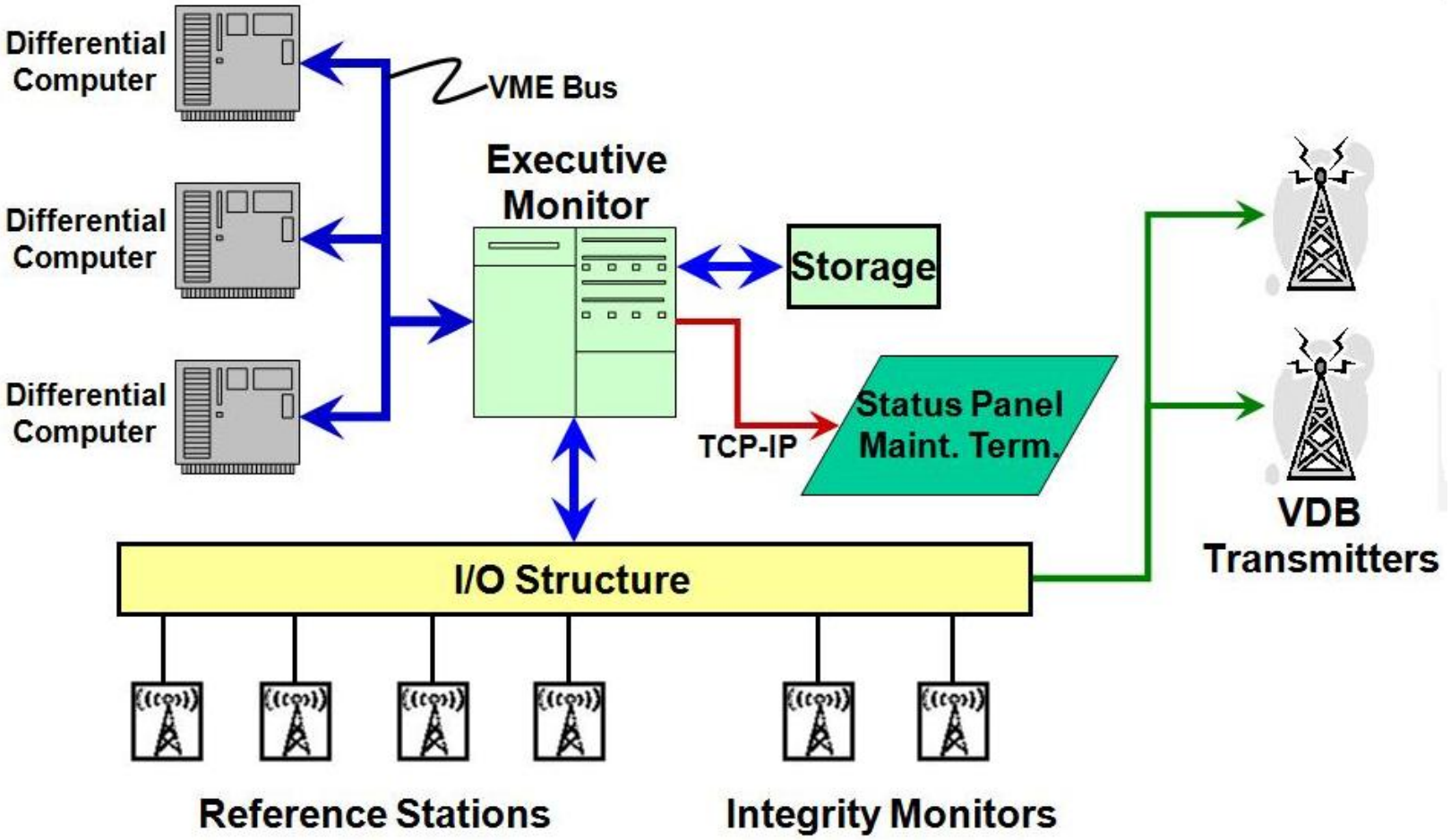
SATNAV-GBAS Project in India

V.K. Chaudhary
Executive Director, CNS-P
Airports Authority of India

GBAS

- The GBAS is a Local Area Augmentation System (LAAS) that provides GPS correction data and navigational landing data to local-area aircraft equipped with a LAAS-enabled navigational device.
- The GBAS transmits these data via a VHF Data Broadcast (VDB) to local aircraft, allowing an aircraft to determine its position to within 2 meters, and to land with repeatable predictability at a pre-determined location on the target runway under Category I instrument landing conditions.
- The GBAS equipment design has been considered with the overhead to expand its capabilities to Category II and Category III landing conditions. Category III approach allows aircraft to land with zero visibility utilizing 'autoland' systems at a very high accuracy of 2 meters.

