LSE

SKY HIGH ECONOMICS

Chapter Two:
Evaluating the economic benefits of connected airline operations

A CONDENSED READ

inmarsat aviation

> The aviation industry is facing increasing pressure to cut emissions and reduce its overall environmental footprint. Yet, the sector is growing. To accommodate further growth and enhance efficiency, while taking into account the environmental impact of aviation, global airline operations need a major overhaul. By 2035, air traffic is forecast to double – an exciting prospect to capitalise on, but unachievable if infrastructure and technology are not better utilised.

John Broughton
Senior Vice President,
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Operational connectivity is the key to an aviation industry fit for the future

The airline industry faces several significant challenges in the next two decades, as demand for passenger travel shows no signs of slowing.

Congestion at major airport hubs and in busy airspaces is already a well-documented issue, set to only become more problematic as additional flights take to the skies with every passing year.

Mounting operating costs - including rising fuel costs and expenses from delays and cancellations - continue to weigh heavily on airlines. Paradoxically for some carriers, these costs now stand in the way of their ability to expand operations and capitalise on the opportunity that growing customer demand could bring.

The aviation industry is facing increasing pressure to cut emissions and reduce its overall environmental footprint. Yet, the sector is growing. To accommodate further growth and enhance efficiency, while taking into account the environmental impact of aviation, global airline operations need a major overhaul. By 2035, air traffic is forecast to double – an exciting prospect to capitalise on, but unachievable if infrastructure and technology are not better utilised.

The solution? Connected operations. Just as businesses on the ground have become increasingly reliant on data and connectivity to operate in the modern world, the aviation industry is undergoing its own digital transformation with the emergence of the connected aircraft.

Facilitated by satellite communications and integrated with the IoT, high-speed, secure onboard connectivity can have a significant and wide-ranging operational impact. Information exchanged in real-time generates a wealth of new opportunities for airlines to drive efficiencies. Ground crews have access to a wealth of data during flights that was once only available after the aircraft had landed. And, if the aircraft has a problem, it can transmit critical data to the ground in real-time.

By giving airlines access to a wealth of real-time data and insights, connectivity is transforming traditional flight deck communications from a safety service into a strategic asset, with significant commercial advantages.

Weather tracking is just one example of such transformation. Before enhanced satcom capabilities, pilots would receive weather information prior to take-off. Needless to say, weather changes quickly and for a transoceanic flight, weather information could be long outdated before an aircraft enters an area with variable weather patterns.

The connected aircraft allows pilots to track weather systems instantly and change route depending on the information coming into the cockpit. This can not only prevent turbulence, reduce delays, and enhance safety, but also reduce fuel costs by an estimated 1% per flight.

When you consider the additional savings that operational connectivity can bring, the potential fuel saving jumps to 2.5% - a significant proportion of the near 20% of costs that airlines currently spend on fuel.

The benefits of enhanced connectivity are broad, encompassing everything from fuel savings, minimising delays and cancellations, enhancing maintenance capabilities, increasing airspace capacity and raising the bar in aviation safety. These operational improvements will also have a positive effect on the environmental impact of aviation, helping to lower fuel usage and contributing to industry targets to mitigate CO2 emissions from air transport. **Sky High Economics: Evaluating the economic benefits of connected airline operations** forecasts that connected operations will save the global airline industry up to $15 billion annually by 2035.

With a rich history in this space, built upon more than nearly 30 years' experience delivering innovation in the form of secure, satellite communications to airlines, Inmarsat is the leading provider of connectivity for safety and digital aircraft operations. Our services give airlines real-time insights to speed up their digital transformation. With a suite of applications proven to lower operating costs, all solutions are delivered via our own state-of-the-art network, giving assured levels of security and safety.

Many aircraft already have technology installed to start operational savings immediately, and many airlines are already exploring the benefits of IP-enabled fleets. Those acting on the opportunity will reap the rewards for many years to come.

John Broughton
Senior Vice President,
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Inmarsat Aviation

Connected aircraft will save the aviation industry $15 billion annually by 2035

With more and more passengers taking to the skies each year, air traffic is set to double by 2035 to over seven billion passengers annually.

While such exceptional growth presents a wealth of opportunities for airlines, it also poses a complex challenge. Without a more efficient use of technology and infrastructure, it will be almost impossible for the industry to keep pace. Delays and cancellations will continue to increase, fuel costs will become unsustainable and – without enhanced communication permitting planes to fly closer together – our airspace will meet its capacity limit.

Safety must remain the top priority as congested airspace becomes even busier. The need to increase airspace capacity must be balanced with growing environmental concerns around aviation's contribution to global emissions.

The key to building an aviation industry fit for the future is enhanced connectivity. Real-time data exchange between the aircraft and the ground can deliver a raft of operational benefits across everything from fuel consumption and emissions, to maintenance, airspace management and delays.

