

startical



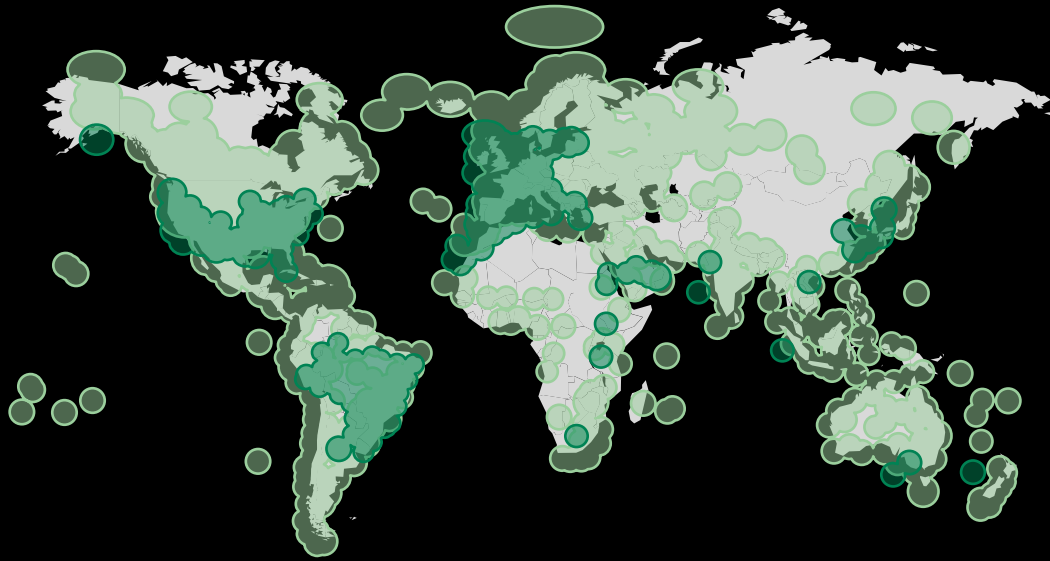
SATELLITE-BASED VHF VOICE AND DATA COMMUNICATIONS

SESAR INNOVATION DAYS

Startical
December 2025

PROBLEM FRAMING

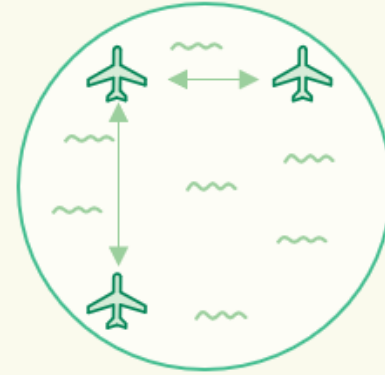
Large oceanic regions lack terrestrial VHF and conventional surveillance



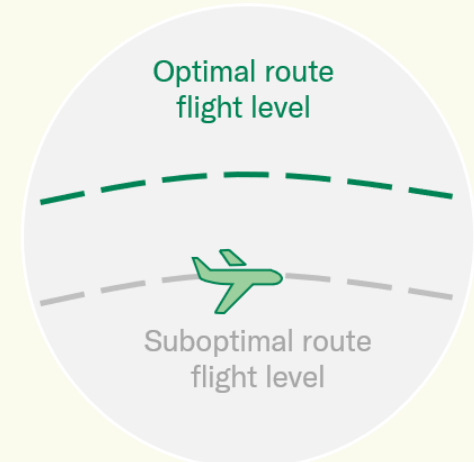
Deliver ATS-grade communications everywhere, with no avionics changes and no new procedures.

There is no other option than using SPACE

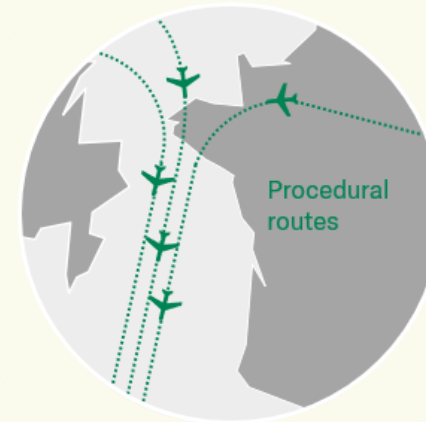
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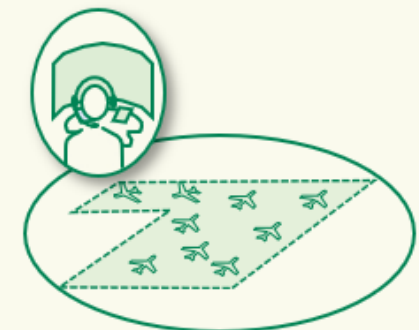
WIDER SEPARATION



