

Inmarsat ATM Safety Update

NAT TIG



26 April 2023

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Inmarsat

Agenda

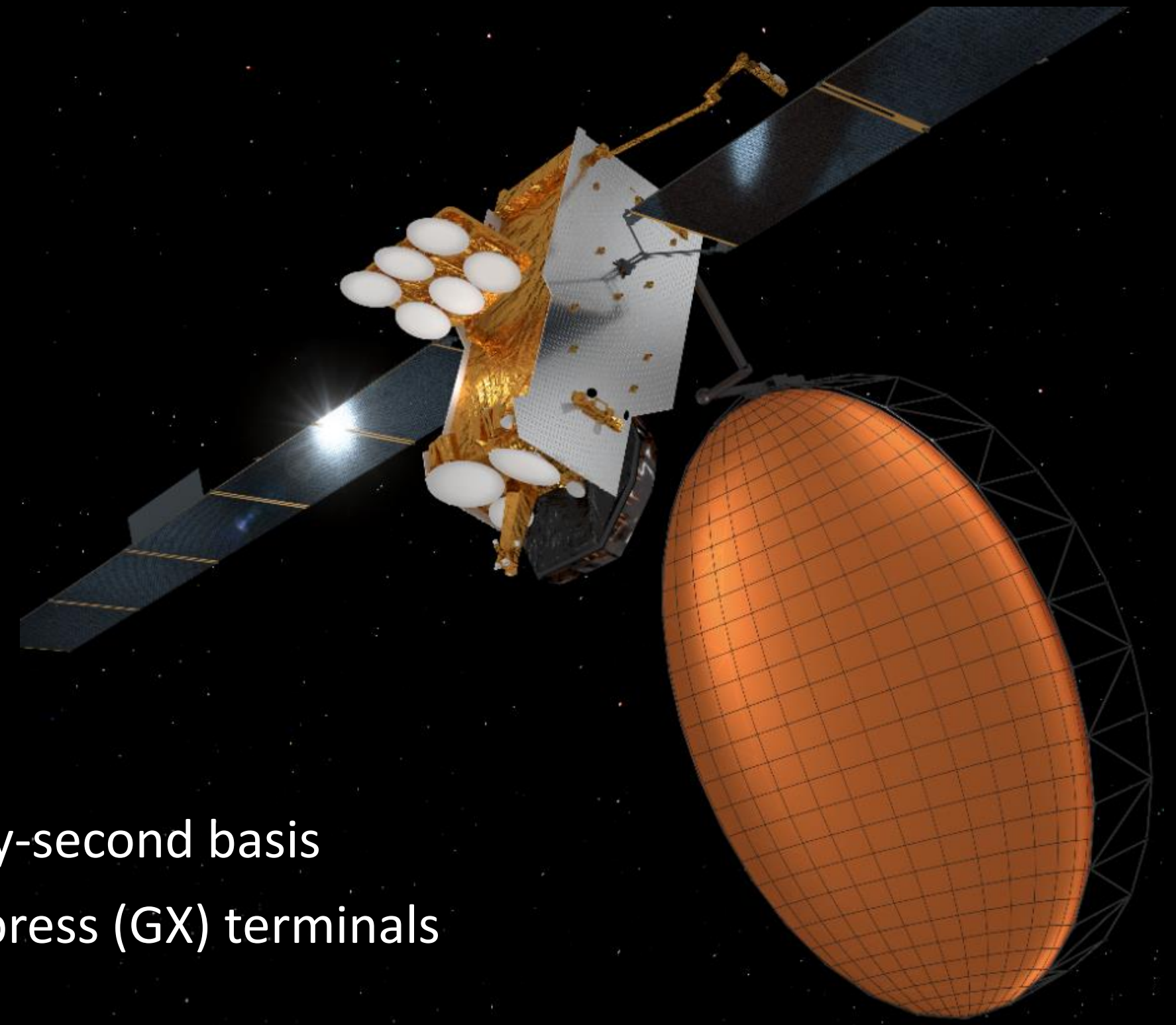
- I-6 deployment
- System and Network Updates
- Satvoice
- China Programme
- Iris

