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

Flight Validation of LPV (SBAS)

Capt. Anoop Kachroo

Chief Pilot & Director Operation, Flight Inspection Unit, Airports Authority of India

Mr. Sachin

Assistant General Manager, Flight Inspection Unit, Airports Authority of India

ICAO

FLIGHT VALIDATION OF LPV (SBAS)

01 Role and work profile of FIU (Flight Inspection Unit of AAI)

02 Introduction as a Flight validation Pilot

03 Pre Flight Duties

04 In Flight Checks

05 Post Flights Role

ICAO

01

Role and work profile of FIU (Flight Inspection Unit of AAI)

Short description in succinct summary (Introduction)

ICAO

SBAS Capability FIU Fleet

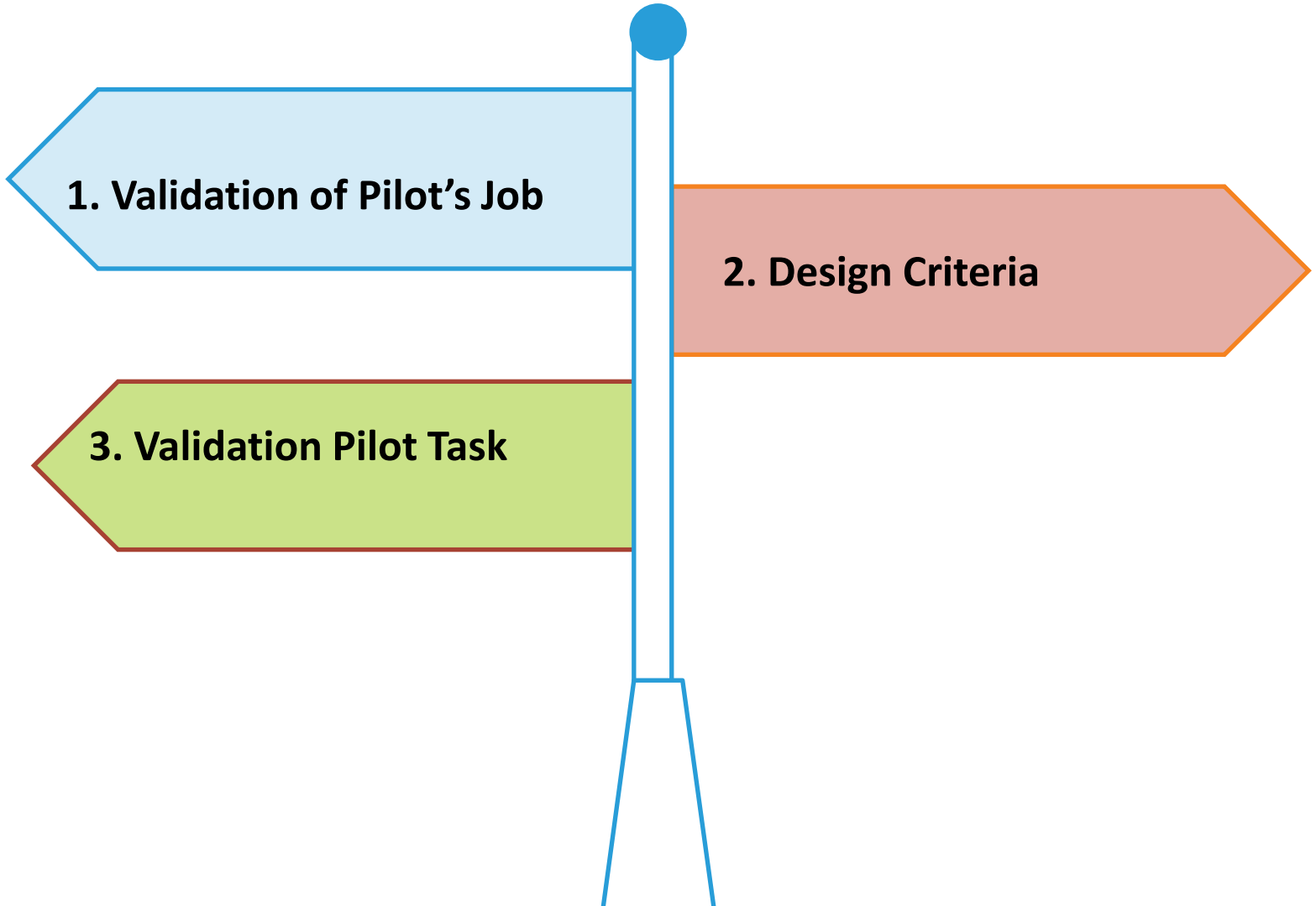
FIU Fleet – Global SBAS Capability

All FIU aircraft fitted with SBAS receivers
Compatible with 4 major service providers:

- WAAS – USA
- EGNOS – Europe
- MSAS – Japan
- GAGAN – India

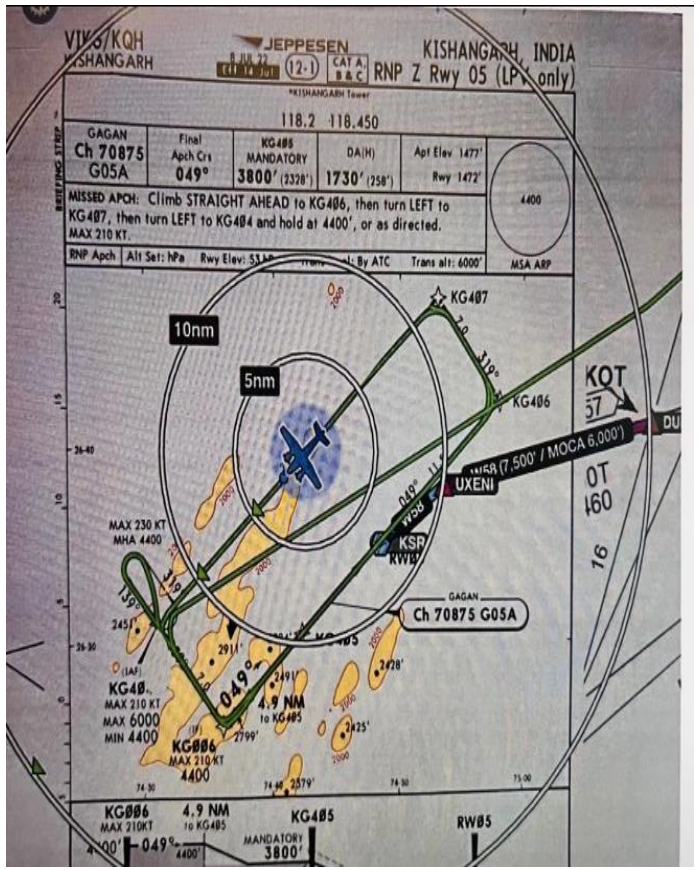
Ensures global interoperability and high-precision validation capability

02. Introduction as a Flight Validation Pilot



2.1 Satellite-Based Augmentation System (SBAS)

First AAI (FIU) successful SBAS procedure validation flight in August presence of DGCA officials on Board dated 13th December 2022 at VIKG and DGCA approval for special Ops PBN-RNP (LPV) for AAI,