LOW VERTICAL and HORIZONTAL EFFICIENCY

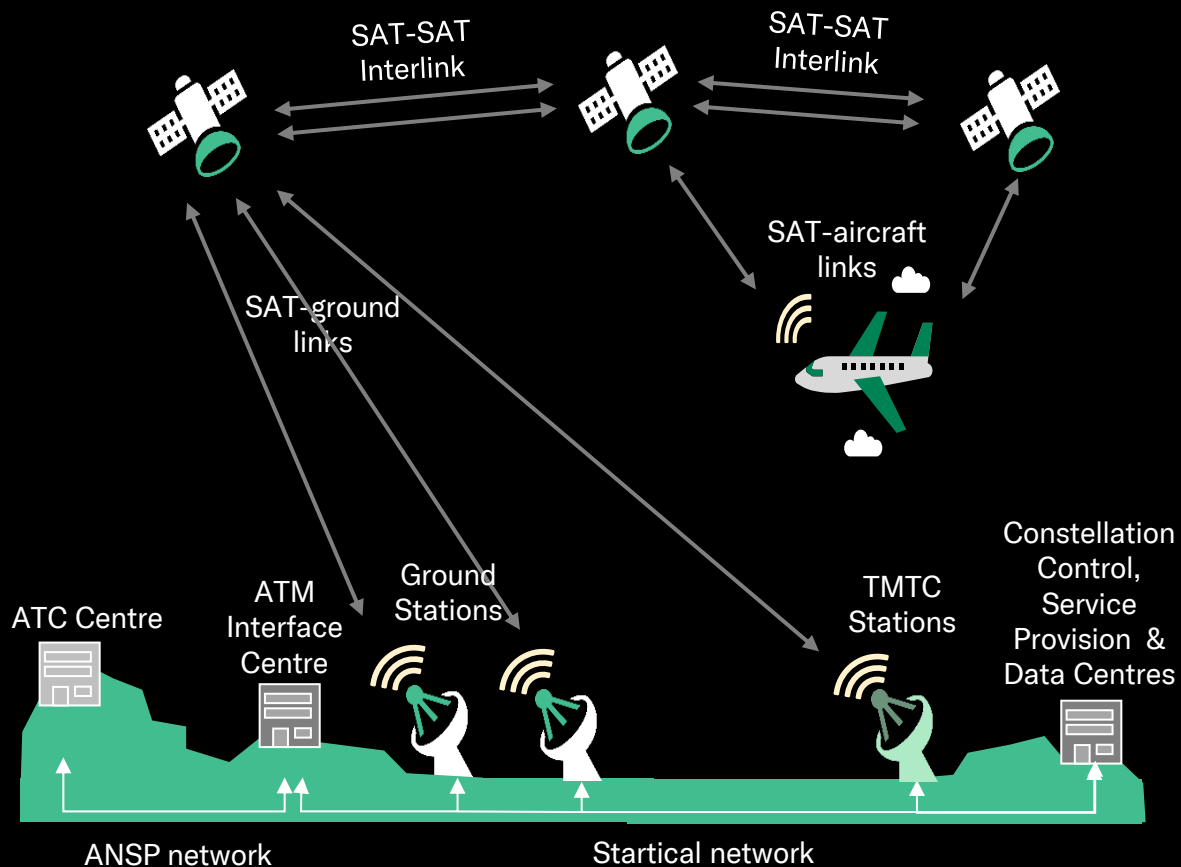


LOW PRODUCTIVITY



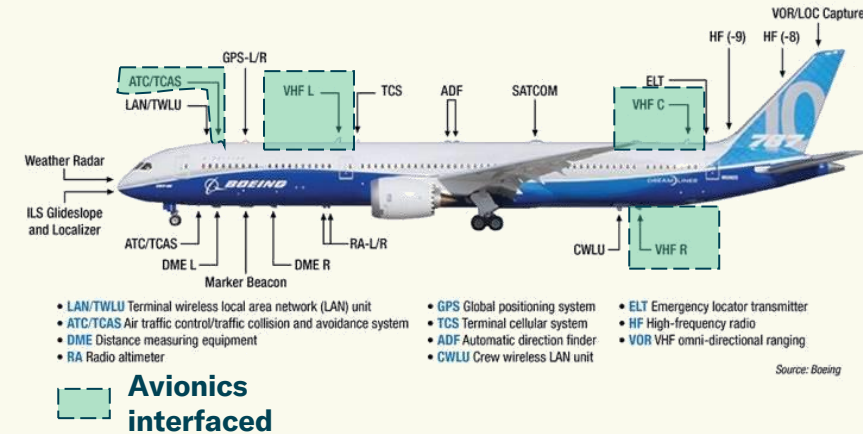
WHAT'S OUR SOLUTION?