I-6 Deployment



16 Satellites – Capability

- Ka and L band Payload
- C band and Ka band feeder links
- Electric propulsion (no apogee motor)
- Supports standard and extended L-band
 - 1518-1559 MHz
 - 1626.5-1660.5 MHz and 1668-1675 MHz
- Dynamic beam forming to match demand on a second-by-second basis
- Backwards-compatible with existing ELEREA and Global Xpress (GX) terminals



Inmarsat I-6 F1 and I-6 F2

I-6 F1

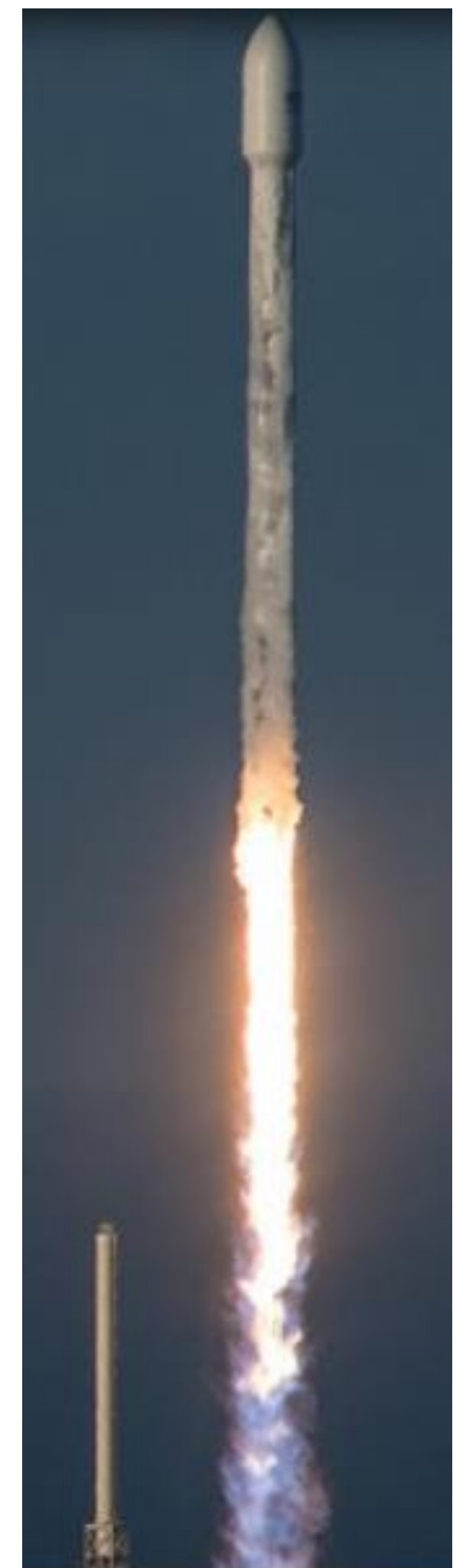
- Japan's Mitsubishi Heavy Industries launched I-6 F1 in December 2021
- Its fully electric propulsion system has now raised it to geostationary orbital slot, 36,000km (22,000 miles) over the Indian Ocean
- I-6 F1 L-band services will be initiated in Q3 2023 following final testing

I-6 F2

- A SpaceX Falcon 9 rocket launched I-6 F2, from Cape Canaveral, Florida on 18th February 2023
- I-6 F2 is scheduled to enter into operation over the Atlantic in Q2 2024



Successful I6F1 launch on 21st December 2021
- 14:33:52 pm GMT



SpaceX Falcon 9 rocket

System and Network Updates

System upgrades:

- Expanding Classic Aero and SB-S data logging and performance assessment support tools available to DPs
 - Functional upgrade being made to the Classic Aero GES gateways (software release v9.2.3) and SB-S AGGWs (v2.4.9)
 - Improvements have now been implemented in the Classic Aero GES gateways to limit Classic Aero uplink transmission delays
- Continued enhancement of Classic Aero and SB-S 1.0 cyber protection tools

Satellite Network:

- Inmarsat is currently confirming the introduction plan for I-6 use by Classic Aero and BGAN based services. Detailed simulation work is on-going with suppliers and UT manufacturers.

