सत्यमेव जयते

नागर विमानन मंत्रालय, भारत सरकार

MINISTRY OF CIVIL AVIATION, GOVERNMENT OF INDIA

भारतीय विमानपत्तन प्राधिकरण

AIRPORTS AUTHORITY OF INDIA

ICAO APAC SBAS-GBAS IMPLEMENTATION WORKSHOP FOR AIRSPACE USERS

"Enhancing airport accessibility and safety on final approach with SBAS and GBAS"

14th to 16th October 2025

Bengaluru, India

Concept and benefits of GBAS - SBAS

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Regional Sub-Office

ICAO

GBAS & SBAS

Concept

Benefits

Implementation challenges

Satellite constellations

- GPS
- Glonass
- Galileo
- Beidou

Several types of errors :

- Satellite clock & ephemerid
- Ionosphere
- Troposphere

And lack of integrity

Need to elaborate corrections

Global Navigation Satellite System (GNSS)

GPS

Glonass

Galileo

Beidou

Three types of augmentations

\+

ABAS 

Aircraft Based Augmentation System

GBAS 

Ground Based Augmentation System

SBAS 

Satellite Based Augmentation System

Future : Development of dual frequency multi constellation receiver. Great improvement of PBN coverage all over the globe, especially for the vertical.

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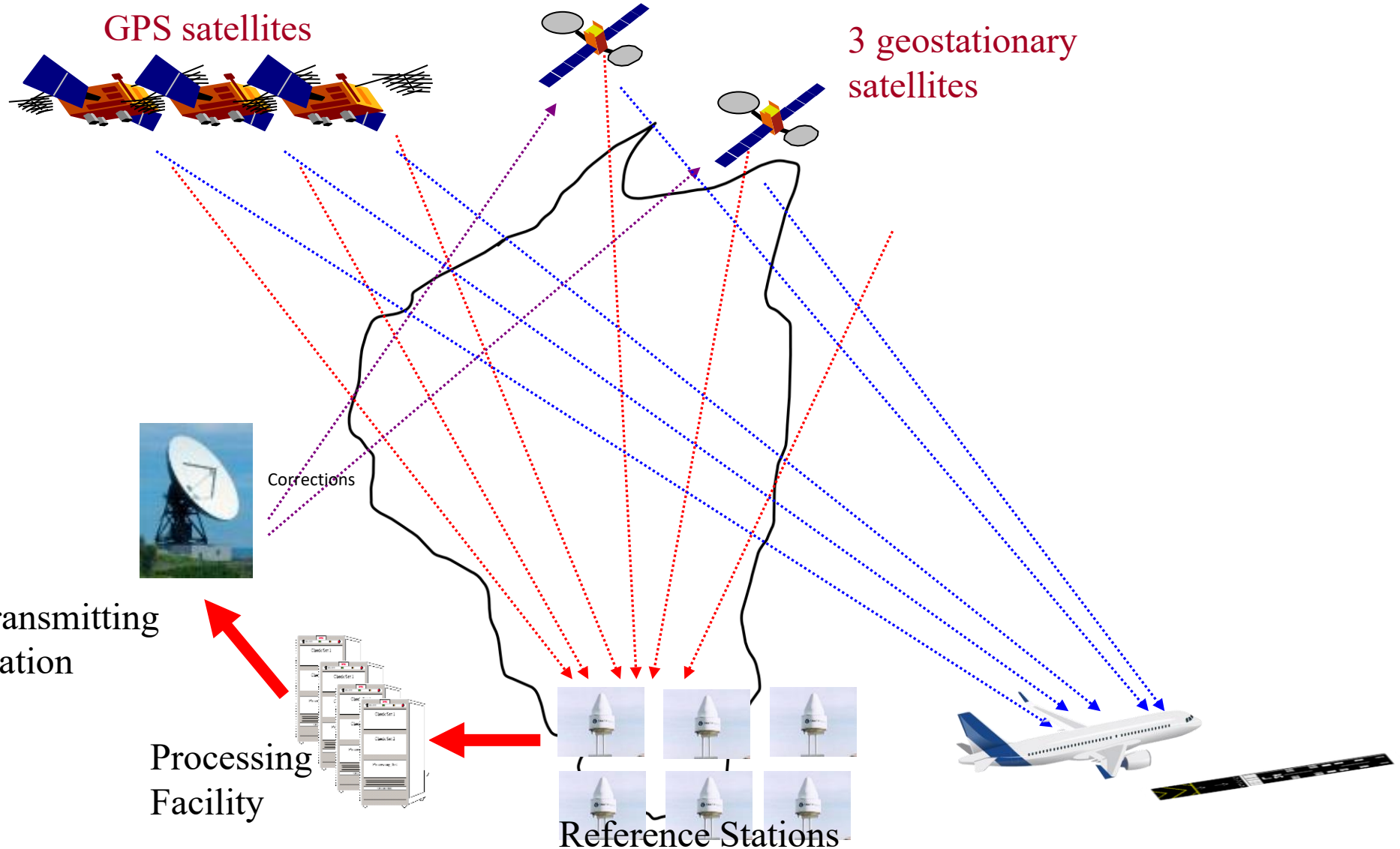
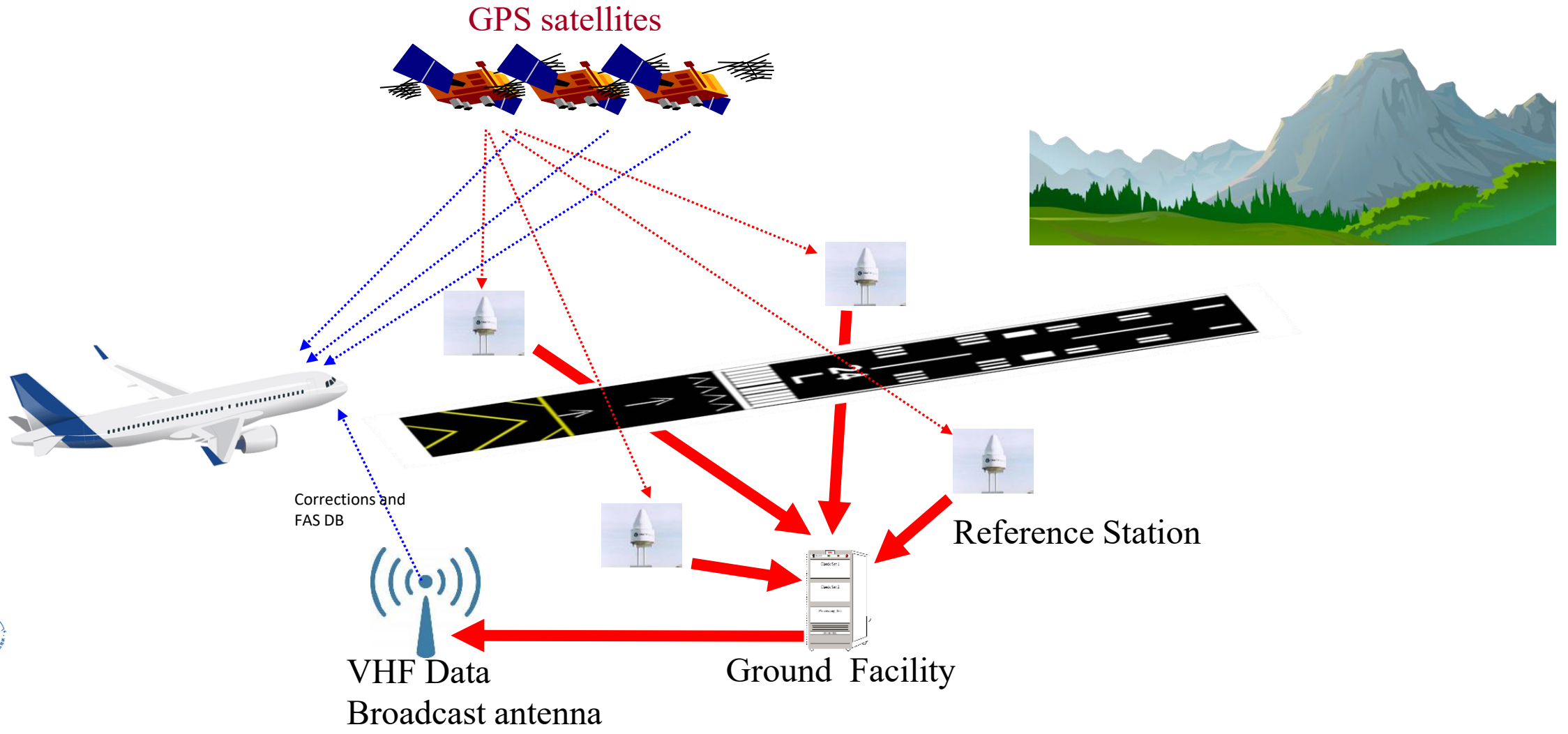
SBAS architecture



