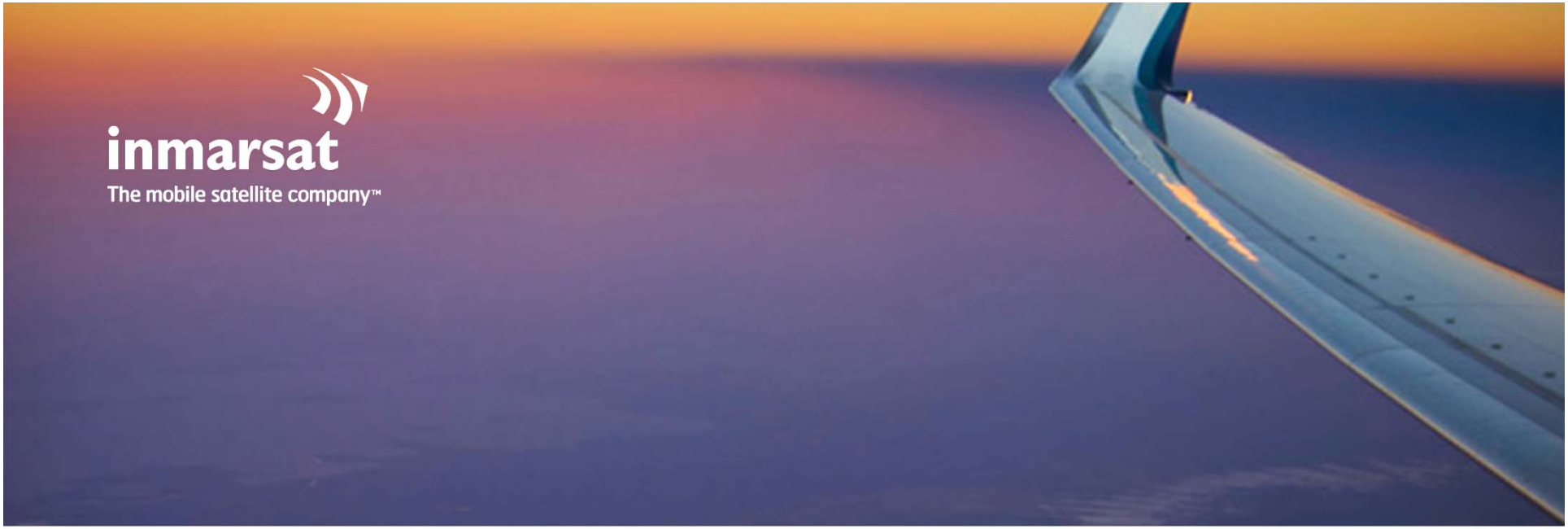

Initial 4D Trajectory Management via SwiftBroadband

Iris Event Salzberg

Feb 5, 2013

Background: Inmarsat Aviation Services

- With more than 11,000 aircraft relying on global in-flight connectivity from Inmarsat, we are the most widely used satellite operator in the industry
- Almost all new wide body aircraft delivered by Airbus and Boeing are line-equipped with Inmarsat satcom equipment
- The current system comprises 11 geostationary satellites as well as the ground network

