Inmarsat ATM Safety Update

FIT ASIA Meeting

25-28 July 2022

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BUILT TO FLY

inmarsat AVIATION

Agenda

- Introduction
- Benefits of Inmarsat satellite communications
- Inmarsat Iris: Performance Class B Satcom
- Inmarsat commercial UAV services
- China update

OUR BUSINESS

15 Satellite in commercial service

6 Launches planned for GX and ELERA

31 Satellite access stations with significant investments planned

Serving customers and end users in:

AVIATION	17,000 aircraft connected
ENTERPRISE	800,000 assets connected
MARITIME	160,000 vessels connected
GLOBAL GOVERNMENT	190 departments across over 90 nations
US GOVERNMENT	153,000 terminals installed

1800+ People in 22 countries, across 33 sites

99.9% Network Reliability

158 Customers* across 158 countries

*Direct business

24/7 Customer support available

1,368 Trusted partners worldwide

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

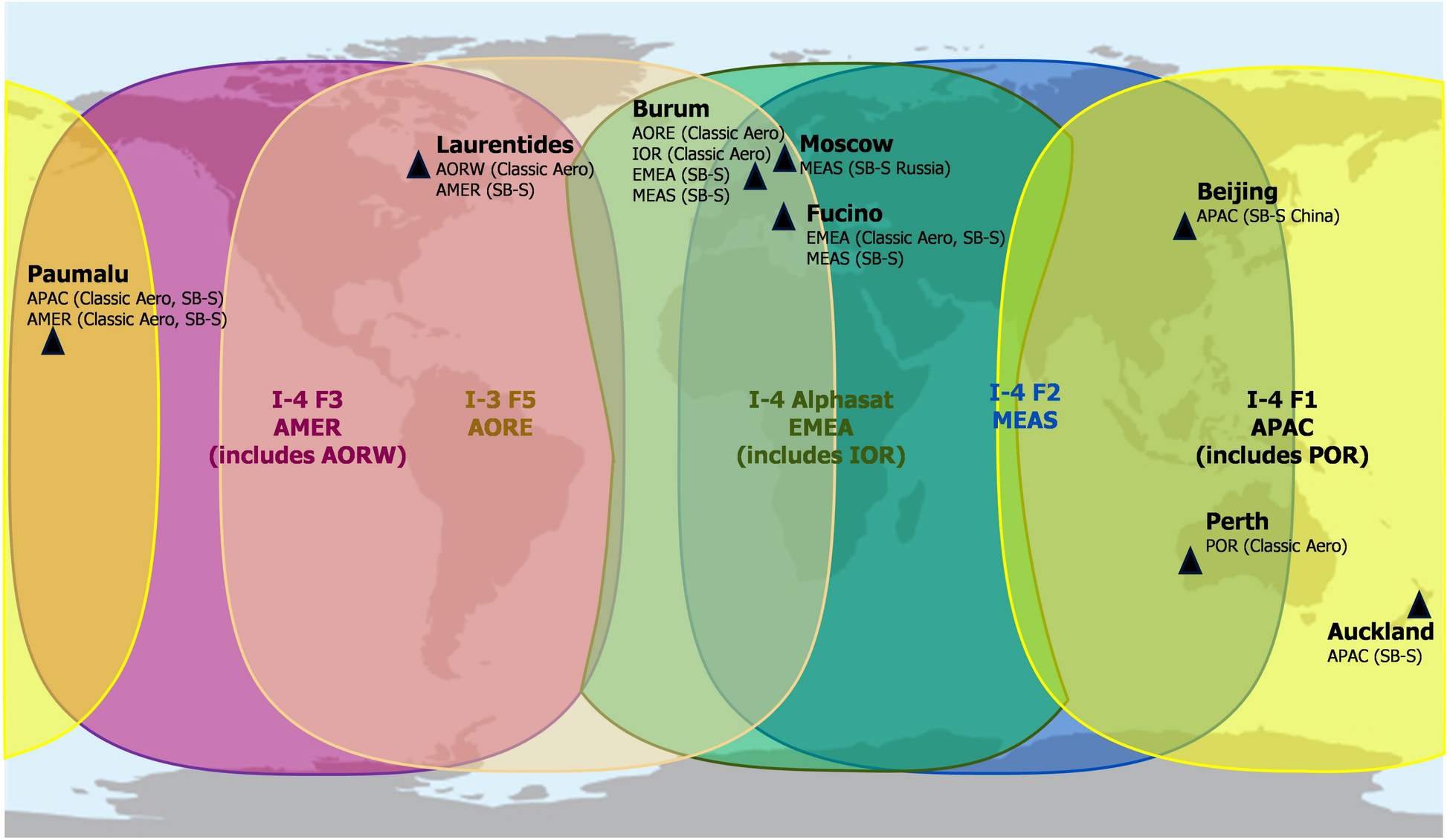
SB-S 2.0, ATN/OSI plus:

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

EXTENDED LIFE

Service life beyond 2040

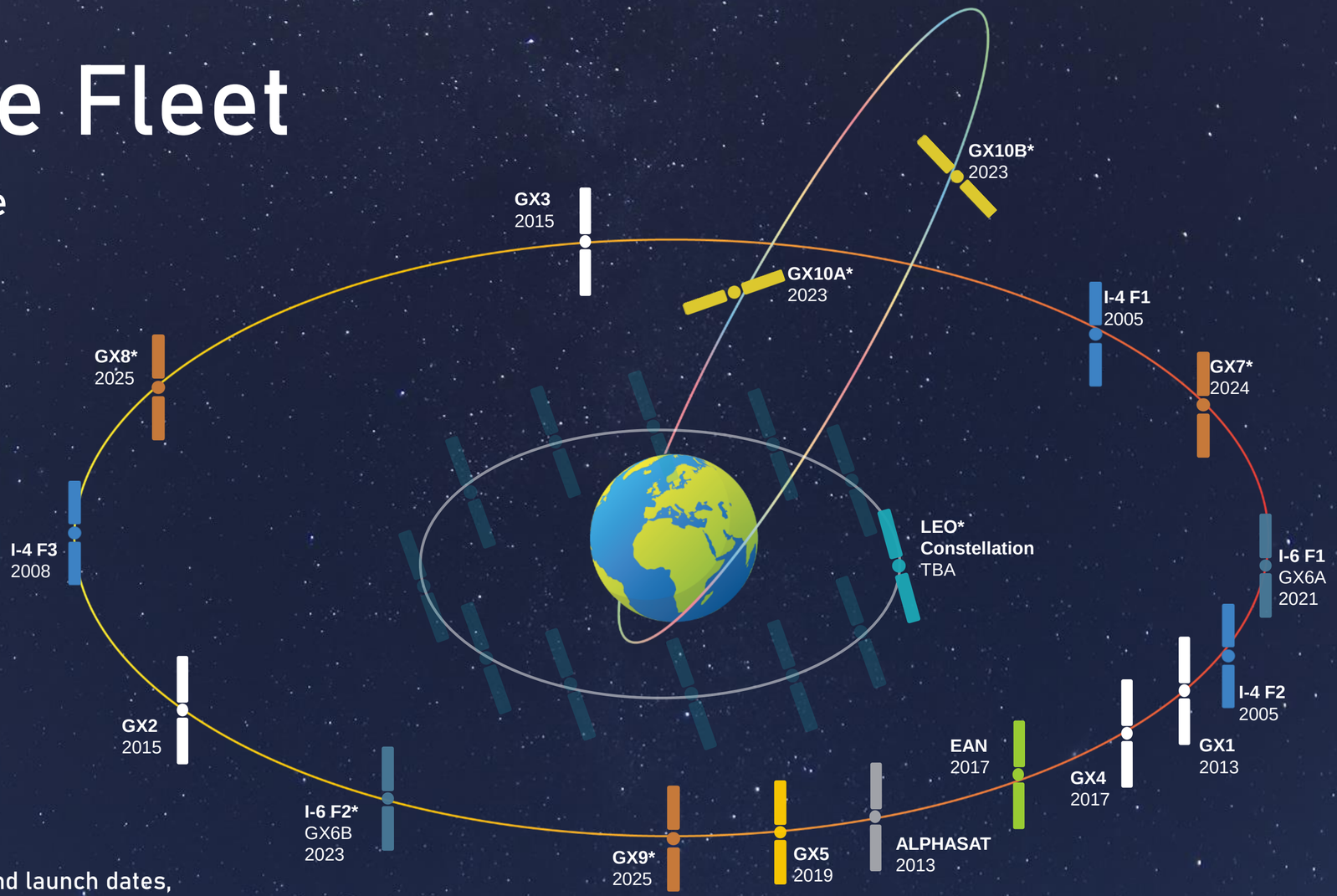
Inmarsat Operational Coverage Map (Classic Aero and SB-Safety)



