Space based ADS-B

ICAO Asia/Pacific Regional Webinar

September 2021

Presentation Outline & Speakers

- **Technical Overview**
  - ✈What is Space based ADS-B (AB)
  - ✈Status Update in Asia Pacific (AB)
- **Benefits & Use cases**
  - ✈Complete the coverage (GD)
  - ✈CRV integration (GD)
  - ✈Use cases (GD)
  - ✈Commercial product services (AB)
- **ADS-B in a COVID world (AB)**
- **Why Space based ADS-B (AB)**
- **Q & A**

Adam Burford
Regional Director Asia-Pac
Aireon

Greg Dunstone
Sales Engineer
Aireon

A Quick Aireon Overview

2011

Aireon created in 2011 to provide global, real-time air traffic surveillance, regardless of location

IRIDIUM CONSTELLATION

Cutting-edge constellation with Aireon's ADS-B receivers on each satellite, completed in January 2019

ALL PAYLOADS IN ORBIT AND OPERATONAL

- All 66 Aireon ADS-B payloads active and operational as of April 2019
- Over 413,582,875,283 ADS-B position messages received.

ANSPs

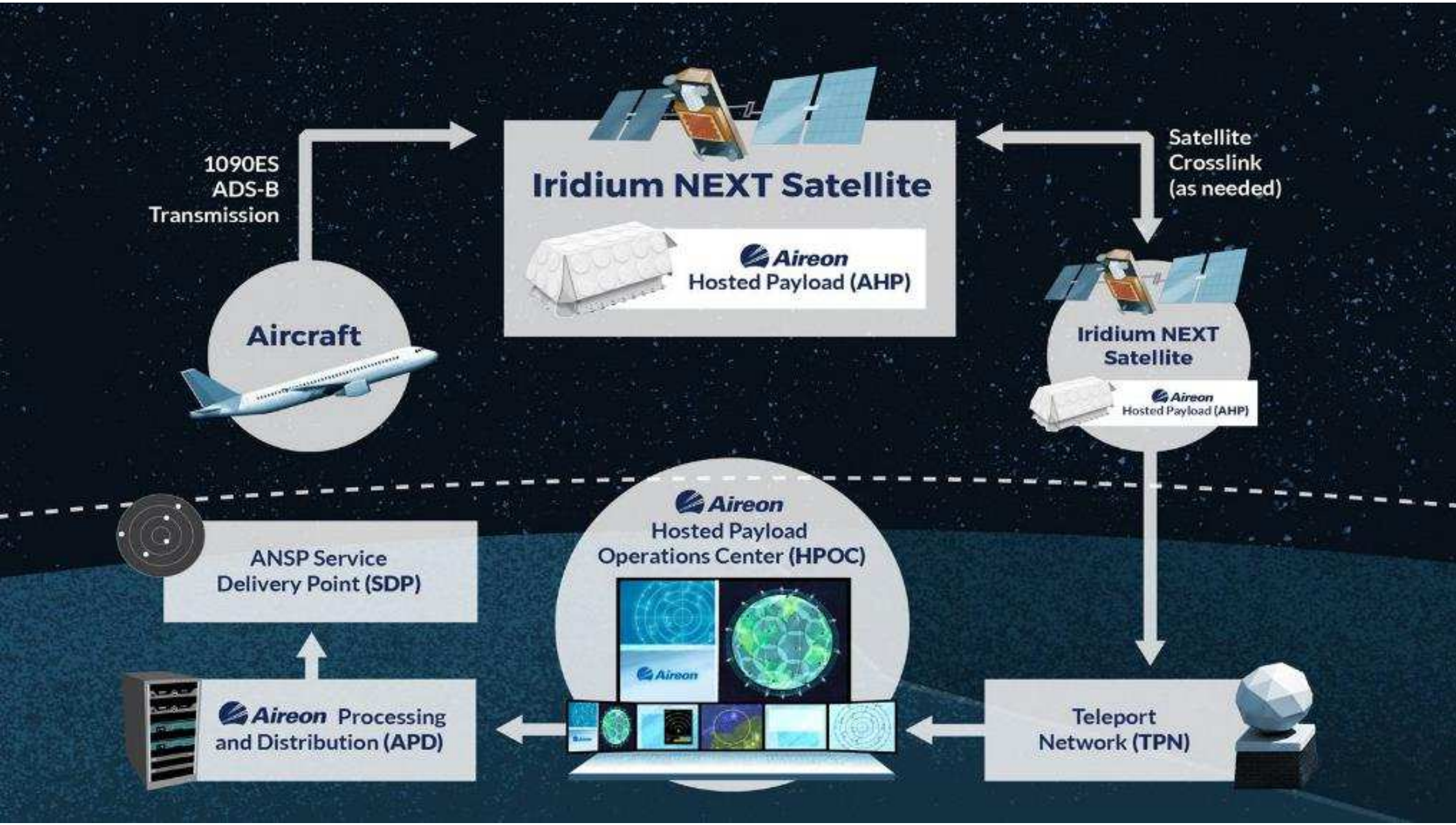
- A total of 20 ANSPs making up 40 countries have signed agreements to deploy space-based ADS-B.
- NATS and NAV CANADA, DC-ANSP, ASECNA, Airports Authority of India (AAI), Isavia and Singapore are already operational

