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| ICAO



GNSS Interference Monitoring: Technology Capabilities in the Context of the Asia Region

Diego Albert

Asia Sales Director - AIREON

GNSS Interference Monitoring: Technology Capabilities in the Context of the Asia Region

01

GNSS Interferences: Increasing threat to aviation

02

Can we detect GNSS anomalies globally and real time ?

03

Asia Context: AIREON Satellite Technologies to monitor GNSS interferences and allocate where the aircraft is

01 GNSS Interference: Increasing threat to aviation



GNSS Interferences: Increasing threat to aviation

Forbes

FORBES > BUSINESS > AEROSPACE & DEFENSE

GPS Spoofing in the Middle East Is Now Capturing Avionics

Eric Tegler Contributor @

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Dec 5, 2023, 09:15am EST



Avionics like those equipping Bombardier's Global 7500 business jet and other commercial aircraft ... [+] BOMBARDIER

"What we've seen since late September," University of Texas researchers say, "is unprecedented. We have never seen

THE DIPLOMAT

ASEAN BEAT | SECURITY | SOUTHEAST ASIA

GPS Jamming in Myanmar

Drone warfare in the country has become a potential nuisance for airline pilots.



By Sribala Subramanian
October 18, 2024

Increasing GNSS interference: UK and EU warn aviation

April 11, 2023 - By Dana Goward

Est. reading time: 2:30



Myanmar's drone warfare directorate rolls out new UCAV

By Anthony Davis | 22 January 2025

"Since possible geographical



A delta-wing one-way attack UAV fielded in Karen State in eastern Myanmar. (Free Burma Rangers)

The Myanmar Armed Forces' Directorate of Drone Warfare has begun deploying a new, indigenously manufactured one-way unmanned combat aerial vehicle (UCAV) across regional commands in what appears to be a nationwide rollout.

First seen in December 2024 in insurgent video footage from western Rakhine State, the distinctive delta-wing-configured 'suicide' UCAV has now been confirmed as deployed in January 2025 in Karen (Kayah) State in the east of the country.

Imagery made available to *Janes* by the Christian volunteer medical service Free Burma Rangers (FBR) revealed details of the new munition following an attack on a school in Tagaylaung village in Karen State's Bilin township on 16 January 2025. Two UCAVs were used in the attack, which damaged the school in an area where the insurgent Karen National Liberation Army (KNLA) operates but failed to inflict casualties.

The Serious Threat Of GPS Spoofing: An Analysis

Patrick Veillette, Ph.D. | October 09, 2023



Aircraft afflicted with GPS Spoofing have flown perilously close to the Iranian border without clearance to fly into Iran's airspace.

Credit: OpsGroup

A serious threat to the safety of

EASA partners with IATA to counter aviation safety threat from GNSS spoofing and jamming

26 Jan 2024 SUGGESTED



COLOGNE, January 26, 2024 - The European Union Aviation Safety Agency (EASA) and the International Air Transport Association (IATA) announced the conclusions of a [workshop](#) jointly hosted at EASA's headquarters to combat incidents of GNSS spoofing and jamming.

The workshop's high-level conclusion was that interference with satellite-based services that provide information on the precise position of an aircraft can pose significant challenges to aviation safety. Mitigating these risks requires short-, medium- and long-term measures, beginning with the sharing of incident information and remedies.

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Portable GPS(L1 L2 L3 L4 L5) All Frequency Signal Jammer



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GNSS Interferences: Increasing threat to aviation