Satellite Fleet

Current and future

Updated: 24-02-22

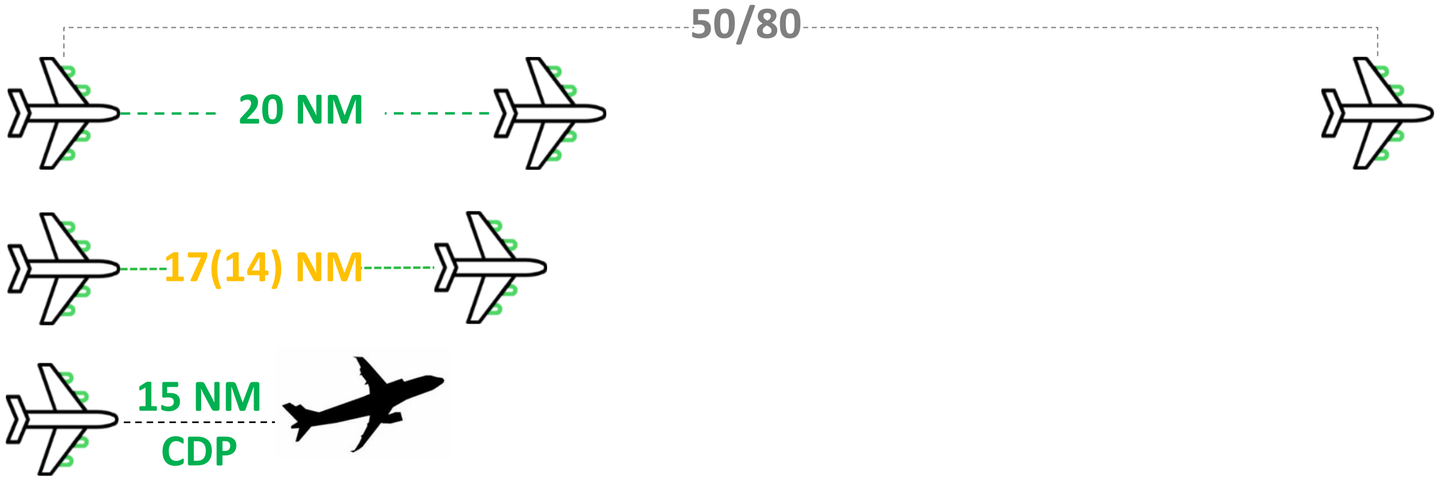


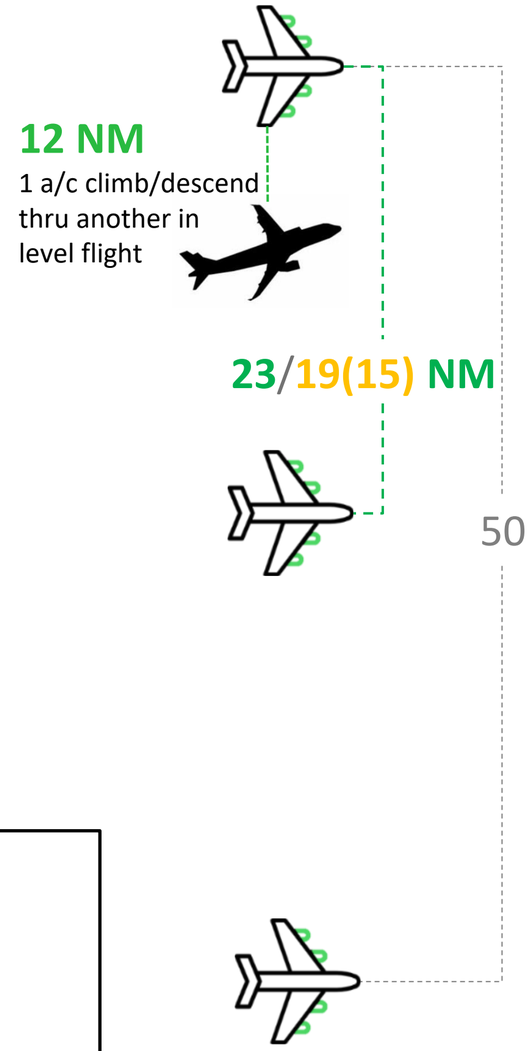
Note: current indicative positions and launch dates, does not include narrowband backup satellites
*Future locations and dates subject to change