Satvoice

Satvoice 1-Stage VoIP Connectivity

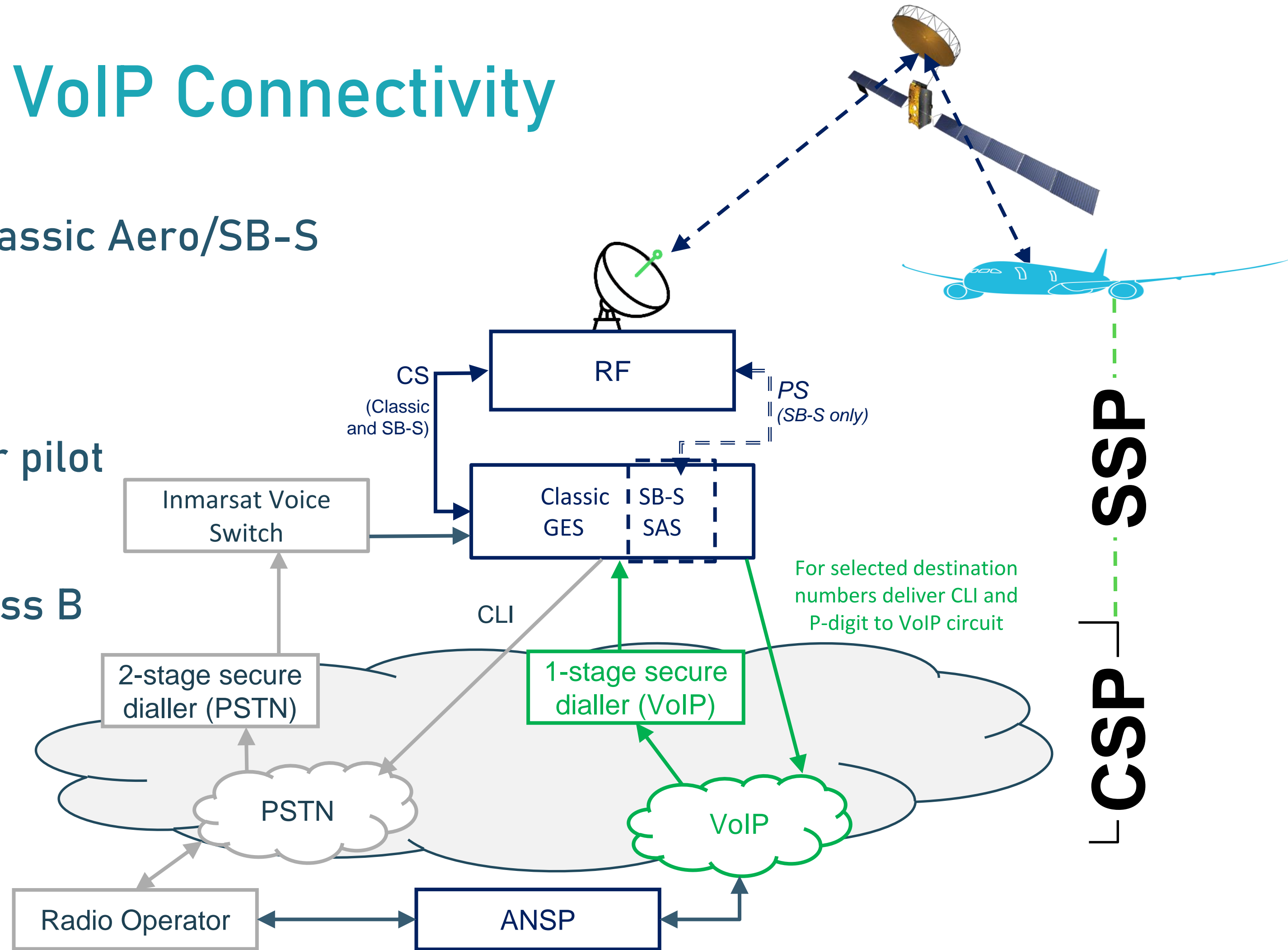
- Fast satellite VoIP with Classic Aero/SB-S networks & equipage