A CONSTELLATION OF 200+ SATELLITES



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AIRCRAFT WILL NOT NEED ANY ADDITIONAL AVIONICS EQUIPMENT



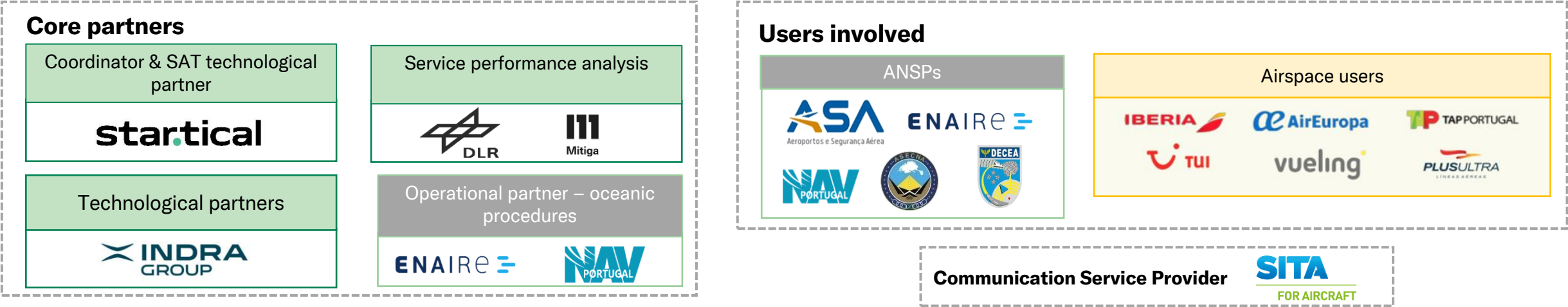
ATCOs/PILOTS WILL NOT NEED ANY NEW TRAINING AND ADS-B/VHF DATA WILL BE PROCESSED AS USUAL BY ATC SYSTEMS



Startical will own a constellation **fully designed and developed for ATM purposes** which will translate into controlled costs.