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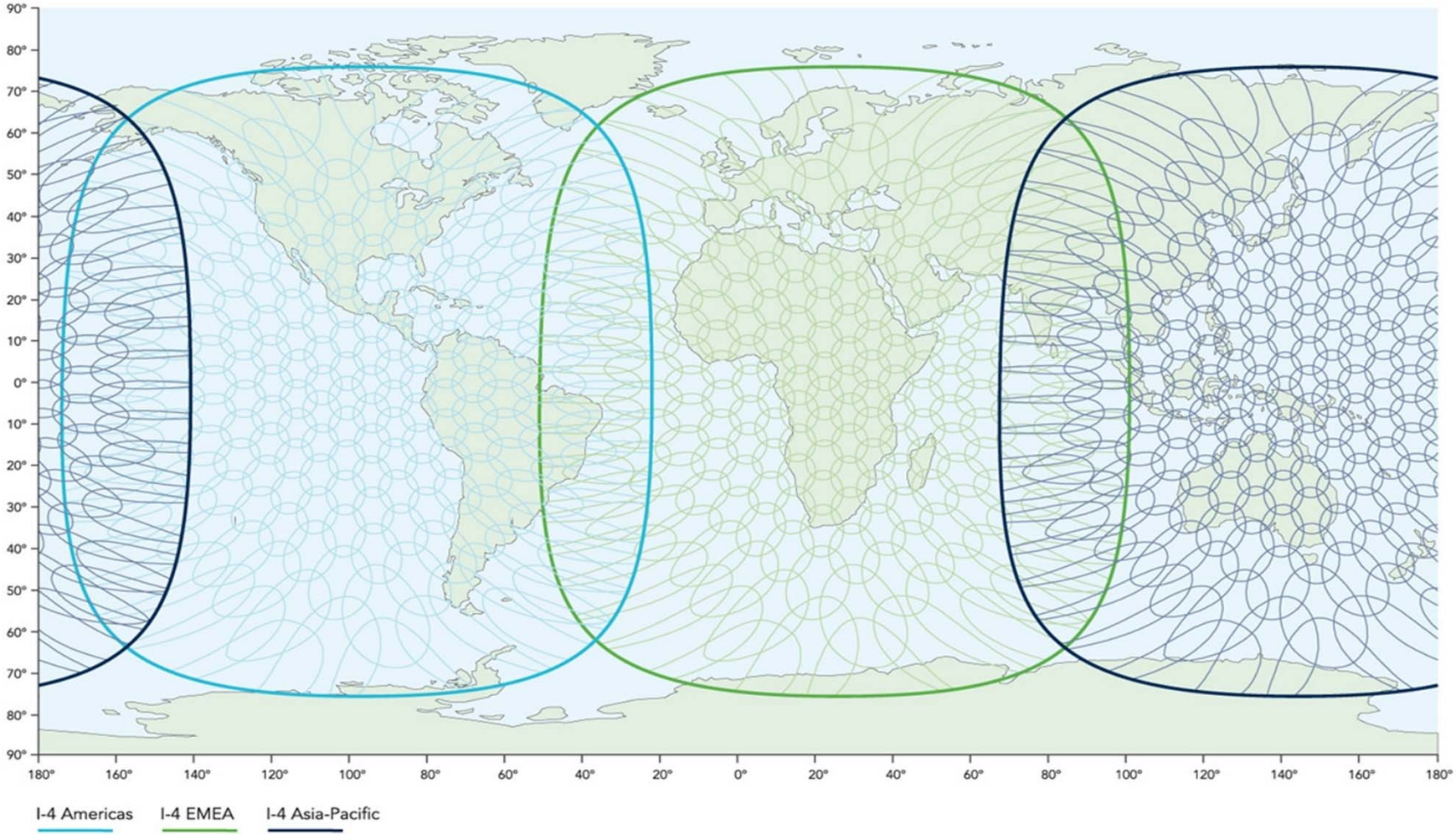
Inmarsat-4 coverage



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SwiftBroadband Oceanic Safety

Overview

- SwiftBroadband has been in service since October 2007, and now has widespread use for non-safety applications
  - SwiftBroadband operates on the same platform as Inmarsat's Broadband Global Area Network (BGAN), which also supports land and maritime services
  - Uses Inmarsat's I4 L-Band satellites and Ground Earth Stations
- The **SwiftBroadband Oceanic Safety programme** enhances Inmarsat's existing SwiftBroadband service to provide a safety service
  - Meeting ICAO GOLD RCP240
  - Meeting the requirements for support of 30/30 NM operations
  - Meeting the required high service availability and lower message latency
  - Achieving spectrum and cost efficiencies over Classic Aero
- Now entering flight trial stage with pioneer airlines