GBAS Ground Equipment



GBAS- Increases Infrastructural Efficiency

- One single GBAS installation at an airport can be used for all runways in 25Nm radius having 30 different approach paths including curved, segmented and missed approaches thereby securing safety and significant fuel savings for commercial air carriers.
- It shall be capable of transmitting multi-segment landing paths to include circular arcs.
- This highly reduces the need for costly redundant infrastructure and represents significant cost savings in maintenance and upkeep of existing ILS equipment at each individual runway.
- It can be installed at sites where multiple runway are in use, on mobile platforms where temporary runway facilities are to be provided and where siting criteria for ILS equipment installation are difficult to meet due site constraints.
- Furthermore, the on-ground application of GBAS allows easy and orderly routing of aircraft to and from gates.

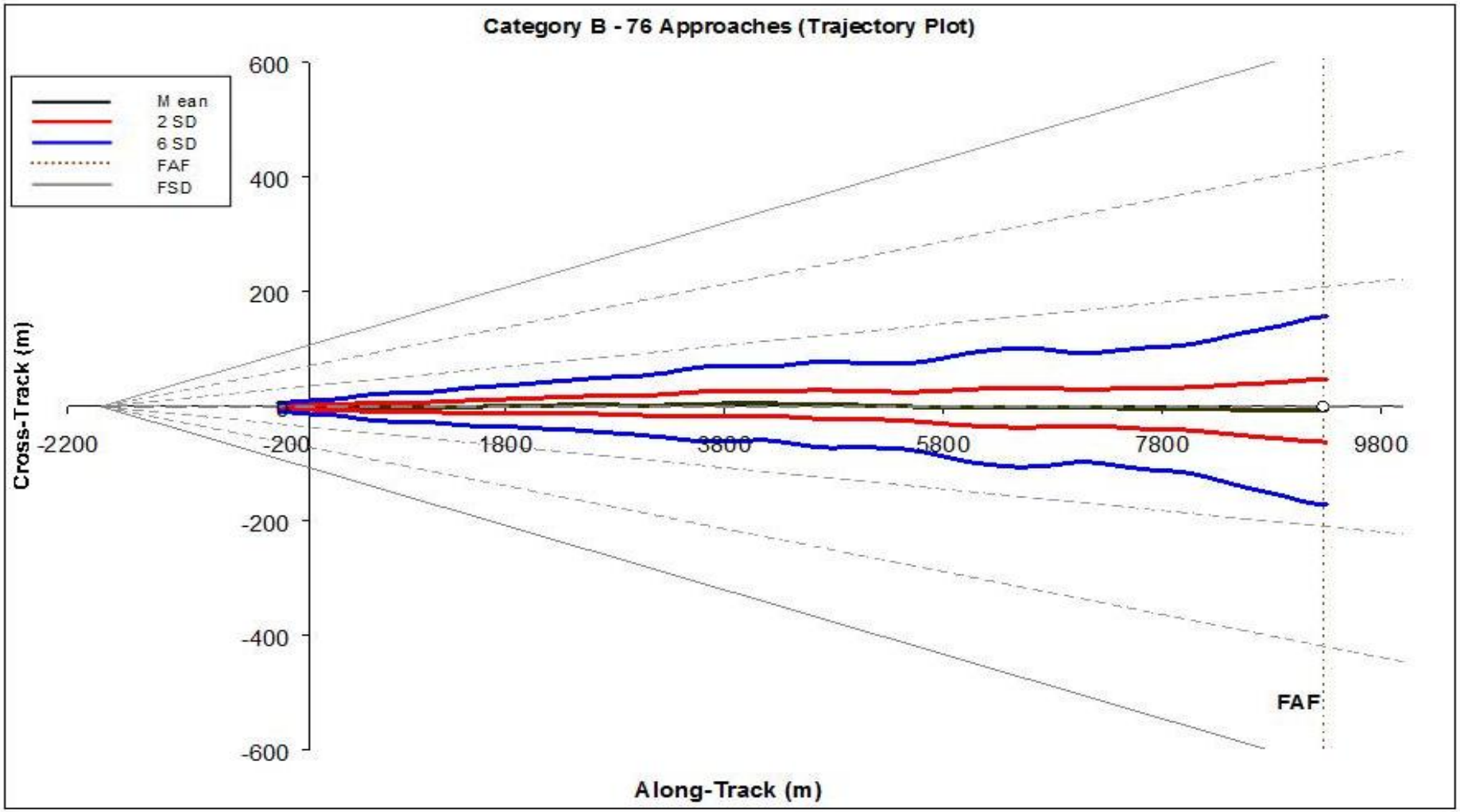
GBAS-SYSTEM INTEGRITY

- The GBAS system shall offer *deterministic* and not *probabilistic* system integrity.
- It shall use closed-loop system design, enabling it to self-check the validity of the transmitted VDB signal to the aircraft.
- The GBAS system shall use independent, external monitors for feedback to ensure the Nav System Error (NSE) is maintained within the specified tolerance.
- Any time NSE tolerances over D8PSK VDB are exceeded, the transmission of MT1, MT2, MT4, MT5 messages (RTCA/DO-246C compliant messages) and VDB transmission shall be suspended to ensure no hazardous misleading information is transmitted.
- The GBAS shall conform to the International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPs), Annex 10.