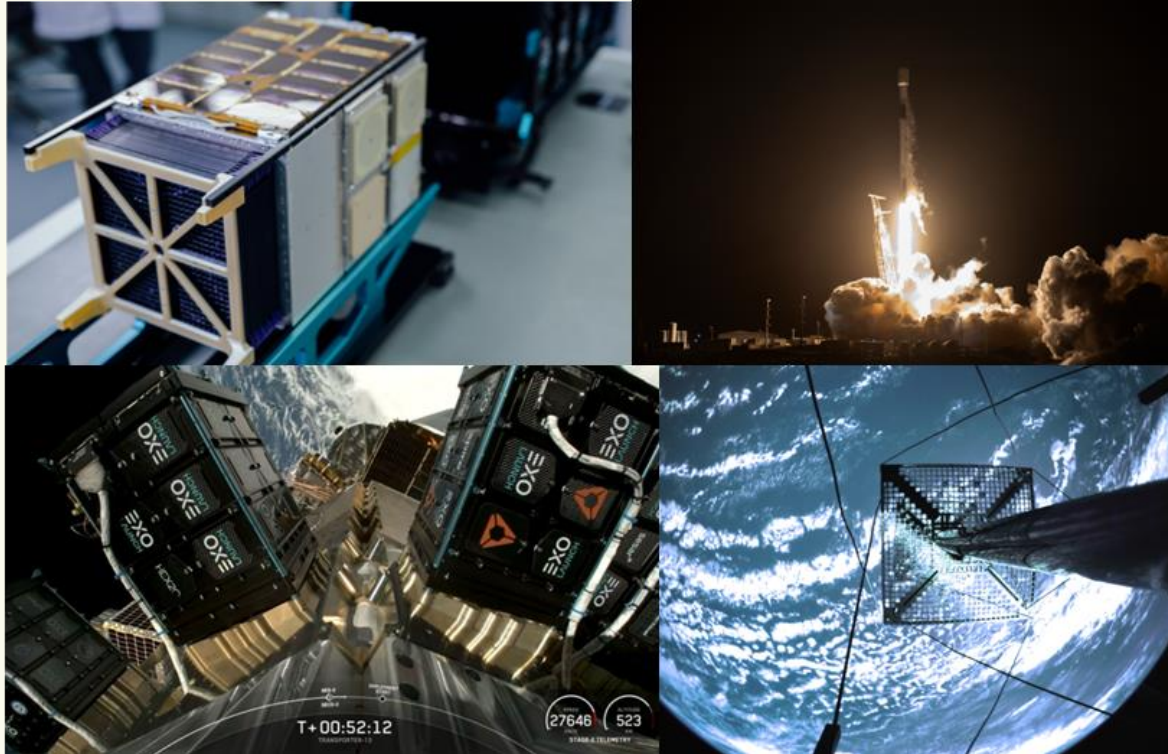
ECHOES AT A GLANCE

ECHOES



ECHOES: IN ORBIT DEMONSTRATORS

IOD.1



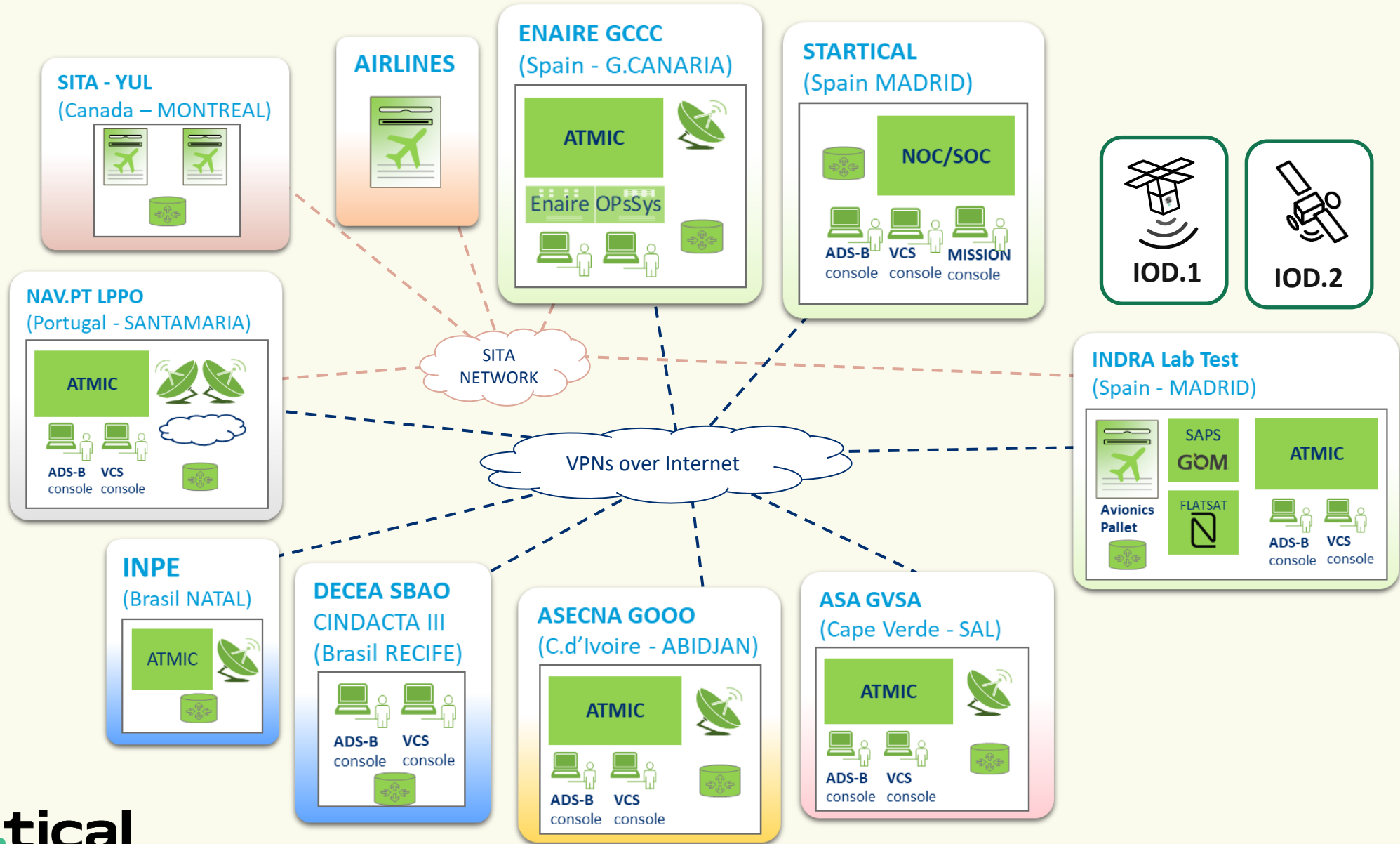
Launched on March 15th 2025

IOD.2



Launched on June 23rd 2025

ECHOES STATUS: SOLUTION ARCHITECTURE



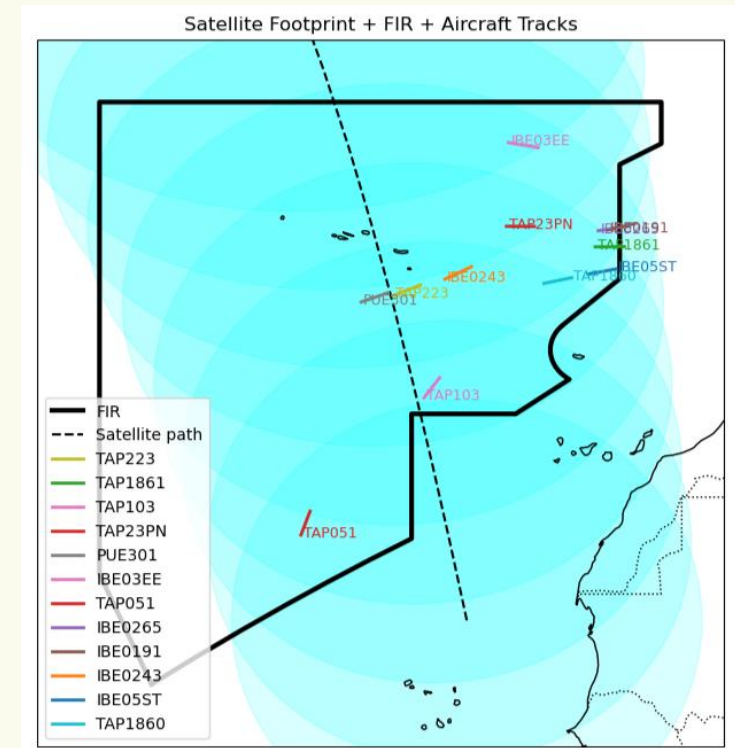
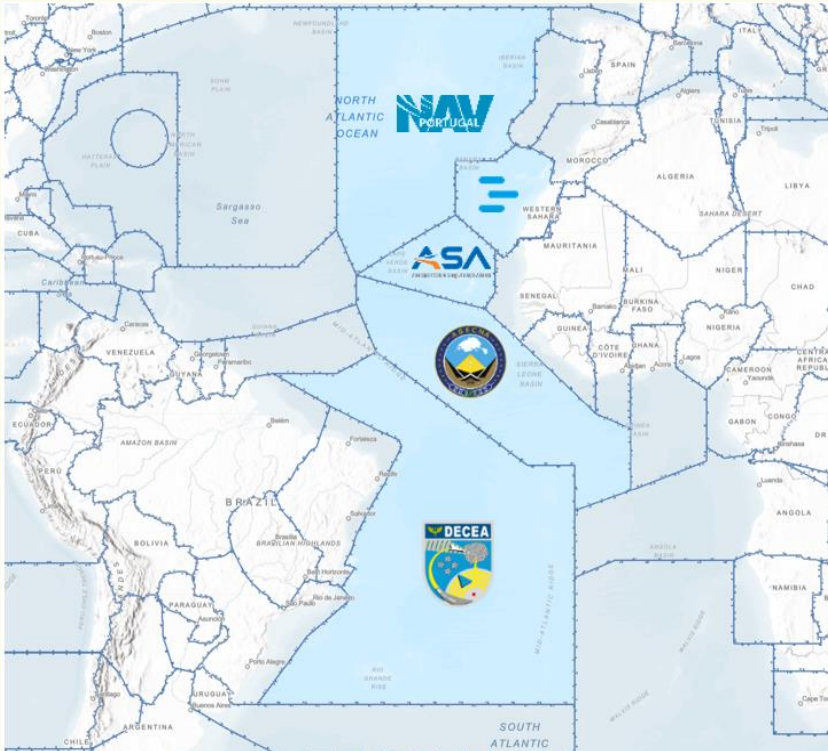