Benefits of SATCOM

- A key technology contributing to globally harmonized, safe, resilient, secure, efficient, and sustainable services:
  - Oceanic and Remote: FANS CPDLC/ADS-C, Voice, AOC, IP
    - Performance-based reduced separation
    - User Preferred Routes
    - Dynamic Airborne Reroute Procedures
    - ATFM and EFB applications
  - Dense Continental Airspace: (FANS)/ATN CPDLC/ADS-C, Voice, AOC, IP
    - 4D Trajectory Data Link (4DTRAD) w/ ADS-C EPP and extended CPDLC message set for Trajectory Based Operations
  - UAS and UTM
- Satellite-based technologies can complement terrestrial systems
  - Accelerate the digitalization of ATM
  - Support a coherent rationalization of the overall CNS infrastructure
    - SATCOM does not require complex ground infrastructure

Current ATM Benefits of SATCOM





- Performance-based reduced separation
- ADS-C Climb/Descend
- User Preferred Routes
- Dynamic Airborne Reroute Procedure

Communication	Surveillance	Equipage
CPDLC (RCP240)	ADS-C (RSP180)	FANS + RNP4 + HF backup
CPDLC (RCP240)	ATS Surveillance System	FANS + RNP4 + HF backup
HF		RNP10/4/2 or RNAV + HF

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SATVOICE 1-Stage VoIP Connectivity

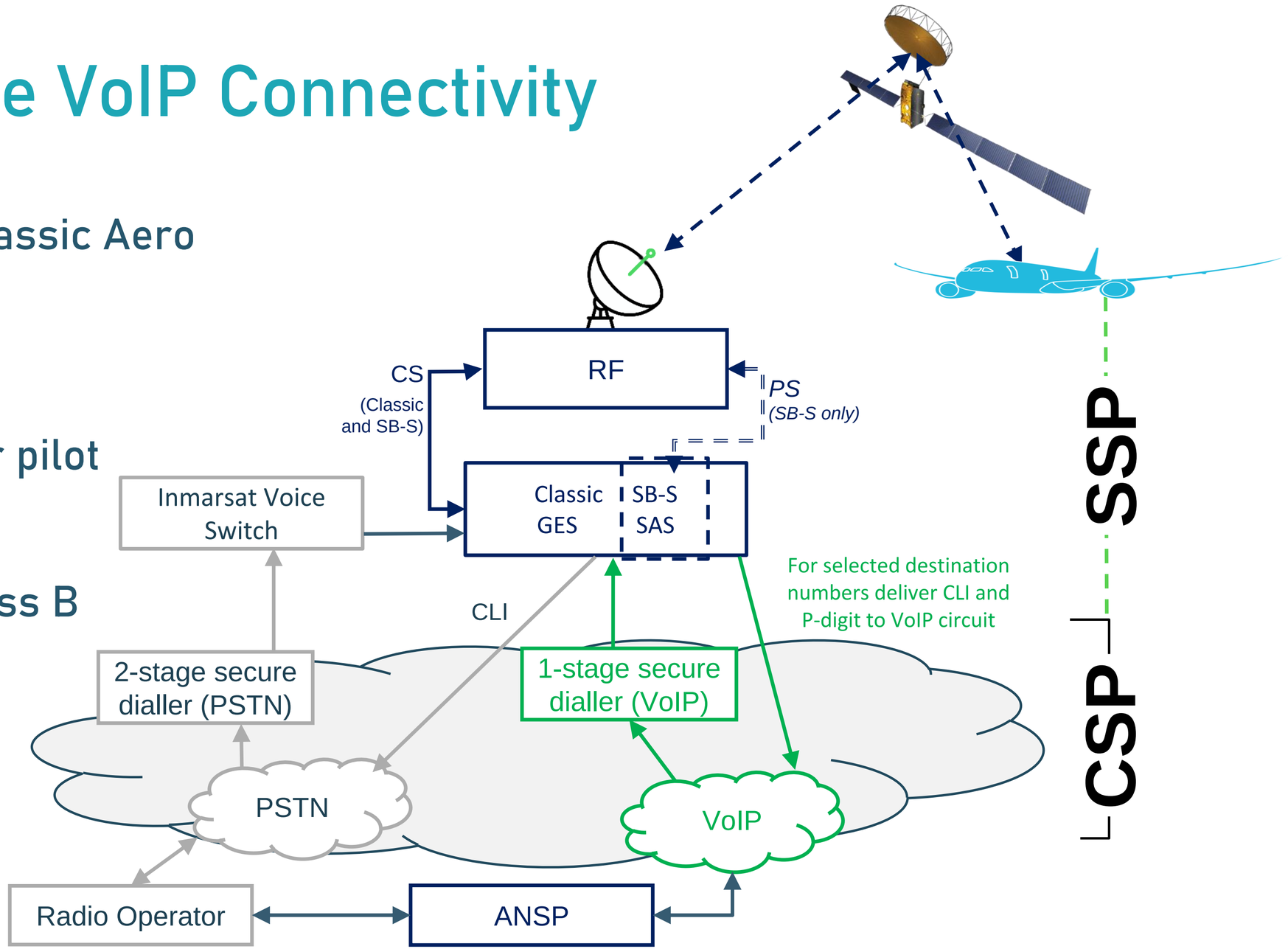
- Fast satellite VoIP with Classic Aero network & equipage