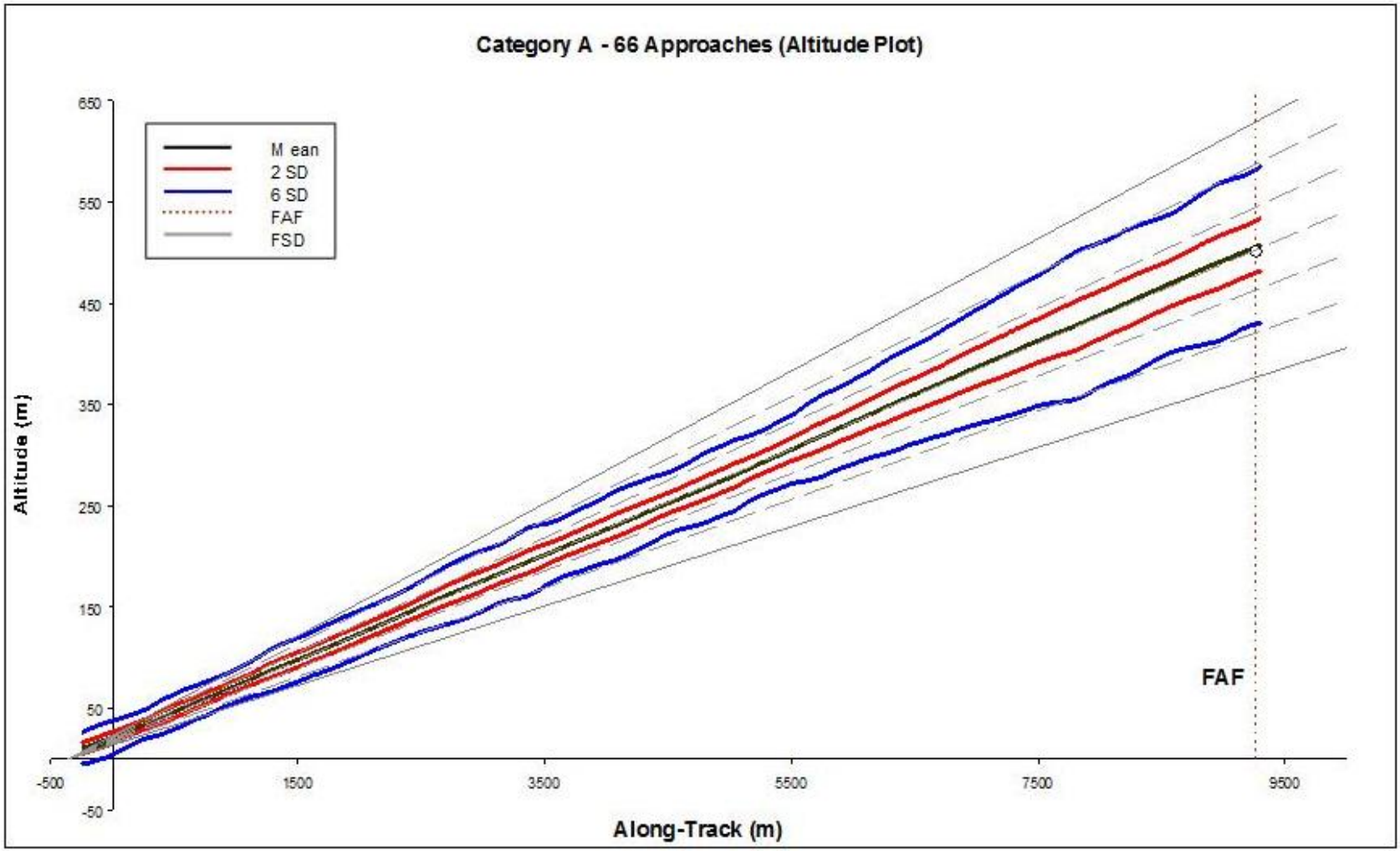
Flight Testing

- The GBAS system shall be flight tested for both straight in and curved approach paths.
- The 6 sigma deviation signifies 67.00% probability that the flight path was within horizontal and vertical area of interest (mean flight path), and the 2 sigma deviation signifies a 99.99% probability that the flights were within mean flight path.
- The Two and Six Sigma deviations over mean flight path in over 300 landings (test approaches) shall be used for GBAS and the results shall be compared against ILS metric or norms .