Commercial Services

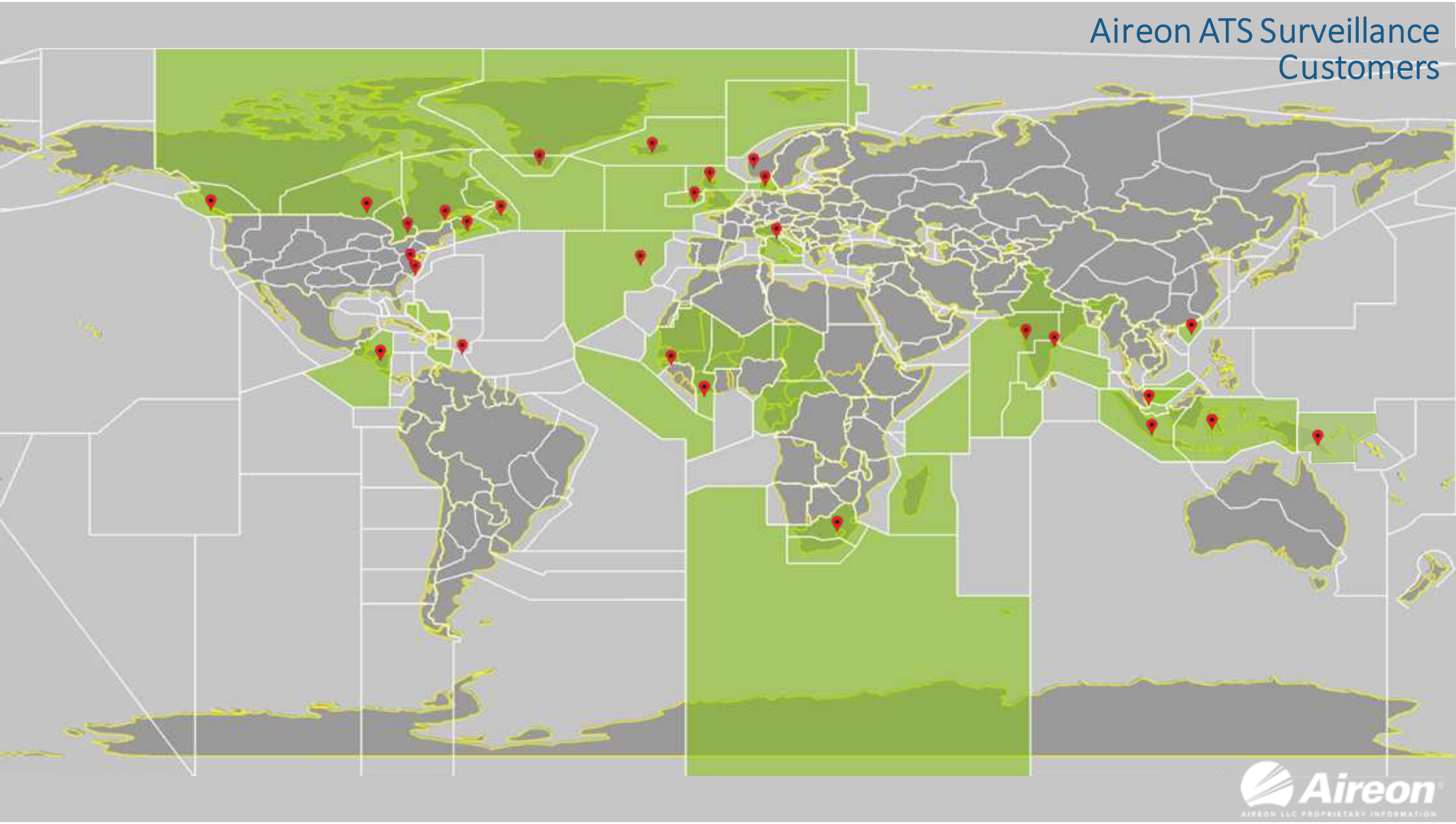
- Launched three new products in October 2020:
  - AireonSTREAM™
  - AireonINSIGHTS™
  - AireonFLOW™

What is Space based ADS-B ?


Colored By Altitude
Color Legend
0 to 2,000 Feet
2,000 to 5,000 Feet
5,000 to 10,000 Feet
10,000 to 18,000 Feet
18,000 to 40,000 Feet
40,000 Feet & Above
Pacific
The Aireon satellite based system detects all ADS-B equipped aircraft worldwide for ATC separation purposes @ ATC Quality
Aireon
Aireon Space-Based ADS-B
01 to 05 March 2018 - 32 Payloads


1090ES
ADS-B
Transmission
Iridium NEXT Satellite
Aireon
Hosted Payload (AHP)
Satellite
Crosslink
(as needed)
Aircraft
Iridium NEXT
Satellite
Aireon
Hosted Payload (AHP)
Aireon
Hosted Payload
Operations Center (HPOC)
ANSP Service
Delivery Point (SDP)
Aireon Processing
and Distribution (APD)
Teleport
Network (TPN)