Trends

- Aircraft are operated intensely with ever increasing requirements for seamless, dependable connectivity:

- Data-link and voice cockpit services
  - Air Traffic Control communication
  - Electronic Flight Bag connectivity
- Automated engine health monitoring

- Passenger connectivity and cabin applications
  - WiFi and GSM/GPRS services
  - Content delivery
  - Telemedicine, retail and CRM

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SwiftBroadband Avionics Evolution

Typical ARINC 781 Shipset

Compact SwiftBroadband Shipset

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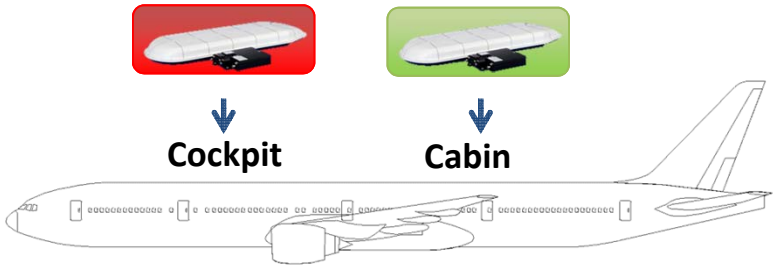
Differentiation needed between data streams

Hard vs. Soft Partitioning

HARD

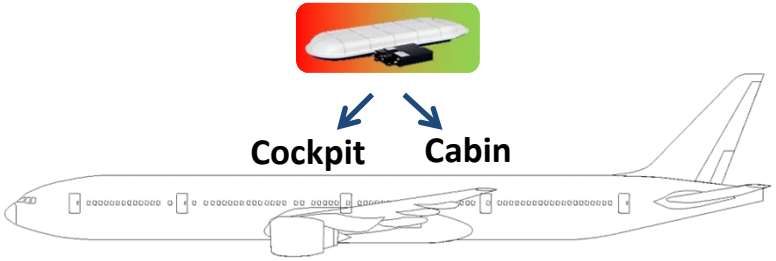
Several services with dedicated hardware (air gap)



+ *Physically independent systems*
+ *Common cause failure mitigation*
- *Expensive*
- *Weight penalty*
- *Interference*

SOFT

Several services sharing common hardware



+ *Cost effective*
+ *Light*
- *Complexity*

How to manage segregation between services?