7

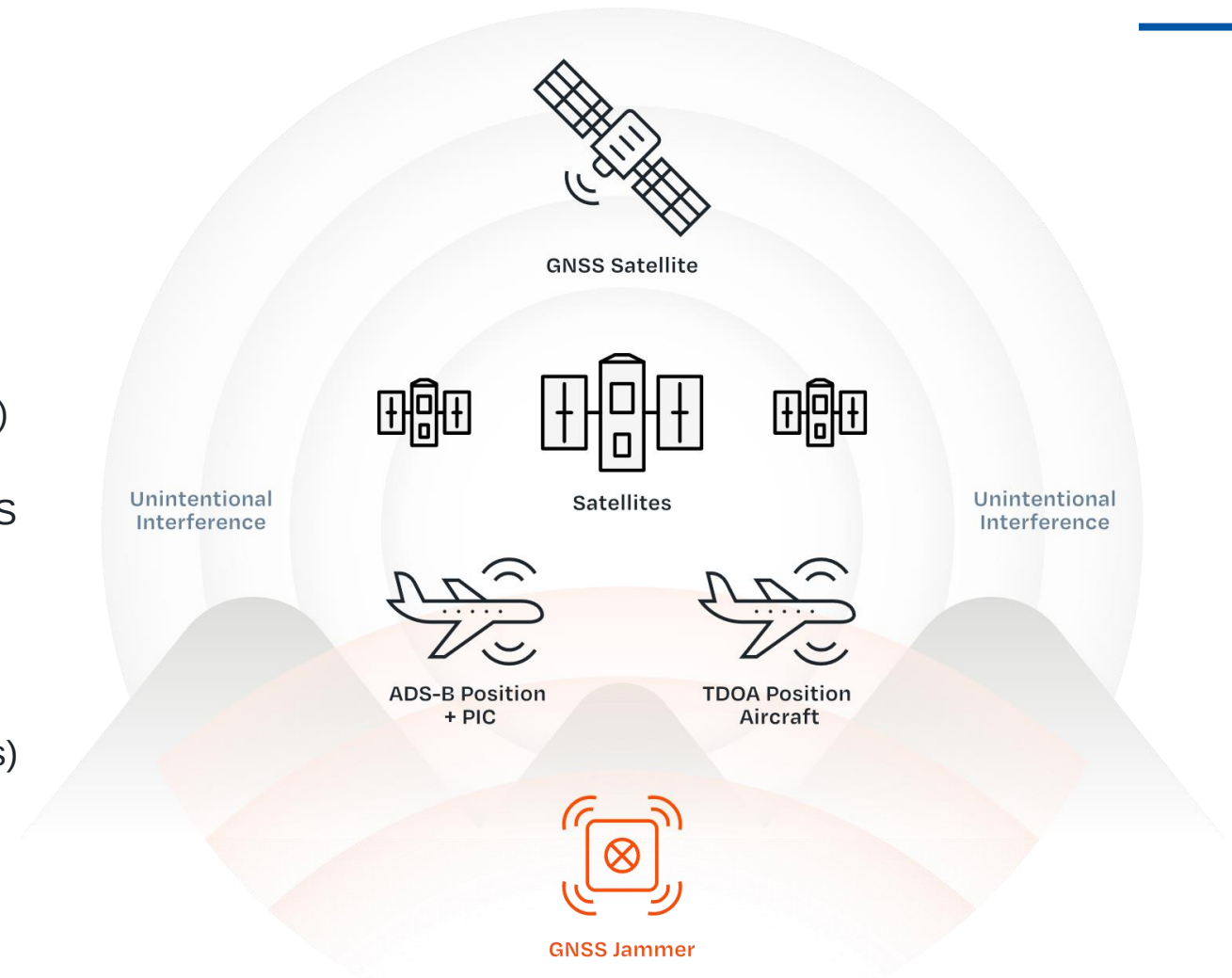
Types of anomalies

Unintentional

- GNSS/GPS Interference (terrain, multipath, space weather, L-Band noise)
- Malfunctioning avionics or aircraft GNSS receiver
- Malfunctioning GNSS constellation or payload

Intentional

- GNSS/GPS Interference (Ground-based, Air-based)
- GNSS/GPS Interference with a stronger GNSS/GPS signal (signal spoofing)
- Malfunctioning avionics (cyber event)
- ADS-B message spoofing (non-aircraft transmissions)



GNSS Interferences: Increasing threat to aviation

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Types of anomalies

Unintentional

- GNSS/GPS Interference (terrain, multipath, space weather, L-Band noise)
- Malfunctioning avionics or aircraft GNSS receiver
- Malfunctioning GNSS constellation

(Ground-based, Air-based)

- GNSS/GPS Interference with a stronger GNSS/GPS signal (signal spoofing)

ISSUE #1: Can we detect, monitor and analyze GNSS Interferences affecting the avionics systems?

ISSUE #2: In case of such GNSS interferences, can we calculate the 'Real Track' of the aircraft?

GNSS-B message spoofing (non-aircraft transmissions)



Unintentional Interference

Satellites

Unintentional Interference



GNSS Jammer



02

Can we
detect GNSS
anomalies
globally and
real time?