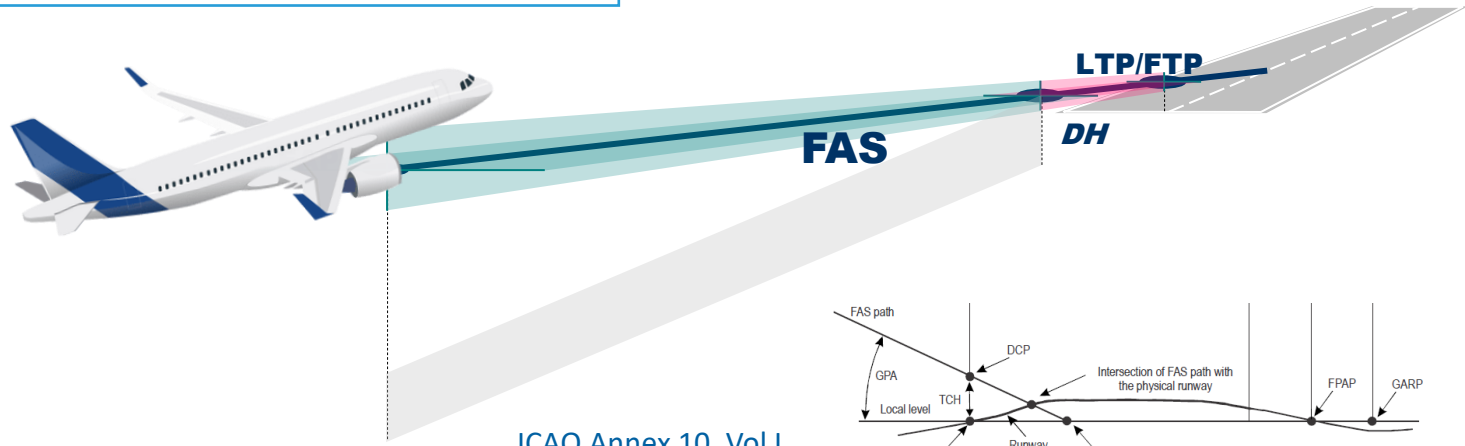
GBAS architecture



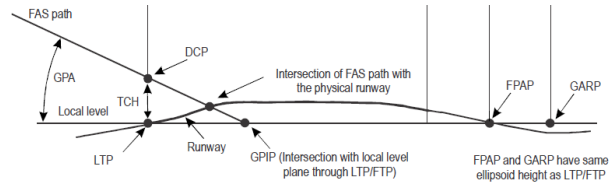
Final Approach Segment Data Block

Contains key parameters of the approach procedure

One FAS DB per approach procedure



ICAO Annex 10, Vol I



For GBAS, sent to the plane via VHF DB from GBAS ground station
For SBAS, stored in the aircraft data base

Pilot selects the desired approach and the avionics decodes the FAS DB, ensuring high level of integrity through the CRC (Cycle Redundancy Check)

