AEROSPACELAB'S RF MONITORING MISSION : OBJECTIVES, ACHIEVEMENTS, AND FUTURE PERSPECTIVES

By Thibault Bertrand

AEROSPACELAB

Aerospacelab's cutting edge Data Portfolio

Founded in March 2018 in Belgium, Aerospacelab is an end-to-end satellite solutions provider. Our proprietary satellites are operational and provide data for both institutional and commercial uses.

Optical Multispectral

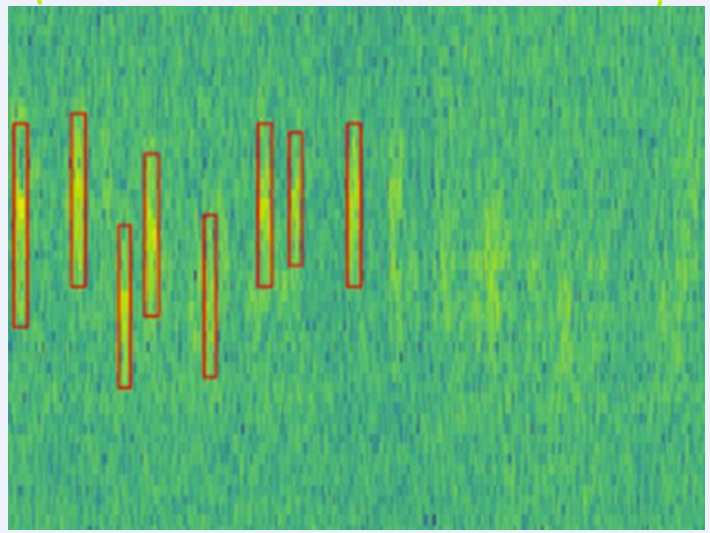
Proprietary Satellite launched in Nov 2023

Optical Very High Resolution

Proprietary Satellite launched in Mar 2024

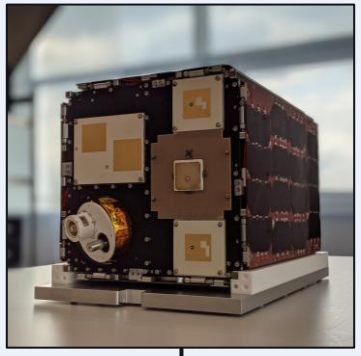
Radio Frequency Sensing

Proprietary Satellite launched in Mar 2024

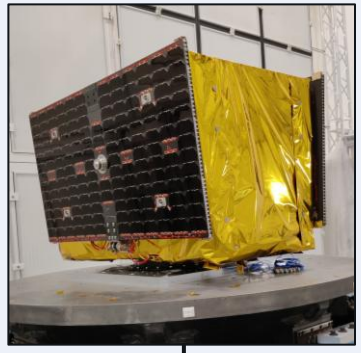


Orbiting satellites

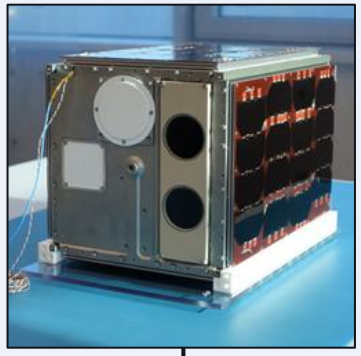
The company's beginning March 2018



Arthur-1
Q2-2021



Grégoire
Q2-2023

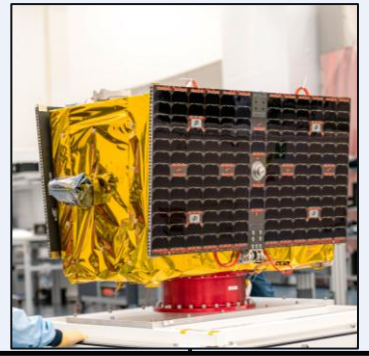


PVCC
Q3-2023

MSI
Q4-2023

Pulsar
Q2-2025

RFS
Q1-2024



VHR
Q1-2024

And many launches in perspective for the future...