  ≈ 8-15 sec GTA call setup

- Enables direct controller pilot communications

- ICAO Annex 10 PfA for Class B SARPS

- OPDLWG RCP tasking



BUILT TO FLY

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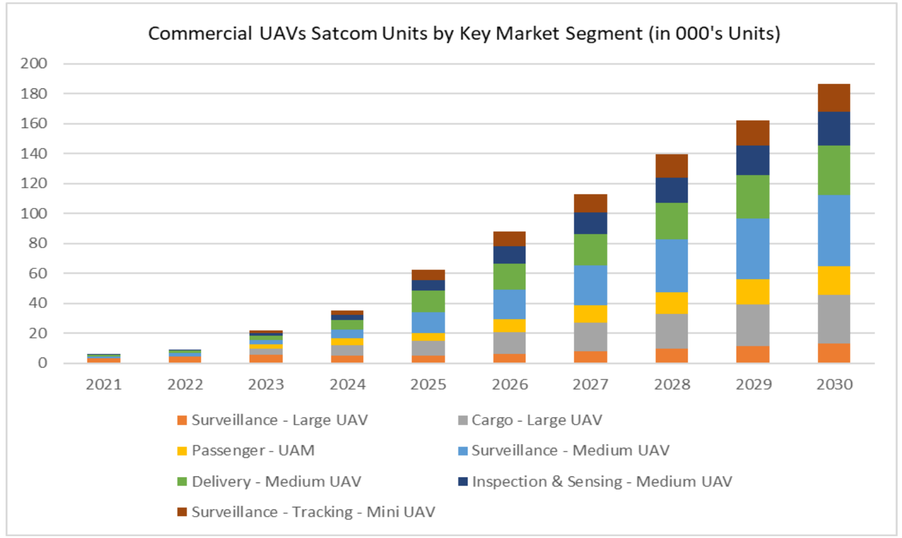
Iris: Satellite datalink for dense continental airspace

- **Performance Class B SATCOM for data (ATN OSI and ATN IPS) and voice services**
  - ATN OSI Service available for entirety of Europe and other global geography as soon as it is operational (Q2 2023)
    - EasyJet to equip up to 11 Airbus A320neos, set to begin flying from November 2022 for Iris capability evaluation
  - ATN IPS Service available globally as soon as it is operational (Q2 2027)
  - Seamless global integration: No need for ground infrastructure (using the existing ATN backbone to include ARINC/Collins, SITAONAIR)
- **Mature technology — SB-S service operational**
- **Designed to meet ATS B2 requirements**
  - 4D Trajectory Data Link (4DTRAD)
    - Expanded CPDLC message set;
    - i4D Trajectory Based Operations (TBO) and Full 4D TBO (ADS-C EPP)
  - RCP130/RSP160 as well as RCP240/RSP180
  - Cyber security requirements
  - Voice w/ 1-stage dialing and DCPC capability (ATS Oceanic and non-safety voice communications)
- **IP provides increased information sharing capabilities (wx, maintenance, etc)**