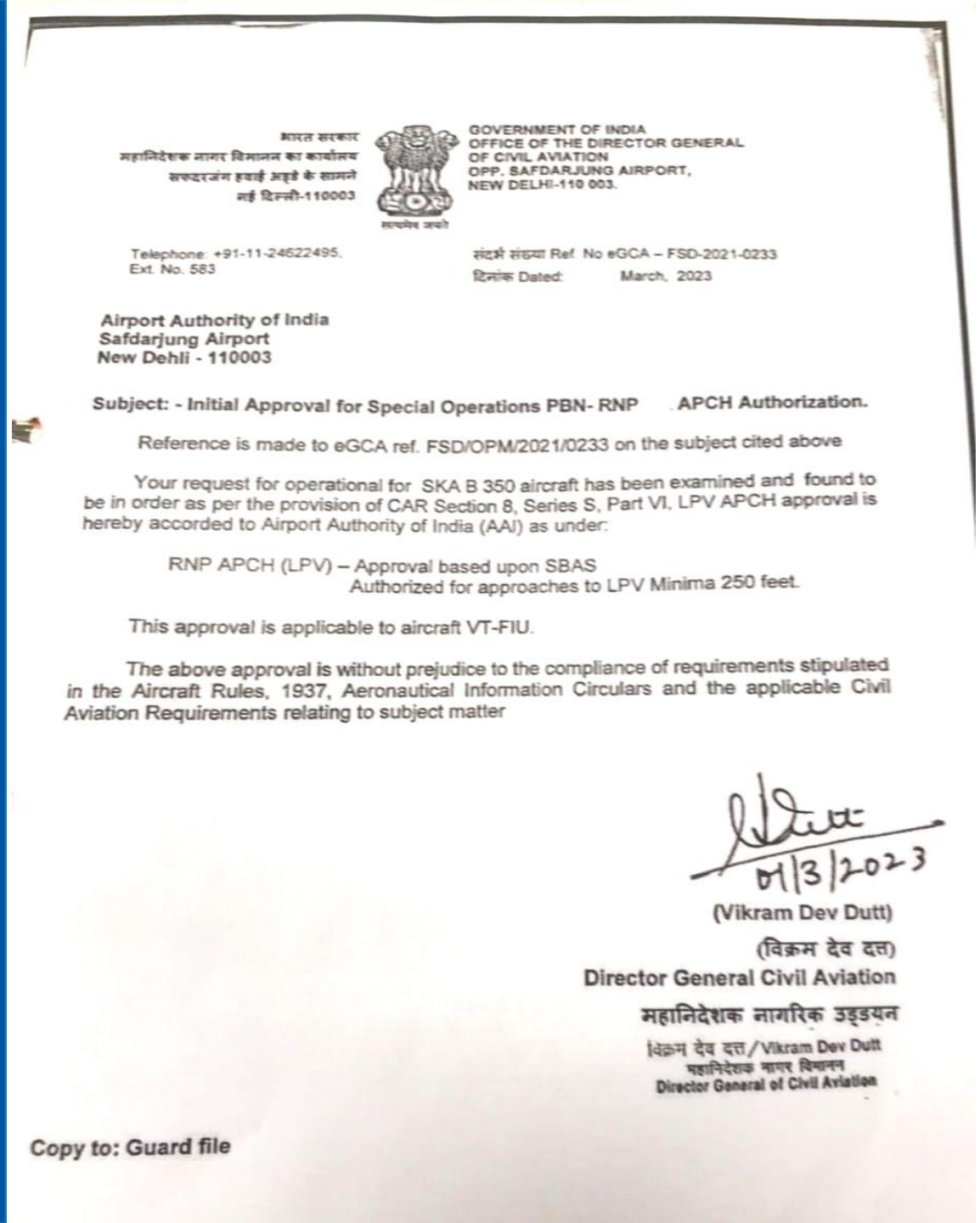


ICAO

2.2 SBAS procedures validation carried out by FIU

1. After successfully conducted Kishangarh SBAS procedure validation Flight and DGCA approval, AAI FIU has successfully completed the following SBAS procedure validation flight as under:

(i) Belagavi- VOBM RWY 26/08
(ii) Kandla- VAKE RWY 23/05
(iii) Jalgaon- VAJL RWY 27
(iv) Kolhapur- VAKP RWY 25
(v) Jabalpur- VAJB RWY 24
(vi) Porbandar- VAPR RWY 27
(vii) Udaipur- VAUD RWY 26
(Viii) Surat- VASU RWY 04



भारत सरकार
महानिदेशक नागर विमानन का कार्यालय
सफदरजंग हवाई अड्डे के सामने
नई दिल्ली-110003

GOVERNMENT OF INDIA
OFFICE OF THE DIRECTOR GENERAL
OF CIVIL AVIATION
OPP. SAFDARJUNG AIRPORT,
NEW DELHI-110 003.

Telephone: +91-11-24622495,
Ext. No. 583

संदर्भ संख्या Ref. No eGCA – FSD-2021-0233
दिनांक Dated: March, 2023

Airport Authority of India
Safdarjung Airport
New Dehli - 110003

Subject: - Initial Approval for Special Operations PBN- RNP APCH Authorization.

Reference is made to eGCA ref. FSD/OPM/2021/0233 on the subject cited above

Your request for operational for SKA B 350 aircraft has been examined and found to be in order as per the provision of CAR Section 8, Series S, Part VI, LPV APCH approval is hereby accorded to Airport Authority of India (AAI) as under:

RNP APCH (LPV) – Approval based upon SBAS
Authorized for approaches to LPV Minima 250 feet.

This approval is applicable to aircraft VT-FIU.

The above approval is without prejudice to the compliance of requirements stipulated in the Aircraft Rules, 1937, Aeronautical Information Circulars and the applicable Civil Aviation Requirements relating to subject matter

01/3/2023

(Vikram Dev Dutt)
(विक्रम देव दत्त)
Director General Civil Aviation
महानिदेशक नागरिक उड्डयन
विक्रम देव दत्त/Vikram Dev Dutt
महानिदेशक नागर विमानन
Director General of Civil Aviation