RF sensing satellites

Payload coverage

WA: 4x Deployable Whip Antenna

- Range 0.1GHz to 1GHz
- Active antenna with 24dB gain

LFA: 1x Low Frequency Horn Antenna

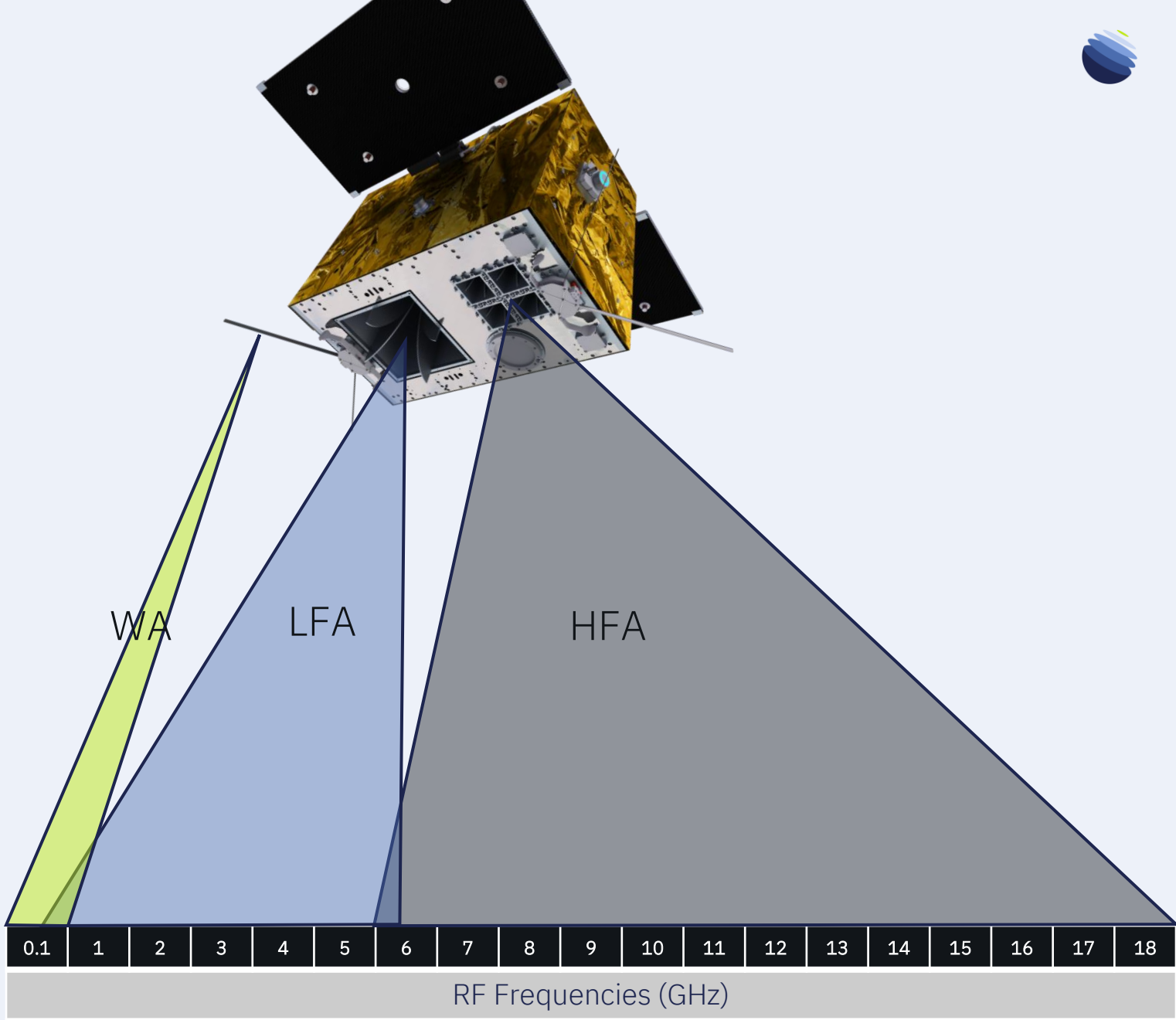
- Range 0.45GHz to 6GHz dual polarization
- Antenna gain between 6.23dBi up to 15.3dBi
- Active antenna gain of 16.5dB up to 29dB

HFA: 4x High Frequency Horn Antenna

- Range 6GHz up to 18GHz dual polarization
- Antenna gain between 15.3dBi up to 21dBi
- Active antenna gain of 22dB up to 29dB

Key spacecraft capabilities:

- Maximum instantaneous bandwidth: 56MHz
- Timestamp: GPSDO based clock, expected <20ns accuracy,
- X-Band download: 5GB / pass per spacecrafts



Why do we need space monitoring ?