ECHOES STATUS: Voice and Data excercises

Voice Exercises:

Opportunity traffics flying over the trials area are contacted. Both, the pilot and the controller of the corresponding ANSP, assess the quality of the communication. Performance measurements

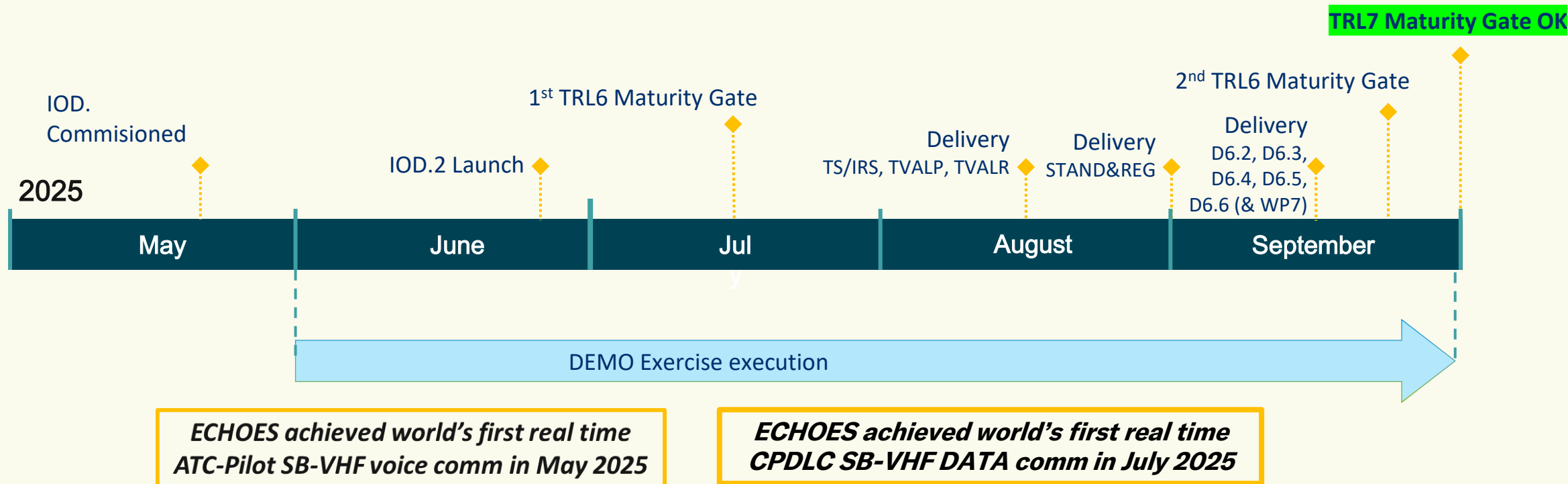
Data Exercises:

Data messages are to/from the corresponding ANSP to/from the opportunity traffics, through the SITA network. Performance measurements



ECHOES: Exercise execution timeline

- The execution of the **Demonstration exercises** performed to reach TRL7 was initiated once IOD.1 was launched and commissioned

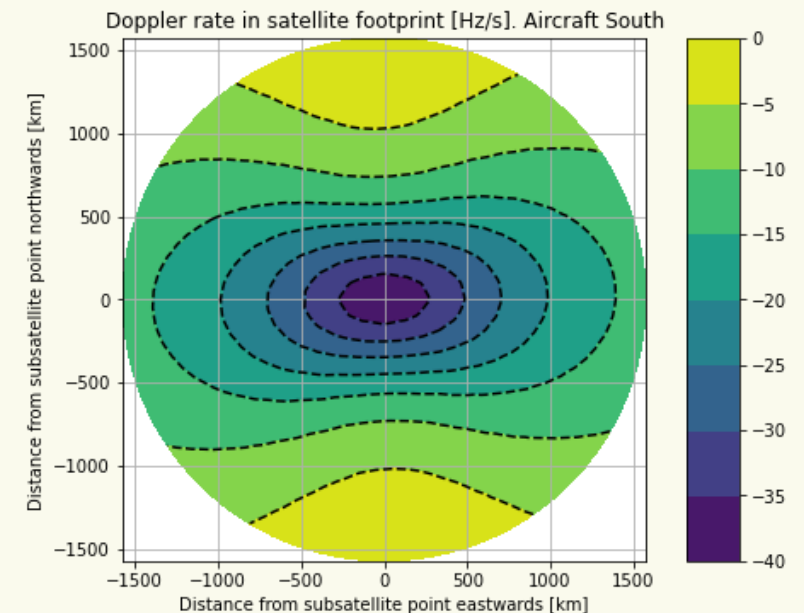
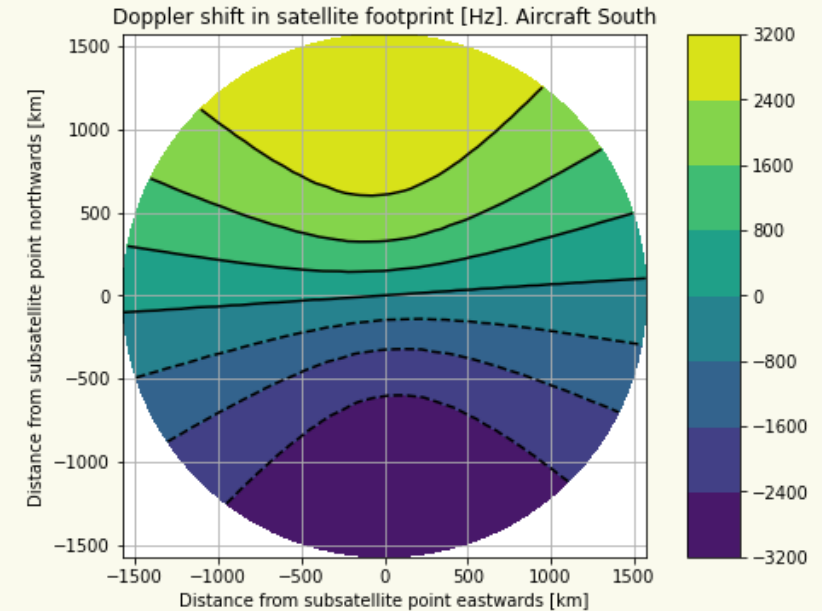


COMPATIBILITY WITH CURRENT AVIONICS

Doppler effect

- Considering the satellite and the spacecraft travel in opposite directions so the relative velocity adds up, the maximum doppler shift experienced by the aircraft is (transmitted frequency is 137 MHz)

	Doppler shift [Hz]	Doppler rate [Hz/s]
Maximum	± 3158.65	-38.2
Satellite contribution	± 3026	-36.59
Aircraft contribution	± 132.6	-1.6



Frequency compensation

VHF Data

Pre-compensation can be based on the type of communication. There are 2 types of messages regarding VHF data, if the message is directed to a specific aircraft (Point to point) or broadcasted to a certain region like the Ground Station Information Frames (GSIF).

