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Airbus status on SBAS
EGNOS Service Provision Workshop
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Agenda

1. Introduction

2. SLS on Airbus families

3. Way forward
Introduction

Approach categories and examples

- Visual approach
  - Example: Navaid beacons

- Non precision approach
  - Example: Instrument Landing System

- Precision approach
  - Example: RNAV (GNSS)
  - Example: Satellite Landing System
Introduction

Airbus xLS concept

• ILS is the reference instrument approach for all pilots

• xLS concept provides ILS look-alike crew interface
  • MLS and GLS were the first applications of the xLS concept

• Airbus also introduced FLS (FMS Landing System) to provides an xLS solution for Non Precision Approaches:
  • Conventional (e.g. VOR, NDB,..)
  • RNAV(GNSS) (RNP APCH)
  • LOC only (or G/S transmitter failed)

The xLS concept expands the ILS operational benefits

GLS: GBAS Landing System
MLS: Microwave Landing System
Introduction

Airbus xLS concept

ILS PFD
Introduction

Airbus xLS concept

PFD: Primary Flight Display

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Airbus xLS concept

• xLS is based on:
  • Identification of the final approach reference segment (Lateral and Vertical)
  • Computation of LOC and G/S deviations from the reference segment

• Final Approach Segment is equivalent to the ILS beam

• LOC and G/S deviations are used by both pilots and A/C systems in the same way as ILS deviations
  • Pilots get similar interfaces for all xLS functions (e.g. ILS, GLS, FLS…)

• The Multi Mode Receiver (MMR):
  • Manages the radio sensors
  • Computes deviations
  • Ensures interface with display and guidance systems
**Introduction**

**SLS architecture**

- Geo SBAS satellite signals
- FAS data
- LS tuning
- GPS signals
- LOC and G/S deviations

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**ILS look-alike architecture**

- Display approach capability
- Display SLS procedure
- Approach mode arming
- FCU: Flight Control Unit
- PRIM
- FCDC
- CDS

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**Abbreviations**

- FAS: Final Approach Segment
- FCDC: Flight Control Data Concentrator
- FCU: Flight Control Unit
- MMR: Multi-Mode Receiver
- Geo SBAS: Geostationary Satellite-Based Augmentation System
- SLS: Satellite-Based Lateral System
The new SBAS / LPV approaches are halfway between RNAV(GNSS) and GLS approaches:

- Technology is very similar to GLS
- Charting is made through RNAV approaches (with LPV minima)

RNAV/LPV approaches is in line with xLS concept

SLS acronym was selected for the A/C function supporting SBAS applications (LPV or LP)

SLS is the last brick of Airbus xLS concept on A350 XWB
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SLS on Airbus families

SLS function on Airbus families

**A350**
SLS function certified since EIS
Selected by 9 customers

**A320 / A330**
Under feasibility assessment

SLS is part of xLS Airbus concept and is now in service on A350
SLS on Airbus families

• A350 option status
  • Combined option “SLS and GLS”
  • Certified since Entry-Into-Service

• Recent achievements
  • First A350 deliveries to Qatar Airways and Vietnam airlines
  • High selection rate by A350 customers
  • New customers recently selected option (Asiana Airlines and Etihad Airways)

Strong interest of airlines in SLS function
SLS on Airbus families

SLS customers

- Finnair
- Cathay Pacific
- Qatar Airways
- SriLankan Airlines
- Etihad Airways
- Ethiopian Airlines
- Asiana Airlines
- China Airlines
- Vietnam Airlines
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Way forward

GNSS on Airbus aircraft

A core function serving CNS

**Navigation** to increase airport accessibility, provide better efficiency with more direct routes and less fuel consumption

**Communication** to provide enhanced passenger’s comfort: SATCOM, IFE

**Surveillance** to enhance efficiency and provide safety nets: ADS-B, TAWS, BTV, ROPS…
Way forward

GNSS roadmap overview

New core GNSS constellations, SBAS and GBAS under development:
- Multi-GNSS Receiver ICAO standards not mature: key missing inputs from GNSSs constellations providers to build airborne receiver standards
- New GNSSs Operational requirements not yet identified => ConOps
- Two to four GNSS core constellations in future MMRs not before 2025

➢ R&T focus on preparing and feeding standardization, and identify Multi-GNSSs incremental operational benefits and technical requirements
Way forward

**Multi Constellation / Dual Frequency**

Airbus supports standardization for DF/MC SBAS MOPS by 2021/2022

- Prototyping and flight tests of DF/MC SBAS receiver opportunity
- Identification of Multi-GNSSs incremental operational benefits
- Identification of technical requirements:
  - L1/L5 CDMA, Mandates management, receiver logics, A-RAIM opportunity, resilience
- Airbus does not forecast to certify DF/MC SBAS Receiver before 2025
Way forward

**Autoland with SLS**

Airbus develops a SBAS error model to support CAT I autoland

- Thesis co-funded by ENAC, ESA and Airbus with support from EGNOS and WAAS
- Study of Cat II feasibility
- Results expected mid 2017, standardization to follow supporting future certification at next opportunity
Way forward

Airbus expectations

LPV 200 with EGNOS to enhance operational benefits

LPV approaches can provide benefits:
- To airports currently not having precision approach
- To main runways as a backup of ILS
- To alternate airports in case of diversion

➢ Lower minima can provide operational improvement for airlines
Way forward

Airbus expectations

LPV 200 with EGNOS to enhance operational benefits

More LPVs to raise airlines interest

Number of airports with LPV (with runway > 2000m):
- 300 in USA
- 60 in Europe and increasing!
Way forward

Airbus expectations

LPV 200 with EGNOS to enhance operational benefits

More LPVs to raise airlines interest

Additional SBAS constellations

Actual and potential SBAS constellations
Way forward

Airbus expectations

LPV 200 with EGNOS to enhance operational benefits

More LPVs to raise airlines interest

Additional SBAS constellations

LPV expansion will increase airlines interest
Thank you for your attention!