Dr Alexander Grous, Department of Media and Communications, London School of Economics (LSE) and author of **Sky High Economics**, sees a clear case for the adoption of connected aircraft: "At the moment, the industry experiences delays and costs that in many cases can be either entirely prevented or minimised. And the enabler will be the use of advanced broadband comms to the cockpit and cabin."

The economic opportunity, quantified by **Sky High Economics**, is immense. By 2035, connected operations are forecast to save the global airline industry up to $15 billion annually.

Route optimisation and fuel savings

Flight crews flying connected aircraft can coordinate flight path changes in the air to take the most optimal route. With access to real-time graphical weather displays in the IP-enabled cockpit, bad weather can be avoided, and from the ground, minor route changes can also be suggested such as changing a flight plan to take advantage of more favourable wind at a different altitude.

Pairing route optimisation with efficiencies accruing in other areas, connected operations can generate fuel savings of 2.5%. With around 20% of total airline operating costs currently spent on fuel, the impact of these savings will be significant in reducing bottom line expenditure.

The forecast 2.5% fuel saving equates to an annual reduction of 8.5 billion litres of fuel, and 21.3 million less tonnes of CO_2 emitted. This presents a significant opportunity to reduce the industry's carbon footprint in an era of growing environmental awareness and concern.

Enhanced maintenance capabilities

Globally, airlines spent $62.1 billion in maintenance, repair and operations costs in 2016, a figure set to reach $90 billion by 2024. Reducing turnaround times and the time aircraft spend on the ground (AOG) through predictive maintenance is clearly an urgent priority for airlines seeking operational efficiencies.

Better utilisation of inflight data will be key to giving airlines visibility on an aircraft's performance while it is still flying, driving efficiencies for maintenance operations on the ground. With inflight aircraft health monitoring capabilities, airline operations teams can pinpoint faults and utilise the information to make informed decisions that can reduce unscheduled AOG.

This is crucial, as unplanned maintenance has a significant knock on impact on airlines' wider operations, causing approximately half of all delays. Now, with the advent of predictive techniques,

parts can be replaced before they fail in scheduled maintenance windows. Or, if a more urgent problem is detected while an aircraft is in the air, the data can be offloaded in real-time to allow the replacement part to be readied and pre-positioned at the gate.

Reduced delays and cancellations

Together, route optimisation and enhanced maintenance capabilities will go a long way in improving disruption management. This is a top priority for the industry, given that global flight delays cost an estimated $123 billion each year.

Where connectivity is fully utilised in disruption management to reduce the impact of delays, cancellations and diversions and enhance predictive maintenance, annual savings have potential to reach $11 billion.

Revolutionising airspace management

With major global airports already nearing 100% capacity, satellite connectivity provides an opportunity to streamline airspace management. This will be crucial as demand for air travel continues to increase exponentially.

Flight separation is an area of considerable focus for regulators and airlines. 4D trajectory management initiatives and secure real-time data exchange between aircraft and air traffic control offer the potential to reduce separation minima. This lowers fuel consumption, emissions and enhances safety, while permitting more controlled arrival times, and increasing airport throughput.

This is key to meeting growing passenger numbers without incurring additional delays, fuel burn and emissions, or additional infrastructure costs such as new airport construction.

Assured flight safety

Importantly, enhanced connectivity is also driving forward new concepts of flight safety.

Real-time data exchange to and from the cockpit enables valuable flight updates, including aircraft telemetry, graphical weather and animated views of the surrounding environment. Pilot awareness of the aircraft's physical location and altitude is a significant aspect of safe flying, reducing the chance of loss of control and other factors that can cause accidents.

In addition, the connected aircraft can stream flight data to a virtual Black Box in the Cloud™ (BBIC). In the unlikely event that a plane begins to behave abnormally - such as veer off course or descend too rapidly - the system can automatically stream all data and key metrics to the ground instantly. Not only can an aircraft's location be constantly monitored, but airlines and ATC can instantly understand what exactly that aircraft is doing.

Mark Rosenker, former Chairman of the U.S. National Transportation Safety Board, said of the latest developments: "Safety is a key benefit that IP can deliver to the plane in operations, and to ATC. This can usher in a new era of real-time tracking, metrics, and exception-engagement that ultimately could avert an emergency or a worse outcome. The benefits are many."

