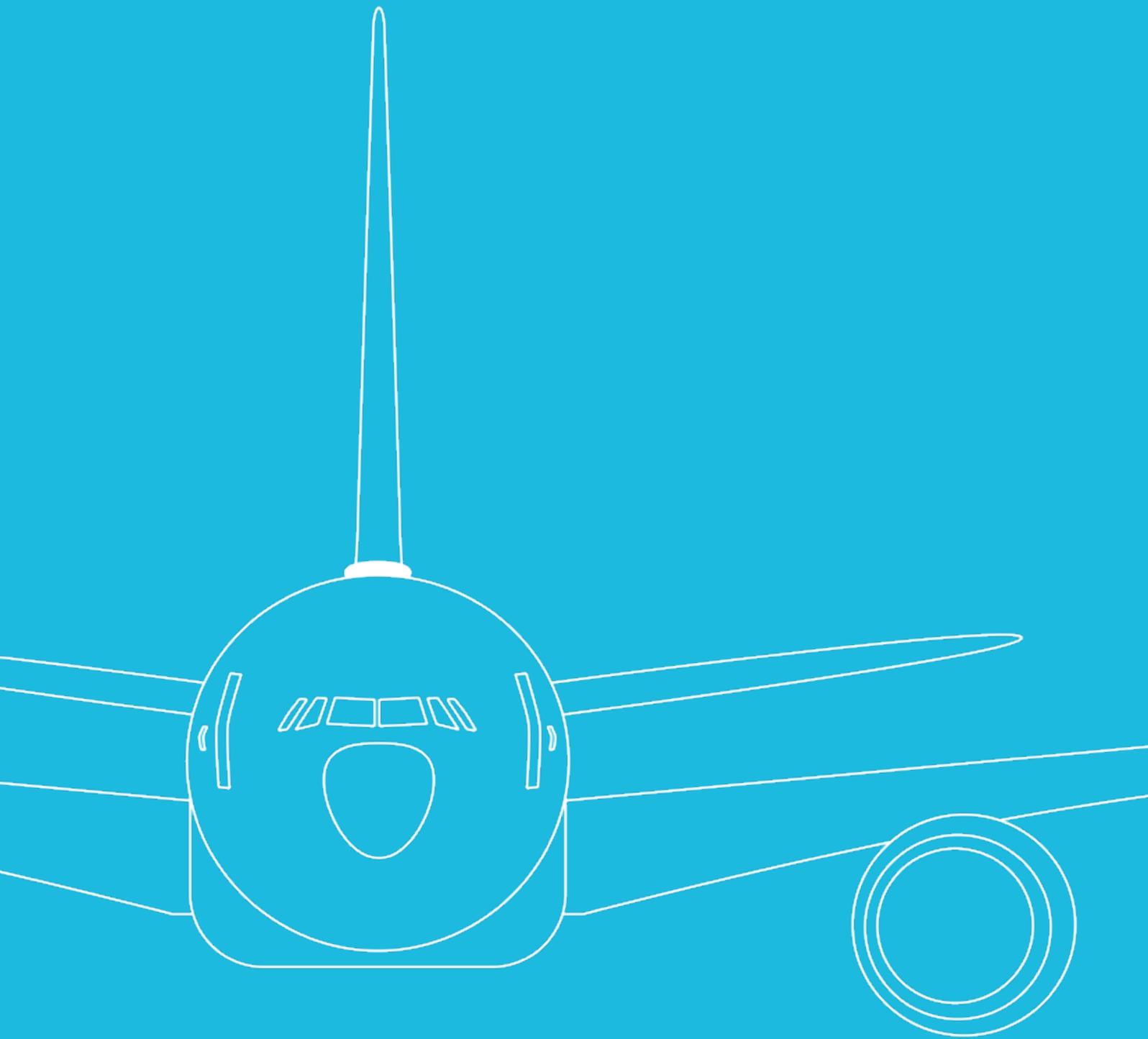


# THE CORRECTLY CONNECTED AIRCRAFT



REALISING THE FULL POTENTIAL OF THE COMPLETE  
CONNECTED FLEET

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# INTRODUCTION: THE COMPLETE CONNECTED AIRCRAFT TRANSFORMS THE ECONOMICS OF COMMERCIAL AVIATION

Michael E. Rack, Senior VP, Core Business at Inmarsat Aviation

The future of connected aviation is changing. Expectations of connectivity performance are ever-increasing and, by 2035<sup>1</sup>, more passengers will be flying each year than the number of people living on the ground right now. That's more than 7 billion passengers. Recent research indicates that today 6 out of 10 passengers believe inflight Wi-Fi is no longer a luxury, but a necessity<sup>2</sup> – and we believe that proportion will be even higher in coming years.

But far from being a challenge, connectivity in the cabin represents opportunity. Airlines are quickly coming to the realisation that inflight broadband opens new horizons of passenger value-creation. In 2018, connected ancillary sales will be worth \$784m to airlines and independent research from the London School of Economics (LSE) indicates this will grow to \$30bn annually by 2035<sup>3</sup>. Creating new ways to deliver inflight digital engagement will also help airlines reimagine their passenger experience, differentiating services to secure customer loyalty and market share.

However, it's not just broadband in the cabin that's changing the way people fly. Digital transformation touches every part of our industry. Over the last 15 years, cockpit satcom has saved airlines \$3bn<sup>4</sup> – and that's just using basic digitised Air Traffic Control (ATC) and Airline Operational Communications (AOC) procedures of the past. New concepts of airline

operations will use the power of today's IP-based flight deck connectivity to offer real-time, secure information and communications to airlines and controllers. This will drive further efficiency gains in flight operations and airport operations and maintenance – potentially saving many more billions of dollars industry-wide.

The equation is simple. Connected passengers generate revenue and connected operations reduce costs. Critical to digital transformation in aviation industry economics is the concept of the 'complete connected aircraft', where passenger, operations and safety capabilities are all powered by broadband-speed connectivity.