Copy to: Guard file

03

Pre Flight Duties

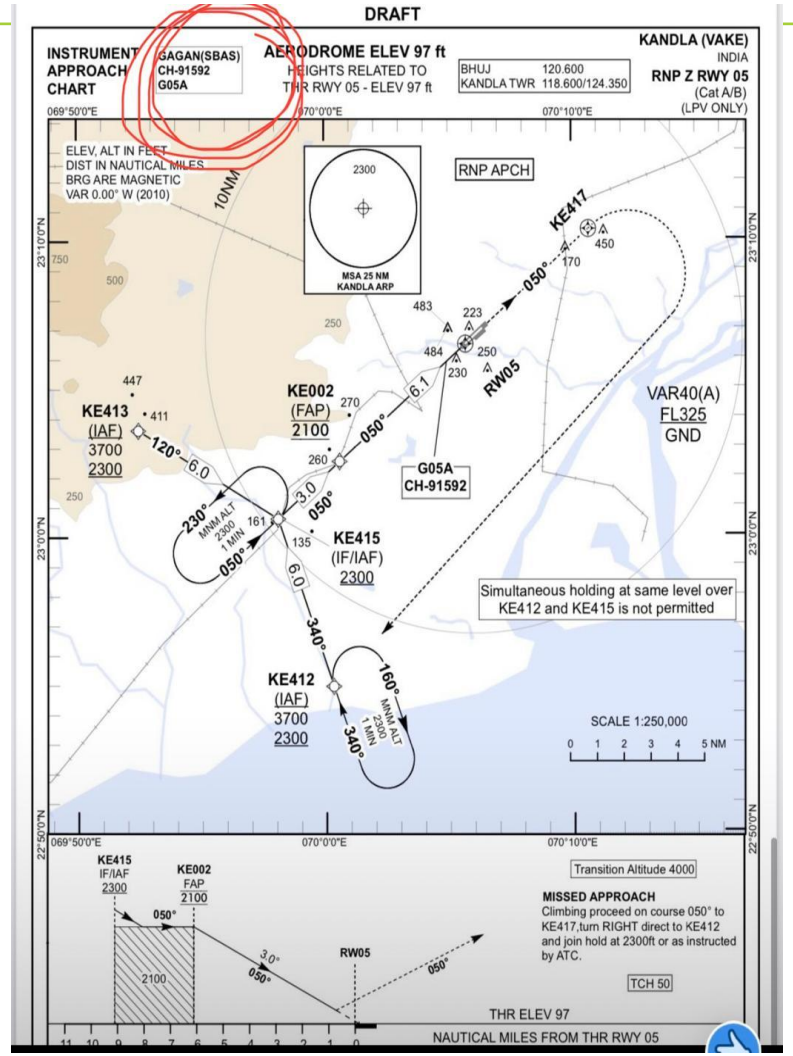
Pre Flight Duties as Validation Pilot

- Documentation & Briefing
- Aircraft & Avionics Preparation
- Calculations & Checks
- Coordination & Safety
- On Ground System Setup

3. Pre Flight Duties

Sub Para 2.

Aircraft and Avionics Preparation



04

In Flight Checks

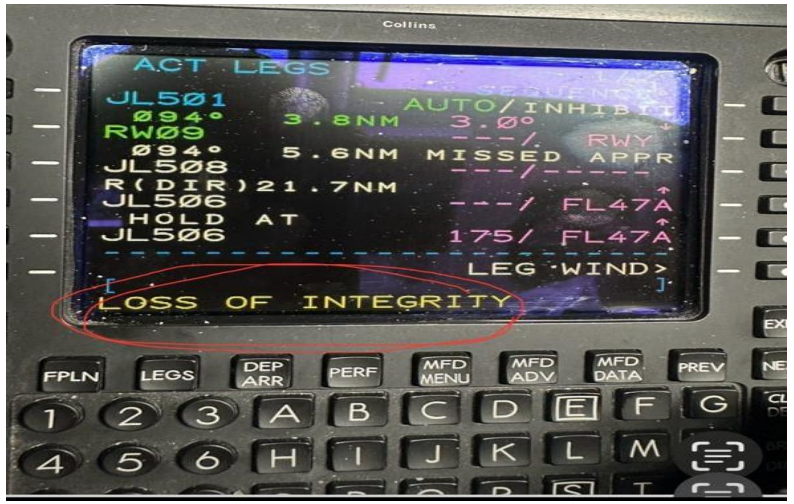
In flight Validation Task

1. Fly the LPV Procedure with auto Pilot coupling
2. General Flying and Safety
3. Navigation and Avionics Monitor
4. Flight profile execution
5. Monitor cockpit annunciations
6. Coordination with ATC and Inspection Team
7. Key Checks during Approach

ICAO

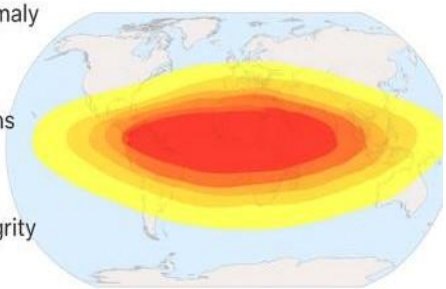
4.1

Ionospheric effect in India resulted in "loss of integrity" during LPV (SBAS) procedure validation on several occasions



Ionospheric Effects on SBAS Integrity

- India lies in equatorial anomaly region → high ionospheric disturbances
- Scintillation & TEC variations cause GNSS signal delay and errors
- Leads to loss of SBAS integrity → LPV minima may not be available



- Pilots may see: "LPV Not Available" / "Integrity Lost" messages
- Mitigation (AAI + ISRO): dense ground stations, signal monitoring, dual-frequency GNSS

ICAO

4.2

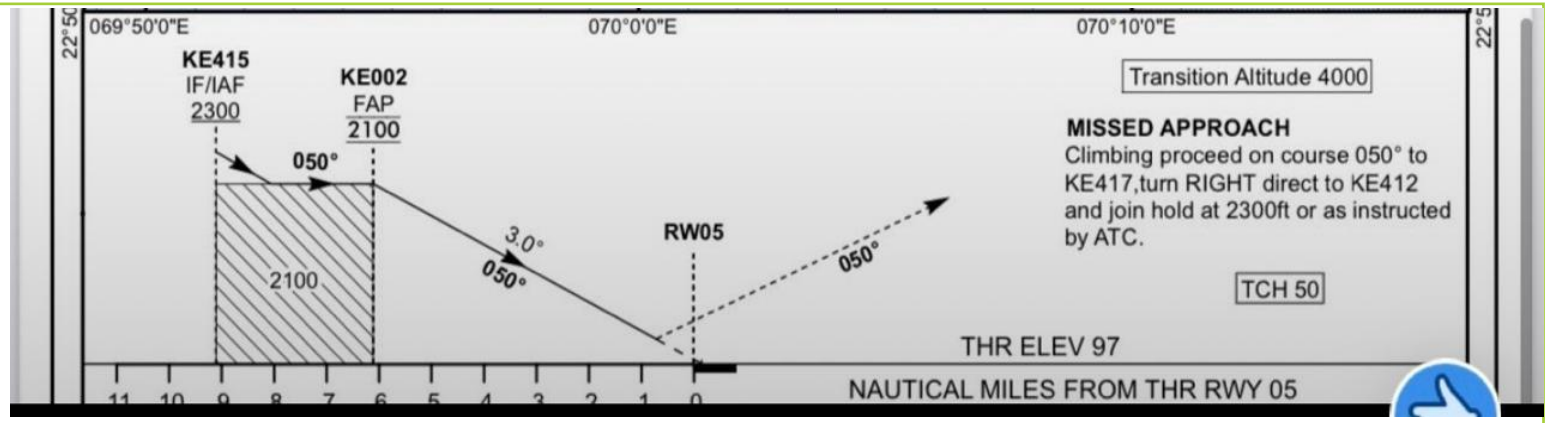
Key Advantages of SBAS (Flight Validation Pilot's View)