How is Aireon monitoring GNSS Interferences (1/2)

Video

Global coverage

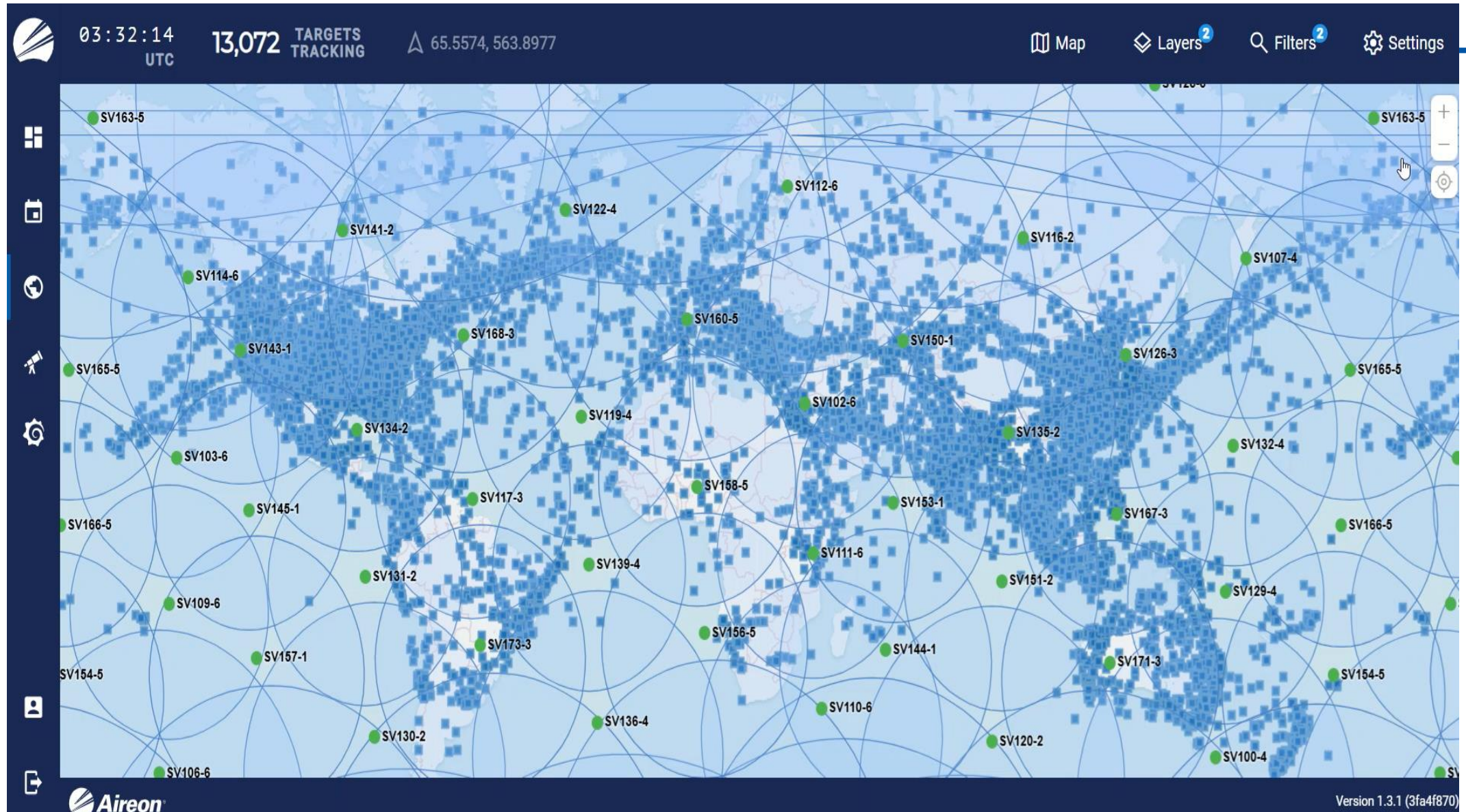
Real-time situational awareness of GPS Performance within Airspace

Low latency "real time alerting"

Multiple payload detection of events

Time-difference-of-arrival (TDOA) geolocations

Independent positioning Identification and reference track



Aireon's Space-based technology is advantageous for GNSS Interference detection

How is Aireon monitoring GNSS Interferences (1/2)