- **Point to point** → Communication to a specific aircraft:

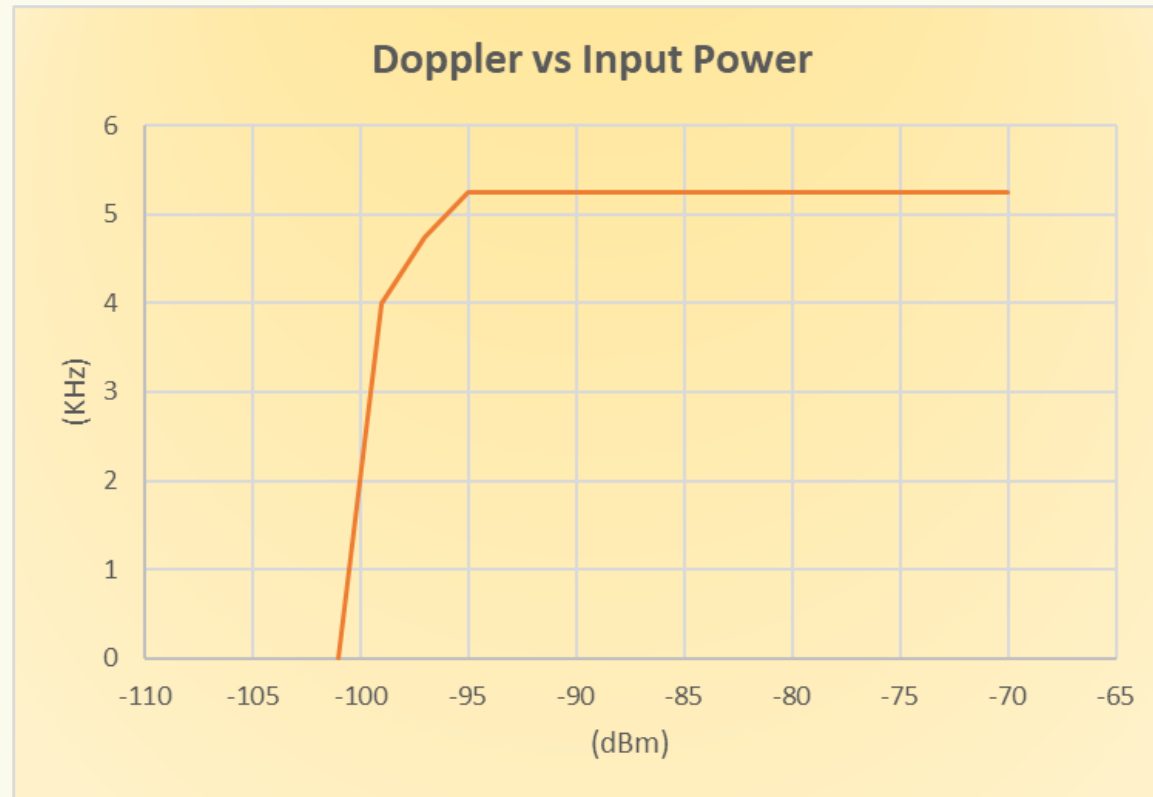
The message contains the **identification** of the aircraft to which the message is directed. Based on the **position** information of the aircraft and the satellite, both known, the necessary frequency shift is computed based on the expected **Doppler shift** at the receiving aircraft

- **Broadcast** → Communication to a specific region:
The same message is transmitted **several times** with different **frequency offsets** to guarantee that the frequency received by the aircraft is within the frequency capture range. It is important to note that an **aircraft can handle** the reception of the same **message twice** and that the **traffic generated would remain low**.

Frequency compensation

VHF Data

The VHF-2100 radio, manufactured by Collins Aerospace, is one of the most commonly installed on board aircraft