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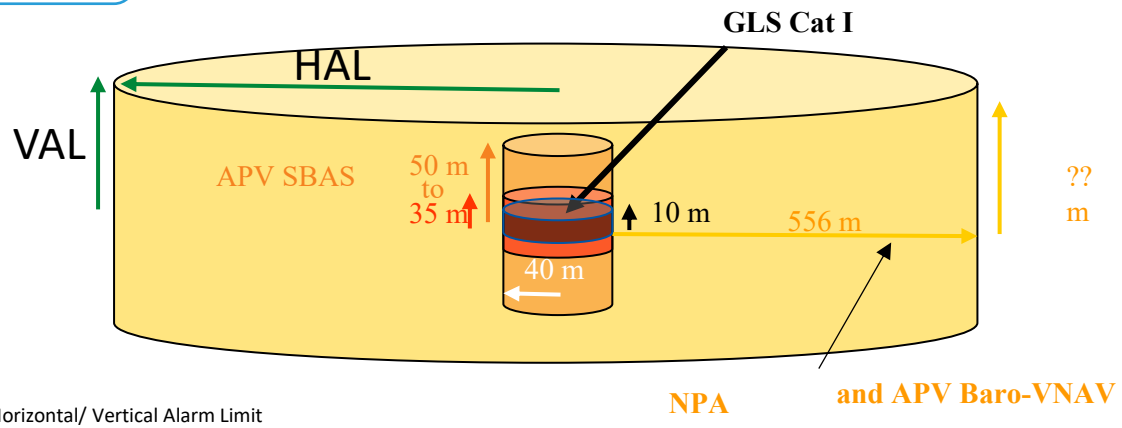
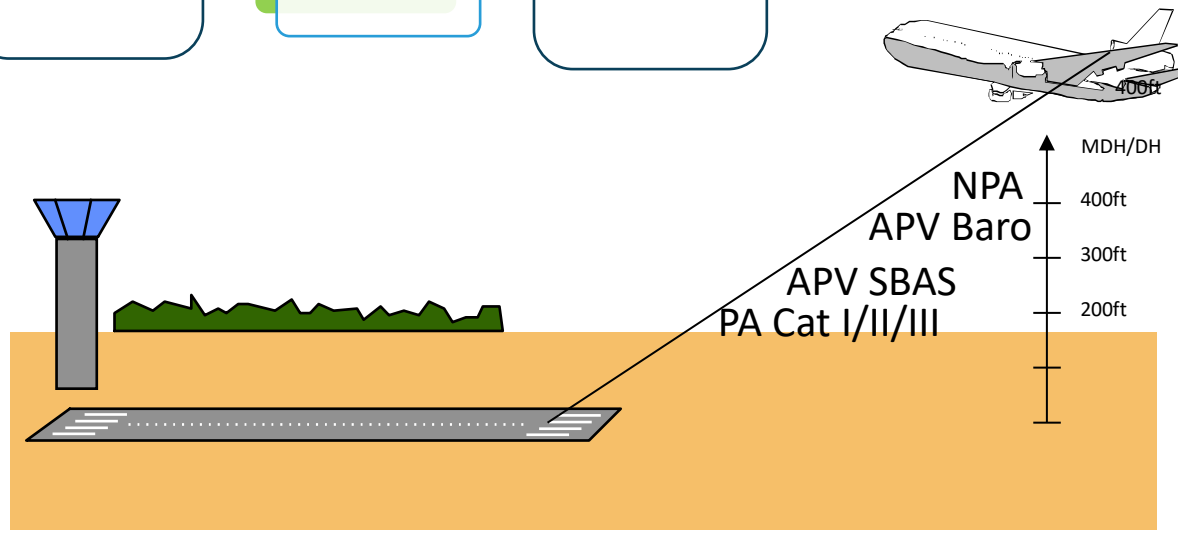
APV procedure