Video

Global coverage

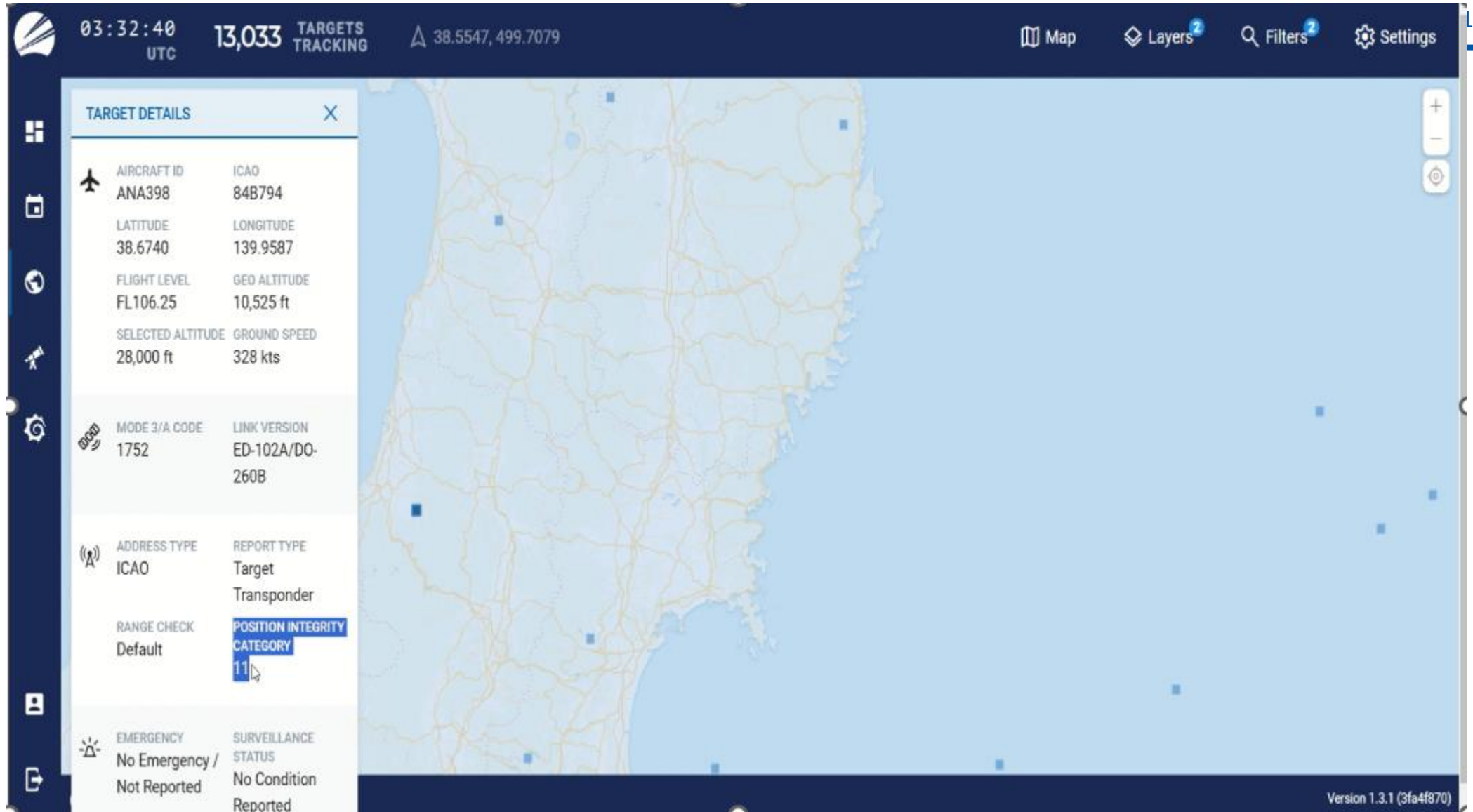
Real-time situational awareness of GPS Performance within Airspace

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Time-difference-of-arrival (TDOA) geolocations

Independent positioning Identification and reference track



Aireon's Space-based technology is advantageous for GNSS Interference detection

How is Aireon monitoring GNSS Interferences? (2/2)

PIC

Industry value

Position Integrity Category (value of 'GPS Error')

TARGET DETAILS	
 AIRCRAFT ID	ICAO
ANA398	84B794
LATITUDE	LONGITUDE
38.6894	139.9290
FLIGHT LEVEL	GEO ALTITUDE
FL97	9,675 ft
SELECTED ALTITUDE	GROUND SPEED
28,000 ft	315 kts
 MODE 3/A CODE	LINK VERSION
1752	ED-102A/DO-260B
 ADDRESS TYPE	REPORT TYPE
ICAO	Target Transponder
RANGE CHECK	POSITION INTEGRITY CATEGORY
Default	11
 EMERGENCY	SURVEILLANCE STATUS
No Emergency / Not Reported	No Condition Reported