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By 2035 there will be

 **7bn**  
airline passengers  
each year<sup>1</sup>

These passengers will  
help generate

**\$30bn**   
of ancillary revenue<sup>3</sup>

<sup>1</sup><http://www.iata.org/pressroom/pr/Pages/2016-10-18-02.aspx>

<sup>2</sup>[www.inmarsataviation.com/benefits/passenger-experience/Air-travellers-see-inflight-broadband-as-an-essential-freedom](http://www.inmarsataviation.com/benefits/passenger-experience/Air-travellers-see-inflight-broadband-as-an-essential-freedom)

<sup>3</sup><https://www.inmarsataviation.com/benefits/revenue-opportunities/The-sky-s-the-limit>

<sup>4</sup>[www.inmarsataviation.com/benefits/heliosstudy](http://www.inmarsataviation.com/benefits/heliosstudy)

## *Connected passengers generate revenue and connected operations reduce costs*

Inmarsat Aviation is leading the digital revolution of the complete connected aircraft. We're the only satcom provider that can deliver the promise of the complete connected aircraft over our own networks. Using our many decades of experience in delivering connectivity to the aviation industry, we're helping airlines navigate the complex choices on this new frontier. Airlines that desire the full benefits of inflight connectivity today are faced with barriers to adoption. With the requirement to move large volumes of data to and from the aircraft comes architectural, regulatory and configuration challenges. All of this data has varying urgency, usefulness and must be routed to different areas of the airplane – called 'data domains' – in order to address and optimise cost, regulatory and efficiency factors. The optimal configuration for each unique airline must be defined by its individual requirements.

To put it simply, a connected aircraft is easy to obtain, but the correctly connected aircraft is a more elusive asset. Some single-solution providers don't offer the

most helpful information about secure and efficient ways to manage all passenger, operations and safety data. And without designing a connectivity solution that supports the full suite of capabilities within key service domains, airlines stand in danger of missing out on the total benefit.

Inmarsat Aviation is ready to help airlines realise the full potential of a correctly connected fleet. The complete connected aircraft is now a reality.

**Bring it on.**

*A connected aircraft is easy to obtain,  
but the **correctly** connected aircraft  
is a more elusive asset*

## EXECUTIVE SUMMARY

- Three ICAO-defined connected data domains deliver different commercial benefits to airlines
- Different connectivity services have features that best support each type of data domain
- No service over a single frequency band enables airlines to realise the full scale of benefits of a complete connected aircraft
- Inmarsat is the only operator of fully-owned and managed networks providing global high-speed broadband to both cabin and cockpit
- Airlines need expert advice to define and deliver the combined connectivity solution that's right for their needs



**This paper provides our vision of the correctly connected aircraft**, with explanations and recommendations involving frequency bands, aircraft domains and data priority. We know each airline has a unique fleet, crew and regulatory environment, and we hope our insight will begin to help airlines define their pathway to achieving a completely connected fleet.

**The potential of the connected aircraft can only be fully realised by correctly connecting each ICAO (International Civil Aviation Organization) data domain according to its role and characteristics, as well as its approved uses.**

For passenger services, inflight broadband will improve passenger experience and unlock new ancillary revenue streams. Broadband-enabled operations will save fuel, reduce delays and facilitate more efficient maintenance. Satcom-based safety means better communications, navigation and surveillance (CNS) and ultimately enables air traffic control infrastructure to safely increase the number of planes in a given airspace to meet ever-growing demand.

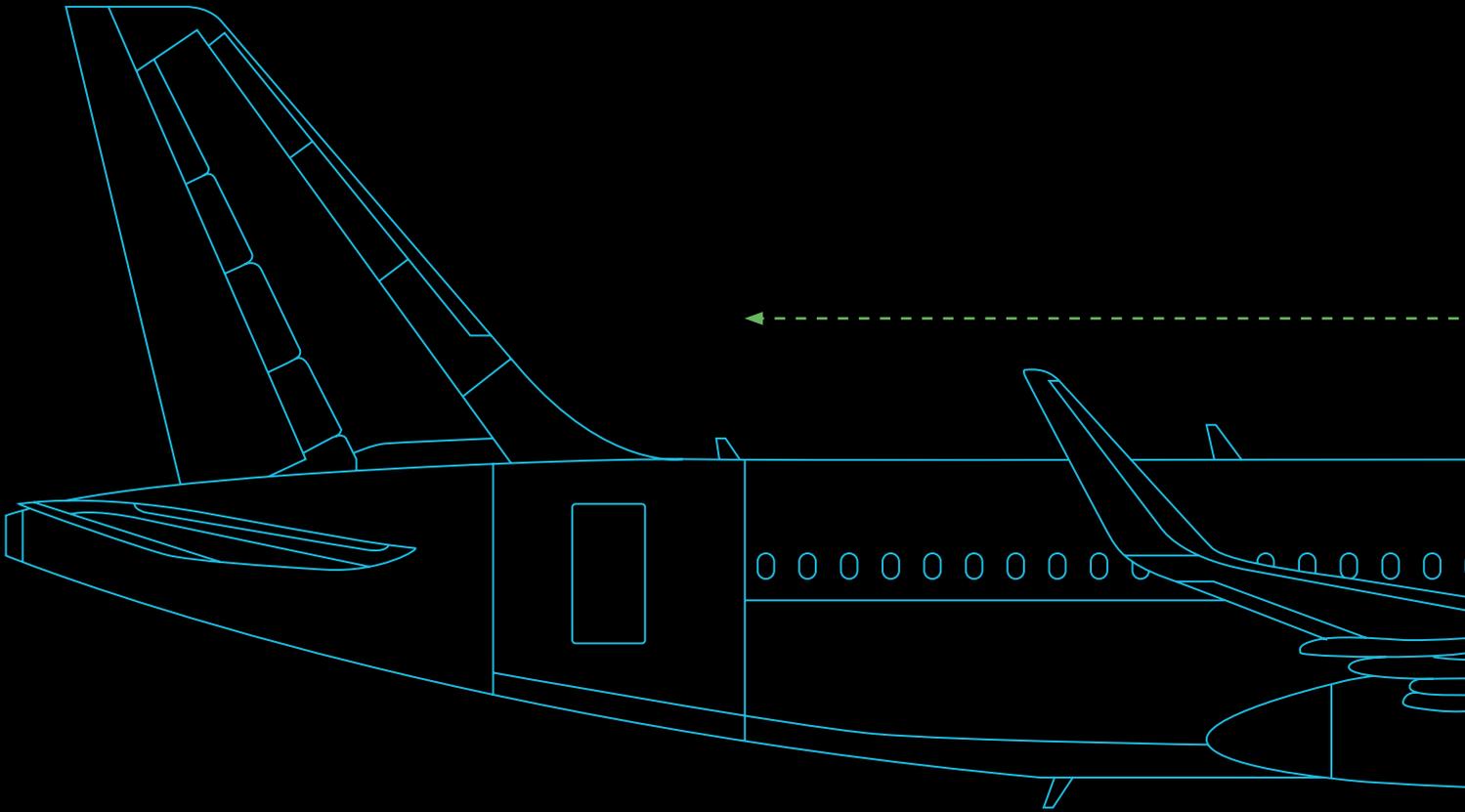
**Connecting the entire aircraft is a complex undertaking**, with implications that are often poorly understood. Airlines are in danger of missing out on the full potential of the connected aircraft if they don't get it right. No single connectivity service alone can meet all the requirements for a complete, correctly connected aircraft. We'll explain the features of a variety of services and how they can work together to deliver the ideal set of capabilities.