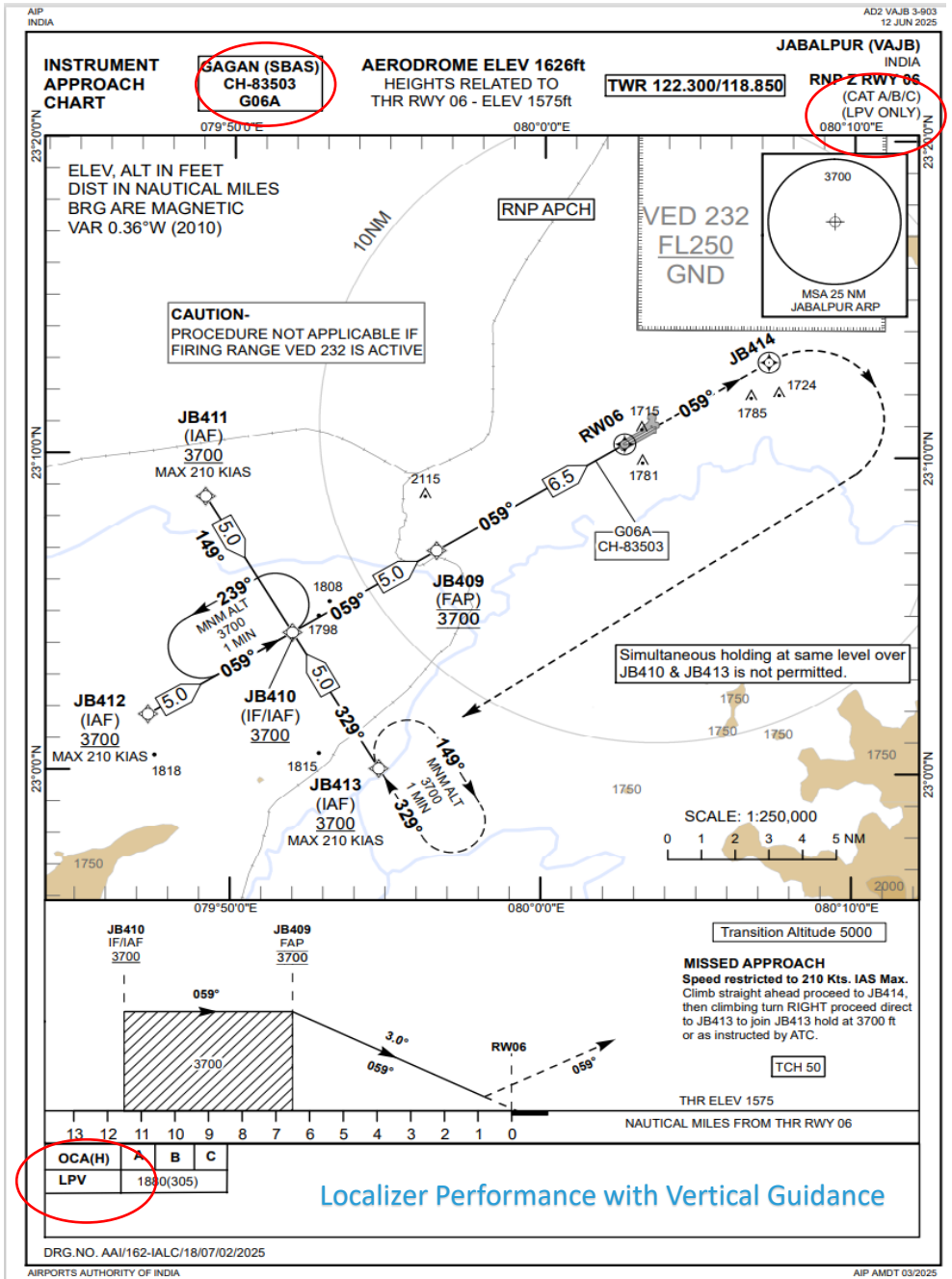
Source : ICAO Annex 6

- ICAO Approach classifications
  - Type A — Minima >= 250ft
    - Lateral (2D) — NPA — Non Precision Approach
      - Conventional Procedure
        - VOR/DME
        - NDB
        - LOC
  - Type B — Minima < 250 ft
    - Lateral and Vertical (3D) — PA — (Precision Approaches)
      - Conventional procedure
        - ILS MLS