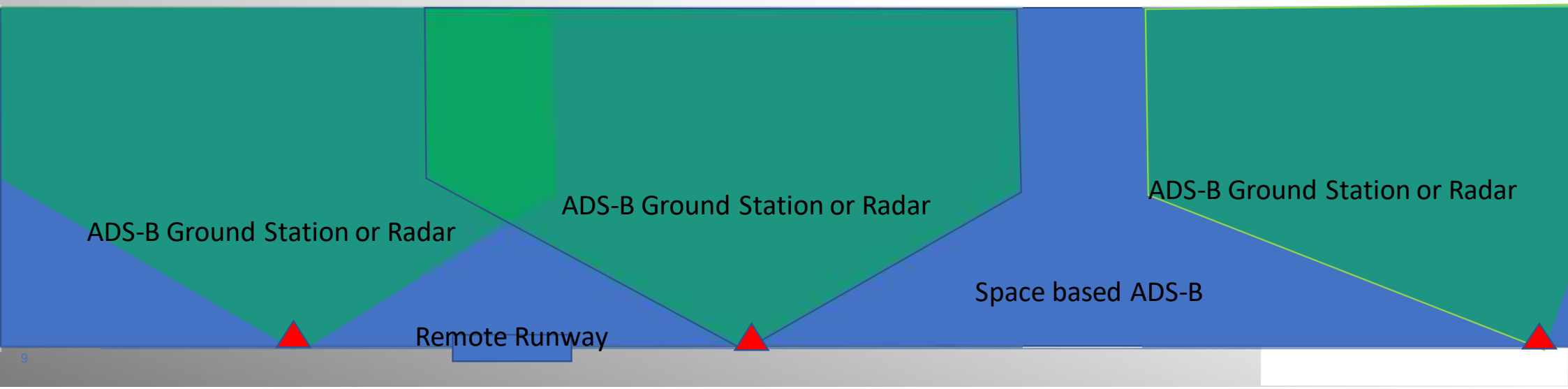
Aireon ATS Surveillance Customers



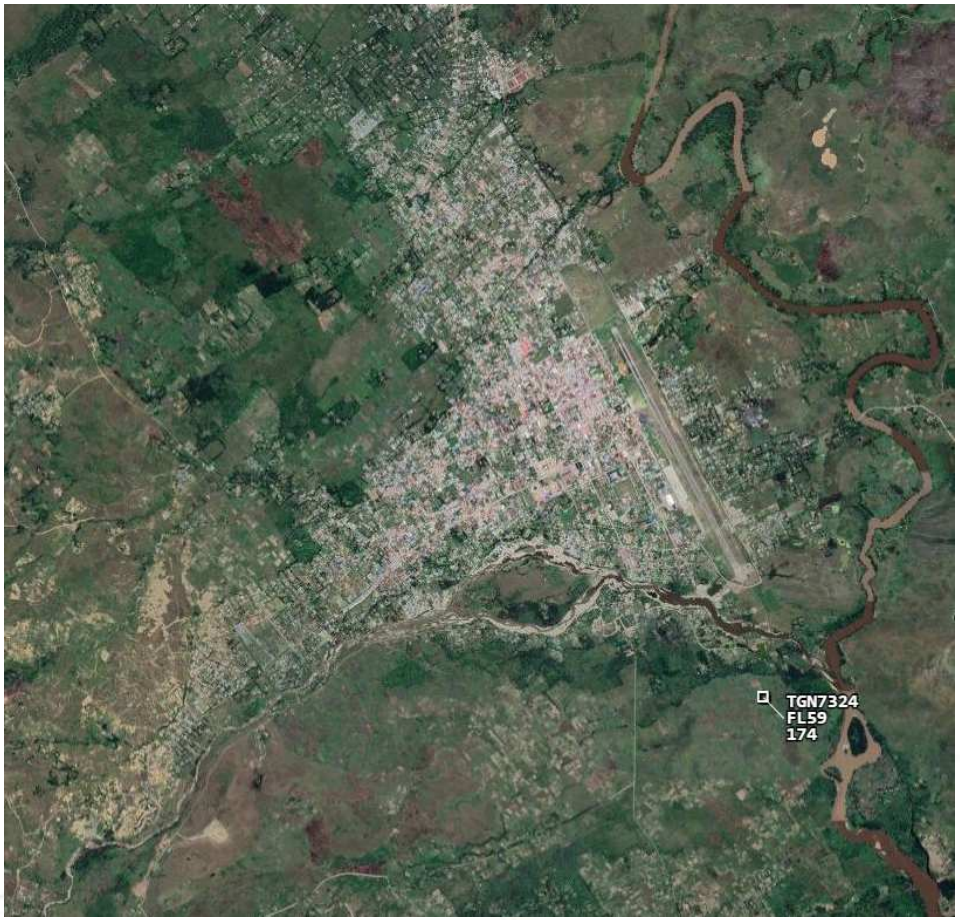
Complete the coverage

Space based ADS-B Completes the coverage

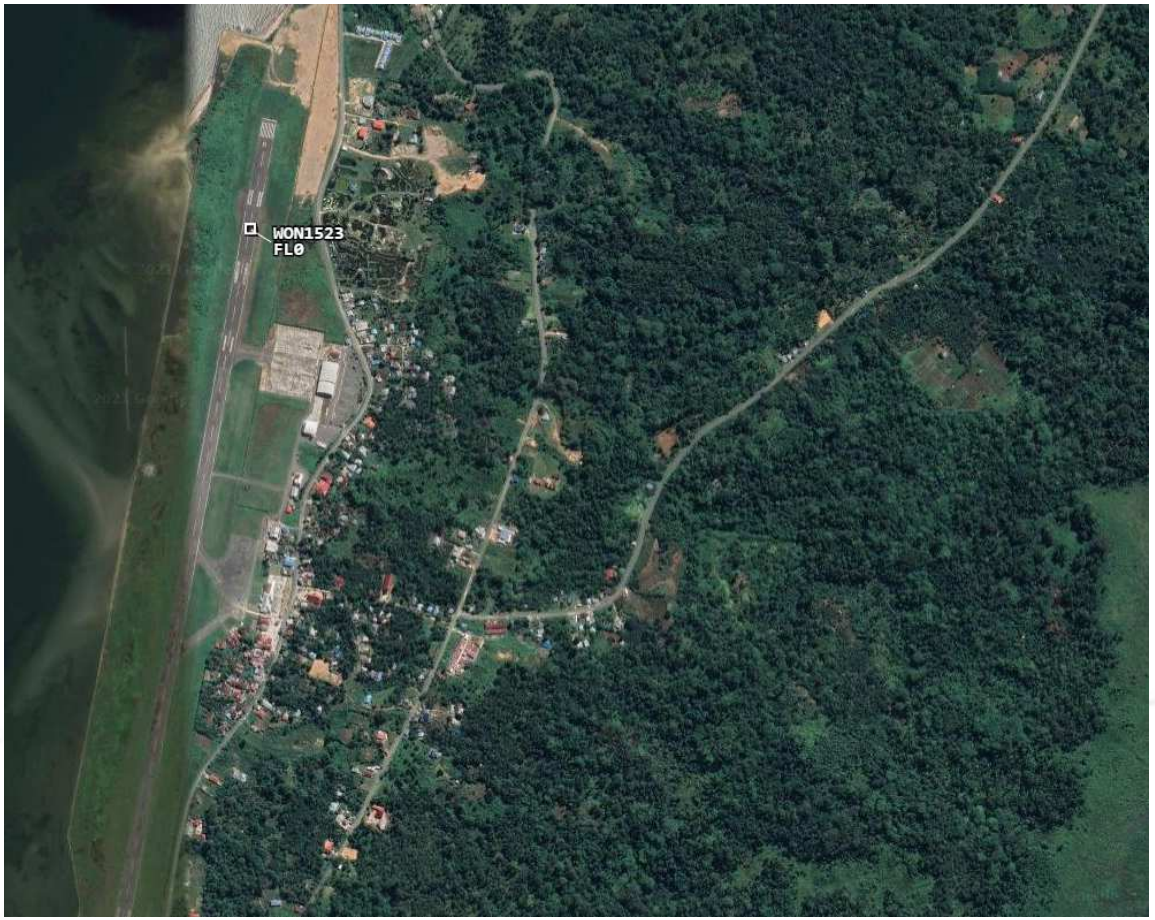
- **Remote terrestrial and Oceanic airspace**
- **Below and between radar and ADS-B ground stations**
- **At all runways and airports - even remote dirt strips**
- **For all equipped aircraft**
  - ✈ 125 watt and top antenna