≈ 8-15 sec GTA call setup

- Enables direct controller pilot communications

- ICAO Annex 10 PfA for Class B SARPS

- OPDLWG RCP tasking



Satvoice 1-Stage VoIP Connectivity

SITA:

- SITA have already implemented VoIP SIP infrastructure to support 1-stage ground-to-air dialling, and to support air-to-ground calling on private networks avoiding the PSTN, for reliable carriage of priority and CLI

Satellite Network:

- Collins are in the process of implementing their VoIP SIP infrastructure
- Initial results (reported by Collins at PARC) indicated a significant reduction in Ground-to-Air call set-up time
- Inmarsat is supporting the Collins implementation through setting up test short codes with VoIP routing, and coordinating on test calls
 - Collins is currently working with FedEx to perform Inmarsat satcom call-back checks

China Programme Update

Inmarsat Satcom Services for China



SB-S 1.0 Infrastructure

- Inmarsat's Chinese distribution partner, CTTIC, and ACARS processing partner, ADCC, introduced SB-S 1.0 commercial services in 2021
- Two aircraft have been supported using the CTTIC AGGW gateway since 2021
- Full commercial service for the remaining Chinese-registered SB-S 1.0 aircraft achieved in April 2023, three aircraft now in operation

SB-S 2.0 Infrastructure

- SB-S 2.0 capability is in-place today – future options being investigated for support via local infrastructure

Inmarsat Satcom Services for China



Classic Aero FANS/ACARS datalink & voice enhancements

- Inmarsat has implemented infrastructure to support CTTIC as a Classic Aero DP, with ADCC ACARS message processing
- Comprehensive ground testing began in 2019
 - Ground platforms and networks; voice and data communications; FANS and AOC ACARS
- Successful Flight evaluations completed:
 - Air China A350, B-307C Beijing to Shenzhen and return (Nov 2021)
 - Grounded aircraft FANS tests with Airways New Zealand test rig & in-country flight test (Nov 2021)
 - PEK-LAX and return with Air China A350, B-307C (July 2022)
 - Sichuan A330 & Central Airlines B777 operating scheduled routes continues
- Commercial service with CTTIC as Classic Aero DP, and ADCC ACARS processing began on 25th January 2023
- FANS evaluation continues in the EMEA/IOR and APAC/POR regions (Central Airlines B-2079, 36003060 and Sichuan Air B-308F, 36013230) more aircraft to follow

China Classic Aero Update

Since ADCS are now processing satcom ocean region data – a new set of ACARS identifiers are used in the messaging:

ID	Service	Ocean Region
B1A	SB-S	AMER
B1P	SB-S	APAC
B1E	SB-S	EMEA
B1M	SB-S	MEAS
B3I	I3 Virtual	IOR
B3P	I3 Virtual	POR
B3W	I3 Virtual	AORW
B3E	I3	AORE
B4A	I4	AMER
B4P	I4	APAC
B4E	I4	EMEA

Iris: Satellite Data Link for trajectory based operations (ATN service)

What is Iris?