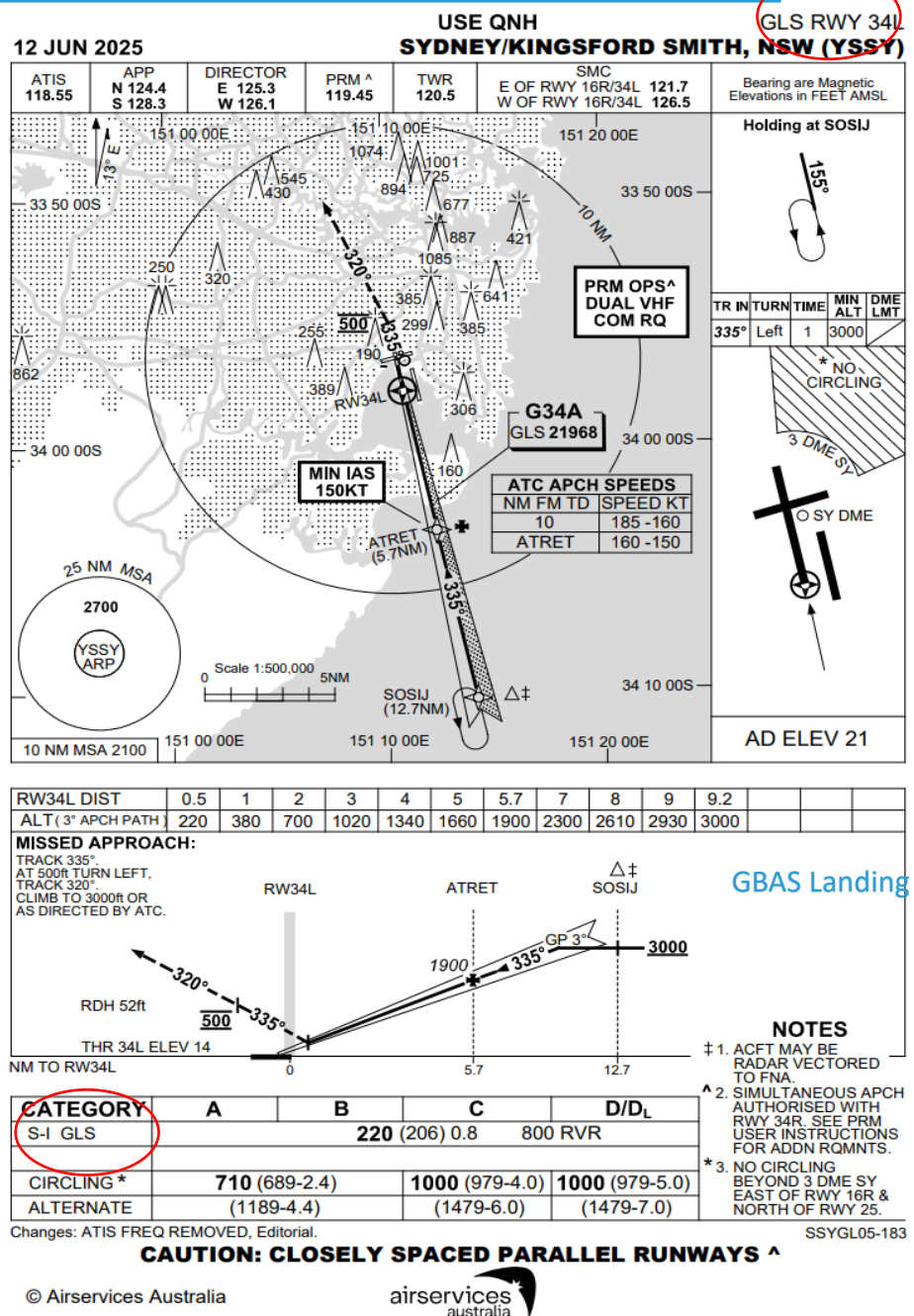




RNP with LPV minima and GLS charts



GLS RWY 34L



GBAS Landing System

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GBAS & SBAS

Concept

Benefits

Implementation challenges

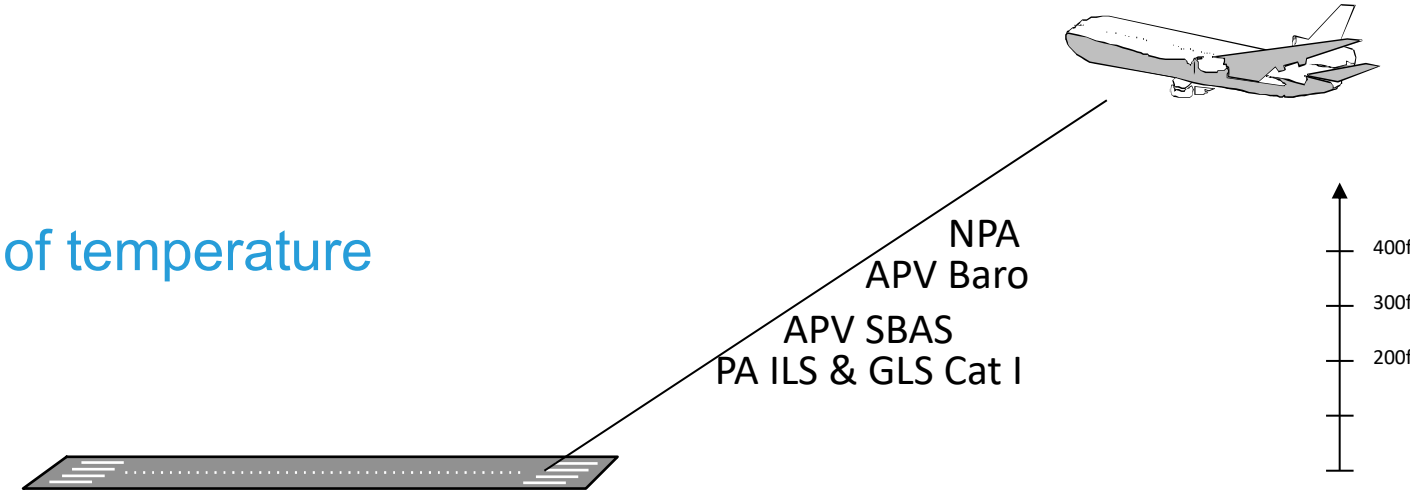
GBAS SBAS expected benefits

Main benefits on the final segment

Horizontal and Vertical **geometric** guidance to a Decision Altitude/Height

ILS look alike

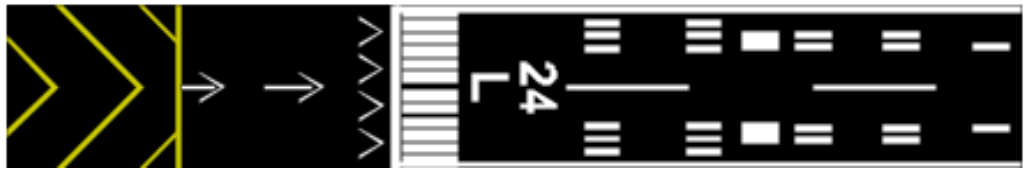
Independent of QNH setting and of temperature



NPA : Non Precision Approach
APV : Approach with Vertical guidance
PA : Precision Approach

GBAS SBAS expected benefits

- Can bring operations
  - SBAS : down to CAT I operations (APV 250 ft and SBAS CAT I 200 ft), not CAT II/III capable
  - GBAS : CAT I to CAT III operations (special study for Ionosphere)
- Can serve
  - SBAS : All IFR runway ends on a whole continent
  - GBAS : All IFR runway ends at the same airport



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GBAS SBAS expected benefits / Airlines

- ✓ILS like display in the cockpit so cost saving in pilot training
- ✓Improve accessibility to regional airports with RNP (LPV minima) approaches
- ✓Worldwide interoperability through GBAS/SBAS signal compliance to ICAO Standards Annex 10 and receiver standards
- ✓Improve safety and efficiency of procedures, reducing CO2 emissions and fuel consumption
- ✓Integrity of navigation approach segment data with FAS DB CRC

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GBAS SBAS expected benefits / ANSP - Airport

Improve safety and efficiency of procedures, reducing CO2 emissions

Less ground navaid infrastructure, saving costs

- GBAS :
  - ✓ One station to serve several runway ends
  - ✓ Much less sensitive area around GBAS station compared to ILS installation
  - ✓ Flexibility in the modifications of the approach data
- SBAS :
  - ✓ One system serving many airports
  - ✓ Can be used by Helicopter for PINS approach

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GBAS SBAS expected benefits / ATC

✓ **Stabilized & Predictable Approaches**
Highly precise paths reduce deviations, unstable approaches, and missed approaches — improving traffic sequencing and predictability.

✓ **Lower ATCO Workload**
Aircraft follow procedures down to DH with minimal vectoring, easing monitoring demands and reducing urgent re-directs.

✓ **Reliable Alternate to (ILS) or other landing procedures**
Maintains landing capability and traffic flow when ILS or other types of landing procedures is unavailable or under maintenance.

✓ **Enable High-Capacity Parallel Operations**
Precision supports simultaneous parallel approaches, sustaining runway throughput safely and efficiently.