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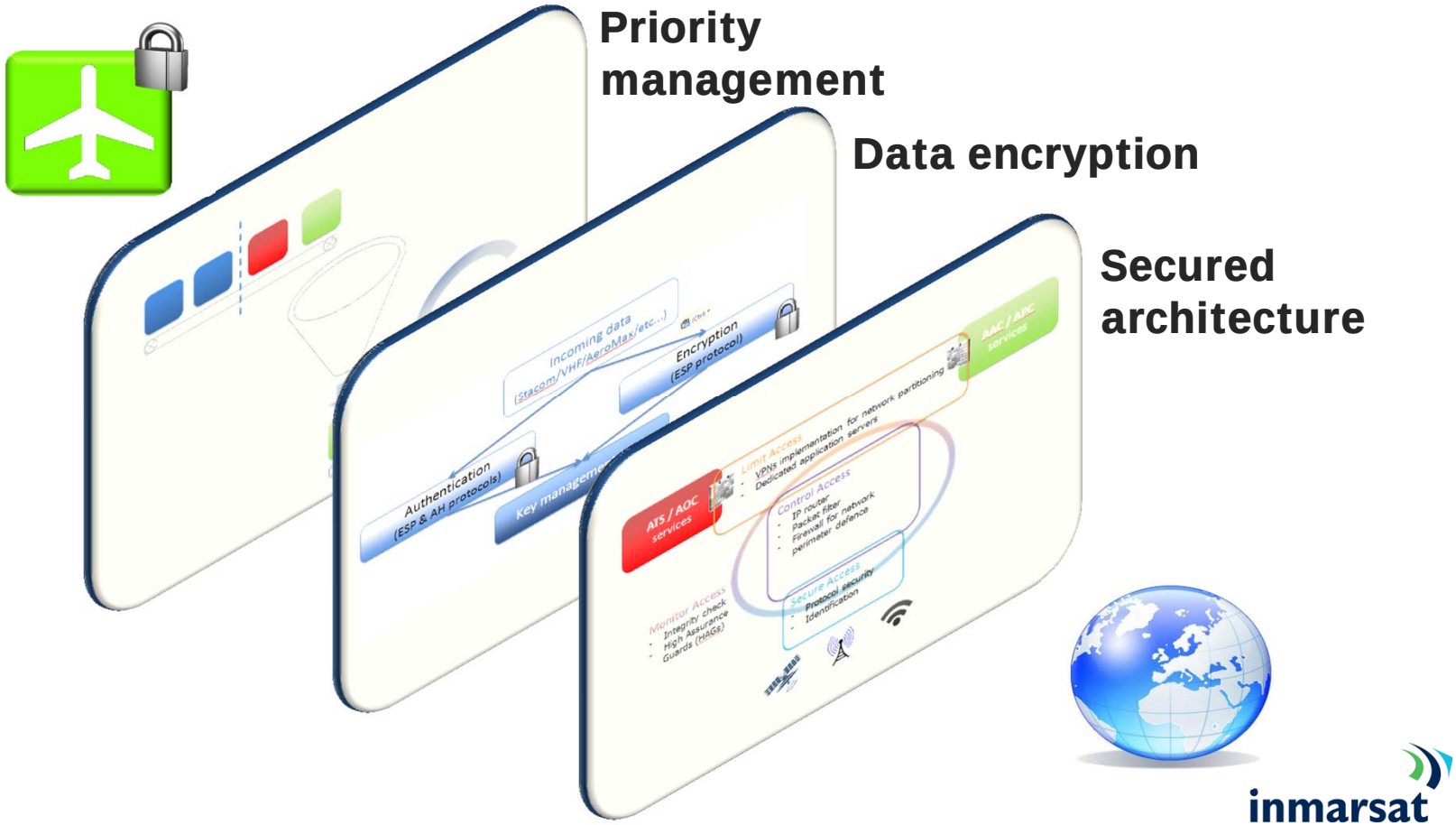
Within the avionics three types of solution are required:

- A secure architecture to prevent attacks from unauthorized users
- Data encryption to ensure only authorized users have access
- Priority, Precedence and Pre-emption mechanisms