**Inmarsat Aviation's technology and experience help airlines realise the full commercial value of the complete connected aircraft.** We'll illustrate how Inmarsat Aviation is the only network operator able to provide connectivity for all aspects of the complete connected aircraft. Our expertise is based on more than 25 years of serving the aviation industry. Over 90 percent of the world's oceanic flights rely on Inmarsat for cockpit communications and surveillance, giving us the experience necessary to offer robust counsel. Our newest services offer high broadband speeds for both cockpit and cabin connectivity. We constantly invest in our networks to add capacity so we can meet future demand. And we have the scalability to work with airlines and partners, however they need, to deliver an optimal solution.

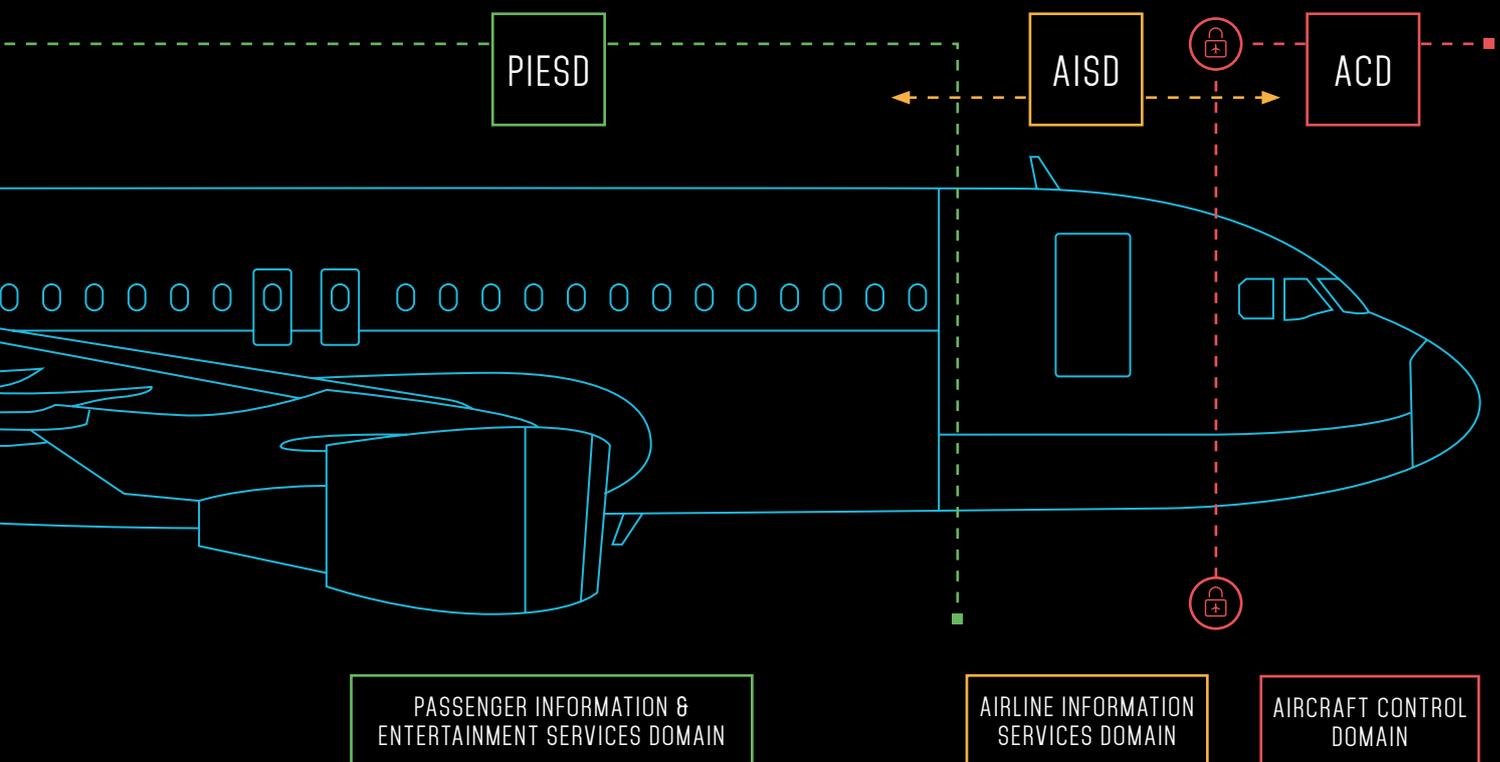
*Inmarsat is the only operator of fully-owned and managed networks providing global high-speed broadband to both cabin and cockpit*

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## THE THREE ICAO DATA DOMAINS



ICAO recognises three distinct aircraft data domains and we believe these should be used by airlines when categorising the type of information carried over a connected aircraft network configuration. Collectively, the optimal use of these three types of domain delivers the full scope of commercial value to an airline – through incremental revenue and operational cost savings.



ICAO terminology used for the three aircraft data domains<sup>5</sup>

In the next section, we explain the differences between these three data domains: their levels of criticality, how they deliver value to the airline and what type of connectivity profile they each require for best performance.

<sup>5</sup>For further reading see [www.icao.int/Search/pages/results.aspx?k=aircraft%20domains](http://www.icao.int/Search/pages/results.aspx?k=aircraft%20domains)



## PASSENGER INFORMATION AND ENTERTAINMENT SERVICES DOMAIN (PIESD)

Definition: passenger entertainment and network services. This domain can comprise multiple systems that interconnect, such as passenger device connectivity systems and broadband television or connectivity systems.



**44%**

said they would stop using their preferred airline if it only offered poor quality Wi-Fi<sup>7</sup>

PIESD data delivered through passenger Wi-Fi gives airlines the ability to maximise incremental and long-term revenues. Airlines are using inflight broadband to enhance their passenger experience, delivering digital brand engagement and personalised services that build relationships with customers – driving loyalty and repeat purchase decisions that increase market share and passenger lifetime value. Through ancillary revenue generators like selling Wi-Fi access to passengers, connected inflight e-commerce, digital advertising sales and premium-price streamed IFE, a connected seat can be worth up to three times as much as one that isn't.<sup>6</sup>

While connected airline operations save money through efficiency, connected passenger services make money through increasing passenger value.

That means the features of the connectivity service to support PIESD data need to ensure a high quality experience for passengers. Passengers

want to stream, browse, text and work freely without interruption – 44% said they would stop using their preferred airline if it only offered poor quality Wi-Fi.<sup>7</sup> Reliability must be a consideration for airlines that want to keep pace with global consumer expectations. As passenger appetite for inflight Wi-Fi increases, the connectivity service that supports it must have the assured high bandwidth and future-proof capacity to meet demand. High quality Wi-Fi is now a “must have” in the eyes of the passenger.