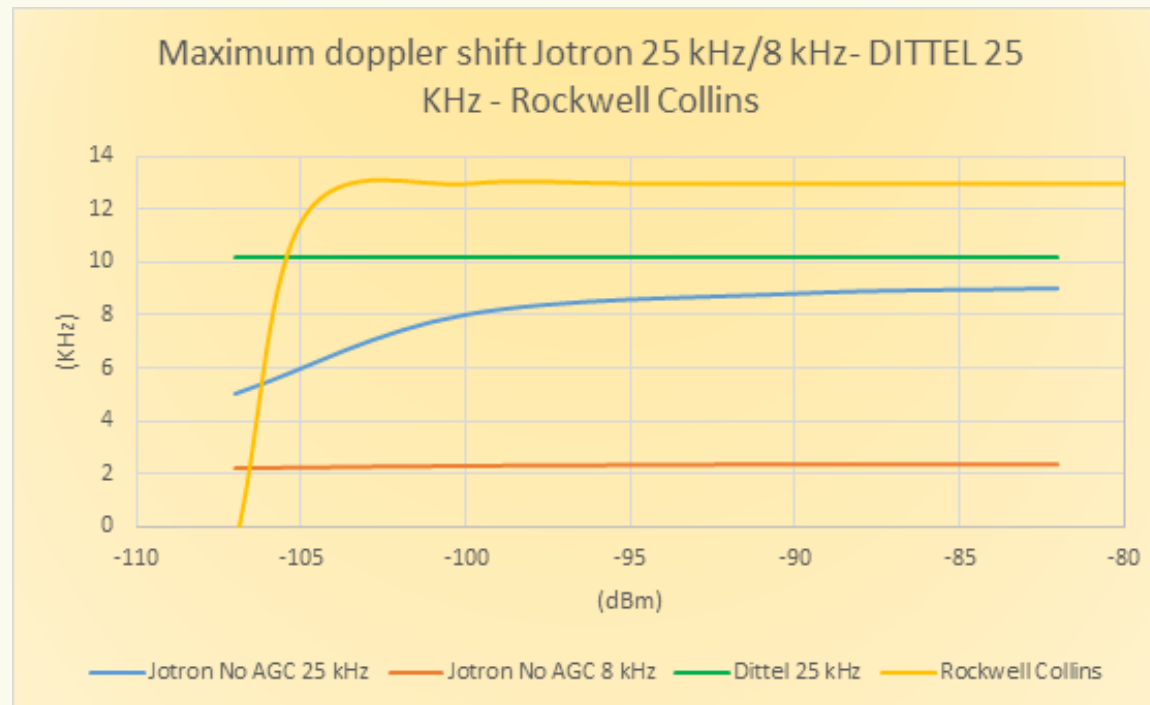


Frequency compensation

VHF Voice

According to ICAO Annex 10, Vol III, Part 2 [2], the capabilities of the airborne radios at reception of VHF Voice signals over 25 kHz channel are:

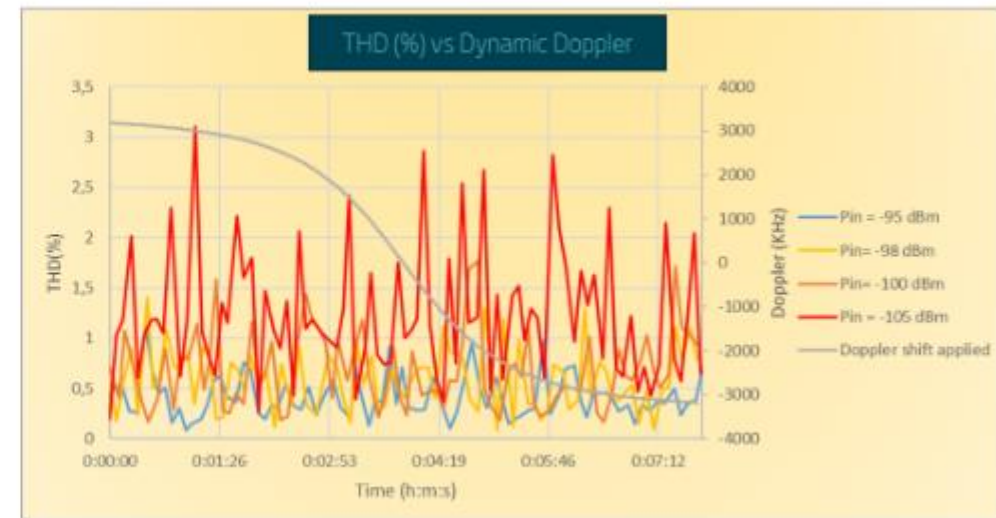
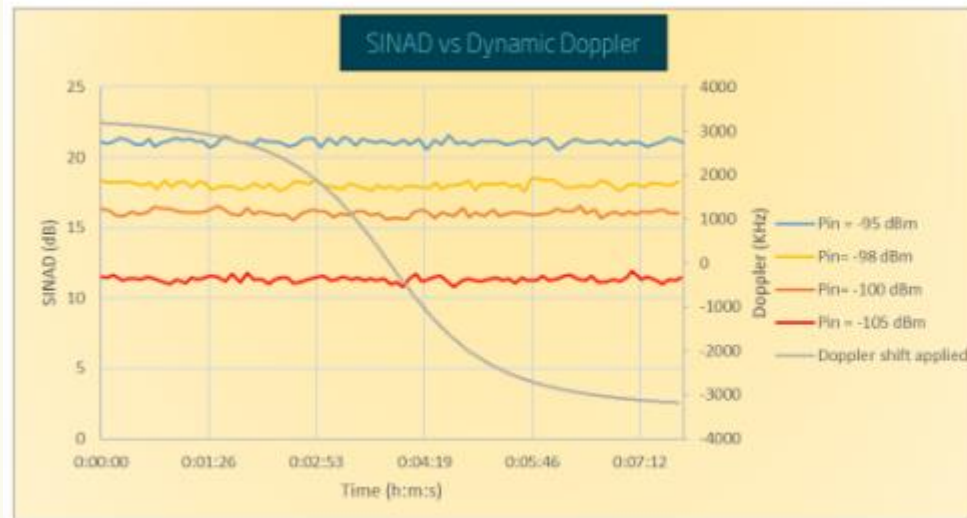
- Effective acceptance bandwidth with offset carrier: ± 8000 Hz
- Effective acceptance bandwidth without offset carrier: ± 6850 Hz



Frequency compensation

VHF Voice

- In the radio tested, 25 KHz channels support Doppler shifts higher than the maximum Doppler shift expected due to satellite movement (3.2 kHz).
- The behavior of the audio demodulated when Doppler is applied is within the limits specified in ICAO SARPS (SINAD >10 dB and THD <5%)





VHF

VOICE

COMMUNICATIONS

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THANK YOU
GRACIAS

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