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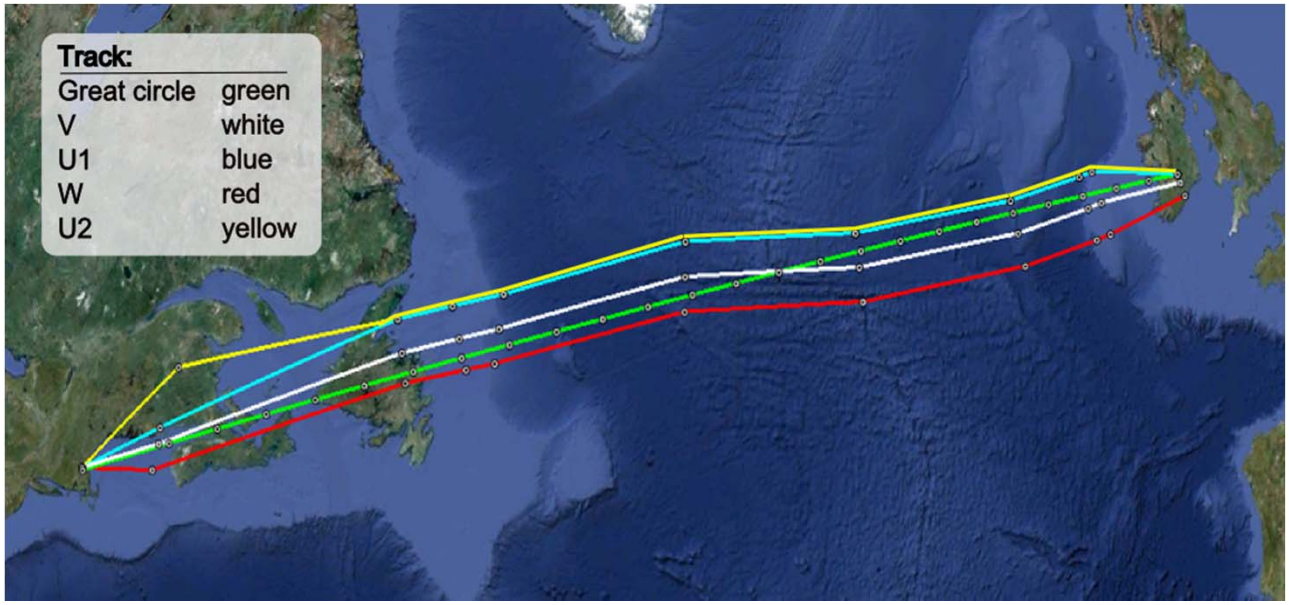
Air Traffic Management

- Since introduction in the 1990s, FANS has enabled a revolution in oceanic ATM, facilitating:
  - reduction in separations allowing more aircraft on ideal great circle tracks
  - the use of dynamic re-routing as a result of weather changes
- The efficiency benefits justify the install and operating costs



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Initial 4D Trajectory Management

- The next phase of development will to be support applications required for initial 4D trajectory management
- Recent ESA commitment of €11.5m under “Iris” program
- To upgrade the existing SwiftBroadband network to match performance requirements set for VHF Datalink and standardised in EUROCAE WG-78 and RTCA SC-214
  - Increasing system availability
  - Reliable transfer of ATC and AOC traffic
  - Integrated with Air Traffic Management networks and ANSP systems
- Leading to even more efficient airspace operations:
  - Environmental benefits and fuel savings through preferred routings
  - Improved traffic predictability (particularly at oceanic boundaries) leading to reduced controller workload

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System Upgrades

- In our current phase of THAUMAS we have performed an availability and failure modes and effects analysis
  - Highlights areas for improved fault detection and failover
  - Design for fast system recovery and efficient redundancy management
- Development of ground and aircraft gateway functions
  - Supporting dual stack (ACARS and ATN/OSI) protocols
  - Interconnect to European Air Traffic Management Network
  - Multilink management (VHF and satcom)
- RAN implementation of new bearer types for low-gain terminals and behavioural changes short latency
  - Design work has been funded through current Iris THAUMAS project
  - Implementation would build on RAN4.0 for a future release
- To operate on Alphasat (planned launch 2013)