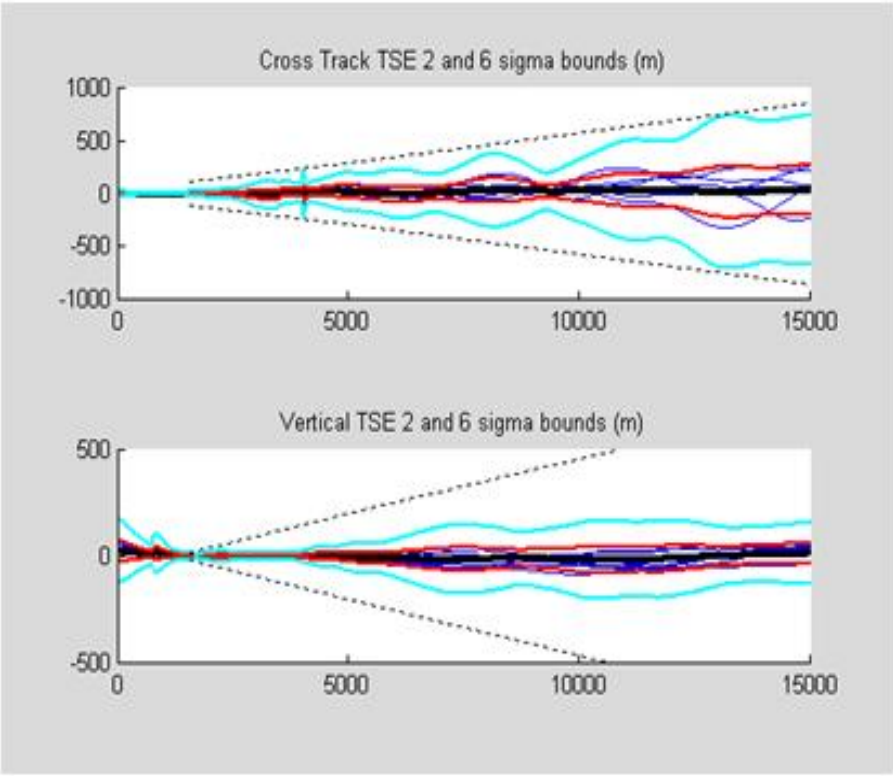
Lateral Navigation Simulation Studies



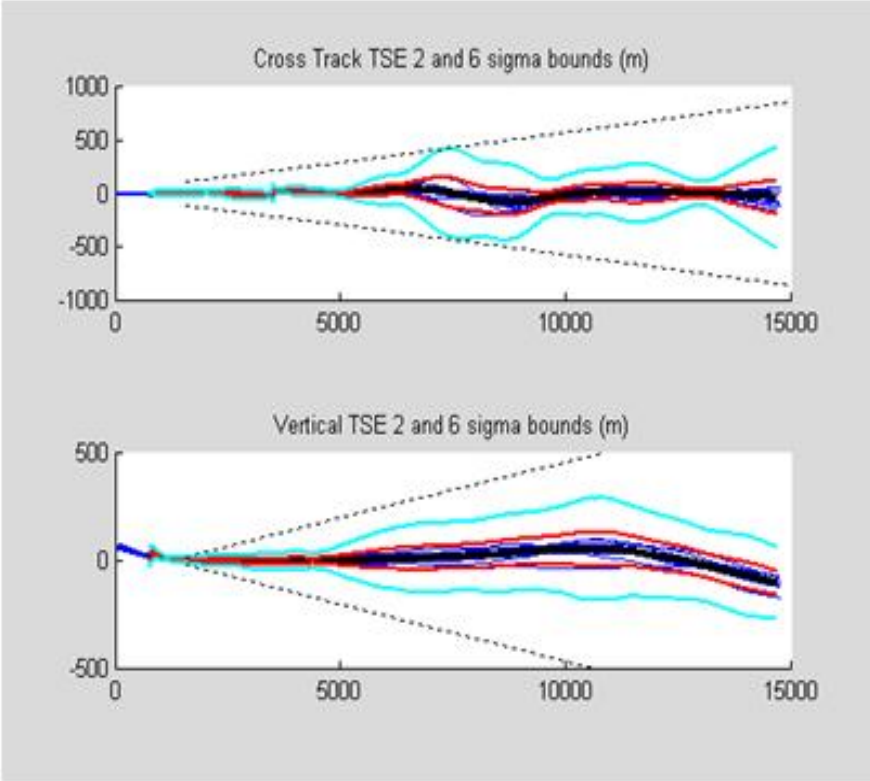
Vertical Navigation Simulation Studies



Curved Path Statistical Studies



180 Degree Approach to Landing



90 Degree Approach to Landing

GBAS Acceptance

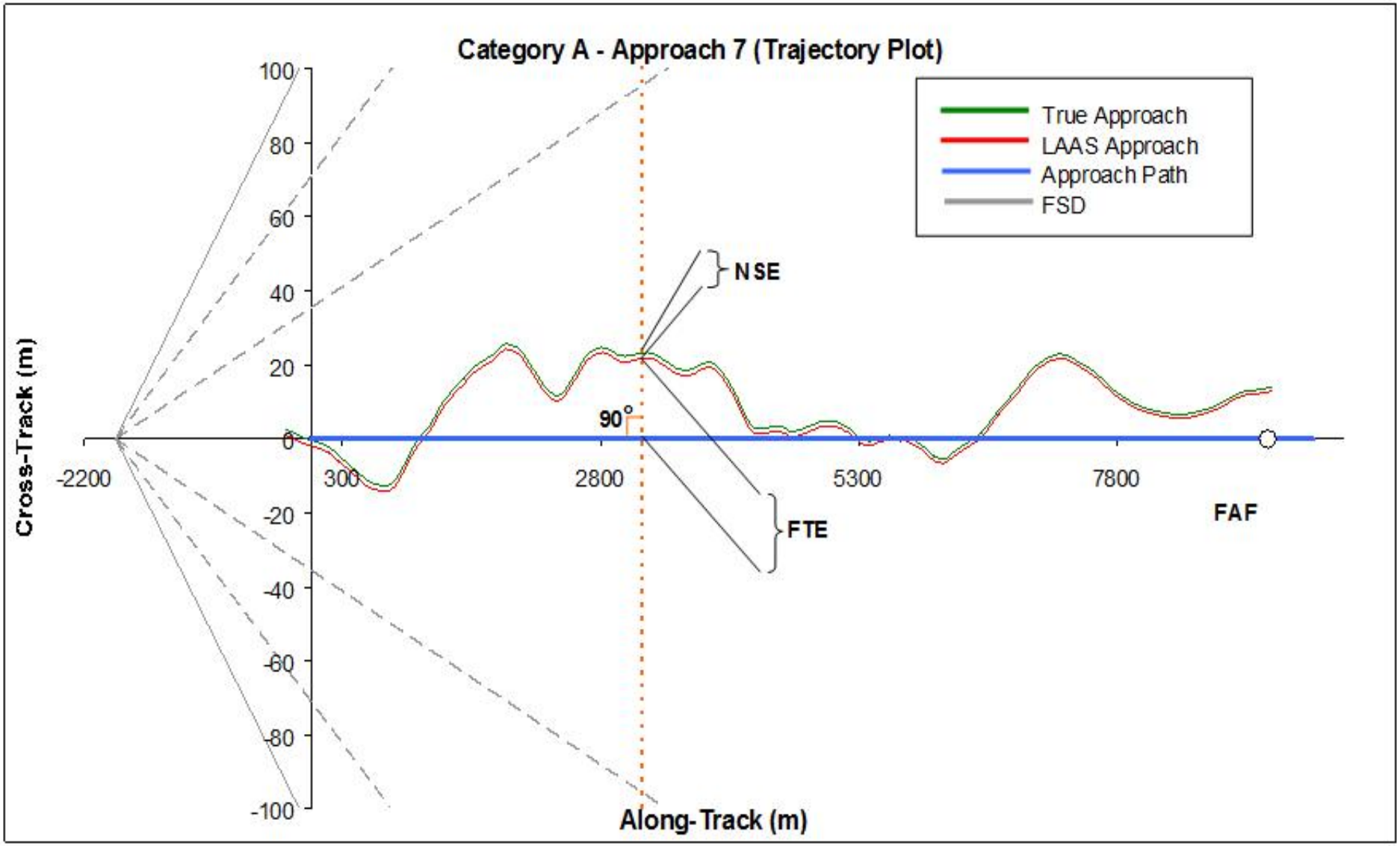
- The System has been designed for smooth transition for pilots from current landing system to GBAS.
- Multi-Mode Receiver in aircraft incorporates GBAS correction and interfaces with aircraft system seamlessly.
- Pilots are presented with the same Course Deviation Indicator used in current landing system.

GBAS ERRORS

- Flight Technical Error (FTE)
- Navigation System Error (NSE) due to ground and airborne navigation equipment.
- Total System Error (TSE)=FTE + NSE

- FTE is the greatest contributor to TSE