Plus, airlines need to be able to deliver digital brand engagement and revenue-generating interactions consistently across their whole fleet and on all routes. To achieve maximum value from passengers, airlines must be able to depend on seamless route coverage. A stable, low price of data ensures affordable capacity and helps airlines maximise PIESD data ROI.

<sup>6</sup><https://www.inmarsataviation.com/benefits/revenue-opportunities/Connecting-the-captive-market>

<sup>7</sup>[www.inmarsataviation.com/benefits/passenger-experience/Air-travellers-see-inflight-broadband-as-an-essential-freedom](http://www.inmarsataviation.com/benefits/passenger-experience/Air-travellers-see-inflight-broadband-as-an-essential-freedom)



## AIRCRAFT CONTROL DOMAIN (ACD) – MISSION-CRITICAL DATA

Definition: data specific for the safe operation of the aircraft. This includes communications, navigation and surveillance (CNS) data for air traffic management (ATM), flight information and alerting, and direct Airline Operations Communications (AOC) that also affect aircraft safety, regularity and efficiency.



Between 2001-2016,  
space-based CNS  
delivered

**\$890m**

additional value to  
airlines through  
increased airspace  
capacity on  
transoceanic routes  
alone<sup>8</sup>

The secure exchange of ACD data helps controllers track and manage aircraft more accurately, in the air and at airports, and enables better communication between pilots and the ground. It assures adherence to the highest standards of international aviation safety.

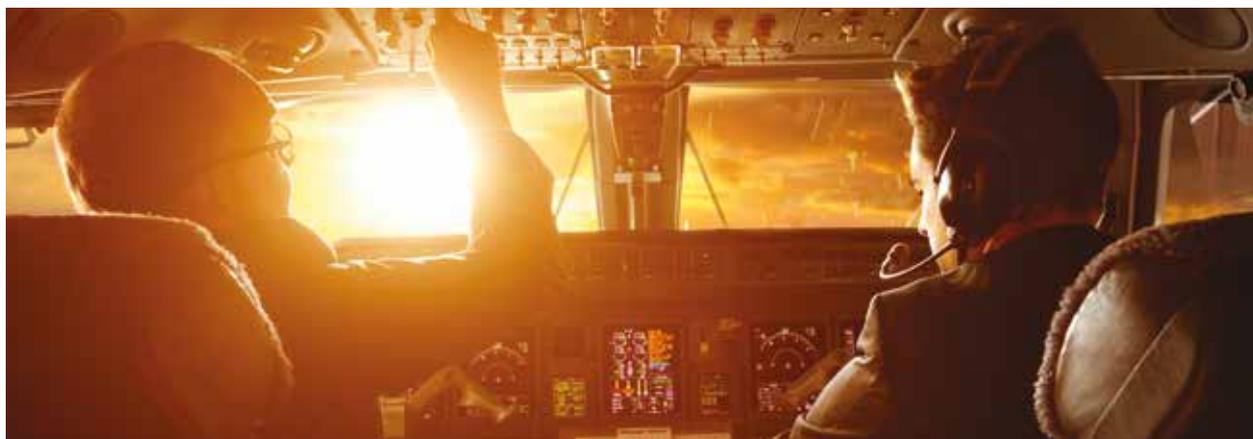
In addition, satcom-based CNS unlocks international air navigation service providers (ANSPs)' ability to modernise and automate ATM processes.

This leads to further reducing separation minima (the standards dictating the safe vertical and lateral distances between planes), which allows more planes to fly safely in the sky at any time and increases seat capacity on high-value flight routes. Between 2001 and 2016, space-based CNS delivered \$890m additional value to airlines through increased airspace capacity on transoceanic routes alone.<sup>8</sup>

And because air traffic controllers and pilots will use this mission-critical data to manage the position and direction of an aircraft, it's crucial that it's secure. These voice and data services use the most protected and reliable spectrum – codified for safety purposes by ICAO and protected by every country. The main objective of these services is to expedite the safe and efficient movement of aircraft by

providing direct controller to pilot communications. They also give an airline authority over the initiation, continuation, diversion or termination of a flight, as well as airline dispatch, engineering, operations and scheduling functions. All connections must perform as required by the ICAO GOLD (Global Operational Data Link Document) standards for reliability and performance, which require full service redundancy.

Because of its mission-critical nature, the exchange of this data needs to be guaranteed at any time, anywhere an aircraft flies or moves, through all conditions and possibilities. ACD data needs a connection platform that's highly robust and dependable in all weather and environment conditions, in the air or on the ground. Plus, it needs complete service coverage of global commercial airline routes. Modern airframes are being built with advanced connectivity requirements embedded in their flight control systems, so a secure connection to handle ACD data will become an essential industry norm.



<sup>8</sup>[www.inmarsataviation.com/benefits/heliosstudy](http://www.inmarsataviation.com/benefits/heliosstudy)



## AIRLINE INFORMATION SERVICES DOMAIN (AISD) – OPERATIONAL DATA

Definition: data for the operation of the aircraft, but which does not have a bearing on the control of the aircraft. AISD platforms may be used to support applications and content for either cabin or flight crew use. AISD data is not defined as mission-critical even though it may be highly commercially and operationally important.



Connected AISD data can digitally transform the way airlines operate

Today, much AISD data is collated and conveyed using paper-based processes, or stored digitally on the aircraft and extracted or downloaded when the plane lands at an airport. The full value of passenger information data, technical fault reports, engine performance reports and other similar data can't be realised if the information isn't conveyed in real-time as the aircraft flies. With today's improved connectivity, aircraft can communicate what needs to happen on the ground long before the plane reaches its destination.

Connected AISD data can digitally transform the way airlines operate. From paperless cabin crew briefings to reporting technical faults before the plane lands, airport turnarounds become more efficient and more likely to stay on schedule. A connected fleet, that provides constant engine and systems performance intelligence across the world, enables airlines to make better-prepared, more strategic decisions about asset utilisation – and predictive maintenance can be based on more timely insight. A connected Electronic Flight Bag (EFB) can give pilots detailed, visualised information about aircraft performance, avoid bad weather conditions and save fuel.

To access the full commercial impact of real time AISD data via efficiency gains, the data exchange needs to be supported by a highly reliable connectivity service. Performance and weather data need to be rich to be useful, so they require relatively high bandwidth and appropriately low-priced data. While platforms within the AISD do not directly influence the control of the aircraft, the data contains varying levels of sensitivity that airlines may prefer to separate from any passenger-accessible networks. Most importantly, to roll out consistent digitised processes and operational information transfer across an entire fleet, the airline should expect a connection that has full redundancy and coverage everywhere they fly across the world.

