Delivering Air Traffic Modernization

1. Air traffic management is under pressure

More people are flying than ever before. A record 3.8 billion passengers took to the skies in 2016. While impressive, this number is expected to nearly double by 2035. This means there will be almost as many passengers in the air that year (7.2 billion)[1] as there are people on the ground right now. By 2035, the number of aircraft in service is projected to reach 41,000[2] – nearly twice as many as today.

In today's crowded skies, European airspace is amongst the most travelled. The radio frequencies we use to manage flights over Europe are nearing full capacity. Delays and cancellations are common due to congested air traffic, causing frequent bottlenecks at airports. If this trend continues, the economic consequences could be severe. Airspace is a vital infrastructure in today's economy; just as important as roads, railways and ports.

To address this issue, the European Commission launched the Single European Sky Air Traffic Management (ATM) research programme. Also known as SESAR, its mission is to ensure the safe and efficient utilisation of airspace and the air traffic management system within Europe and worldwide. It also intends to modernise current communication procedures and increase, even further, the safety of aviation passengers and crews.

2. Opening up the skies with Iris

Today, while you may be able to text with your smartphone in the cabin, pilots and controllers still use VHF radio to communicate via voice calls to air traffic control. These calls congest the radio spectrum and make up a large portion of an air traffic controller's workload. To unburden the controllers and free up the airwaves, the European Commission and SESAR are seeking technologies that improve communications between pilots and air traffic controllers. The idea is that the currently congested spectrum does not become the limiting factor for the much-needed increase in aviation capacity. In response, the European Space Agency (ESA), in agreement with SESAR, launched the Iris Programme, a satellite-based communication solution that relieves the pressure on ground-based radio frequencies by using mobile satellite communications. Iris is a Public-Private Partnership to enable continental satellite communications for air traffic management over Europe. Its goal is to develop a safe, secure and highly resilient satellite-based ATM alternative to the currently congested radio frequencies. Iris is an application that will operate on Inmarsat's SwiftBroadband-Safety platform, which provides secure high-speed broadband communications to the flight deck.

In Greek mythology, Iris links the sky and the earth.

Iris is the personification of the rainbow and the messenger of the gods.

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[1] http://www.iata.org/pressroom/pr/Pages/2016-10-18-02.aspx

[2] http://www.boeing.com/commercial/market/current-market-outlook-2017/

Iris: Delivering Air Traffic Modernization

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3. How Iris works

Controller-pilot communications previously made using voice communications are now improved by the use of broadband digital text communications

With Iris, pilot and controller communications are digital – position reports, clearances, runway conditions – sent and received via terminals in the cockpit and the flight control facility.

To illustrate the efficiency gains that Iris will bring, imagine the year is 1990 and you're explaining driving directions to a friend over the telephone. You relay the directions verbally, speaking them step-by-step as your friend on the other end of the line copies them down, asking you to repeat a word here and there. Now imagine it's five years later and you both have text messaging – the information that took ten minutes to convey via phone now takes you seconds to send with a text with perfect clarity.

Flight control becomes more precise

Iris is also designed to enable initial '4D' trajectories, pinpointing an aircraft in four dimensions: latitude, longitude, altitude and time, which is one of the major concepts defined in SESAR. This will enable precise tracking of flights and more efficient management of traffic through Trajectory-based Operations (TBO). TBO allows pilots and controllers to collaborate on flight trajectories and calculate the shortest available routes, cruise at optimum altitudes, and use continuous climb and descent paths, saving fuel and improving the environment.

Imagine you're driving down a busy road and you get caught in a traffic jam at a toll booth. Fast forward ten years into the future, and driving is now more automated. A controller at the toll booth can see the vehicle's current location and predict its trajectory over the next 15 minutes. The controller can then send a message to slow down or accelerate certain cars, thereby benefiting all cars by spacing them out and preventing the traffic jam.

Delivering unprecedented security

Analogue aircraft communications of the past were simple and easy to secure, but the transition to high-speed broadband IP services ushers in an era of greater connectivity and more devices with the potential to connect. Iris will be part of Inmarsat's highly secure cockpit communications network, which is segregated from passenger communications in the cabin. Iris protects aircraft communications from cyber threats with security gateways. These gateways provide a VPN barrier between the ground and each aircraft that assures mutual authentication and integrity of data exchange. They also securely connect the flight management systems on-board the aircraft to the corresponding systems used by air traffic controllers on the ground.

When we first brought computers into our homes in the late 80's, security was of little concern. With no internet capabilities, only those people within our homes could access our computers. Ten years later you have a new computer in your house with an always-on internet connection. At that point, security then became a primary concern, and you were likely to invest in antivirus software.

These three scenarios illustrate how Iris will change air traffic management. By bringing these enhanced capabilities both to pilots and controllers, Iris will enable the aircraft and the ground to communicate more effectively, increasing the efficiency of aviation procedures.

4. Top 3 benefits for airlines

Iris is key to unlocking SESAR's capacity, safety and efficiency benefits:

- **Fuel savings:** With initial 4D enabled by Iris, air traffic controllers and pilots proactively share and agree on the trajectories to be flown, while integrating airspace user preferences. This flight profile optimisation will reduce fuel burn and emissions and reduce the need for vectoring and holding patterns.