GBAS Errors


Category A - Approach 7 (Trajectory Plot)
True Approach
LAAS Approach
Approach Path
FSD
NSE
FTE
90°
FAF
Cross-Track (m)
Along-Track (m)
100
80
60
40
20
0
-20
-40
-60
-80
-100
-2200
300
2800
5300
7800

Current GBAS Projects in India

- M/s Thales ATM, Gmbh has been awarded work order for Rs.19.92 Crores on 31st Mar 2008.
- Project Deliverables are:
  - 01 no's SITC of GBAS Ground equipment for Delhi IGI Airport.
  - 01 no's SITC of GBAS Ground equipment for Mumbai CSI Airport.
  - 03 no's SITC of MMRs for AAI Calibration Aircraft and Integration to AFIS 2000.
  - 01 no's SITC of In country Repair Facility.
  - 01 Lot of Spares.

All GBAS Ground Equipments are CAT I supporting 30 approaches and are upgradable to CAT II & III.

Current Status of GBAS Project

- Desktop Studies Completed.
- Site Assessment Studies Completed.
- Site Selection of GBAS ground equipment sites for Delhi and Mumbai completed in consultation with DIAL and MIAL Airport Operators.
- Observations to FAT for Delhi equipment being looked in by M/s Thales.
- RE-FAT organised for March 10.
- Site Preparation for Installation of Ground Equipment Started.

PERSPECTIVE PLAN FOR GBAS

- AAI on learning curve for GBAS.
- Based on performance, GBAS will be used :
  - At airport having multi-runway operations.
  - At airport where the ILS siting criterion are prohibitive for installation of ILS system.
  - To be used at the airports where the traffic density is likely to be high.
  - In the long run, when the ILS gets phased out, GBAS will be used as a landing aid, which is capable of up gradation of CAT-II and CAT-III and can provide positional services.

Thank You