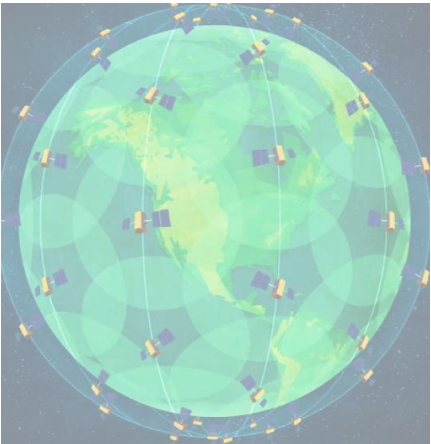
For the value of "PIC", the following conversion table shall be used:

PIC	Integrity Containment Bound	NUCp ED102/DO260	NIC (+ suppl.) DO260A	NIC (+ suppl.'s) Version 2 or higher		
				NIC	A/B	A/C
15	not defined					
14	< 0.004 NM	9	11	11	-	-
13	< 0.013 NM	8	10	10	-	-
12	< 0.04 NM		9	9	-	-
11	< 0.1 NM	7	8	8	-	-
10	< 0.2 NM	6	7	7	-	-
9	< 0.3 NM	-	-	6	0/1	1/0
8	< 0.5 NM	5	6 (+ 0)	6	0/0	-
7	< 0.6 NM	-	6 (+ 1)	6	1/1	0/1
6	< 1.0 NM	4	5	5	-	-
5	< 2.0 NM	3	4	4	-	-
4	< 4.0 NM	-	3	3	-	-
3	< 8.0 NM	-	2	2	-	-
2	< 10.0 NM	2	-	-	-	-
1	< 20.0 NM	1	1	1	-	-
0	No integrity (or > 20.0 NM)	0	0	0	-	-

IPC

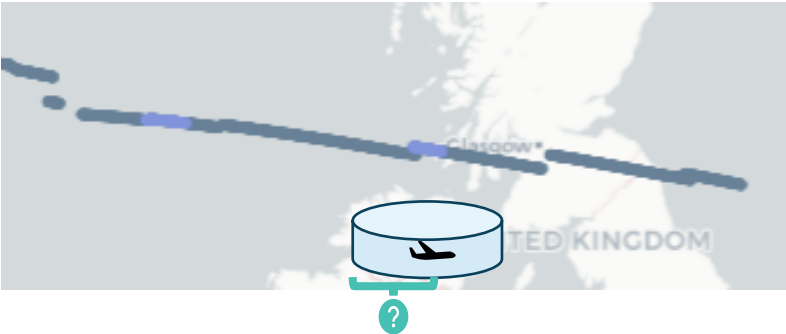
AIREON value

Independent Position Check (value of Iridium Satellite)



Using Iridium Satellite positioning, and by Time-difference-of-arrival (TDOA) geolocations, Aireon is able to define the location of the Aircraft without relying on the GPS given data.

- Aireon IPC (Independent Positioning Check) is a 0/1 value triggered when detected discrepancy between GPS position and Iridium Position
- Aireon Reference Track tracks the aircraft via Iridium TDOA without considering GPS. So we validate the 'real' position of the aircraft.



03

Asia Context:

AIREON Satellite
Technologies to
monitor GNSS
interferences and
allocate where the
aircraft is



03

Asia Context:

AIREON Satellite Technologies to monitor GNSS interferences and allocate where the aircraft is

Aireon Solutions:

1: Real Time Detection:

AIREON GNSS Interferences Monitoring

2: GNSS Data Aggregated:

