LSE

# SKY HIGH ECONOMICS

## **Chapter Two:** Evaluating the Economic Benefits of Connected Airline Operations

A Strategic Overview

In association with

inmarsat aviation

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### Foreword

Welcome to the second chapter of 'Sky High Economics': 'Evaluating the Economic Benefits of Connected Airline Operations'.

Conducted by the London School of Economics and Political Science, the 'Sky High Economics' study is the first of its kind to comprehensively model the economic impact of inflight connectivity on the aviation industry. Following the first instalment, 'Quantifying the Commercial Opportunities of Passenger Connectivity for the Global Airline Industry', released in 2017, this report shines new light on how secure, resilient, high-quality connectivity services can also deliver powerful commercial efficiencies for airline operations, with resulting advantages for safety and environmental impact. It demonstrates multi-tiered benefits across fuel consumption and $CO_2$ emissions, aircraft performance and maintenance, risk mitigation, on-time arrivals and departures, airspace management and improved fleet utilisation.

Inmarsat has a rich history in this space, with over 25 years' experience delivering secure, satellite communications to the cockpits of the world's leading airlines. Now, advances in bandwidth and the rapid emergence of an ecosystem of supporting applications are transforming safety and operations services into a strategic asset, with enormous consequences for the future of the industry.

Today, we're working with many airlines that have already adopted connectivity across the entire aircraft, from cabin to cockpit. As the only operator of fully-owned, managed networks capable of supporting the complete connected aircraft, we're helping those airlines realise new revenue streams and achieve striking operational efficiencies, while managing the secure segregation of passenger and mission-critical safety data. The launch, earlier this year, of Inmarsat's SB-S service, brings high-speed, multi-channel connectivity to the flight crew for the first time, delivering revolutionary new capabilities, from real-time weather reports to inflight aircraft health and performance monitoring. Perhaps most importantly, it represents a crucial step towards the digitisation of air-space management, ushering in improvements in communication, navigation and surveillance essential if the industry is to meet the demands of growing passenger traffic worldwide.

The findings of this research highlight the benefits early adopters are already seeing, and point to many further opportunities soon to come. The complete connected aircraft will be pivotal to the digital transformation of the airline industry.

We are proud to play a part in this revolution and excited by what lies ahead.

Bring It On!

## Executive Summary

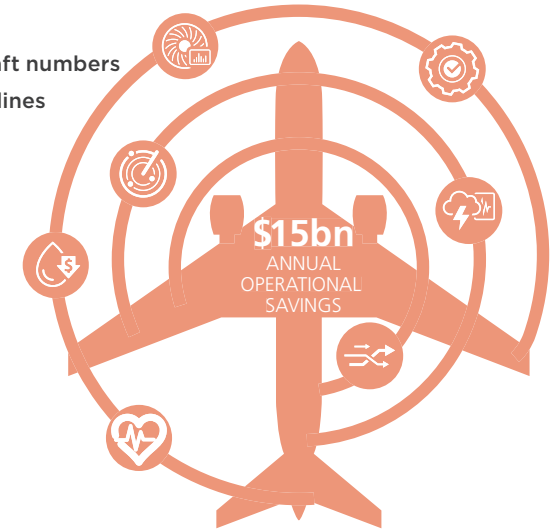
The aviation industry is changing. Just as we witnessed the revolution from the use of analogue phones to smartphones on the ground, digitisation in the skies is transforming the way airlines operate.

At the heart of this change is the connected aircraft.

Our world is increasingly driven by – and dependent on – data. But the internet of things (IoT) has not, until very recently, included the aircraft. Lagging behind digitisation on the ground, the aircraft remained one of the last places on earth without access to high-speed connectivity.

But now, the aircraft is catching up. Facilitated by satellite communications and integrated with the IoT, the connected aircraft is sparking a sky-high data revolution. Real-time data exchange is enabling a wide range of efficiencies and enhancements across fuel consumption and emissions, maintenance, flight optimisation, fleet utilisation, airspace capacity and safety.