## EVALUATING THE FEATURES OF SATCOM SERVICES

Because they serve different purposes, ICAO's distinct data domains require different features of connectivity to best support them. No single connection service can satisfy the needs of all three data domains.

But all three data domains must be satcom-enabled to realise the full value of the complete connected aircraft:

- Mission-critical data must remain segregated from passenger-accessible networks
- Passengers demand a high-speed, seamless Wi-Fi experience; operations data has a varied and complex set of requirements
- Airlines need to select satcom services for both sides of the cockpit door with features and capabilities best suited to each data domain





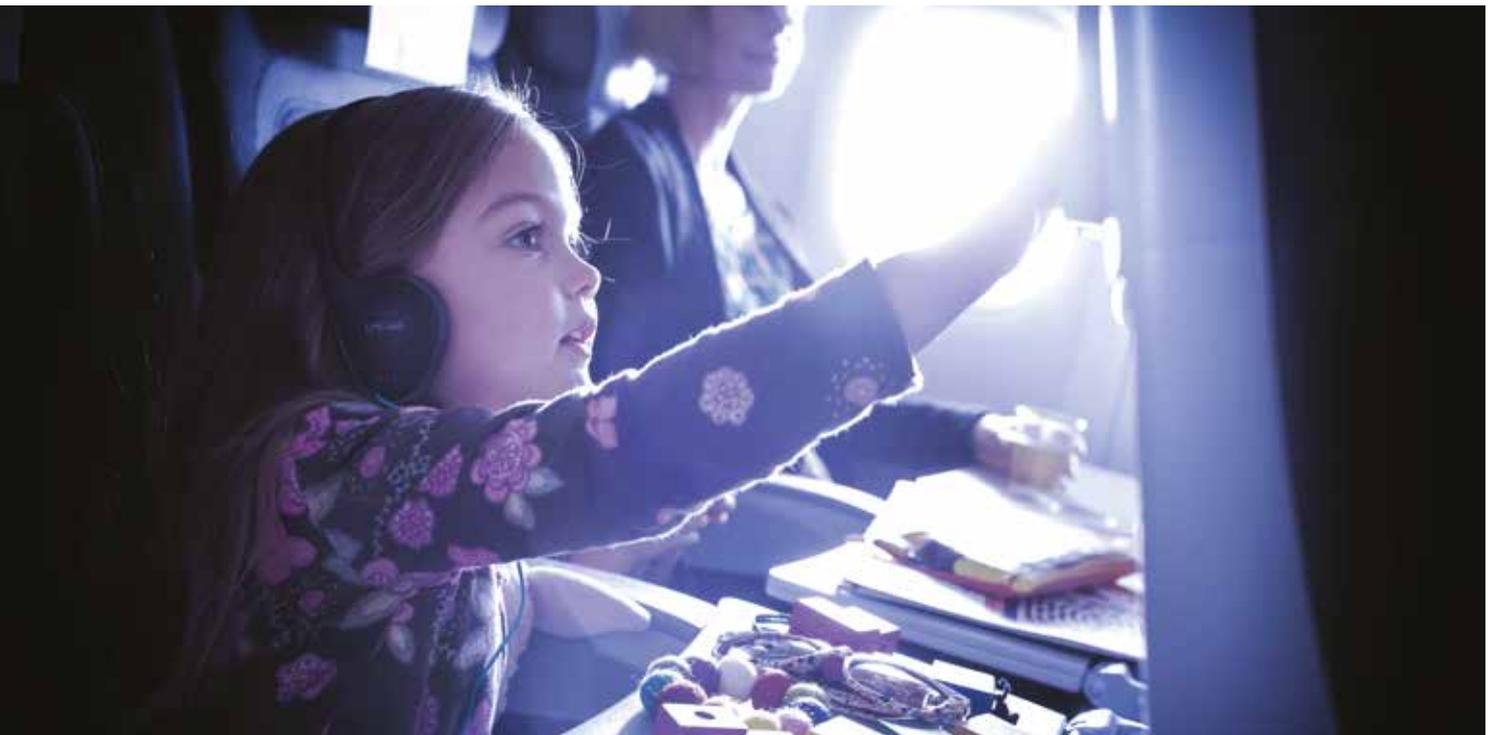
## CONNECTING THE CABIN FOR PIESD

Inmarsat Aviation has designed cabin connectivity services for both global and regional use. GX Aviation is powered by Inmarsat's four Global Xpress satellites, the world's only network of Ka-band high-throughput satellites (HTS) providing reliable, seamless coverage worldwide.

PIESD data connectivity requirement	Cabin service	
	GX Aviation	European Aviation Network (EAN)
High bandwidth	✓	✓
Low cost per MB	✓	✓
High reliability and service consistency	✓	✓
Redundant Infrastructure	✓	✓
Coverage	Global, seamless high-throughput satellite coverage	Regional integrated satellite and ground towers – all EU states plus Norway and Switzerland

The European Aviation Network (EAN) is the world's first integrated S-band satellite and air-to-ground network; designed to serve the needs of Europe's short haul carriers in some of the busiest airspace in the world.

Installing GX Aviation or EAN's high-speed passenger connectivity supports the PIESD's need for high data volume. Seamless coverage, high reliability and service consistency help airlines access the full value to be derived from a connected PIESD in the cabin.





## CONNECTING THE FLIGHT DECK FOR ACD

SwiftBroadband-Safety (SB-S) from Inmarsat Aviation provides IP-enabled secure broadband speed connectivity to the cockpit. To be fit to exchange ACD information, the set of criteria for a connectivity service is more extensive than for PIESD.



ACD data connectivity requirement	Flight deck service
	SwiftBroadband-Safety
Highest reliability – verified 99.9% global availability	✓
Robust in all weather conditions	✓
Solid-state antenna	✓
ICAO safety certified	✓
Authorised for use below 10,000ft and on ground	✓
Coverage of all global flight routes	✓
Priority and pre-emption available	✓
Physically separated from cabin services	✓

Using the proven and established Inmarsat L-band global network, the SB-S platform is completely isolated from any other systems accessible to passengers, thus creating a virtual data ‘fortress door’ between cockpit and cabin. Certified for exchange of safety-critical information by ICAO, SB-S supports the full suite of communication, navigation and surveillance capabilities to enable satcom-based air traffic management.

Inmarsat’s L-band allocation is also protected within the Aeronautical Mobile-Satellite (Radio-communication) Service (AMS(R)S), a service reserved by the International Telecommunications Union (ITU) for communications relating to safety and regularity of flights on civil air routes.