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GBAS & SBAS

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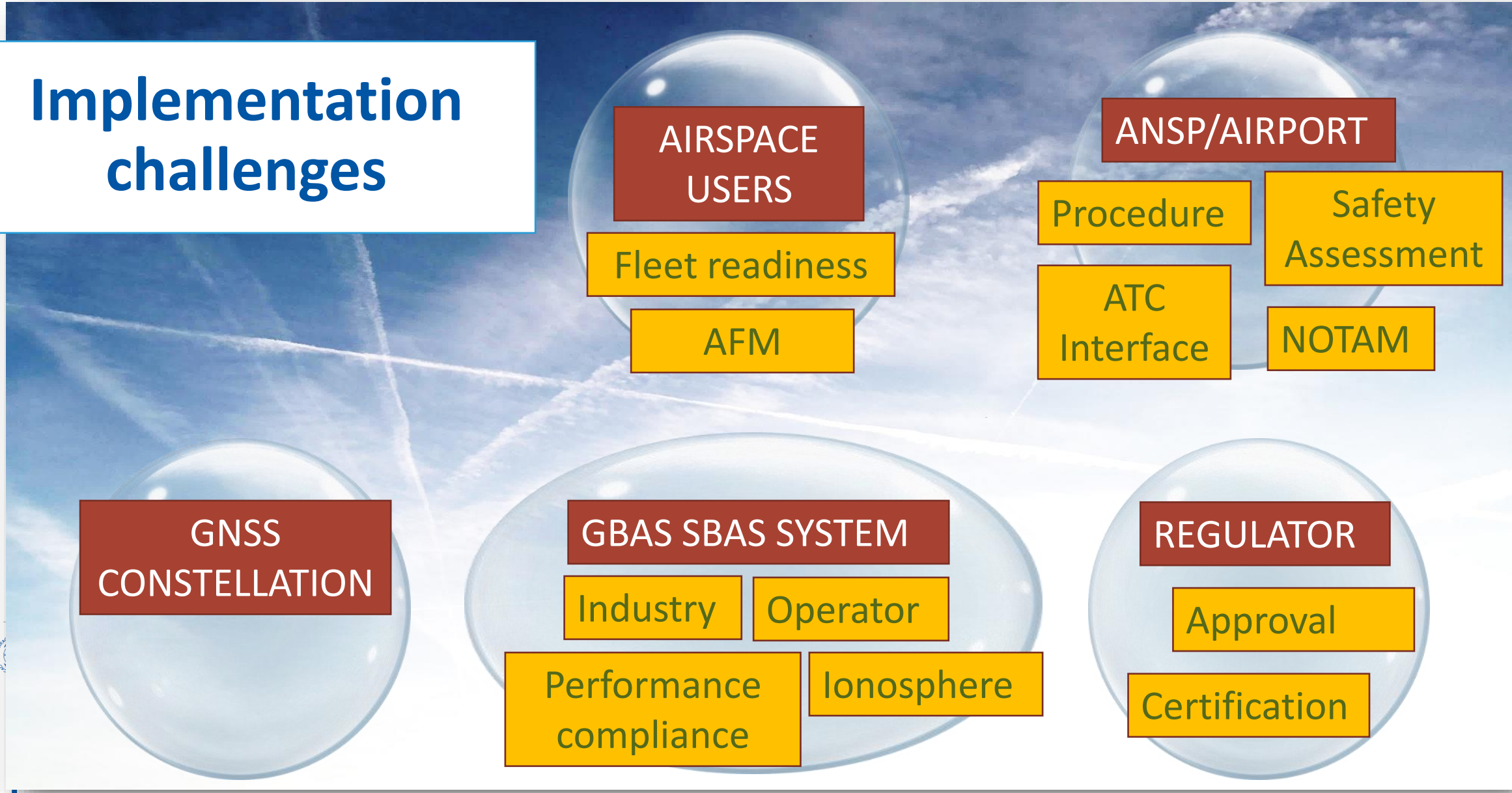

Implementation challenges

Way forward

- Assess your airspace user and ANSP/airport needs in your State

- Consult with
  - your neighboring countries if you wish to use their SBAS system and with
  - countries who have already implemented GBAS system and GLS operations.

- Conduct test bed/simulation to assess the feasibility in your own environment.

- Attend ICAO regional meetings and events to update your knowledge and share your experience

Enjoy the workshop

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Thank You!

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