Coverage to the ground



Bandar Udara Wamena (West Papua)



Kaimana airport (West Papua)

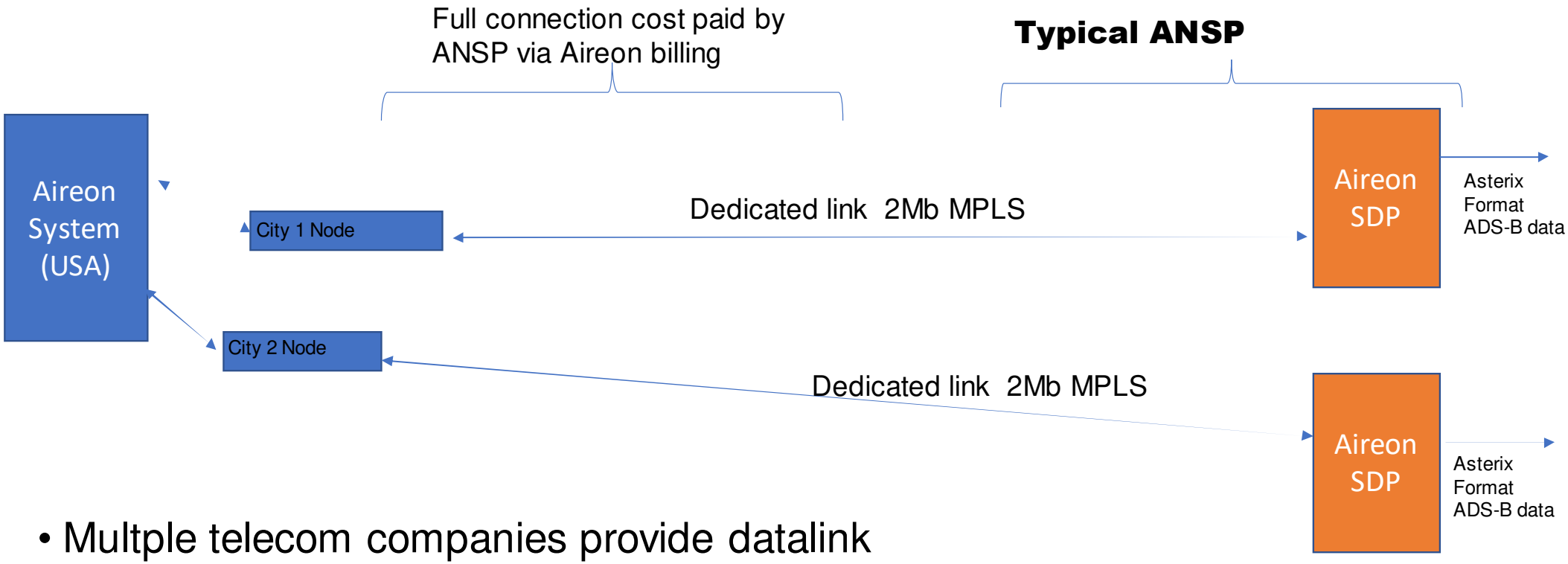
Royal Flying Doctor on dirt strip in remote Australia