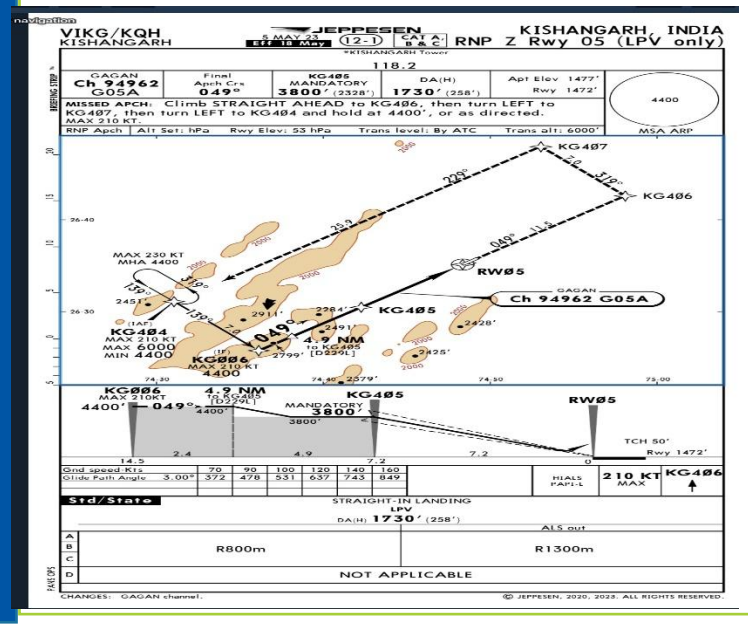
- No temperature errors/restrictions unlike RNP Approaches
- RAIM
- Vertical guidance without ground based equipment
- Wide area coverage
- Integrity Monitoring

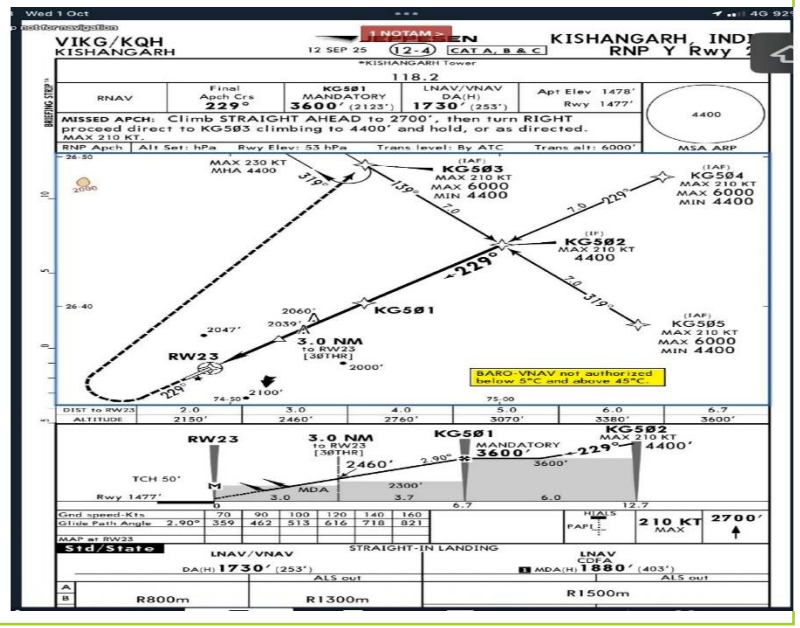
4.2.1

Key Advantages of SBAS

No temperature errors/restrictions unlike RNP Approaches







05

Post Flight Role

1. De-brief with procedure design team
2. Any anomalies observed
3. Procedure is not just compliant but operationally safe and sound
4. Flight Validation Report Preparation as per ICAO DOC 9906 guidelines
5. Conclusion

01
Introduction

Aerodata
AFIS 1210

02

Guidance Material

Ensure

Standardization

Accuracy

Safety

ICAO:

DOC 9906, Quality Assurance Manual for Flight Procedure Design

- Vol 5: Validation of Instrument Flight Procedures

DOC 8071, Manual on Testing of Radio Navigation Aids

- Vol 2: Satellite Based Augmentation Systems (SBAS)