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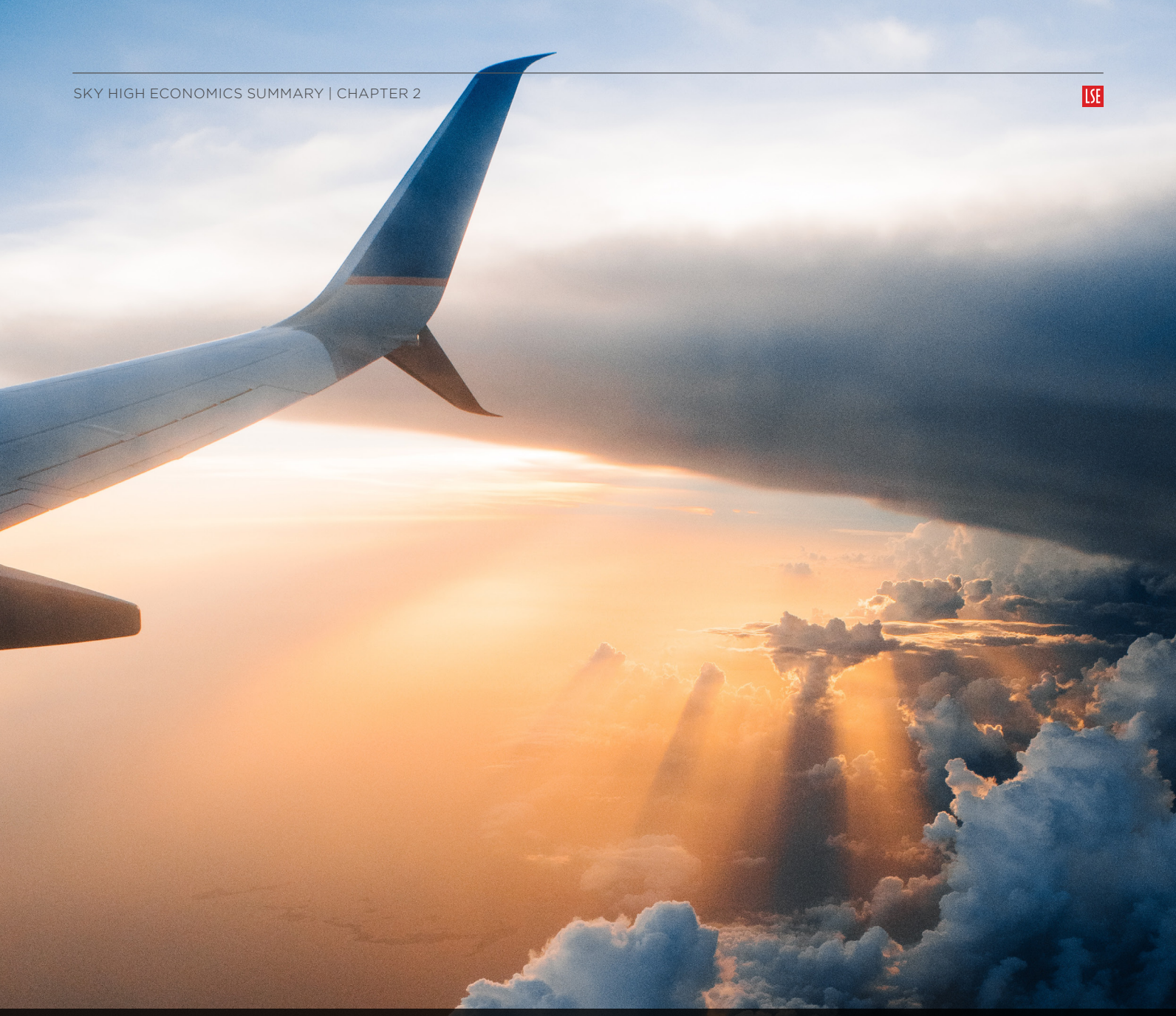

The $45 billion opportunity for airlines

Sky High Economics Chapter One identified a huge opportunity for airlines to capitalise on new ancillary revenue streams enabled by passenger connectivity. Airlines are forecast to gain $30 billion through these broadband-enabled revenues by 2035.

The business case for connectivity has, until now, largely been based on these incremental revenue gains alone. As this chapter reveals, the potential for connectivity to provide impactful operational savings is a crucial part of the broader case for change.

These two areas are not mutually exclusive; they are both part of the wider, end-to-end digital transformation occurring across the industry. The benefits of satellite connectivity could revolutionise the entire aviation ecosystem. While utilising passenger inflight broadband to drive revenue, airlines can reap the benefits of IP-connectivity to overhaul operations. In addition to the $30 billion ancillary revenue opportunity, this brings the industry a $15 billion opportunity to curb operational costs by 2035.

The time for airlines to act is now. Otherwise, the industry may be constrained by the limitations of finite airspace, a growing environmental agenda, and ever-rising costs.

Learnings for airlines

1. The potential to reduce bottom line costs through connected operations encompasses a 2.5% reduction in fuel consumption. Equating to 21.3 million less tonnes of CO2, this also has important implications for the industry's environmental impact.

2. Utilising enhanced connectivity to reduce delays, cancellations and diversions could save airlines $11 billion – a significant chunk of the estimated $123 billion that the industry loses to delays every single year.