VH-XUW EC135 on ground @ Port Headland amongst buildings

Jakarta – on ground aircraft

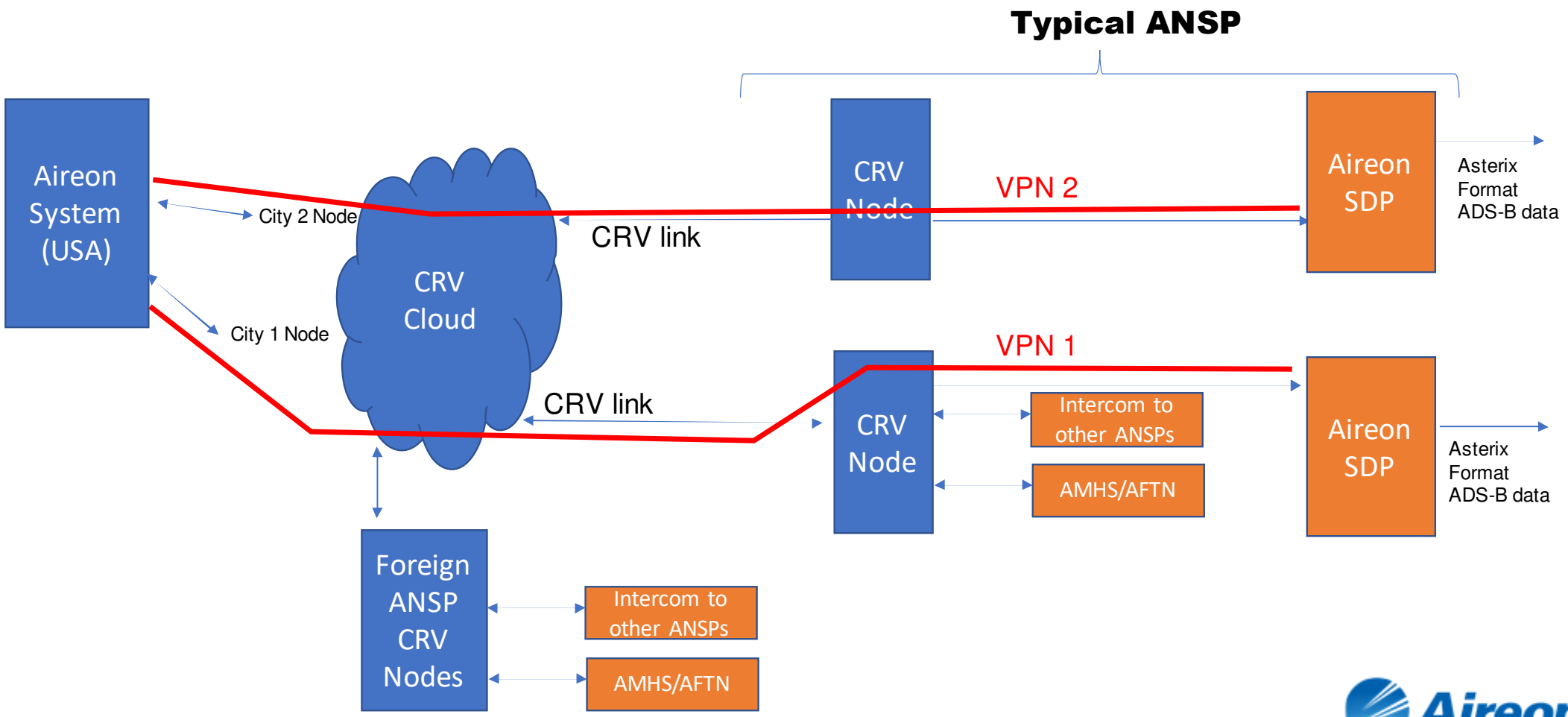
Use of CRV to reduce costs

Typical Aireon deployment : Using MPLS



- Multple telecom companies provide datalink service (USA to ANSP)
- Telecom companies contracted to Aireon
  - their performance is part of the Aireon service

Use CRV to reduce recurring cost



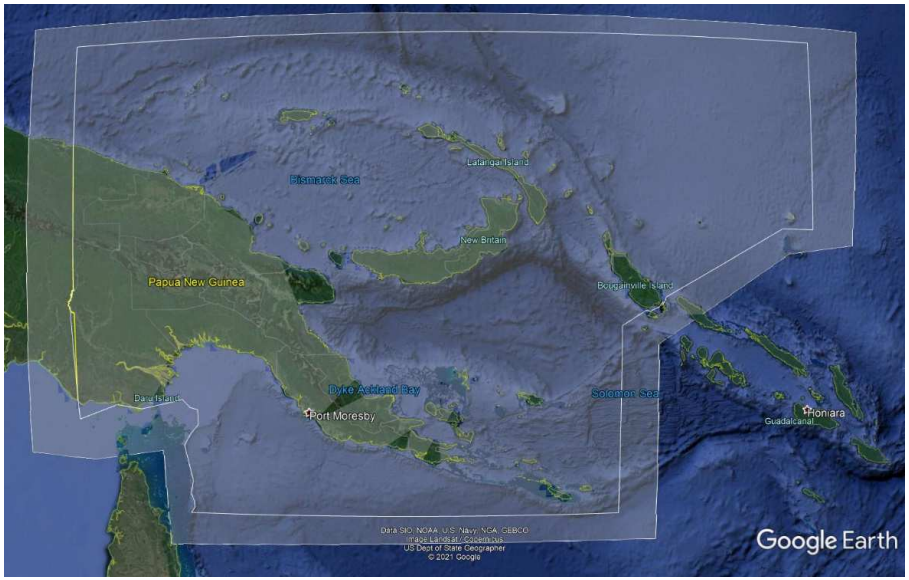
Customer choice regarding communications

- Duplicated or not
- CRV or Not
- Mixed (One CRV and one direct) is OK too
- CRV over MPLS or CRV over VSAT

Space based ADS-B USE CASES

Use Case : 5 Nm Enroute surveillance

- With VHF voice communication
- ICAO requirements remain the same. ADS-B is ADS-B.
- As used by Canada in Edmonton ATC Centre
- To be used by PNG



PARA 8.7.3

Doc 4444-ATM
Amendment No. 9
5/11/20

8.7.3 Separation minima based on ATS surveillance systems

8.7.3.1 Unless otherwise prescribed in accordance with 8.7.3.2, 8.7.3.3 or 8.7.3.4, or Chapter 6 (with respect to independent and dependent parallel approaches), the horizontal separation minimum based on radar and/or ADS-B and/or MLAT systems shall be 9.3 km (5.0 NM).