AIREON Safety Dashboard

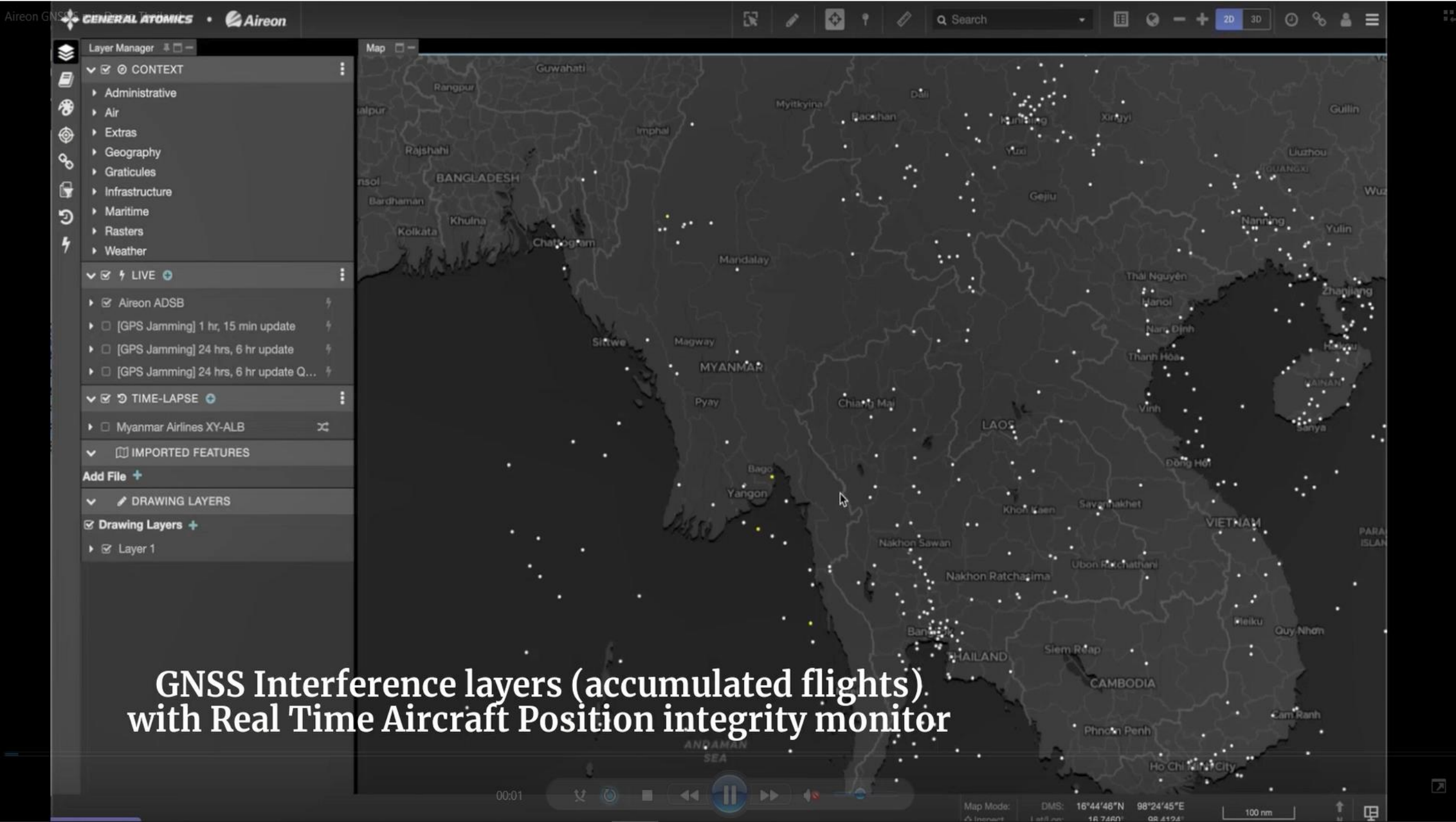
3: Independent Aircraft Tracking (via Iridium constellation, not GPS)

AIREON Independent Position Reference Track

1

AIREON Real Time Monitoring and Event Alerts





2

AIREON Safety Dashboard

GNSS Interferences Database and Analysis



UTC: 2025-02-19 08:28:00

GNSS Interference

Admin Settings

User Guide

Start / End Date

01-2025 - 02-2025

Parameter

Position Integrity Category (PIC)