**Together, these benefits could save the global airline industry between US$5.5 billion–US$7.5 billion annually based on existing connected aircraft numbers – equal to a 0.75–1.00% reduction in the total US$764 billion spent by airlines each year on operational costs. This saving is predicted to sky-rocket to between US$11.1 billion–US$14.9 billion by 2035.**




With more and more passengers taking to the skies each year, air traffic is forecast to double by 2035 to 7.3 billion. Without a more efficient use of technology and infrastructure, the industry will struggle to keep pace with this growth. The need to increase airspace capacity must be balanced with growing environmental concerns around aviation's contribution to global emissions, and the need to assure safety as the skies above us get even busier.

Operational connectivity is helping the industry to tackle these challenges head on. This research indicates that it could save airlines around 2.5%–5.0% of current fuel consumption, with significant impact on $CO_2$ output. Satcom-enabled air traffic management initiatives can further reduce separation distances between aircraft, counteract congestion and manage the movement of aircraft more safely and efficiently. In short, the connected aircraft is more than just a commercial advantage. In today's climate, it is fast becoming an operational necessity.

Drawing on primary research and secondary data, including interviews with airline managers; regulatory agencies; service providers and third parties; subject matter experts, and developers and suppliers of aircraft equipment and software solutions, this study explores the benefits of the connected aircraft across four principal categories: connected operations, maintenance, airline operations and air traffic control.

## Connected Operations Services

Airline operations processes are often complex and, due to the technology available, poorly optimised. The connected aircraft has the power to change this. Improving efficiency and safety across pre- and post-flight reporting, flight planning and logistics, and flight optimisation will reduce the potential for delays, along with associated costs and inevitable passenger frustration.

By integrating real-time aircraft data with Operations Control Centre and customer relationship management databases, airlines can create live dashboards for monitoring and distributing information on the ground. Linking an automated catering solution with reservations and departure control systems can allow for quick adjustments to on-board inventory, saving weight and reducing costs by an estimated 7% per flight. Real-time flight data used to improve the reliability of arrival time prediction could reduce crew-related delays by 33% or more, yielding savings in the region of US$1.2 billion a year.



## Maintenance Operations Control Services

Modern long-haul aircraft can generate up to 500GB of data per flight and each new generation of aircraft is forecast to create around 30 times more data than the model it replaces. This wealth of new data can provide airlines with visibility on an aircraft's systems and performance while it is still flying, resulting in huge efficiencies for maintenance operations on the ground. While today only a small fraction of generated data is streamed during flight, for operational efficiencies to be improved it will be necessary for airlines to access more and more of this real-time data while the aircraft is still in the air.

Transmitting real-time data to secure cloud services or ground-based servers for monitoring and analytics allows faults to be pinpointed before they become major problems. This also enables better decision-making, which can reduce the time that an aircraft spends grounded for maintenance and repairs. Parts can be replaced that are identified as targets for replacement before they fail, during scheduled maintenance windows. This study predicts that reducing the need for unplanned maintenance through such capabilities could save airlines US$5.6 billion each year.

## Airline Operations Control Services

From making flight planning and cabin crews more efficient, to enabling bad weather avoidance and disruption management, the connected aircraft is changing airline operations for the better.

Enhanced connectivity redefines how flight and cabin crews work and communicate. Crew briefing information currently provided manually at the gate can be delivered directly to the aircraft. Traditional pilots' flight bags can be replaced by Electronic Flight Bags, saving weight and enhancing productivity with in-air updates. A continuous secure data exchange can occur between the ground and the aircraft with real-time flight data streaming, including 'Black Box in the Cloud' features.

In particular, live weather updates to the cockpit improve situational awareness and support decision-making. Pilots can avoid areas of severe weather with greater confidence and precision, yielding fuel savings, improved safety and lower $CO_2$ emissions. Industry discussions and trial results indicate that improved navigation and adverse weather avoidance could deliver annual savings of US$1.3 billion globally per year. The benefits of avoiding turbulence could be even higher, yielding up to an estimated US$2.6 billion in annual global fuel savings.