Satellite-based datalink for ATM in continental areas

- IP based/cyber secured
- 10x more bandwidth
- ATN OSI Service available across Europe and other global geography as soon as it is operational (Q2-3 2023)

Mature technology — SB-S service operational

Mitigating current limitations of VDL2 in Europe and enabling more data hungry ATS services

- Enabler for Trajectory Based Operations (i4D/Full 4D)

Capacity to support European ATC datalink operations for next 20 years meeting European standards (ATN/OSI)

Capacity for global operations / compliant with global standards supporting both ATN/ OSI and ATN/IPS

- Currently working with service providers/regulators to ensure interoperability

All datalink and voice services in one airborne terminal (FANS/ATN/AOC/IP)

- IP provides increased information sharing capabilities (wx, maintenance...)
- Voice w/ 1-stage dialing and DCPC capability (ATS Oceanic and non-safety voice communications)

Iris Global

Iris Global (Phase 3), new ESA project, launched in June 2022

- One Work Area is international development & demonstrations for Iris-based services
- Opportunity for key Aviation/ATM stakeholders to benefit from funding for Iris demonstrations
- Opportunity to be a pioneer/early adopter of IRIS in the region
- Future-proof for global ATC and AOC services, as part of fleet renewal

Trajectory-based operations

- Several ANSPs in APAC already demonstrated the use of TBO (via EFB)
- Opportunity to test-bed / develop a prototype of the ATS B2 service over satcom
- Trajectory-based demonstrations between regions (mixed environment)
- Demonstrate the use of the IP connectivity for advanced SWIM-based AOC services

Over 30 years of aviation safety innovation

Classic Aero

1990s - TODAY

SAFETY SERVICES

Safety ACARS

FANS

- CPDLC – RCP240
- ADS-C – RSP180

Cockpit Voice - 2 channels prioritized circuit switched

SwiftBroadband-Safety (SB-S)

2018 - TODAY

SAFETY SERVICES 1.0

Safety ACARS

FANS

- CPDLC – RCP240
- ADS-C – RSP180

Cockpit Voice - Prioritized circuit switched & packet switched channels

ISOLATED IP CHANNEL

AOC ACARS

- Telemetry
- EFB Connectivity

SECURITY LAYER

3GPP Link security

- ACD Domain
- AISD Domain

2022 - Today

SAFETY SERVICES 2.0

SB-S 1.0 plus:

ISOLATED IP CHANNEL

AOC ACARS

- Telemetry
- EFB Connectivity

SECURITY LAYER

ACD: Mutual Link PKI mutual authentication and VPN for data integrity

AISD: 3GPP Security

2023 - Beyond

IRIS

SB-S 2.0 plus:

ATN/OSI for ATN B1/B2 services in multilink with VDL

- CPDLC – RCP130
- ADS-C – RSP160
- 4DTRAD: Exchange of 4D flight trajectories (ADS-C EPP) and 4D route clearances