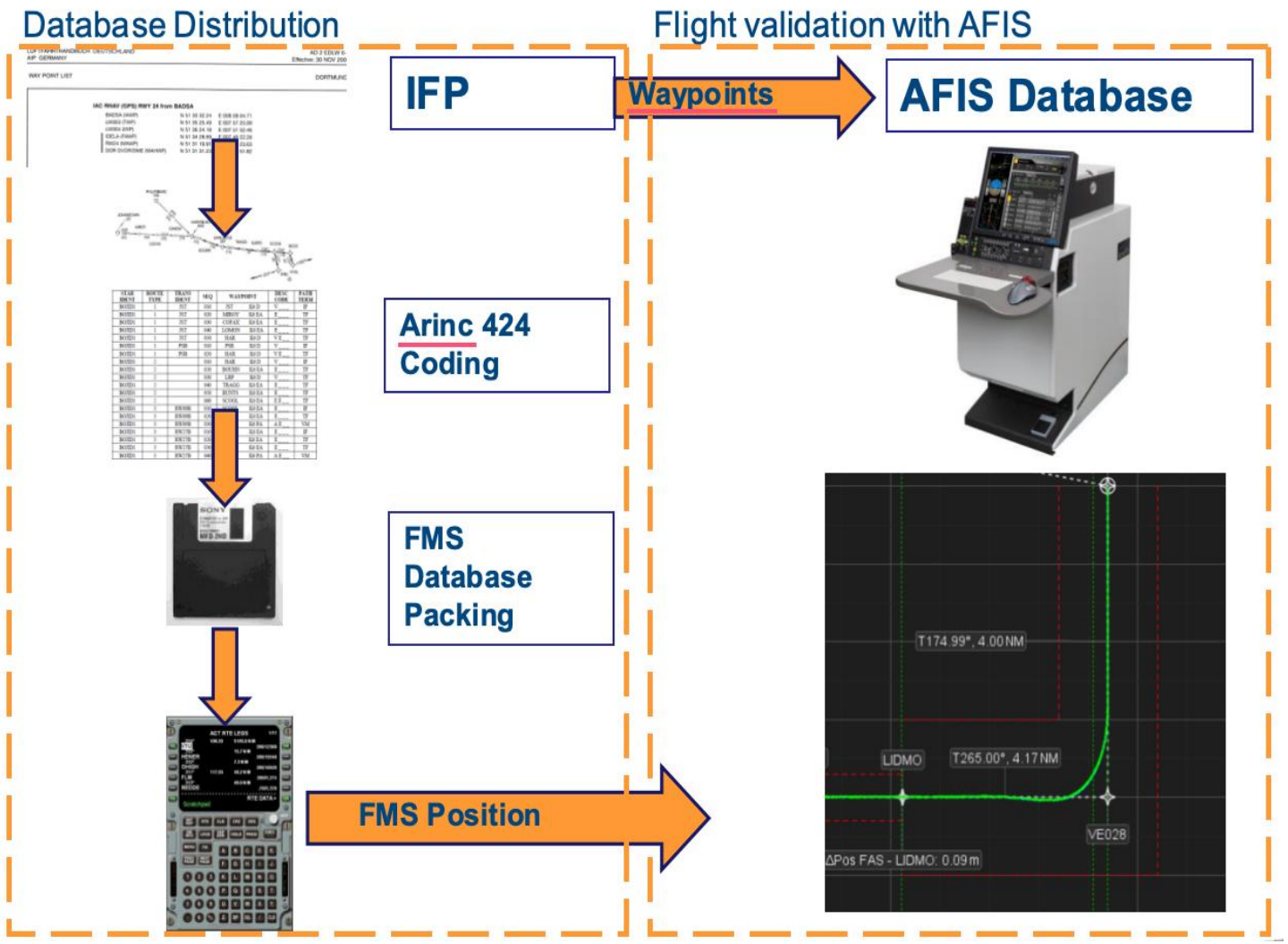
ICAO

03

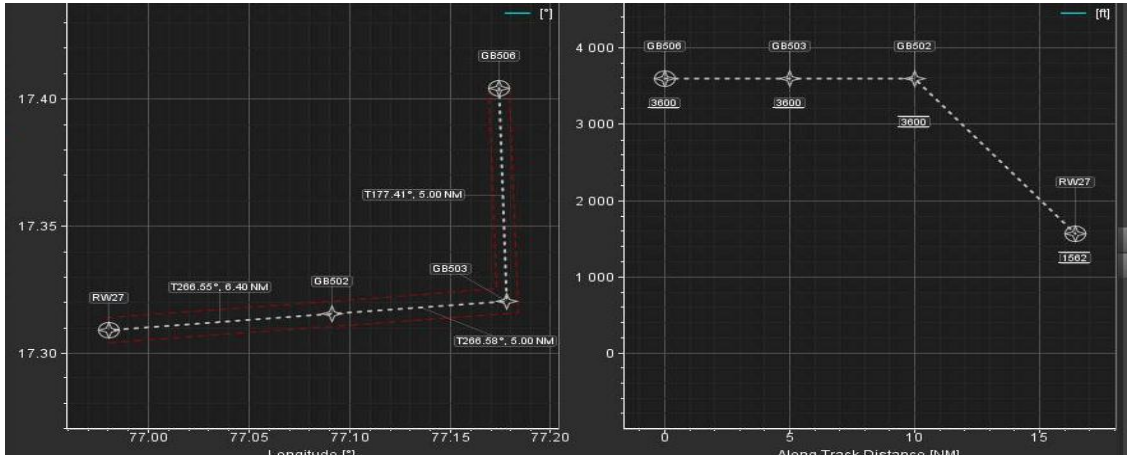
Pre Flight

Custom FMS Data

AFIS Database



Pre Flight
(AFIS Database)



- Make AFIS (Automated Flight Inspection System) Database for Validation - FAS Data, Coordinates of way points, Edit each leg for RNP, HAL, VAL
- Perform consistency and plausibility checks
- Provide means to identify procedure design errors
- Minimize risk of In-flight discrepancies