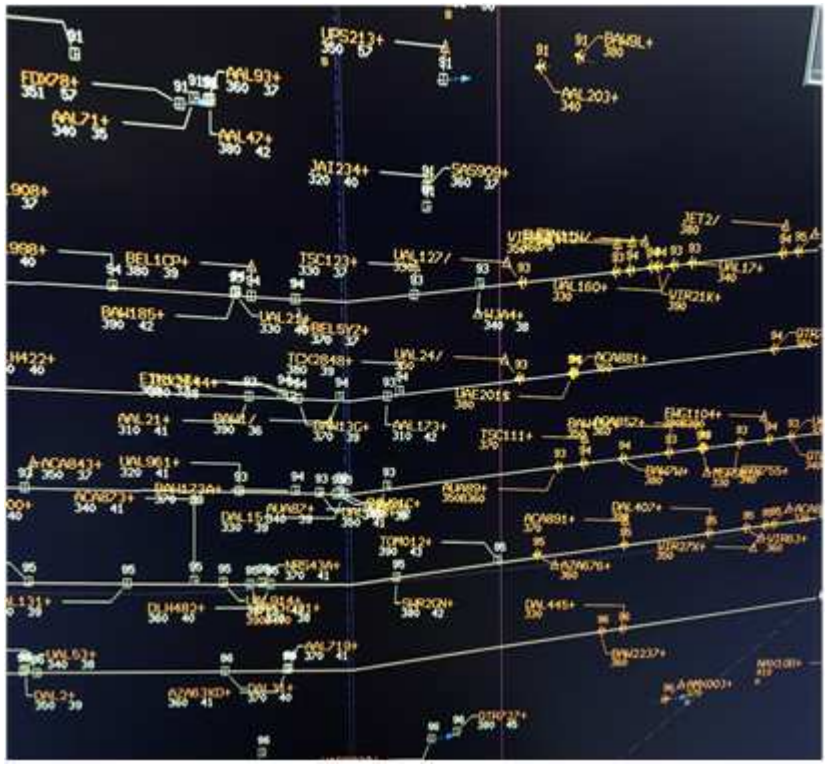
8.7.3.2 The separation minimum in 8.7.3.1 may, if so prescribed by the appropriate ATS authority, be reduced, but not below:

a) 5.6 km (3.0 NM) when radar and/or ADS-B and/or MLAT systems' capabilities at a given location so permit; and

b) 4.6 km (2.5 NM) between succeeding aircraft which are established on the same final approach track within 18.5 km (10 NM) of the runway threshold. A reduced separation minimum of 4.6 km (2.5 NM) may be applied, provided:

Use Case : Reduced Oceanic separation standards

- As per Doc 4444 amendment 9 use Space based ADS-B and CPDLC to reduce Oceanic separation to
  - ✈19Nm lateral / 17 or 15Nm longitudinal
- Used by
  - ✈ Canada – North Atlantic
  - ✈ UK NATS – North Atlantic



PARA 8.7.4

Doc 4444-ATM
Amendment No. 9
5/11/20

8.7.4 Separation minima using ATS surveillance systems where VHF voice communications are not available

8.7.4.2 Unless otherwise prescribed in accordance with 8.7.4.3 and 8.7.4.4, the separation minima shall be:

a) 35.2 km (19.0 NM) lateral spacing between parallel or non-intersecting tracks;

b) 35.2 km (19.0 NM) lateral separation of aircraft operating on intersecting tracks applied in accordance with 5.4.2.1.5 a) and b);

c) 31.5 km (17.0 NM) longitudinal separation of aircraft operating on same tracks or crossing tracks applied in accordance with 5.4.2.9.5 provided that the relative angle between the tracks is less than 90 degrees; and

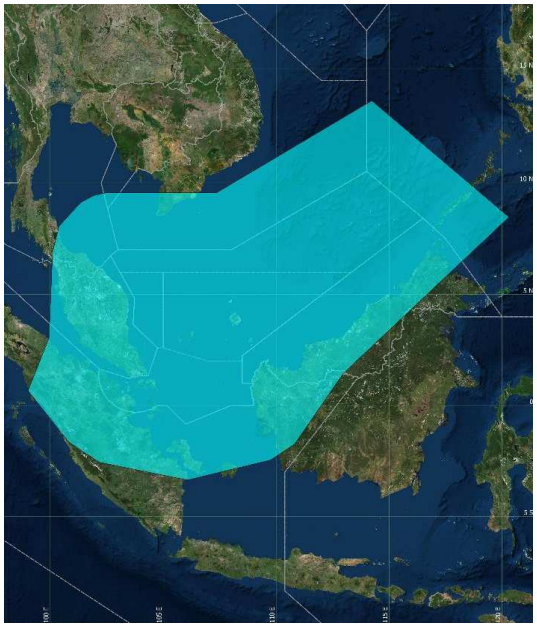
d) opposite direction aircraft on reciprocal tracks may be cleared to climb or descend to or through the levels occupied by another aircraft, provided that surveillance position reports have been received from both aircraft demonstrating the aircraft have passed each other by 9.3 km (5.0 NM).

8.7.4.3 The separation minimum in 8.7.4.2 a) may, if so prescribed by the appropriate ATS authority, be reduced, but not below 27.8 km (15.0 NM), provided either:

Use case : Situational Awareness

- **Reduce workload**
  - Reducing or removing voice position reports and processing
  - Remove need for stepped climbs
  - Remove need for “reaching level” reports
  - Reduce voice communication to remove uncertainty
  - Definite passing support
- **Increase safety**
  - Safety nets
  - SAR
  - Situational awareness
    - Aircraft level
    - Approaching FIR / boundary safety
    - At remote towers or remote airports without towers

- **Used by**
  - India – operatioal=
  - Singapore - operational
  - PNG – CRV operational