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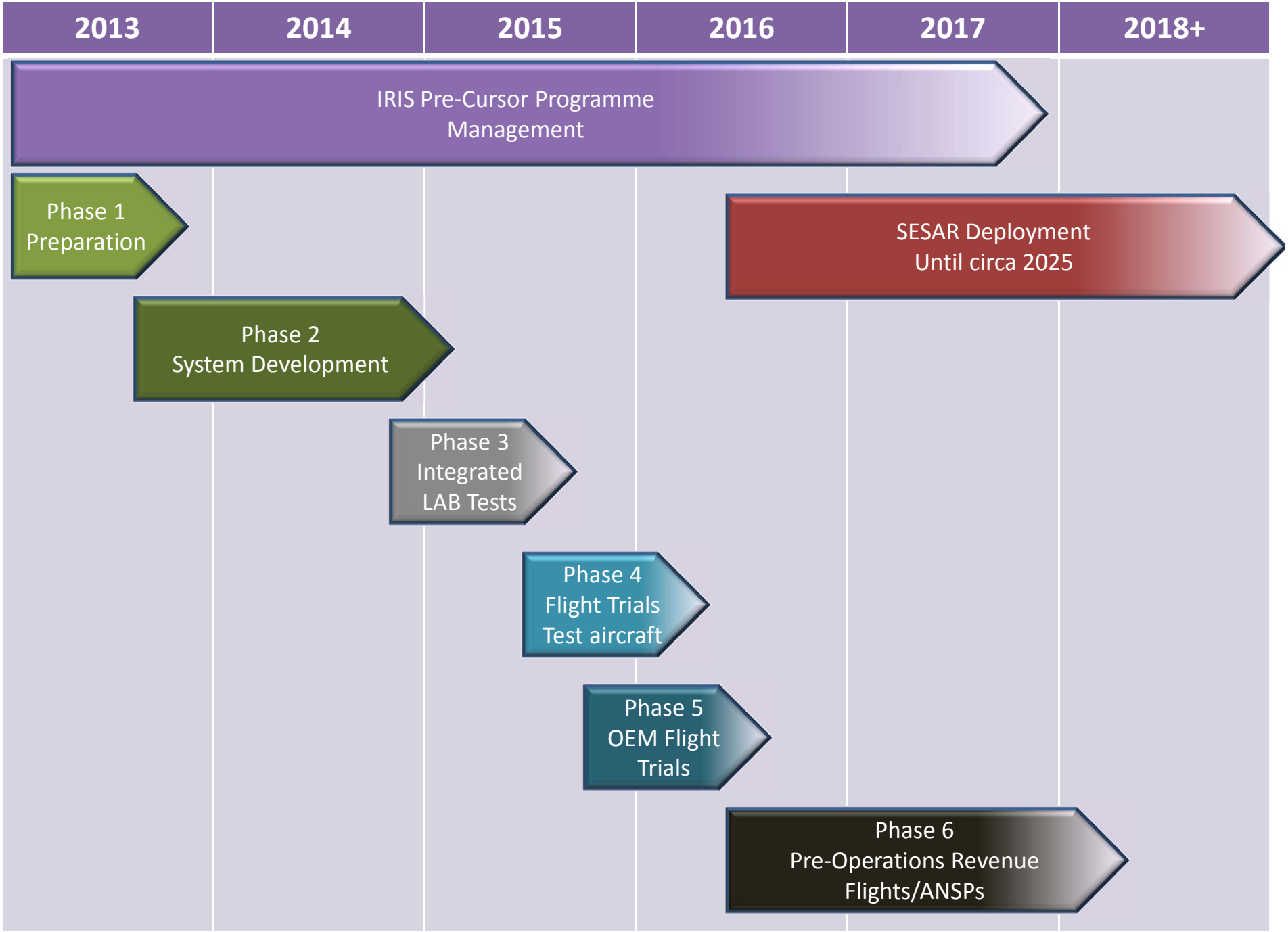
2013
2014
2015
2016
2017
2018+
IRIS Pre-Cursor Programme Management
Phase 1 Preparation
SESAR Deployment Until circa 2025
Phase 2 System Development
Phase 3 Integrated LAB Tests
Phase 4 Flight Trials Test aircraft
Phase 5 OEM Flight Trials
Phase 6 Pre-Operations Revenue Flights/ANSPs

Service Provision

- The IRIS pre-cursor represents a hardening of the SBB product to support medium term continental safety aeronautical applications in a manner that:
  - Continues to support AOC, AAC and APC as well as advanced ATC applications
  - Is scalable in terms of performance to support long term applications
- A Service Provider would be certified by EASA against the SES Common Requirements. The system would be certified against the provisions (ERs) of the Interoperability Regulation and any applicable Implementing Rules.
- The key commercial consideration is how the system is funded. This could be through user charges, or contracts with ANSPs and airlines or a mixture of all three.

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Thank you

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