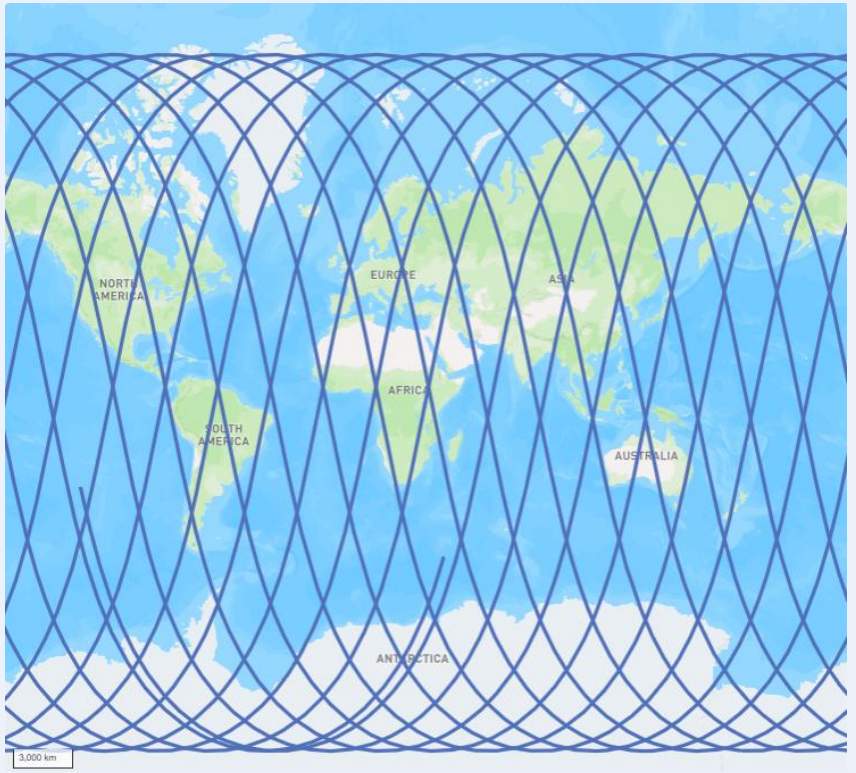
Space-based monitoring can provide a global coverage including in deep ocean, thereby extending the ability of terrestrial stations.

Applications :

- Border monitoring
- Maritime surveillance
- Tracking illegal activities (e.g., illegal fishing)
- Defense
- Spectrum management
- …

Acquisition modes :

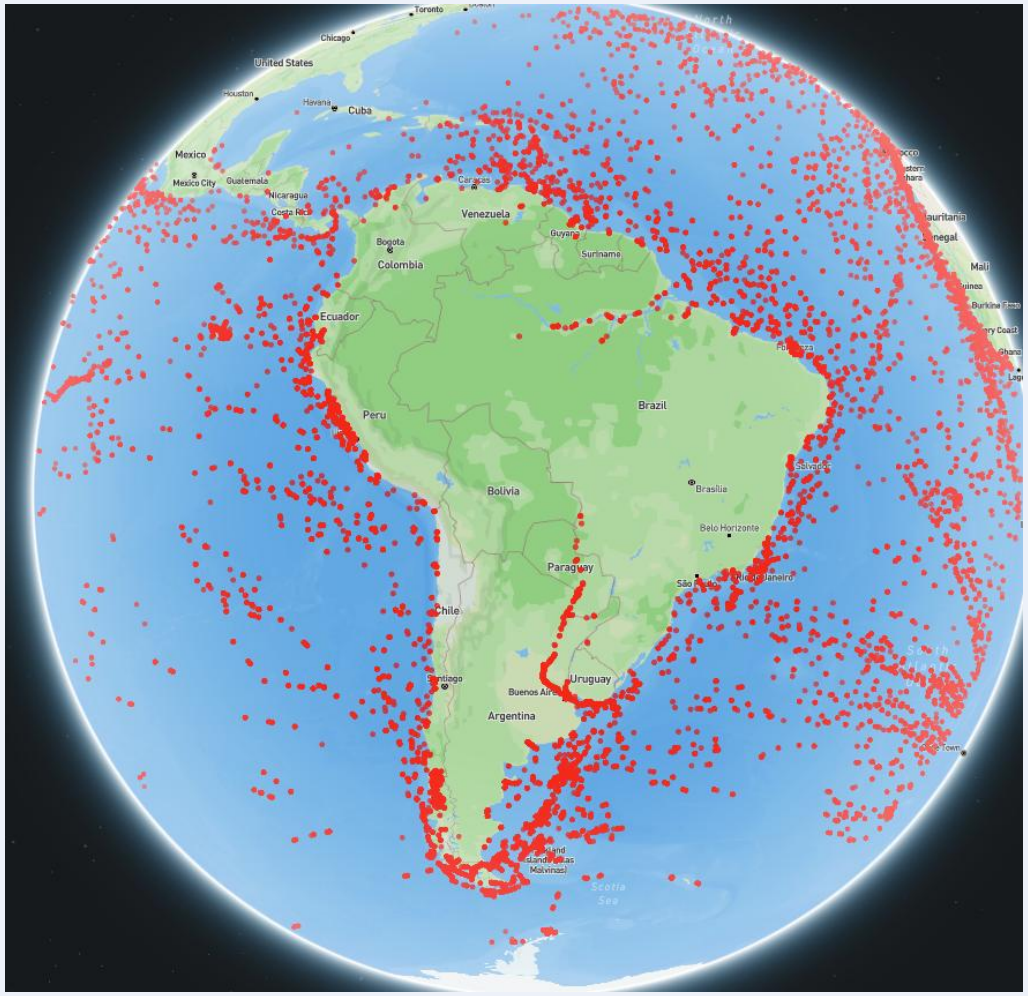
- On-demand : Tasking of the space segment over a specific location on Earth
- Continuous : Continuous survey of specific signals