Inmarsat I-6 enters service

2027 - Beyond

IRIS

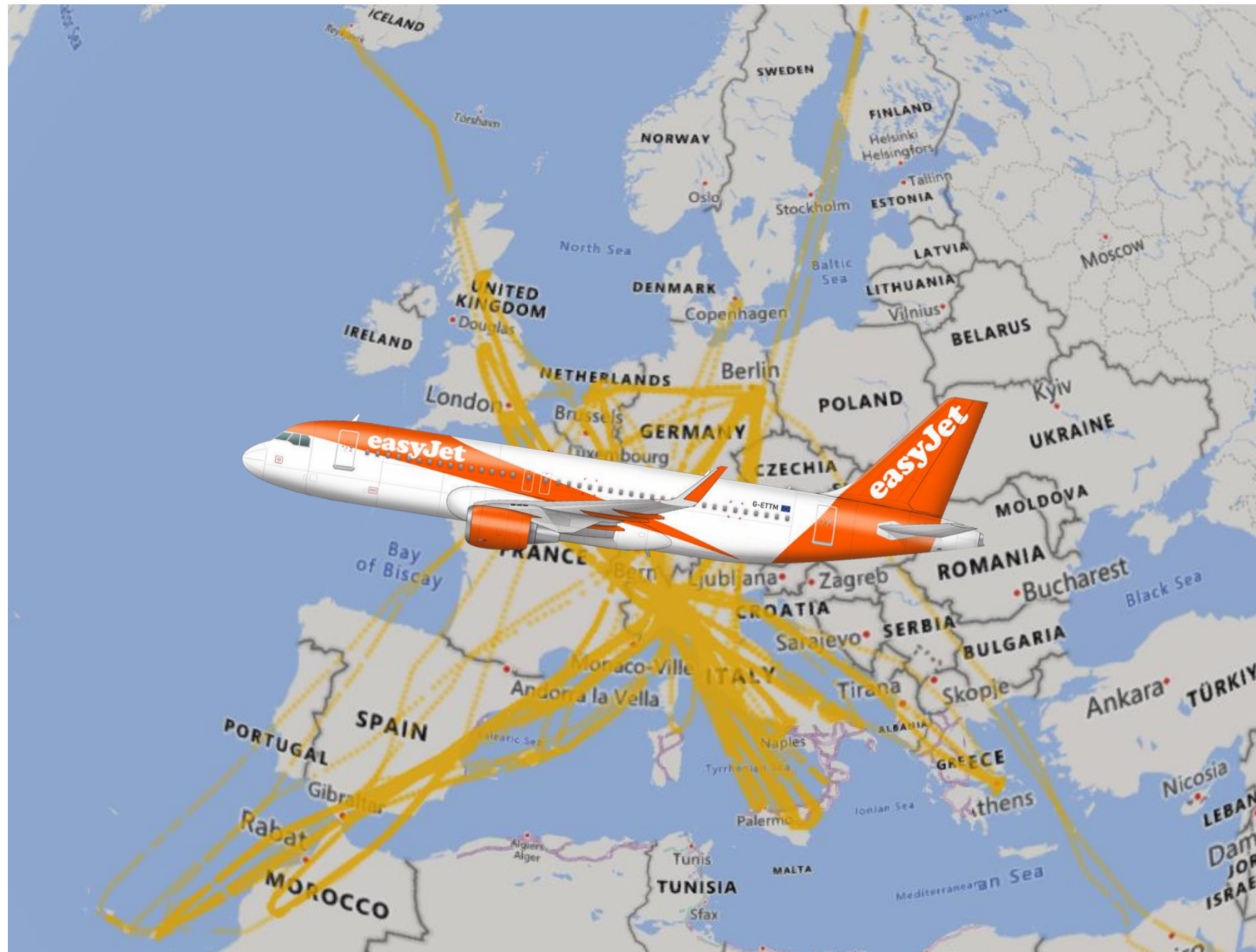
SB-S 2.0, ATN/OSI plus:

ATN/IPS for ATN B1/B2 services in multilink with VDL

EXTENDED LIFE

Service life beyond 2040

Pre-commercial flights with easyJet



Route network from the first 2 EZY aircraft; 24 dec22- 29Jan23

6 aircraft equipped in 2023, 2 already flying

EASA Service certification started, target May 2023

ATM flights starting June 2023, supported by 14 ANSPs

Demonstrating performance and benefits

- ATM functions (CPDLC/ADS-C for EPP)
- Real-time IP connection for EFB, Flight Planning, FDM, etc

Expected benefits:

- Increased ATM capacity, more efficient flight routing
- Reduced delays from lack of ATC capacity
- Potential safety & sustainability improvements (flight plan changes, better routing)
- Improved digital safety by data transfer through secure channels

Airspace users' perspective

7

European airlines selected Satcom for new deliveries, including:



72

72 deliveries for 2023-2024

~220

orders booked for 2023-2028

Avionics Availability: 2022(Airbus/Cobham) / 2024 (Boeing/Honeywell/Cobham)

Thank you