- **Increased airspace and airport capacity:** More precise air traffic management through Iris will open up the skies. An ever more crowded sky and inefficiencies in Europe's fragmented airspace bring extra costs of close to 5[3] billion Euros each year to airlines and their customers. They add 42[4] kilometres to the distance of an average flight, forcing aircraft to burn more fuel, generate more emissions, pay more in costly user charges and suffer greater delays.

- **Environmental benefits:** Reduced flight times, less aircraft noise and lower CO2 emissions. The last of these is particularly important, because we are fast approaching a time when airlines will not only have to pay for the fuel they buy, but also for the fuel they burn.

5. Top 3 benefits for passengers

- **Reduced delays:** with more flights departing and landing on time, your waiting time at the airport and on the runway will be minimised.

- **Reduced flight times:** satellite connectivity has allowed planes flying oceanic routes to file and fly individually tailored flight plans, resulting in significantly shorter flight times. Bringing advanced satcom-enabled cockpit capabilities to narrow-body planes through Iris over Europe will bring the same benefits to continental flights.

- **More environmentally friendly:** more direct and efficient flights will reduce the carbon footprint for European aviation and travellers.

6. Top 3 benefits for Air Navigation Service Providers

- **More efficient traffic flow management:** Trajectory Based Operations will project position information, thereby preventing congestion.

- **Air traffic control speed and accuracy:** Position reports and clearances will be exchanged with the speed and accuracy of text, rather than voice calls.

- **Safety:** Better quality communications enhances safety

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[3] http://europa.eu/rapid/press-release_IP-13-664_en.htm
[4] https://artes.esa.int/iris/overview

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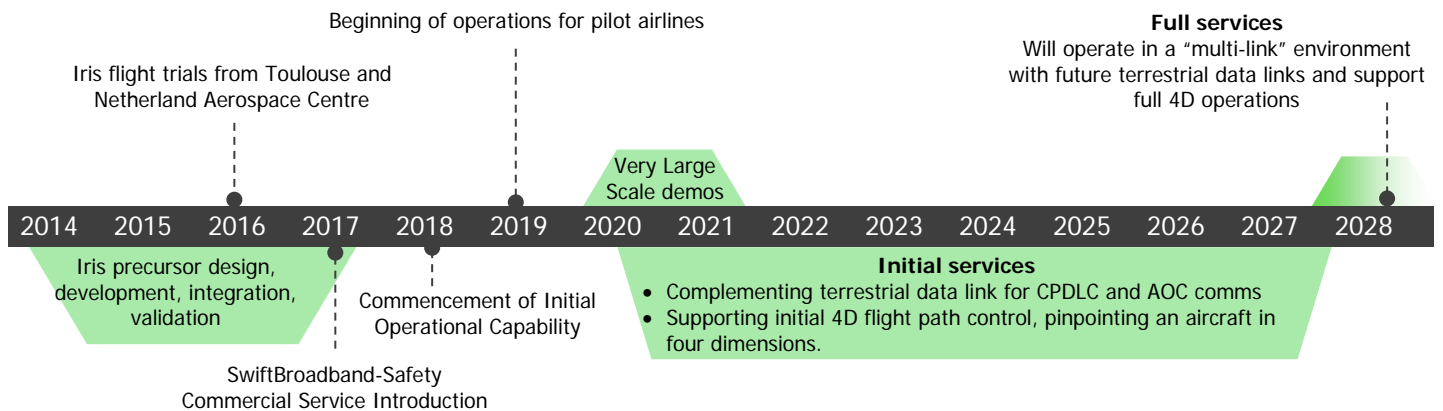
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7. The organisations involved

To date, more than 30 companies have worked to develop and design Iris. The consortium, led by Inmarsat, consisted of major European air navigation services providers, avionics manufacturers, ground industry players. Today, Inmarsat, Thales Alenia Space and CGI are driving the next phase of Iris, with more companies to come.

ThalesAlenia Space
A Thales / Finmeccanica Company

CGI

8. Timeline

Beginning of operations for pilot airlines

Iris flight trials from Toulouse and Netherland Aerospace Centre

Full services
Will operate in a "multi-link" environment with future terrestrial data links and support full 4D operations

Very Large Scale demos

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028

Iris precursor design, development, integration, validation

Commencement of Initial Operational Capability

SwiftBroadband-Safety Commercial Service Introduction

Initial services
- Complementing terrestrial data link for CPDLC and AOC comms
- Supporting initial 4D flight path control, pinpointing an aircraft in four dimensions.

9. Beyond Iris

When fully implemented, the Iris programme will meet the ultimate communication needs of future ATM services. It will offer global interoperability, ensuring that aircraft equipped with a standard terminal will be able to communicate anywhere via compatible satellite systems. The system will be transparent to the pilot and the controller; flight crews will send and receive information to and from flight management facilities seamlessly, securely and efficiently. And all using broadband capabilities never before available to pilots in the cockpit.

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