Use case : Reduce surveillance cost of ownership

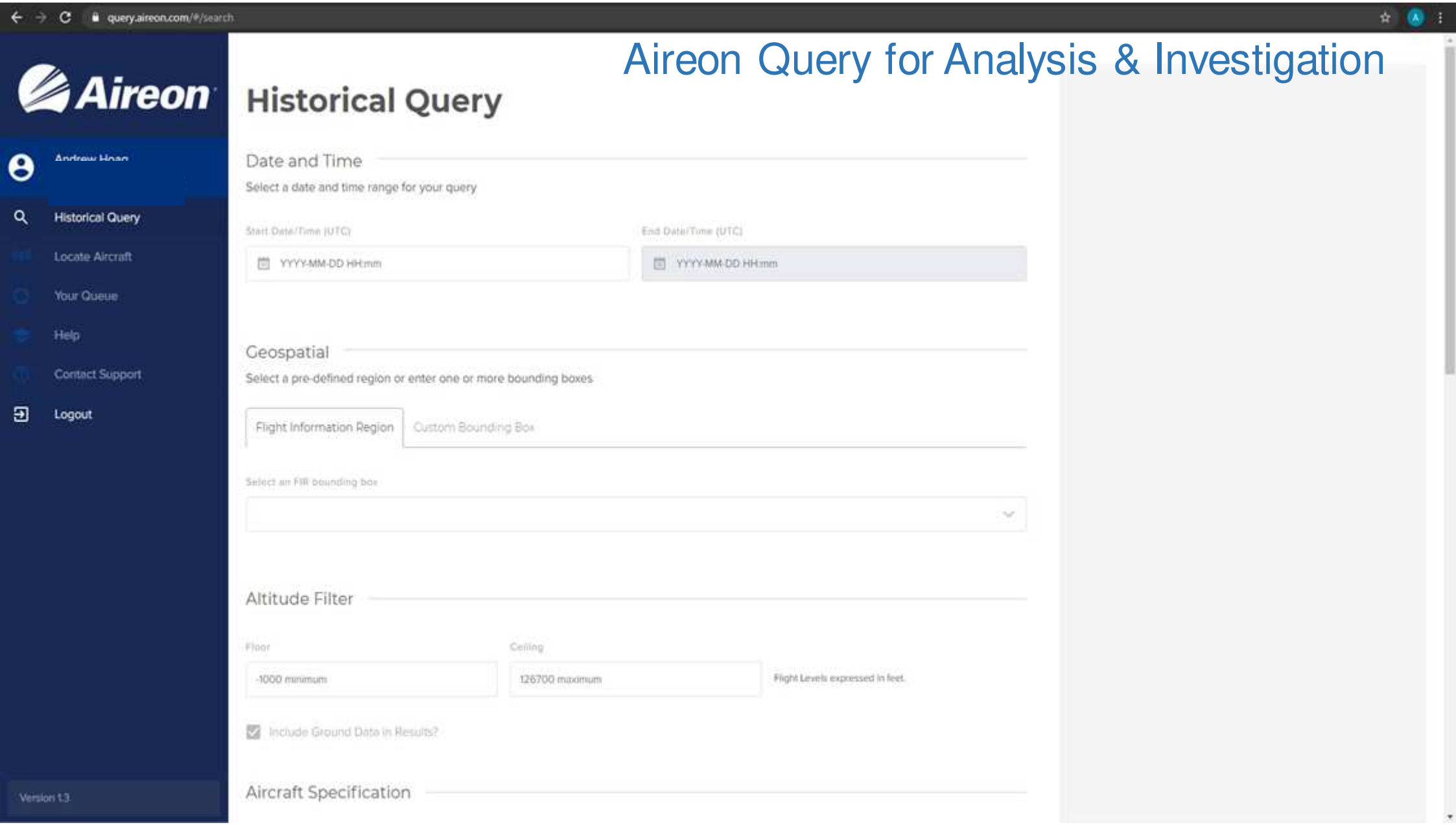
- **Replace**
  - Replace ADS-B or radar ground stations with Space based ADS-B
- **Partially replace**
  - Space based ADS-B instead of terrestrial duplication (One pathTerrestrial – One path Space based)
- **Surveillance as a service**
  - Operational budget instead of capital
  - Maintenance provided by Aireon
  - Aireon provides upgrades when required eg DO260C
  - Remove cost uncertainty (fixed price or flight hour charge)

Commercial Services Product Portfolio

Quick Reference

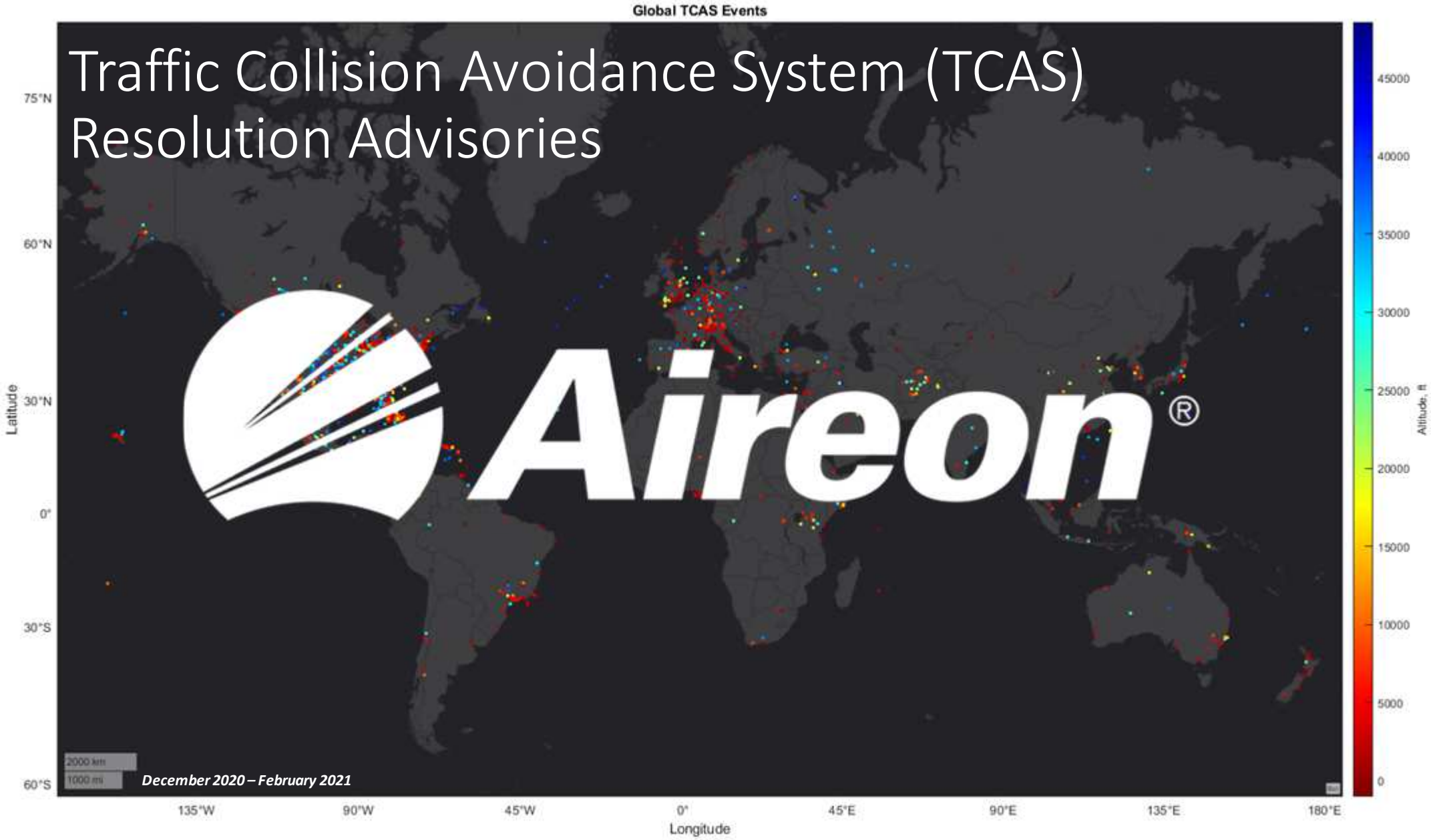
	Aireon STREAM	Aireon INSIGHTS	Aireon FLOW
Data Designed for ATFM			●
Real-Time Position Data Stream	●		●
Includes Additional Contextual Data	●	●	
Historical Data Available		●	
Data Filtering	Global, Aircraft Tail Numbers, OR Area of Interest	Aircraft Tail Numbers OR Area of Interest	Proximity to Area of Responsibility (AoR) or Flight Information Region (FIR)
Standard Data Feeds	Aircraft Tracking, Airport/ Airspace Analysis		
Tailored Data Feed	●		●
Customizable Reports		●	
Coverage Area	Global	Global	Global
Update Rate	Customizable, 4s, 8s, 1 min, 5 min	Daily, Weekly, Monthly	Customizable, up to once per minute
Low Latency Data Source	●		●
AMQP Support	●		●
Compatible with ATFM, SWIM Node, and A-CDM Systems			●
Data Provenance	Aireon's high-fidelity, low-latency surveillance-grade data	Aireon's high-fidelity, low-latency surveillance-grade data	Aireon's high-fidelity, low-latency surveillance-grade data