ICAO

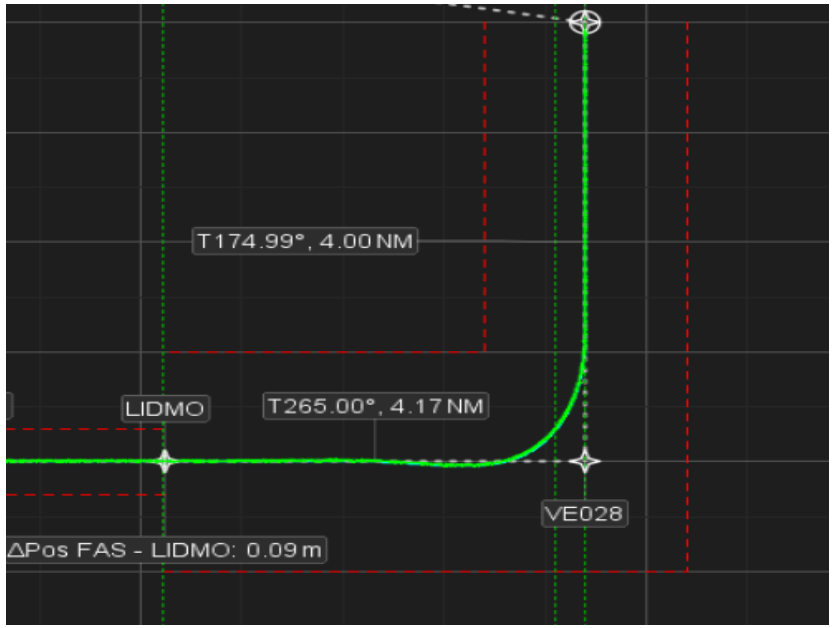
04

In Flight Check with AFIS

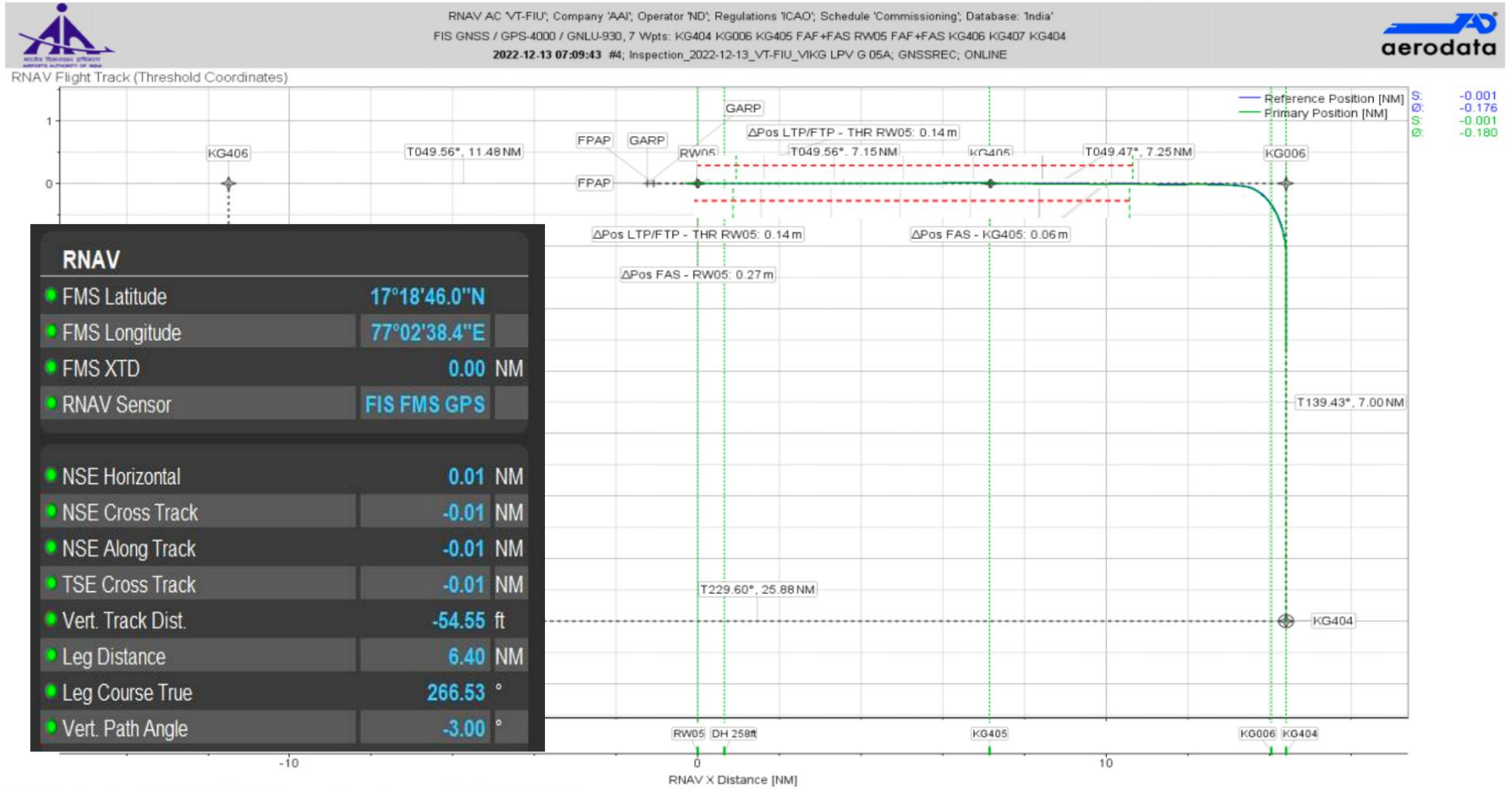
ICAO

In Flight Checks with AFIS

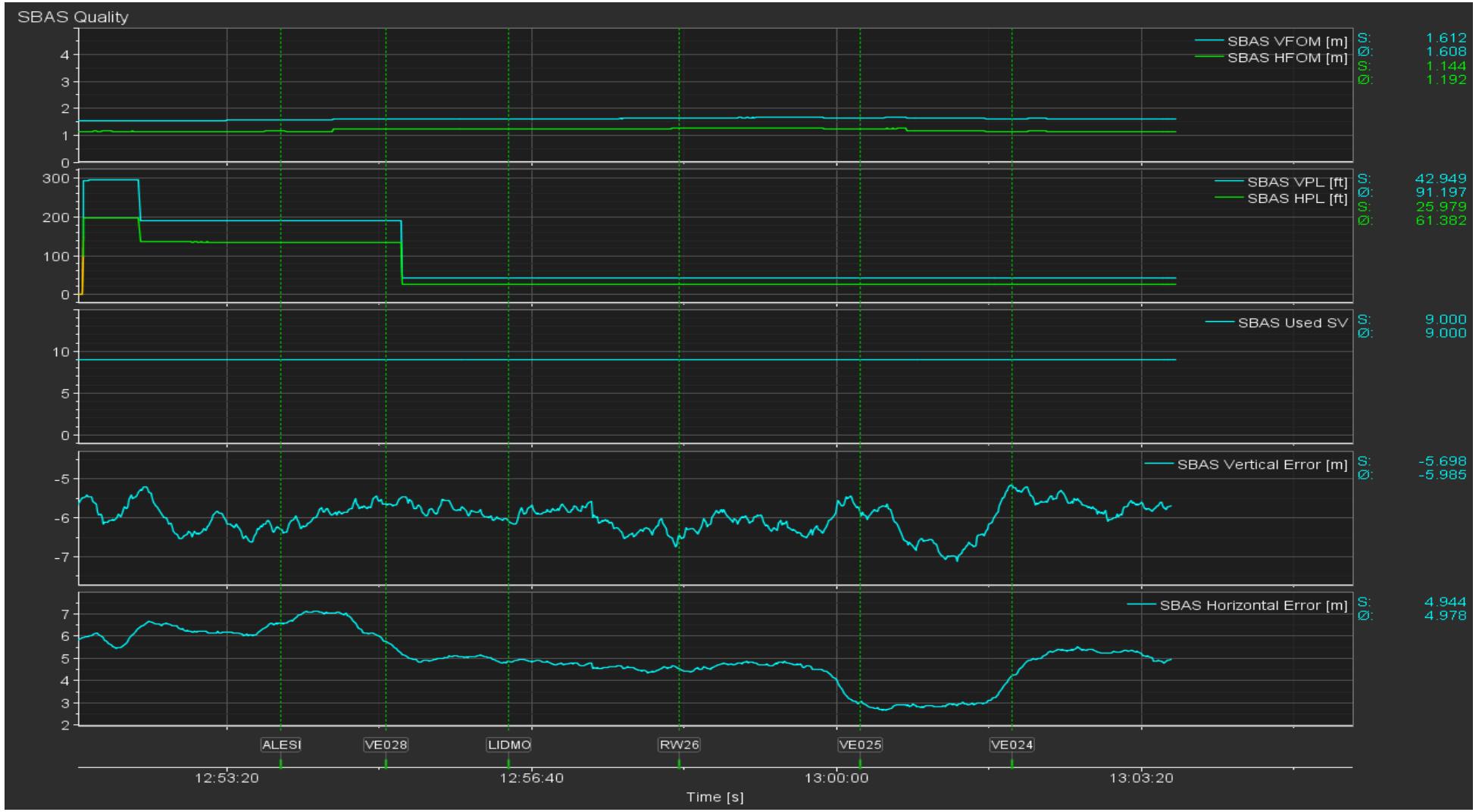
The AFIS records data for documentation and for supporting flight validation pilots in the overall procedure evaluation