Units

Per 10,000

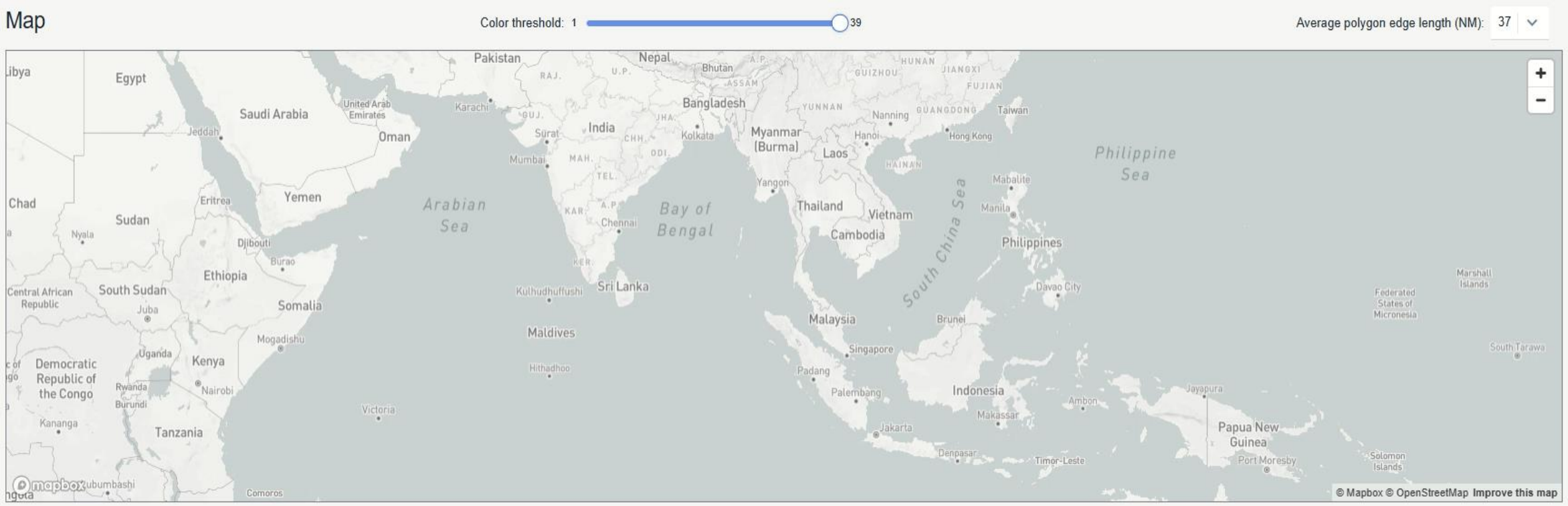
Reset Filters

Apply

Regions

ANSP

Map



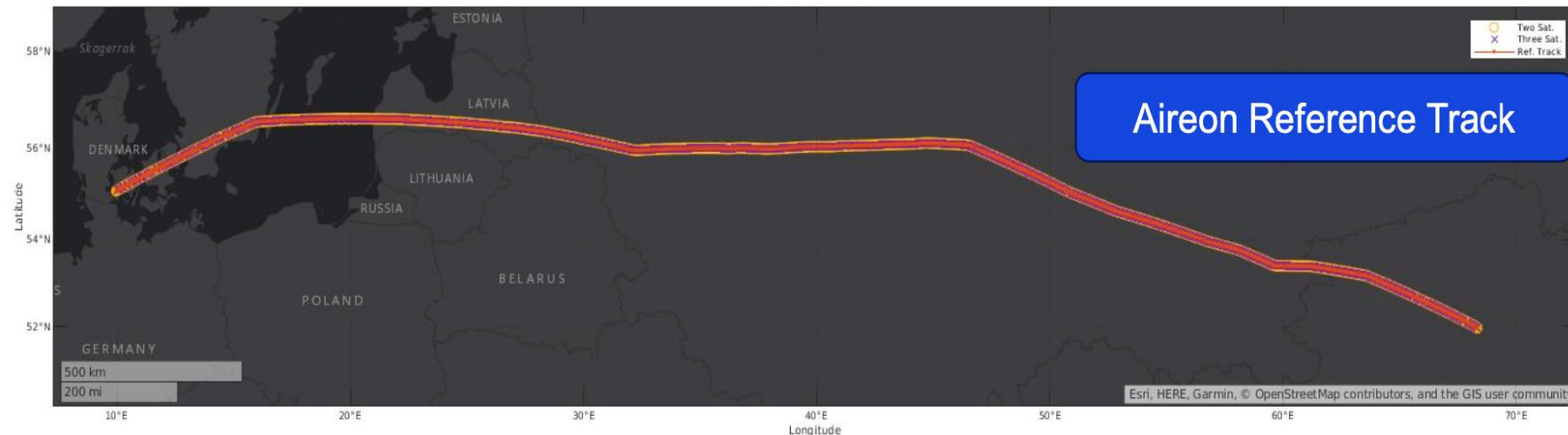
3

Independent Position Identification and Reference Track



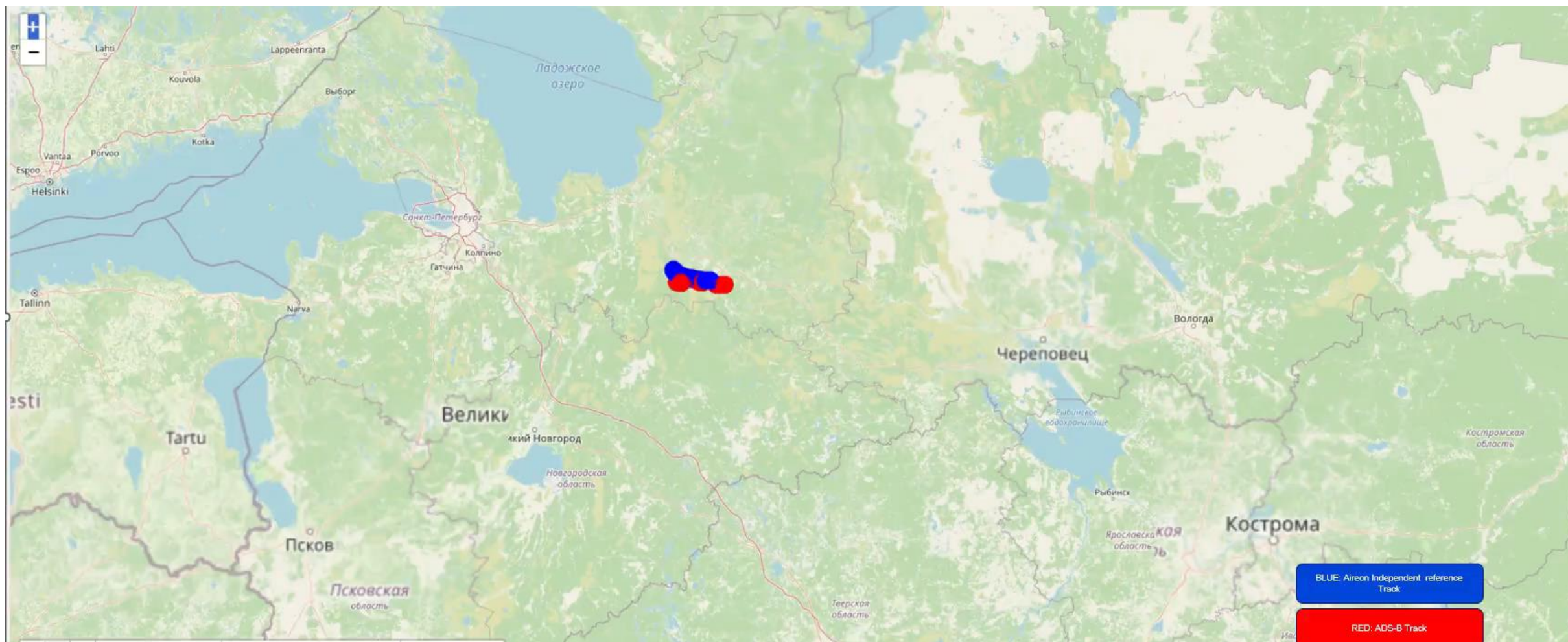
Time Difference of Arrival and Reference Track

- Leveraging the precision and timing of the Iridium constellation, Aireon can detect the location of a transmitting aircraft even when the position reports are no longer valid
- Allows for the tracking of ADS-B equipped aircraft during periods of faulty avionics or when there may be environmental interference
- Provides resilient source for GPS Integrity issues



Aireon Independent Position and Reference Track

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Conclusion: What's next?

2

Aireon aims to cooperate with ICAO and Aviation Industry stakeholders in all areas around GNSS detection, Mitigation and Safety Data Analytics



ข่าว/ประชาสัมพันธ์

Indonesia, Malaysia, Philippines, Singapore and Thailand collaborate and share safety data and information to enhance aviation safety

๑ 17 ตุลาคม 2567