Spacecraft trajectory of VSP RF B1 for a period of 24 hours

Space-based RF sensing can detect isolated ships

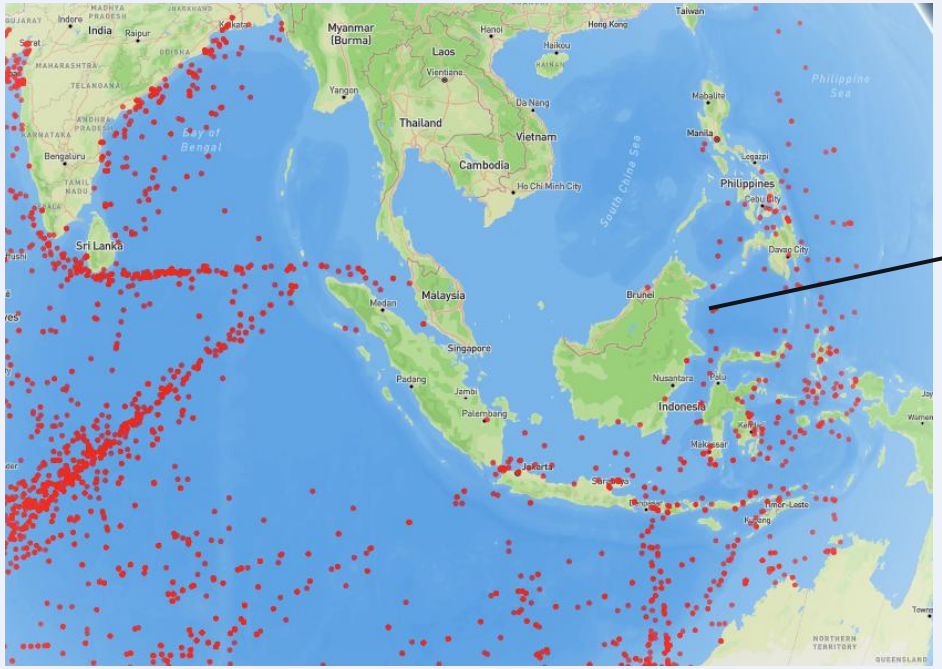
Automatic Identification System (AIS) is used on ships by vessel traffic services to **identify and locate vessels** by emitting their positions at periodic time.