Inmarsat Commercial UAV Solutions

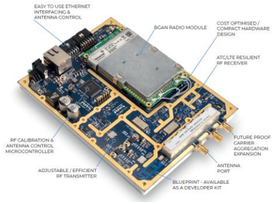
Current estimates show BVLOS growth from a few thousand units in 2021 to more than one million in 2030. As UAV operations expand into more complex airspace – toward integration into controlled airspace with manned aircraft – so does the **need for robust, secure communications and multiple communication links on the vehicles**

Forecast



Cobham UAV200

Honeywell
Small Form Factor
Terminal



TTP – BRM-Works
Solution

Sector

Cargo

Urban transport

Delivery

Surveil/Inspect.

Current Program

- Utilising Inmarsat L band assets for CNS/C2 in a small form factor solution (satcom terminals: UT1 & UT3)
- UT1 Terminal providers: Cobham and Honeywell – Available now!
- Developing reduced CSWaP UT3 – Multi-channel Data Link – Available 2022
- Supporting Global Regulations for BVLOS Commercial UAV Operations with Commercial UAV Safety Solutions
- Working strategically with partners to develop the emerging Commercial UAV Eco System
- than N

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CTTIC/ADCC Classic Aero Statement

To whom this may concern,

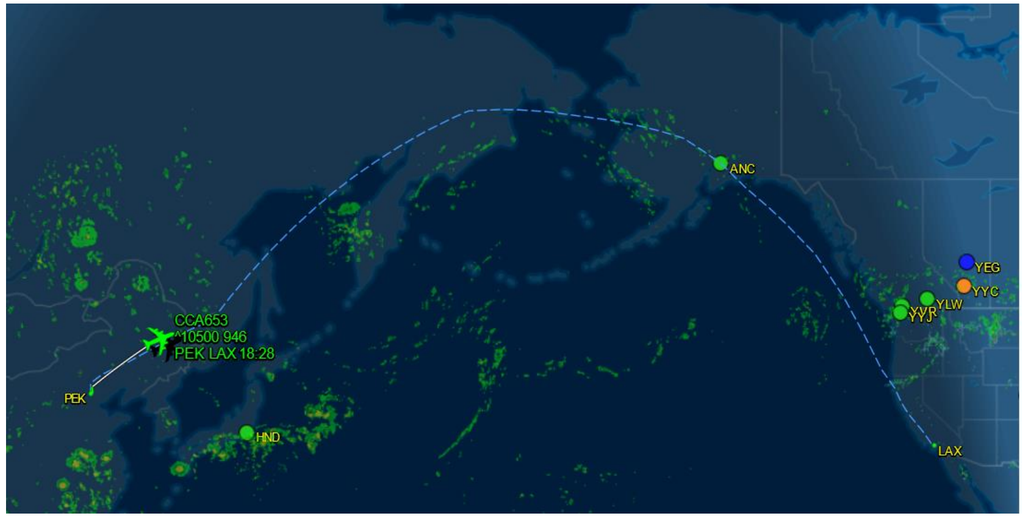
CTTIC and ADCC would like to make the following statement as to a recent flight evaluation for validating Inmarsat's Classic Aero service, of which we wish to provide such service to aviation users all over the world. As we already have completed the infrastructure construction under Inmarsat's support and also constructed a link to end users taking use of the existing ground links. So it is supposed to be nothing different with service in use. We sincerely appreciate your kindly support for this evaluation.

Two flights for PEK-LAX and return pertaining to the evaluation were monitored on 4th, July and 5th, July. Overall, the data captured during the evaluation represents good performance for both cockpit voice calling and FANS (ADS-C/CPDLC) over SATCOM.