## TWO TYPES OF CONNECTIVITY SERVICE, BUT THREE ICAO DATA DOMAINS

Which service best supports the communication of airline operations – or AISD – data? This is the challenge facing airlines that want to benefit from the full commercial potential of the complete connected aircraft.

There is an overlap between commercially valuable data and mission-critical data within some aspects of the AISD, meaning that this data domain needs to be fully or partly carried over a secure, segregated connection. Airlines need to balance the most

cost-effective connection service to carry the volumes of data for effective systems performance monitoring and some connected EFB applications.

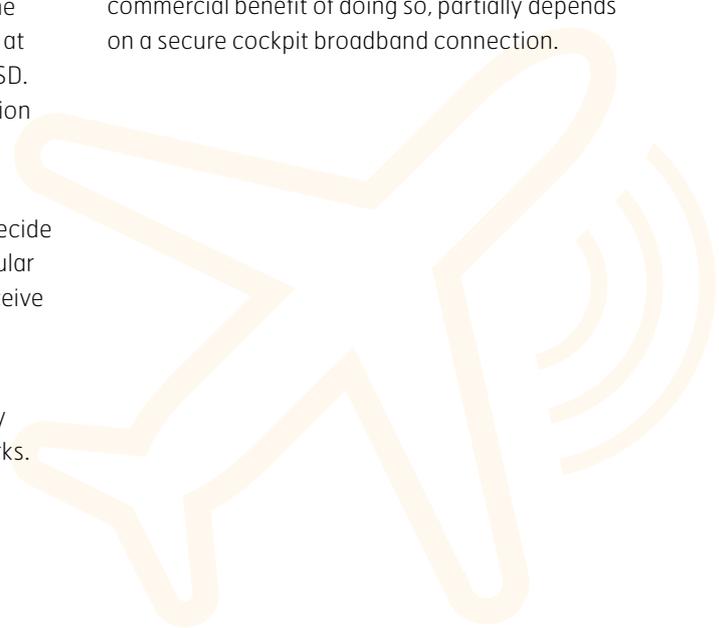
AISD data connectivity requirement	Flight deck service	Cabin service
High reliability	Ultra reliable	Reliable
High bandwidth	High	Very high
Secure – ideally distinct from PAX	Ultra secure Segregated from PAX network	Secure
Route coverage	Global route coverage	Global route coverage
Low data price	Data package subscription based	Very low cost per MB
Works down to the ground	Yes	Dependant on regional regulation
Lightweight equipment	8kg	< 100kg

For airlines, their selection of a solution design to support all three sets of safety, passenger and operations data is additionally dependent on their individual needs and priorities. Without current clear guidance from regulators for some types of operational data, airlines must decide at what level of sensitivity to treat elements of AISD. Consideration should be given to how information delivered to the cockpit interacts with aircraft control systems.

Airlines with certain operational profiles may decide some AISD data is more critical for their particular needs – for example the ability to send and receive operational data whilst on the ground.

Many connectivity providers in the aviation industry claim that operational data can simply be carried over their cabin connectivity networks.

The truth is that, either through defined standards, new standards currently in development, or organisational preference, the transmission of all types of operational data, and the resulting full commercial benefit of doing so, partially depends on a secure cockpit broadband connection.



## THE RIGHT SERVICE FOR THE RIGHT TYPE OF DATA: THE CORRECTLY CONNECTED AIRCRAFT

The complete connected aircraft delivers value to the airline through three areas – safety, operations and passenger connectivity. As the only operator of fully-owned and managed networks providing global high-speed broadband to both cabin and cockpit, Inmarsat Aviation is in a unique position to advise airlines on the best solution design to access that complete potential value.

### OUR VISION FOR THE CORRECTLY CONNECTED AIRCRAFT

A complete connected aircraft solution should be designed to help airlines achieve both the highest security and safety of operation and maximum commercial value – while at the same time assuring optimal performance.

Inmarsat Aviation's vision for which service domain capabilities should be supported by which aircraft

connection is based on evaluating the characteristics of ACD, AISD and PIESD data and matching these to the service features which support them.

The mix of passenger, operational and safety-critical capabilities is split between cabin and cockpit connectivity networks, securely segregated by Inmarsat Aviation's virtual 'data fortress door'. In our recommendation below, some capabilities can be put over either the cabin or cockpit connection and we work with airlines to define the best solution profile.

### CAPABILITIES OF THE COMPLETE CONNECTED AIRCRAFT

#### PASSENGER AND CREW OPERATIONS GX AVIATION/EAN

- PASSENGER WI-FI
- PASSENGER INFORMATION AND ENTERTAINMENT SERVICES
- PASSENGER CRM DATA
- CABIN CREW BRIEFING
- CREW SYSTEMS MONITORING
- AIRCRAFT AND ENGINE HEALTH MONITORING (NON-CRITICAL)

#### MISSION-CRITICAL COMMUNICATIONS SWIFTBROADBAND-SAFETY (SB-S)

- FANS: ACARS; CPDLC
- ADS-C/ADS-B
- ATS VOICE COMMUNICATIONS
- DIRECT AOC COMMUNICATIONS
- BLACK BOX IN THE CLOUD
- FLIGHT PLANS/OPTIMISATION/ I4D NAVIGATION
- TRACKING/INTEGRAL TRACKING/GADSS
- TURBULENCE REPORTING

#### HIGH-VALUE, NON-CRITICAL OPERATIONAL COMMUNICATIONS

- WEATHER UPDATES/WIND UPLINK
- ELECTRONIC FLIGHT BAG/TECH LOG
- QAR DATA
- CHART UPDATES



GX Aviation or EAN and SB-S provide high-speed connectivity on either side of the cockpit door. Our solution design maximises efficient bandwidth usage, for example allocating technical and health performance monitoring via the cabin, while maintaining safety and security as the highest

priority. High-speed Ka-band or integrated connectivity networks can deliver passenger and non-mission-critical operations data. The high-speed SB-S L-band network delivers mission-critical safety and operations data.

# THE RIGHT PARTNER FOR THE COMPLETE CONNECTED AIRCRAFT

Airlines seeking to access the full benefits of the complete connected aircraft require support to design the right connectivity solution for their needs. It's not just about connecting each ICAO data domain. Each airline has its own unique operating context, brand vision and service goals – meaning the types of connection service and the scale of delivery support will be individual to each carrier. Inmarsat Aviation is the only satcom operator with the breadth of expertise required to find the right connected fleet design for each individual airline.