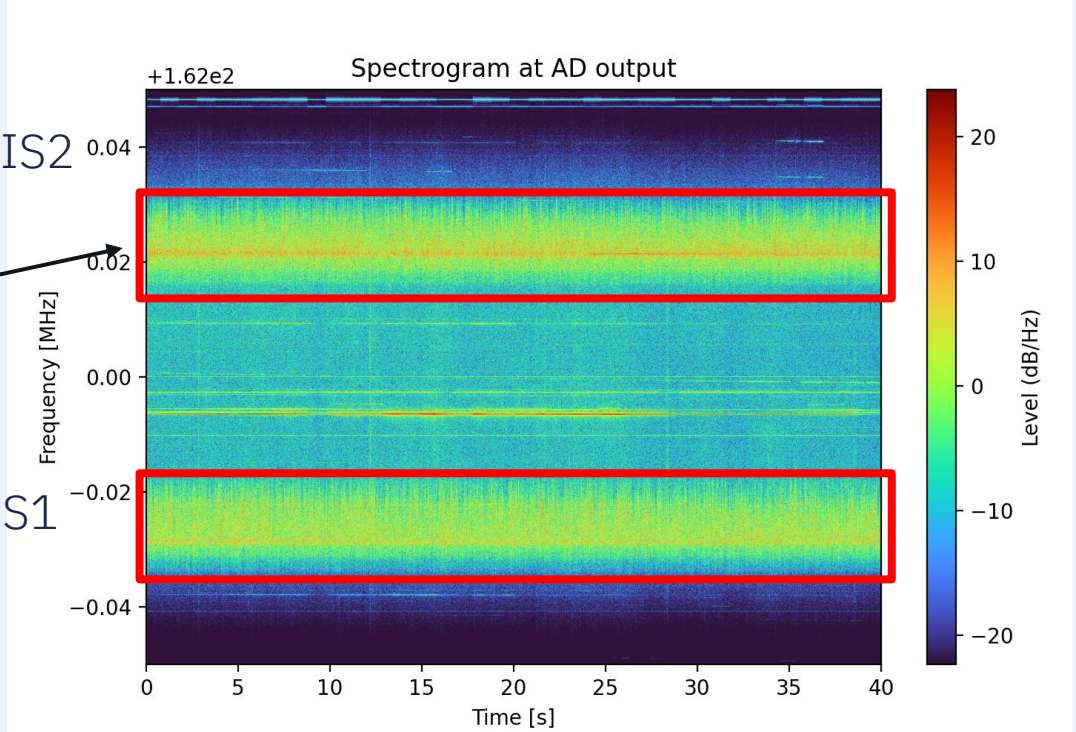
Vessel positions of captured AIS messages taken on 10th of May 2025 centered on south America

RF activity monitoring in specific bands

RF activity density: Space-based RF sensing allow to monitor the activity in AIS bands but can be generalized to other bands. This provides quantitative data on the density of systems in the monitored band and the possibility to accept new entrants.



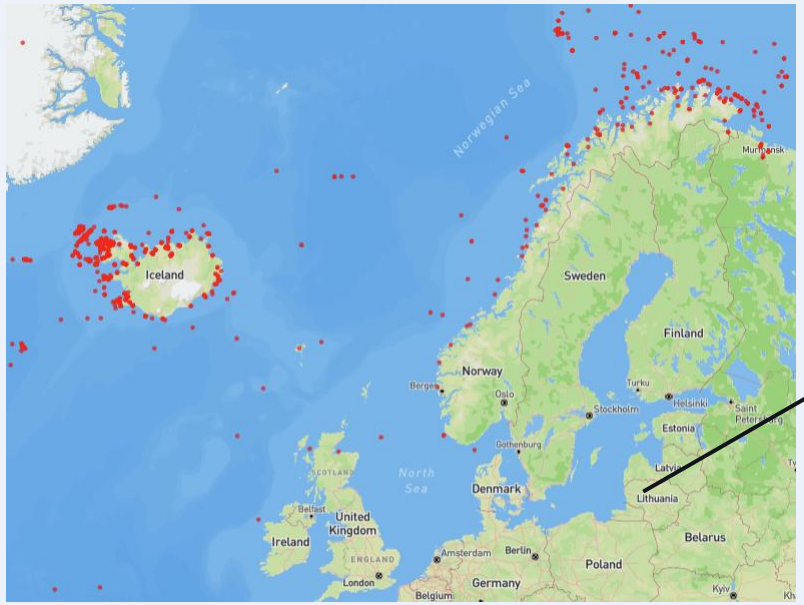
AIS messages detected by VSP RF B1 around the strait of Malacca – May 10, 2025



Space-based monitoring allows for monitoring the quality of AIS services all over the globe