3. With real-time data exchange between aircraft and air traffic control, separation minima can be reduced to ease airspace congestion, lower fuel consumption, enhance safety while permitting more controlled arrival times and increasing airport throughput.

4. Real-time data streaming is driving forward enhancements in safety, through better situational aircraft and flight tracking capabilities that not only monitor location, but constantly evaluate aircraft performance to avert issues and emergencies.

5. The benefits of passenger connectivity and operational connectivity are not mutually exclusive. In addition to the $30 billion ancillary revenue opportunity of passenger broadband, operational connectivity represents a $15 billion opportunity for the industry to reduce its operational costs by 2035.

Enhanced connectivity is revolutionising operations for Hawaiian Airlines

Hawaiian Airlines (HAL) is ranked within the top ten largest airlines in the United States, carrying more than 10 million passengers a year.

The transoceanic carrier offers non-stop services flying to Hawaii from North America, Asia and the South Pacific – including more routes to U.S. gateway cities than any other airline.

In 2018, HAL became the first airline in the world to commercially adopt Inmarsat's next-generation SB-S service for operational connectivity, transforming the airline's operations.

On its latest fleet of Airbus A321neo aircraft, SB-S provides Hawaiian with secure, high-speed broadband connectivity to the flight deck for all voice and data applications.

The result is enhanced airline safety and operations, from instant communication with the ground to real-time, in-flight information.

Improved communications

As well as the significant operational knock-on impact of instant air-to-ground communications, the technology is vastly improving the support available to pilots during flights.

For HAL, one of the most palpable improvements so far has been the quality of voice communication between flight and ground crews.

Captain David Valente, Boeing 767 Fleet Captain, Hawaiian Airlines, notes: "In the past, prior to this system, it would take several minutes to send and receive messages via datalink. Now, it just takes seconds. The quality of voice communication has improved so much that it's like using a telephone, cell phone, or very good landline."

Operations that flex

Changeable and varied weather can be an operational challenge for airlines operating in tropical climates like Hawaii.

When the Kilauea volcano erupted in 2018, displacing thousands of local people and sending vast plumes of ash skywards, the aviation industry was poised for significant regional disruption. However, having adopted SB-S technology, Peter Ingram, President and CEO of Hawaiian Airlines (HAL) told media: “operationally it’s had nil impact - we haven’t cancelled a flight or taken a delay because of the volcano”.

With SB-S, HAL can update flight plans inflight, where they previously had to be prepared 24 hours in advance. Such flexibility is particularly useful given the prevalence of volcano eruptions in the region, and ash clouds which can ground flights for days; pilots can be alerted, in real time, of the exact spread and movement of ash clouds from the active Kilauea and Mauna Loa volcanoes.

The FAA’s Honolulu Air Route Traffic Control Center has been able to allow all the airline’s flights to take off during volcanic activity since the technology was adopted, while many other carriers’ flights in Hawaiian airports have remained grounded.

The IP-enabled cockpit also grants pilots access to electronic flight bag (EFB) apps which combine 3D mapping, weather and air traffic data. Together, these apps help flight crews to identify when to change altitude to avoid turbulence and headwinds – generating significant savings in fuel and curbing costs for airlines.

This is a clear operational benefit with significant financial impact, giving HAL a competitive advantage in the region.

Airline operations fit for the future

For Ken Renwick, Vice President Flight Operations, Hawaiian Airlines, the airline's current use of operational connectivity is just the beginning. "It will continue to evolve. I suspect we will be continuing to develop uses of the product that, at this point, we haven't even imagined."

With the fleet IP-enabled, and the capabilities of the technology continuing to evolve, HAL is in prime position to capitalise on the operational connectivity revolution.

INMARSAT SERVICES

Inmarsat has set the bar for inflight communications as a leader in aviation satcom for nearly 30 years; over 12,500 aircraft use its proven safety and operational solutions today, supporting 90% of oceanic flights.

Inmarsat's standard safety and ATM communications service, Classic Aero, continues to connect aircraft around the world for more than 200 major airlines, jet operators and government agencies.

Building on this rich heritage, Inmarsat is now bringing airline operations into the future, speeding digital transformation for airlines with real-time data and insights.

Inmarsat is the innovative and leading provider of solutions for digital aircraft operations, offering a platform of ever-evolving capabilities to accelerate digital transformation and deliver an operational advantage at a reduced cost, now. Delivered via a proven, resilient network, these solutions provide assured levels of security and resilience for digital aircraft operations.

Many airlines already have ample technology installed already that can enable immediate operational savings. Inmarsat also offers a next-generation operational connectivity service, SB-S, which is available with lightweight terminals, small antenna, IP connectivity and pioneering data packages, with guaranteed linefit positions on Airbus and Boeing.

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