## Air Traffic Control Services

The benefits of the connected aircraft can deliver particularly significant results within air traffic control services. Digitising air traffic management through high-speed satellite connectivity is predicted to deliver $3 billion in annual savings by 2035.

Real-time data exchanges between aircraft and the ground, along with 4D trajectory management initiatives, enable reduced separation distances between aircraft. This can reduce fuel burn and emissions and enhance safety while allowing airspace and existing infrastructure to accommodate air traffic growth.

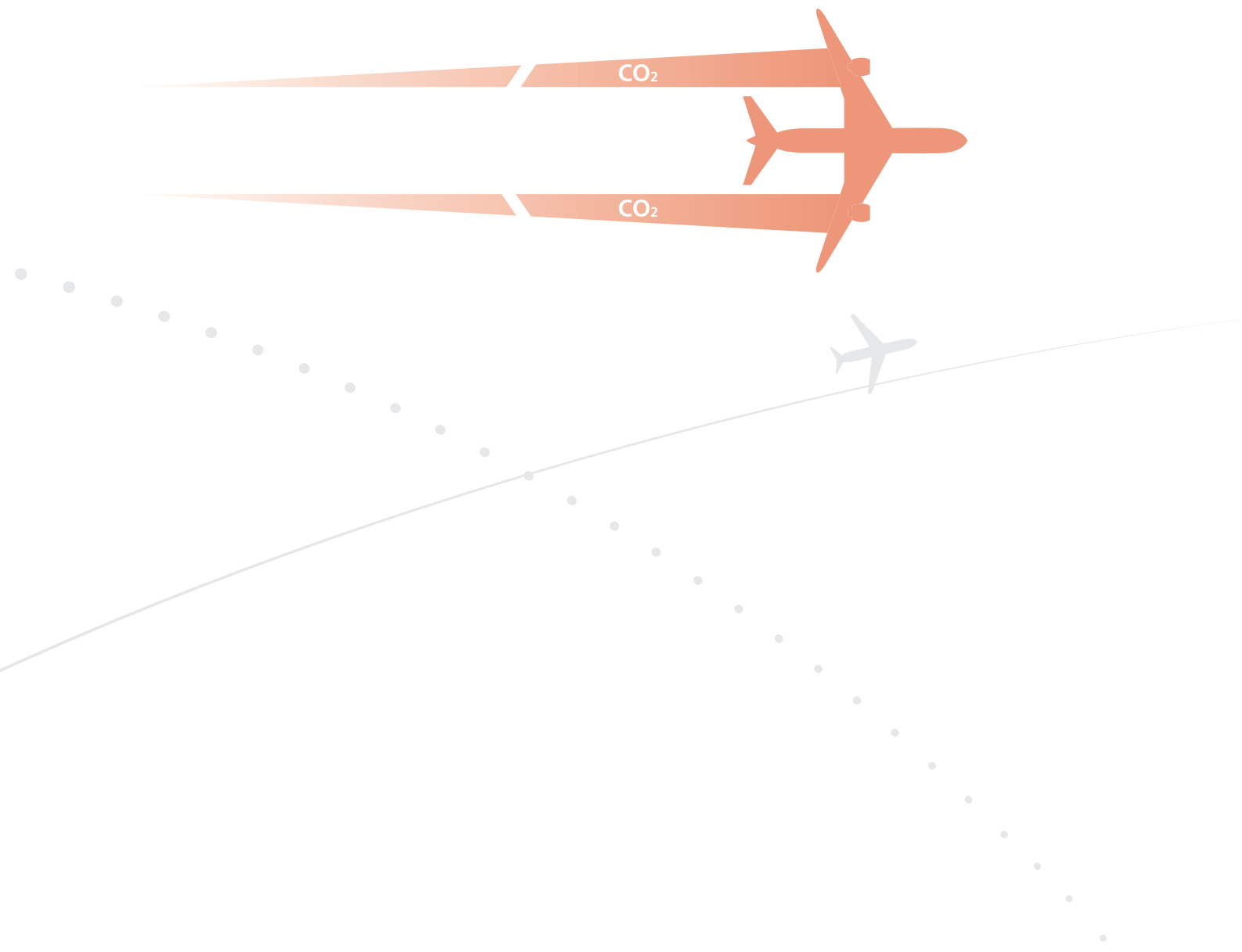
In addition, more efficient use of airspace could significantly cut the 18–20% of airline operating costs currently spent on fuel. This study finds that IP-based flight deck communications could bring about a 1–2% reduction in current global fuel consumption, resulting in savings of US$1.3 billion, 3.39 billion litres of fuel and 8.5 million tonnes of $CO_2$ annually.