## PROVEN EXPERIENCE AND PERFORMANCE

Inmarsat Aviation has been trusted to provide satcom services to the industry for over 25 years and we have been honing our expertise in delivering specialist services for aviation during that time. Nearly all aircraft that fly out of contact of land today – over 11,000 in total, are fitted with our Classic Aero service that meets and exceeds current standards for cockpit communications, navigation and surveillance. The service processes more than 35 million aircraft positional reports a year.

No other single provider can offer airlines purpose-built, truly global and wholly operational networks that connect both passengers and flight decks. Inmarsat has invested, and will continue to invest, in our fully owned satellite networks – ensuring they're always

optimised for the performance needs of global airlines. Inmarsat has already committed to the launch, in 2020 onwards, of its 6th generation satellites to augment capacity for GX Aviation and SB-S.

Many of the world's leading airlines are already selecting GX Aviation as their passenger service. The European Aviation Network is going live, and the launch partner has now equipped 90 percent of its aircraft with the service, with expected completion by early 2019. SB-S is now in flight with Hawaiian Airlines, United Airlines and Shenzhen Airlines. The global platforms are up and running that make the connected aircraft a reality.



## PARTNER TO ATM MODERNISATION AND REGULATORS

Inmarsat Aviation has long been a major stakeholder in driving forward industry satcom knowledge and best practices. This means we are in a position to offer the most up-to-date, robust and future-proof advice to those airlines defining their connectivity platforms to serve ICAO's three data domain requirements.

Our expertise has been used to define the profile and roadmap of key international ATM modernisation programmes, providing the satcom technology to upgrade from congested or outdated communications channels.

We also support and drive key regulatory safety initiatives, such as ICAO's proposed Global Aeronautical Distress and Safety System (GADSS) for improved regularity of flight tracking. Inmarsat is pursuing the use of Automatic Dependent Surveillance – Contract (ADS-C) capabilities to report at the different intervals required. We are working with ICAO, member states, airlines and all air navigation stakeholders to expedite implementation of the GADSS concept.

*Inmarsat Aviation is the only satcom operator with the breadth of expertise required to find the right connected fleet design through a single provider for each individual airline*



## FLEXIBLE SERVICE DESIGN, FROM PIPE TO PASSENGER

Our connectivity services are offered alongside our comprehensive implementation support. For example, with GX Aviation we offer a scalable and bespoke service package – everything from unique applications ecosystems, data and analytics platforms and an end-to-end managed delivery. Airline partners can select the scale of support they need for delivery of the service and we can work easily with other delivery partners for an integrated solution.

There are multiple layers of technology and team capability we offer, grouped into four strategic categories:

- **Connectivity Services** – network, ISP, security, analytics

- **Engineering and Design** – equipment, integration, portals and apps, payment engine
- **Maintenance and Optimisation** – system maintenance and repairs, service performance monitoring
- **Passenger Services** – service and retail consultancy, marketing consultancy, partnerships, passenger care

We created our unique Passenger Services capability to rapidly maximise revenue and ROI from inflight broadband for our customers. Our expert team advises on retail best practice – Wi-Fi pricing and promotion – as well as facilitating integration with OTT content providers and e-commerce engines.



## WORKING WITH A TEAM OF EXPERT PARTNERS

Our services are sold either directly or through a network of independent partners, operating in more than 80 countries worldwide. These partners also manufacture our terminals and develop tailored applications and solutions that enhance the use of our network and add value for customers. We carefully select our partners for their expertise in key market segments to ensure availability of our services. We also run a Certified Application Provider Programme – ensuring efficient, optimised and validated applications running over our networks.

Some of the partners vital to delivering our services:

**AIRBUS**

*Rockwell  
Collins*

*BOEING*

**SITAONAIR®**

**COBHAM**

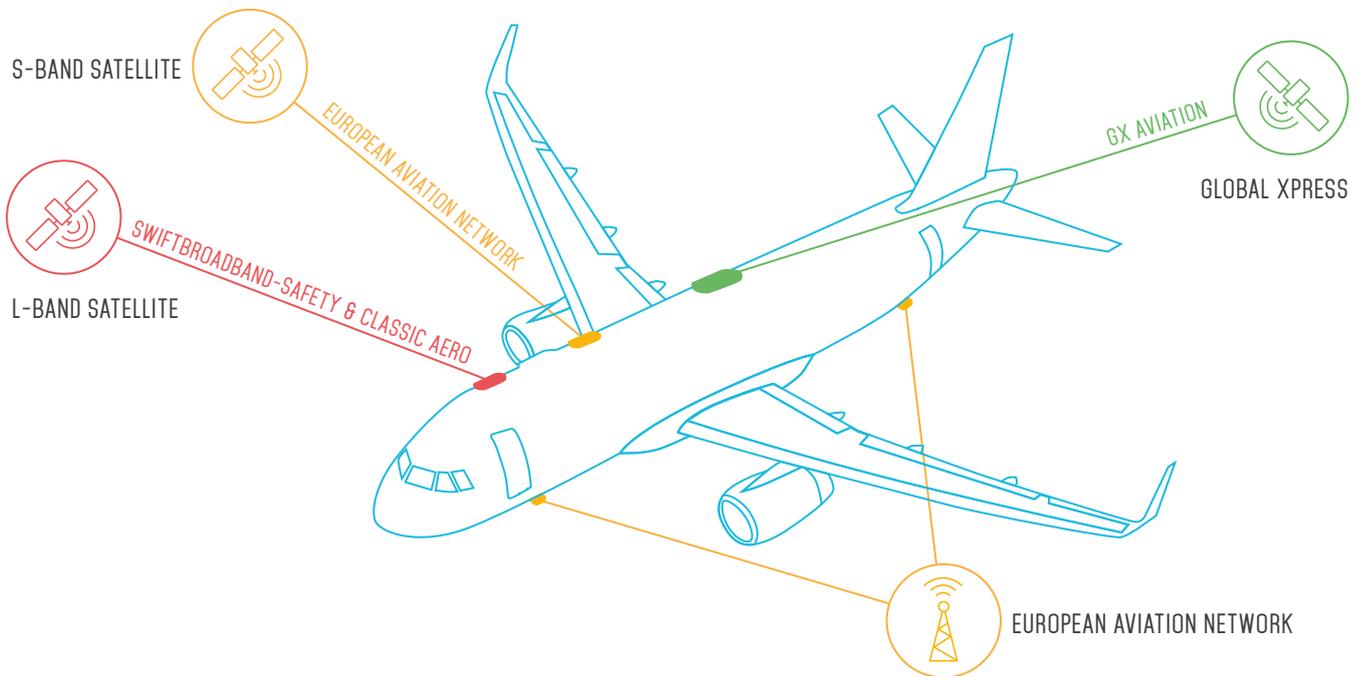
**THALES**

**Honeywell**

**& mcn** SELLING MARINE  
COMMUNICATION & NAVIGATION CO.



## ABOUT SERVICES FROM INMARSAT AVIATION



### GX AVIATION

#### RELIABLE, HIGH QUALITY, AIRLINE-SHAPED, GLOBAL WI-FI

The world's first truly global, high-speed broadband service from a single, trusted partner. GX Aviation delivers uninterrupted, high-speed Wi-Fi worldwide, powered by Global Xpress, the world's first global Ka-band satellite network and the only network built specifically to address global mobility. It's the product of a network strategy engineered to meet the needs of aviation, ensuring consistent coverage and capacity today and a commitment to match demand as it rises.