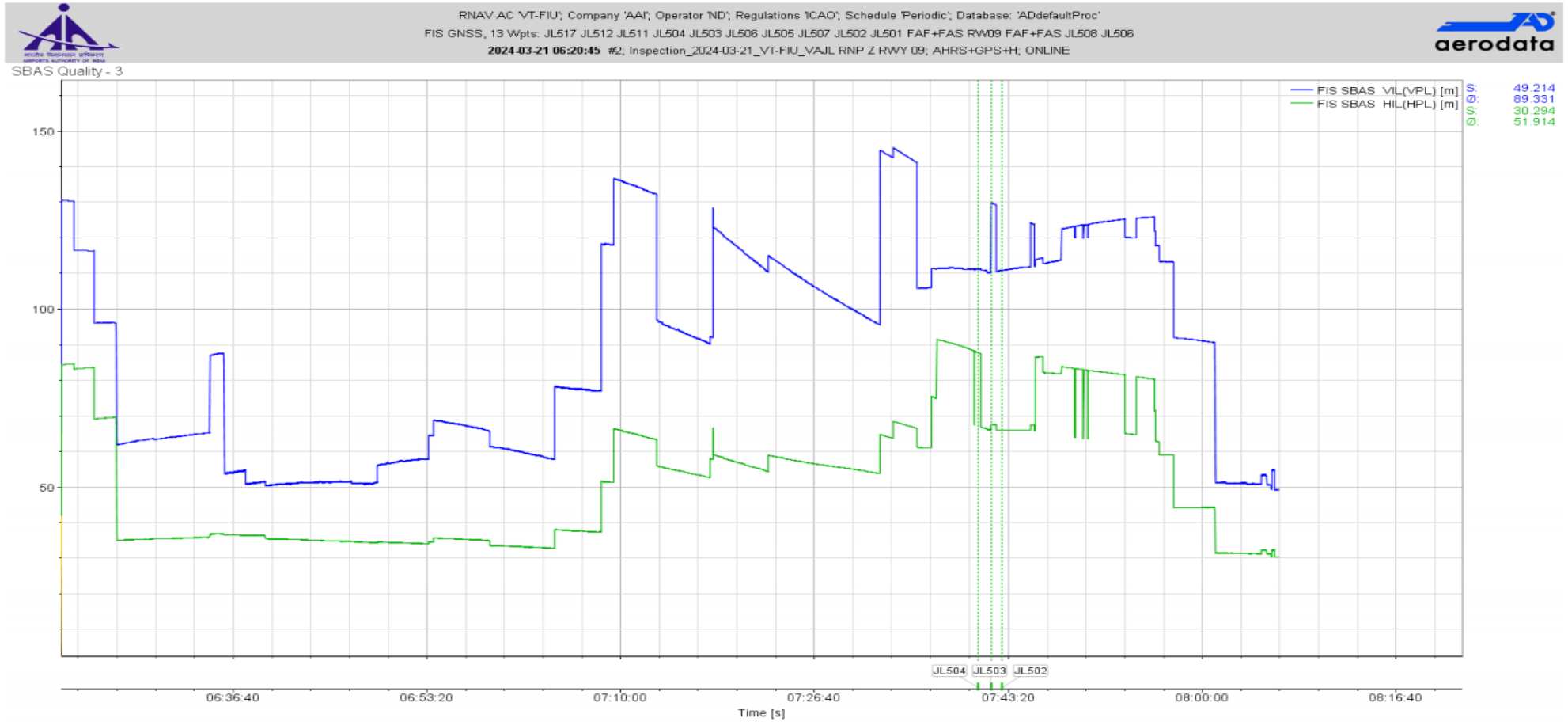
- FMS Navigation Errors
- GNSS / GPS /SBAS Signal coverage and Quality.
- Deviation from the track must not be more than +/- <RNP> NM, 95% of time
- Waypoint, Bearing and Distance accuracy


RNAV AC 'VT-FIU'; Company 'AAI'; Operator 'ND'; Regulations 'ICAO'; Schedule 'Commissioning'; Database: 'India'
FIS GNSS / GPS-4000 / GNLU-930, 7 Wpts: KG404 KG006 KG405 FAF+FAS RW05 FAF+FAS KG406 KG407 KG404
2022-12-13 07:09:43 #4; Inspection_2022-12-13_VT-FIU_VIKG LPV G 05A; GNSSREC; ONLINE
aerodata
RNAV Flight Track (Threshold Coordinates)
Reference Position [NM]
Primary Position [NM]
S: -0.001
Ø: -0.176
S: -0.001
Ø: -0.180
KG406
T049.56°, 11.48 NM
FPAP
GARP
RW05
GARP
ΔPos LTP/FTP - THR RW05: 0.14 m
T049.56°, 7.15 NM
KG405
T049.47°, 7.25 NM
KG006
FPAP
ΔPos LTP/FTP - THR RW05: 0.14 m
ΔPos FAS - KG405: 0.06 m
ΔPos FAS - RW05: 0.27 m
T139.43°, 7.00 NM
T229.60°, 25.88 NM
KG404
RW05
DH 258ft
KG405
KG006
KG404
RNAV
FMS Latitude 17°18'46.0"N
FMS Longitude 77°02'38.4"E
FMS XTD 0.00 NM
RNAV Sensor FIS FMS GPS
NSE Horizontal 0.01 NM
NSE Cross Track -0.01 NM
NSE Along Track -0.01 NM
TSE Cross Track -0.01 NM
Vert. Track Dist. -54.55 ft
Leg Distance 6.40 NM
Leg Course True 266.53 °
Vert. Path Angle -3.00 °
1
0
-10
0
10
RNAV X Distance [NM]
Print date: Tue Dec 13 07:17:44 UTC 2022
Page: 48
AD-AFIS-200 V7.4.10

ICAO


SBAS Quality
SBAS VFOM [m]
SBAS HFOM [m]
S: 1.612
Ø: 1.608
S: 1.144
Ø: 1.192
SBAS VPL [ft]
SBAS HPL [ft]
S: 42.949
Ø: 91.197
S: 25.979
Ø: 61.382
SBAS Used SV
S: 9.000
Ø: 9.000
SBAS Vertical Error [m]
S: -5.698
Ø: -5.985
SBAS Horizontal Error [m]
S: 4.944
Ø: 4.978
ALESI
VE028
LIDMO
RW26
VE025
VE024
12:53:20
12:56:40
13:00:00
13:03:20
Time [s]