## Conclusion

Until recently, the business case for connectivity has been largely based on ancillary revenue alone. The reality is much broader – one that includes not only ancillary gains, but efficiencies that can significantly reduce bottom line operating costs. The two are not mutually exclusive. They are both part of the wider, end-to-end digital transformation occurring across the industry, starting from initial interaction with the passenger and extending well beyond the aircraft's arrival at the destination gate.

The diverse range of benefits of connected operations include economies in fuel consumption, a reduction in delays and improved on-time departures, innovations in maintenance processes, fleet utilisation efficiencies, safety enhancements and others. Together, these are forecast to yield annual savings of up to US$14.9 billion globally by 2035.

The forecast increase in air traffic is both a challenge and an opportunity. The connected aircraft offers a solution to meet demand while facilitating powerful efficiencies and benefits. Without it, the industry may be constrained by the limitations of finite airspace and a growing environmental agenda.



## Fast Facts

- *Sky High Economics* is a three-part research study. It is the first research study of its kind to comprehensively model the socio-economic impact that connectivity can have on the aviation industry.
- *Sky High Economics: Evaluating the Economic Benefits of Connected Airline Operations* highlights how secure, high-quality, enhanced connectivity services can deliver powerful commercial efficiencies for airline operations, with resulting advantages for safety and environmental impact.
- This research study will also include a later report looking at the impact of passenger connectivity on loyalty and behaviour within the aviation industry. The first chapter quantified the global value of broadband enabled ancillary revenues to the airline industry.
- The research found that the potential for multiple savings, efficiencies and safety opportunities could equate to a 0.75%–1.00% reduction in the IATA consolidated US$764 billion annual global airline costs of operation.
- The operational benefits from enhanced broadband are forecast to generate up to US$15 billion for the global airline industry by 2035, as greater connectivity is adopted.
- Today, some airlines currently trialling enhanced connectivity are reporting savings of up to 5% in both fuel and emissions and flight times and delays.
- Real-time flight route optimisation via connected communications could result in a 1% fuel reduction per flight. This equates to 3.39 billion litres, 8.3 million tons of $CO_2$, and US$1.3 billion in fuel costs a year.
- The forecast cost of the 13% of medical emergencies that result in diversions is US$552 million globally. If medical emergency diversions are reduced through connected telemedicine, the benefits could be significant: a reduction of 75% from current diversions yields a cumulative decrease between 2018 and 2035 of US$10 billion in costs.
- Connectivity could deliver a 66% reduction in crew-related scheduling delays – adding up to US$2.4 billion in annual savings.
- Weather is responsible for 70% of all flight delays and is a contributing factor in 23% of aviation accidents. Connectivity, which offers pre- and post-departure opportunities to improve navigation and avoid adverse weather conditions could deliver annual cost savings of $1.3billion.

## Disclaimer

This research represents forecasts and analysis undertaken through both primary and secondary investigation. The data is provided to illustrate potential market growth and is underpinned by assumptions and estimations. Any reliance on the information occurs at the risk and discretion of the user. No responsibility is taken for the use of the information, with users encouraged to undertake their own analysis to validate any decisions.