Global Xpress' three HTS satellites, with a fourth as 'in orbit' back up, cover the globe with a seamless layer of high speed capacity, exceeding the requirements of any known aviation customer. But airline demand is never spread evenly. A consistent service requires additional capacity targeted across congested flight routes and around busy airport hubs at peak times. So Inmarsat directs additional capacity precisely where it's needed, meaning a fast, reliable, consistent quality of service wherever planes fly.

GX Aviation creates the platform for service innovations that revolutionise inflight experience, unlock new revenue streams and build deeper passenger relationships.

- Uninterrupted worldwide coverage over the Global Xpress network
- Ultra reliable high quality aviation connectivity service
- Ka-band spot beam technology, plus unique steerable beams
- Contractually guaranteed minimum data rate to all aircraft
- Upgradeable bandwidth to respond to increasing demand
- Committed to continuous improvement in performance and bandwidth economics

## EUROPEAN AVIATION NETWORK (EAN)

### THE WORLD-LEADING CONNECTIVITY SOLUTION THAT'S TAILOR-MADE FOR EUROPE'S BUSY AIRSPACE

EAN is a revolutionary network developed to meet the particular requirements of European skies. The first of its kind worldwide, the European Aviation Network combines satellite coverage with a complementary air-to-ground network to deliver cost effective, scalable capacity precisely where it's needed across all 28 EU states, plus Norway and Switzerland.

Developed in partnership with Deutsche Telekom, Cobham, Thales and Nokia – the network will give European aviation a global advantage.

- World's first integrated satellite and air-to-ground connectivity network
- High speed in-the-air as on-the-ground Wi-Fi
- High capacity, high throughput, pan-European coverage
- Lower operating costs due to smaller, low weight, low drag antennae
- Guaranteed minimum data rate to all aircraft
- Easily scalable to expand with demand

## SWIFTBROADBAND-SAFETY (SB-S)

### THE NEXT GENERATION HIGH-SPEED FLIGHT DECK COMMUNICATIONS PLATFORM

SwiftBroadband-Safety (SB-S) is Inmarsat's next generation platform offering global, high-speed, secure, IP connectivity for the cockpit. SB-S enables everything from safer operations and better communications to improved fuel efficiency and optimised fleet performance. With its added capacity SB-S also means a lower cost per bit of data, all delivered through smaller and lighter avionics.

- Fly safer and more efficiently with high-speed surveillance and communications over IP
- Global flight tracking
- Optimise flights to reduce fuel burn, saving the environment from unnecessary emissions
- Call quality as clear as using a mobile phone or landline
- Ready to power next generation air traffic modernisation programmes: Iris, SESAR and NextGen
- Flights data streaming for a 'black box in the cloud'

Only Inmarsat can prioritise broadband data to the cockpit, providing segregation between regulated safety services and cabin communications, creating a virtual 'fortress door'. While offering a robust level of encryption and security, it also maximises the integrity and availability of safety data.

#### Features of SB-S:

- Multi-channel prioritised voice and data communications over IP
- Better than 99.99% L-band availability gate-to-gate worldwide coverage to ICAO GOLD standard
- Lightweight equipment – just 8kg
- Subscription-based monthly data package service, ensuring cost effectiveness
- Securely separated from passenger connectivity services
- Ready to meet future safety and operational communications requirements

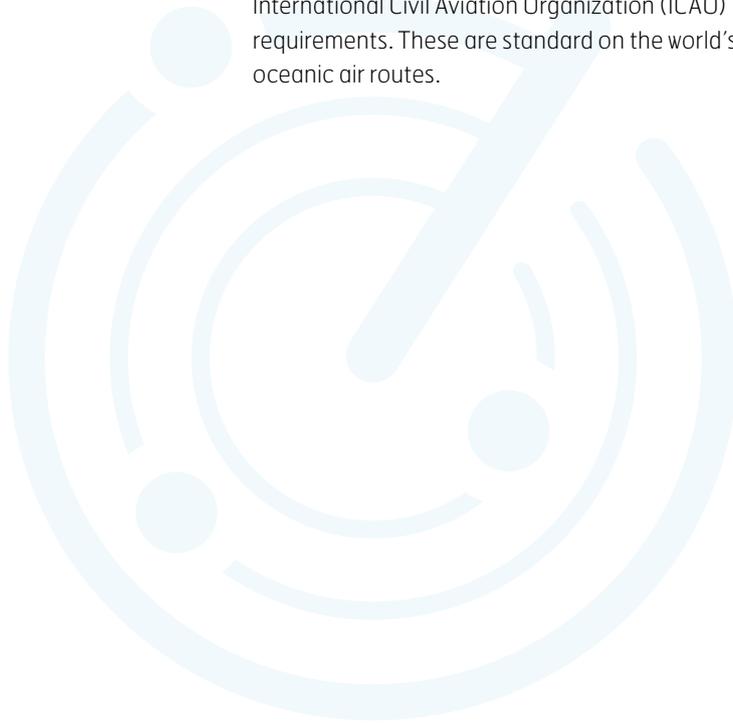


## CLASSIC AERO

### THE INDUSTRY STANDARD FOR SECURE COCKPIT SAFETY SATCOM

The world's leading airlines, business jet operators, general aviation and government agencies have used Inmarsat's Classic Aero portfolio for over 20 years. While SB-S represents the future of cockpit satcom technology through the delivery of new applications that require IP bandwidth, Classic Aero is highly capable and will remain operational for the foreseeable future. Like SB-S, our Classic Aero H/H+ and Aero I services offer Aeronautical Mobile Satellite (Route) Service AMS(R)S communications that meet International Civil Aviation Organization (ICAO) requirements. These are standard on the world's oceanic air routes.

- Meets ICAO global flight tracking, airline flight following and air traffic control separation service needs
- Globally compatible with ICAO's Future Air Navigation System (FANS)
- Fully integrated with Aircraft Communications, Addressing and Reporting System (ACARS) messaging
- Fully interoperable technology pathway from Classic Aero to SB-S, guaranteeing a long-term roadmap for safety and investment strategies



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