RF activity monitoring in specific bands

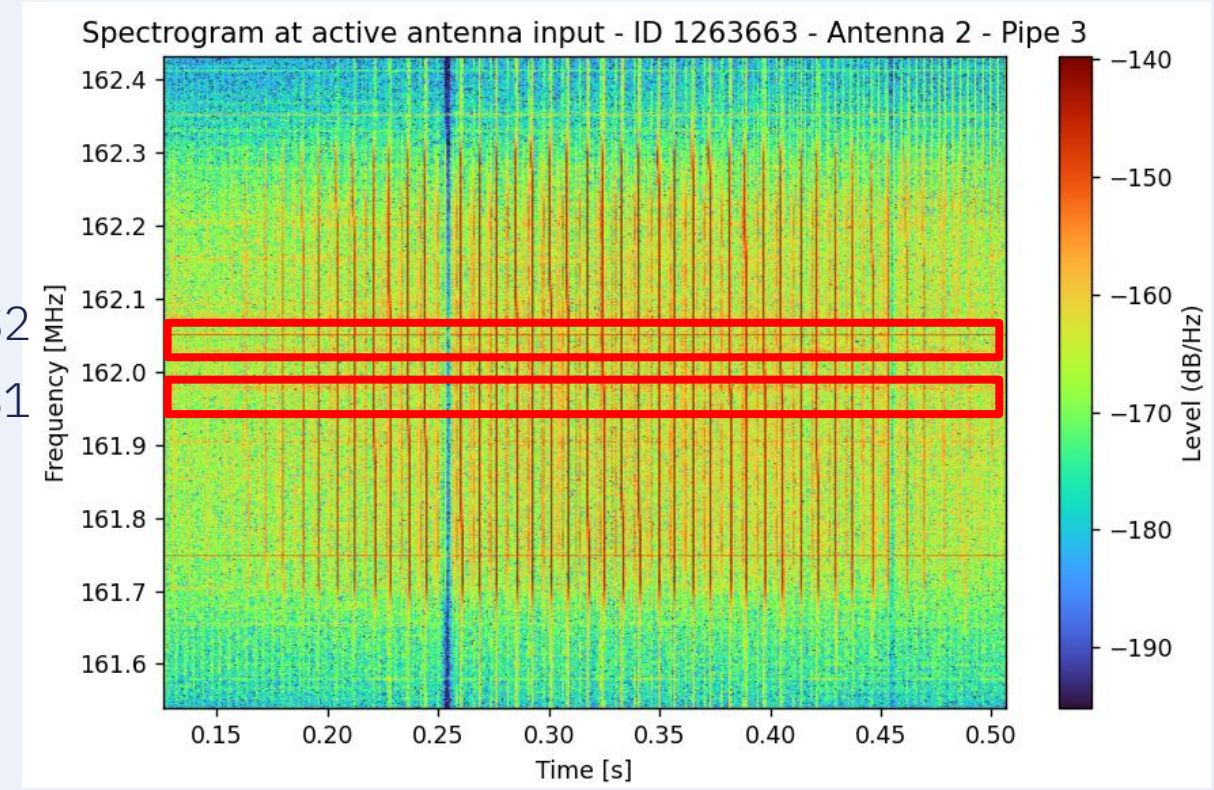
Radio frequency interference (RFI) can be monitored for space. For instance, RFI in the AIS bands could be observed in the Baltic sea. Such interferences from VHF sources (voluntary or not) reduce AIS message detection capacity.



AIS messages detected by Fifi around northern Europe – May 10, 2025

AIS2

AIS1



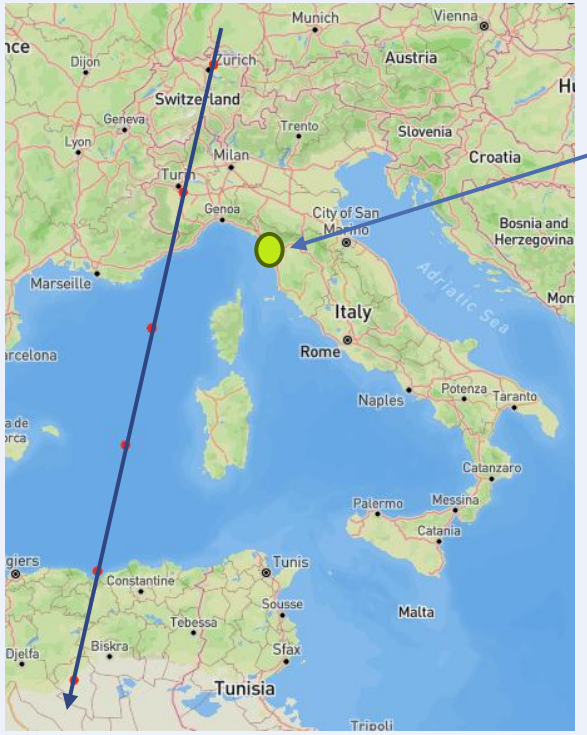
Strong broadband pulse RFI in the AIS bands (vertical lines)