Indonesia, Malaysia, the Philippines, Singapore and Thailand will be launching a Regional Aviation Safety Data and Information Sharing Initiative to enhance aviation safety as air travel achieves full recovery from the COVID-19 pandemic. In a first-of-its-kind initiative in the Asia-Pacific, the five States will collaborate and share de-identified safety data and safety information to identify safety hazards and trends and develop mitigating measures to better manage safety risks. The initiative was first mooted at the inaugural Asia-Pacific Summit for Aviation Safety held in Singapore in 2023. Since then, the States have worked together to agree on the list of safety data and information to share in the first instance and the principles and protocols that will govern data confidentiality.

On 16 October 2024, Mr. Syamsu Rizal, Director of Air Navigation, Directorate General of Civil Aviation (DGCA) of Indonesia; Dato' Captain Norazman Bin Mahmud, Chief Executive Officer, Civil Aviation Authority of Malaysia (CAAM); Captain Manuel

Antonio Lara Tamayo, Director-General, Civil Aviation Authority of the Philippines (CAAP); Mr. Han Kok Juan, Director-General, Civil Aviation Authority of Singapore (CAAS); and Mr. Suttipong Kongpool, Director-General, The Civil Aviation Authority of Thailand (CAAT), signed a Memorandum of Understanding (MOU) to cement the partnership on the sidelines of the 59th Conference of Directors General of Civil Aviation, Asia and Pacific Regions in



Thank You