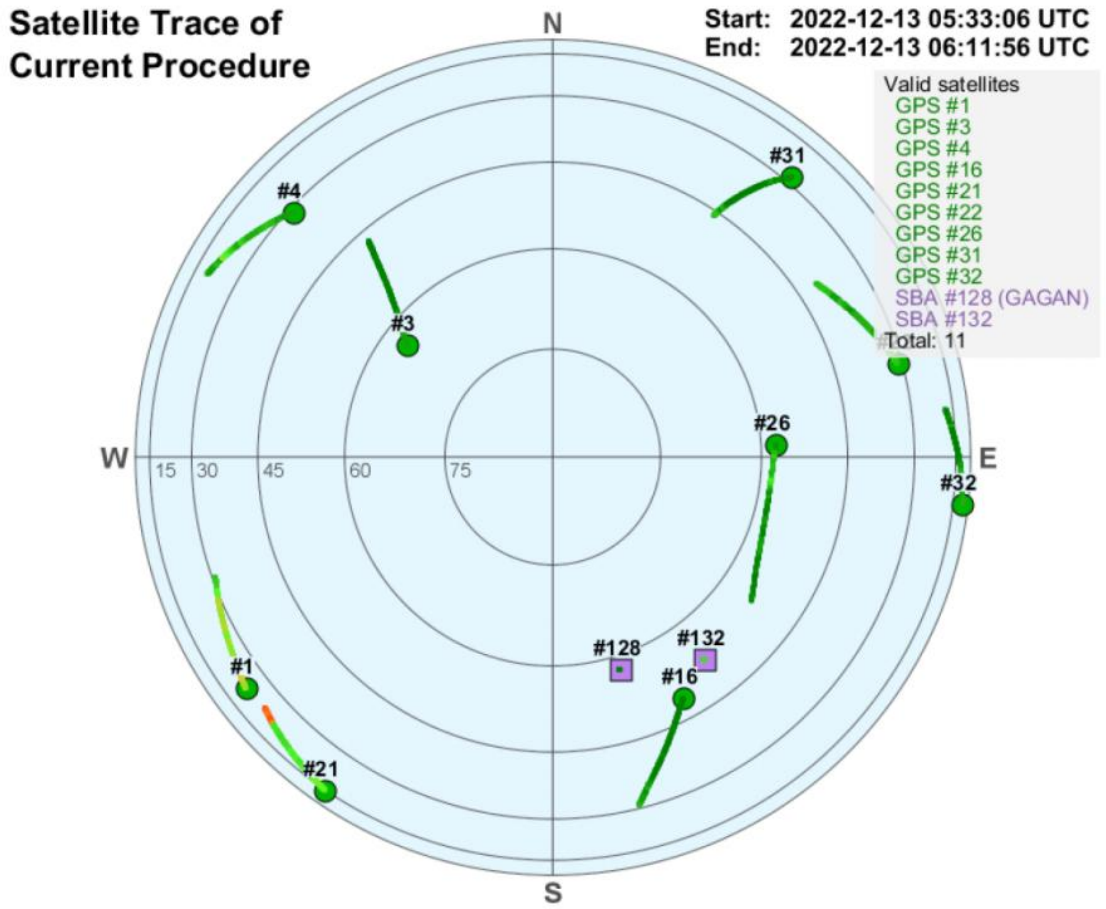
ICAO



Print date: Thu Mar 21 08:06:38 UTC 2024 Page: 9 AD-AFIS-200 V7.4.10

ICAO


Graphics
GPS StoN
GPS User Signal to Noise vs Dist
User GPS C/N0 #1
User GPS C/N0 #2
User GPS C/N0 #3
S: 47.300
Ø: 46.528
S: 45.700
Ø: 45.730
S: 45.900
Ø: 46.688
User GPS C/N0 #4
User GPS C/N0 #5
User GPS C/N0 #6
S: 45.800
Ø: 45.525
S: 35.900
Ø: 42.018
S: 42.300
Ø: 43.071
User GPS C/N0 #7
User GPS C/N0 #8
User GPS C/N0 #9
S: 42.600
Ø: 43.571
S: 44.900
Ø: 46.339
S: 45.700
Ø: 46.355
User GPS C/N0 #10
User GPS C/N0 #11
User GPS C/N0 #12
S: 46.900
Ø: 46.900
S: 45.100
Ø: 44.349
S: 0.000
Ø: none
FINAL_
IP_JAM
RAIM:InAvail
RAIM:None
JAMMER
RAIM:InAvail
RAIM:ok
Along Track Distance [NM]
Interaction
AutoX
AutoY
Slider
Print
Print to File
To Report
Results

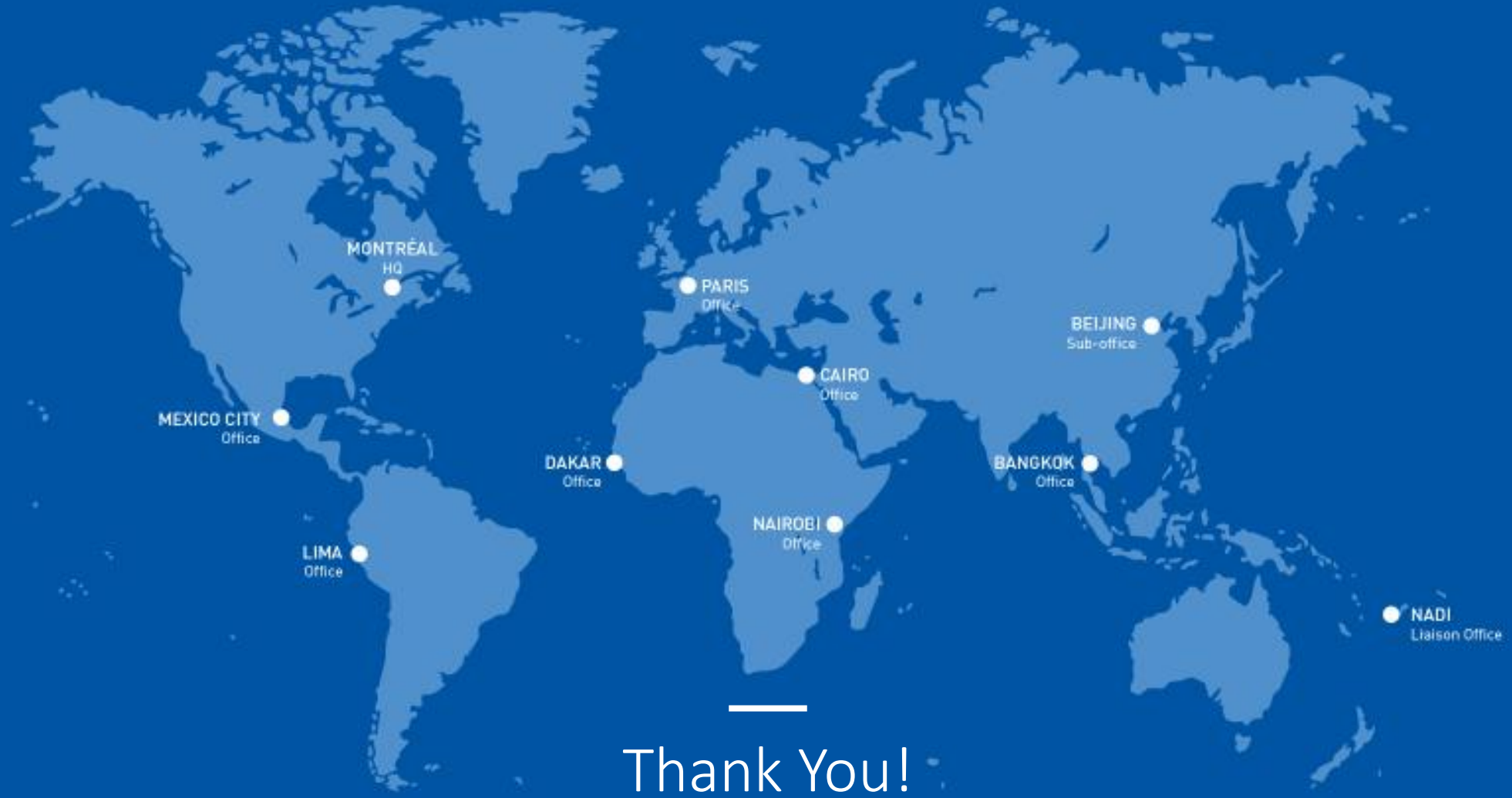


Print date: Tue Dec 13 07:03:44 UTC 2022 Page: 25 AD-AFIS-200 V7.4.10

ICAO

05
Post Flight

- Discrepancy Identification, if any
- Communication with Stakeholders
- Flight Validation Report Preparation as per ICAO DOC 9906 guidelines
- Archiving Data Recording for future reference



Thank You!

ICAO