Interference mitigation – MBI collaboration

VHF data exchange-satellite at 157.3125MHz :

Parameters	Value
Link ID	20
Modulation	QPSK
Message duration	125.35ms
Signal bandwidth	42kHz
Center frequency	157.3125MHz
Output average power	12.5W

VHF data exchange-satellite uplink identification parameters

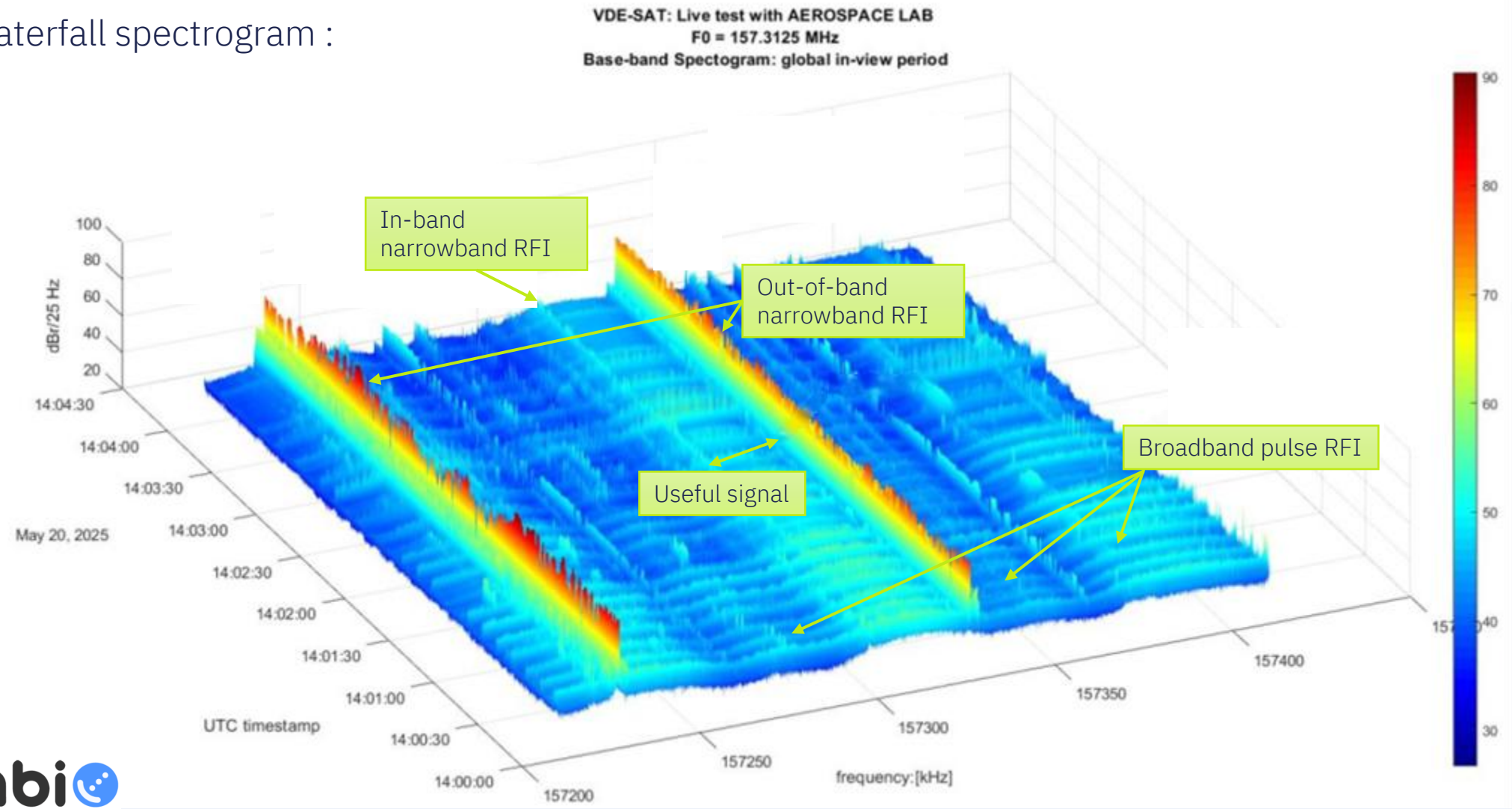


VDES Emitter

Spacecraft trajectory

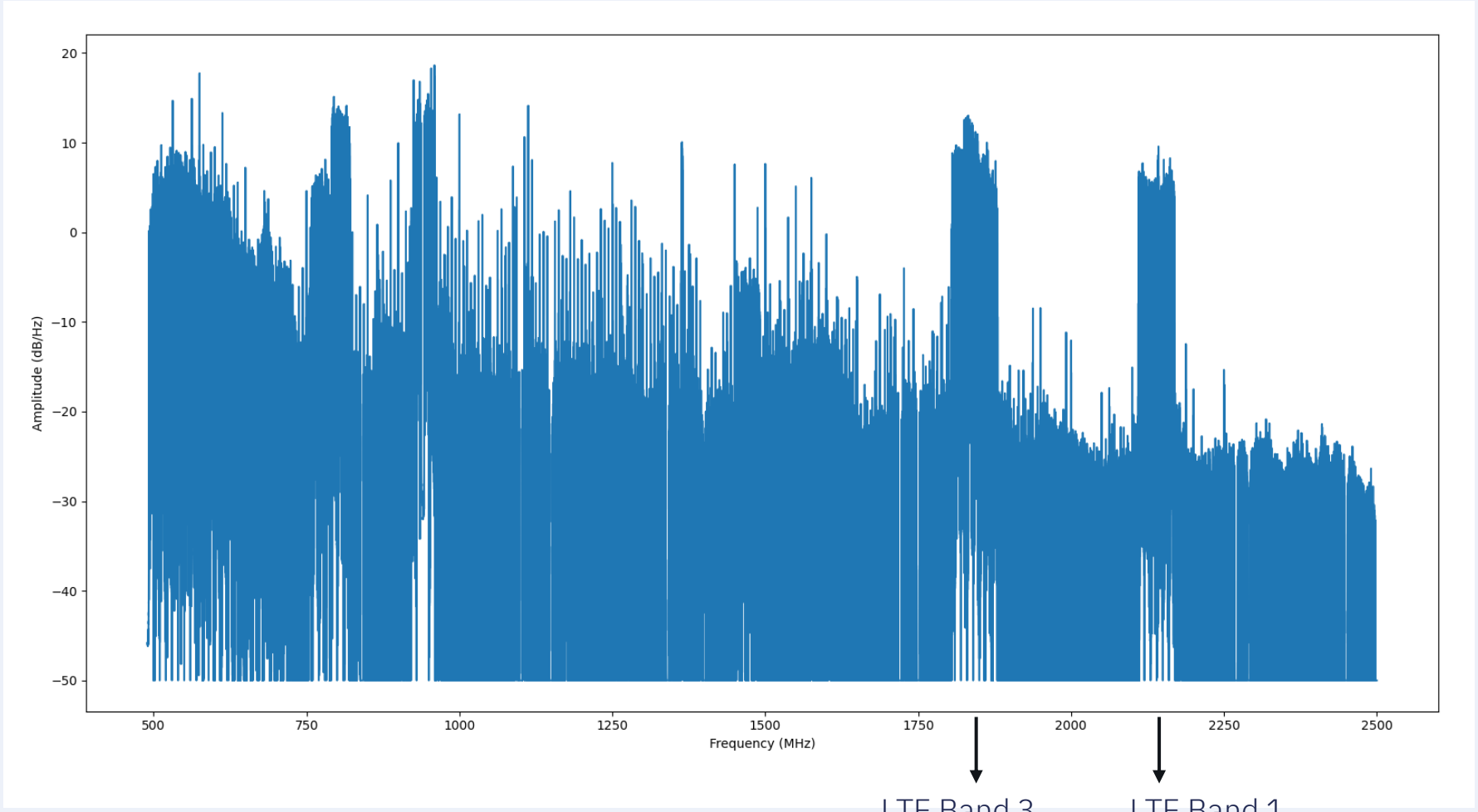
Interference mitigation – MBI collaboration

Waterfall spectrogram :



Spectrum monitoring

Frequency sweep between 500MHz and 2.5GHz :



Conclusion

From ship navigation to airport traffic control and mobile calling, the **radio frequency spectrum** forms the basis of today's modern wireless communications.

In this regard, Aerospacelab believes in the **importance of spectrum monitoring** either to provide **surveillance services** (e.g. AIS) or to **identify, characterize and geolocate RF emission sources**.

Through our space-based services, institutions and industries might gain an enhanced visibility and control over regulated RF channels.

“Make Access to Space Simple so our Customers can Succeed on Earth.”

AERO SPACE LAB

THANK YOU