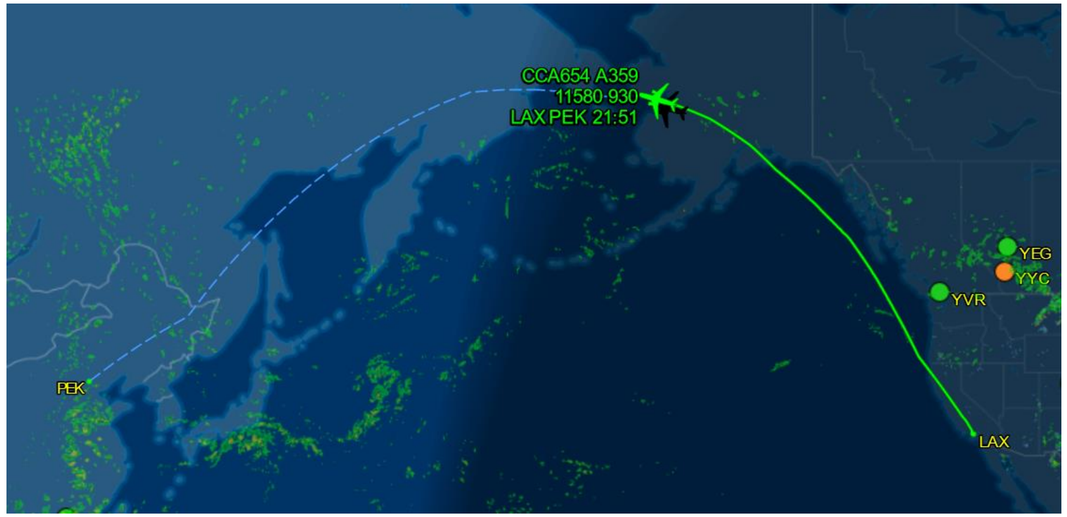
Sincerely!

CTTIC/ADCC Classic Aero Flight Evaluation Update

Tail Number: B-1083
AES ID: 36011506
Flight Number: CA653
Callsign: CCA653
Flight date: 4th July
Take-off Time: 19.45 pm Beijing time (CST)
Landing: 4.30 pm Los Angeles time (PDT)



Tail Number: B-1083
AES ID: 36011506
Flight Number: CA654
Callsign: CCA654
Flight date: 5th July
Take-off Time: 19.02 pm Los Angeles time (PDT)
Landing: 21.51 pm Beijing time (CST)



CCA653 & CCA654 Review

1.Cockpit voice:

Different priorities(Q9,Q10,Q12,Q15) and pre-emptions had been well verified during these two flights.

Classification	Quantity	Comment
Air to Ground	4	AOC calls
Ground to Air	21	with two stage dialing system following ICAO standard

2.ATS Datalink:

D-ATIS: 78 pcs
AFN: 40 pcs
CPDLC: 371 pcs
ADS-C: 379 pcs

All above messages are going through SATCOM and performance looks good, except sometimes it occasionally used HF as uplink media which may be decided by ANSP ground link, so we will further check it with ground link partner.

CCA653 & CCA654 Review

D-ATIS

Callsign	DATIS	uplink	downlink	Comment
CA6666	PANC	2	2	
	CYVR	3	3	
CA653	KLAX	8	8	
	ZBAA	11	11	
	UHMM	0	1	
	UHHH	0	1	
	CYAR	0	1	
	Total	24	27	

CA6666 is an emulated callsign when B-1083 was parked on the ground.

Callsign	DATIS	uplink	downlink	Comment
CA654	ZBAA	13	10	
	ZSQD	1	1	
	ZYTX	1	1	
	Total	15	12	

CCA653 & CCA654 Review

CPDLC,ADS-C

		AFN		ADSC		CPDLC	
		uplink	downlink	uplink	downlink	uplink	downlink
CA6666	Anchorage	2	4	0	0	0	0
	ADCC Emulation	2	2	2	109	2	2
	total	4	7	2	109	2	2
CA653	ADCC Emulation	0	0	0	96	92	69
	Magadan	0	1	0	0	0	0
	Anchorage	3	3	0	0	2	2
	Vancouver	3	4	3	1	6	7
	Oakland	2	2	4	16	5	5
	total	3	8	7	124	100	79

CA6666 is an emulated callsign when B-1083 was parked on the ground.

		AFN		ADSC		CPDLC	
		uplink	downlink	uplink	downlink	uplink	downlink
CA654	ADCC Emulation	2	1	6	107	96	72
	Magadan	0	1	0	0	0	0
	Anchorage	1	2	0	0	1	4
	Vancouver	2	2	3	8	5	4
	Oakland	0	5	0	13	0	6
	total	5	13	9	128	102	86

China Classic Aero Update

Since ADCC are now processing satcom ocean region data, a new set of ACARS identifiers will be 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

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Thank you