AFTM updates Departure to Destination – Worldwide



Aireon Query for Analysis & Investigation

Traffic Collision Avoidance System (TCAS) Resolution Advisories

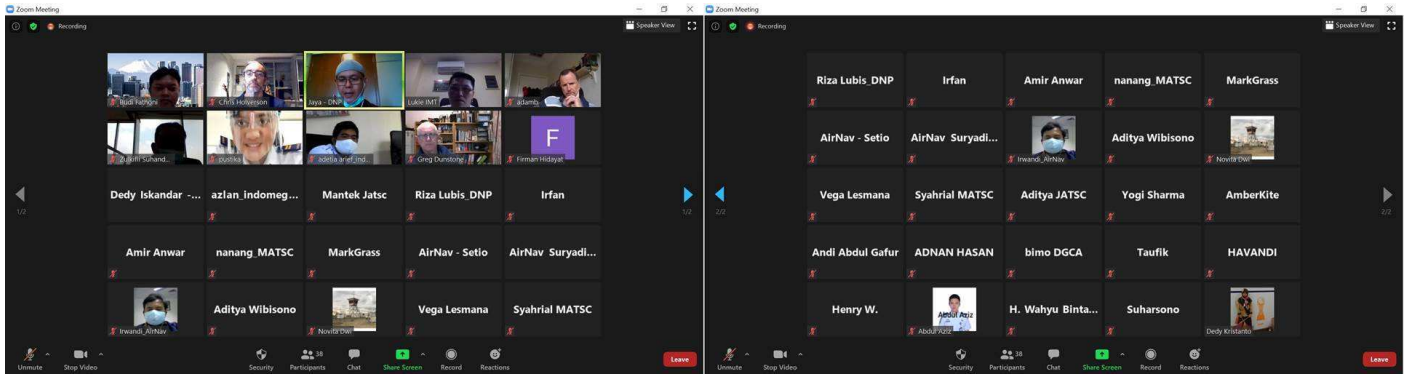


Challenges & Solutions
- No travel / - Automation integration

CoVID Impacts – Asia Pac

Aireon deployment in a COVID world

- Shipment
- ANSP or agent installation
- Remote checkout with help of ANSP via Zoom/Teams etc
- Site acceptance testing via Zoom/Teams etc
- Coordination with ATC automation system vendors for integration
- Many meetings / Team work / Motivation



Why Space based ADS-B ?

- **Surveillance as a service**
  - ✈ Financial efficiency
  - ✈ Known operating cost (fixed per year or variable based on traffic volume)
    - no financial surprises
  - ✈ Very low capital cost. Reduce need for terrestrial duplication (where terrestrial is required)
  - ✈ No maintenance costs, minimal staff costs
  - ✈ Low cost for surveillance coverage
  - ✈ Data communication cost lower if CRV used.
- Airline Customer value
  - ✈ Reduced position reports & pilot workload
  - ✈ Seamless service everywhere – completes the coverage
  - ✈ Safety
- Safety improvement
  - ✈ Surveillance to ground level everywhere – completes the coverage
  - ✈ Search & Rescue improvement / Situational awareness
  - ✈ Situational awareness at FIR boundary into adjacent FIR
  - ✈ Independent of terrestrial events (earthquake, fire, weather, flood etc)

Customized Commercial Proposals

- Fixed per month
  - If traffic climbs you don't pay more
  - Good for fixed budgets
- Or Fixed per Flight hour
  - If traffic drops – you pay less
- Price depends on use case
  - Tier 1 : ATC separation
  - Tier 2 : Support procedural ATC
  - Tier 3 : Flight service
  - Supplement existing surveillance
  - Coverage beneath radar coverage
  - Surveillance where there is none
  - FIR boundary safety
  - Remote towers