Airbus Fleet Readiness for GBAS/SBAS

- Introduction: aircraft ready for all Straight-In approach types
- Airbus xLS concept
  - FLS
  - SLS
  - GLS
- Airbus Fleet Readiness review for A320/A330/A350/A380
- Landing Capabilities Roadmap: What’s next?

- A220 Fleet Readiness Review for GBAS/SBAS
- ATR Fleet Readiness Review for GBAS/SBAS
Introduction:
Reminders of all Straight-In approaches

• 3 main categories: **PA** & **APV** & **NPA**
  – ILS CAT 1 and Cat 2/3 Autoland
  – NAVAIDS based approaches with lateral guidance (VOR, VOR/DME, NDB, LOC only)
  – APV with Lateral & vertical guidance

• **GNSS: NPA & APV**
  – With lateral guidance to **LNAV/LP** minima
  – With lateral & vertical guidance to **LNAV/VNAV** minima

• **GNSS with SBAS: APV & PA**
  – With lateral and vertical guidance to **LPV** minima
    (down to 200 ft = Cat 1 equivalent)

• **GBAS stations as precision approaches**
  – In service at Cat 1 minima with Autoland
  – Cat 2 reachable
  – Cat 3 GBAS approaches – next step
Introduction:
Airbus Strategy for Straight-In approaches

New approach capabilities implemented with minimum operational impact
• ILS as reference: a concept called xLS.
• xLS applies to:
  – All approaches with Precision Approach service
  – Straight-In NPAs, to benefit from ILS look-alike HMI (see FLS description)

Airbus Aircraft ready to fly any approach types with the built-in xLS concept
Introduction:
Airbus Strategy for Straight-In approaches

• Benefits
  – Reduced Crew training
  – flexibility: e.g. easy swapping from ILS32L to RNAV32R

• Same ILS-lookalike HMI for all kinds of approach types
• Flying the deviations (diamonds)
Introduction:
Airbus Strategy for Straight-In approaches

ILS look-alike HMI
Similar displays whatever the modes
Airbus xLS concept:
Flying Non-Precision Approaches / Focus on FLS

- FLS allows conducting existing **Non Precision Approaches** (VOR, VOR/DME, NDB, NDB/DME, RNAV, LOC only) in a similar manner as **Precision Approaches (ILS)** with similar display, guidance & alerts.

- The aircraft is guided along a “**virtual**” beam computed by the FMS, **corrected from temperature**.

- Standard **ILS laws** used by the AP/FD for guidance.

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June 2019 GBAS/SBAS Implementation Workshop
Airbus xLS concept:
Reaching the “equivalent CAT 1” GNSS approaches with LPV minima – Focus on SLS

- Thanks to this technology based on differential GPS, it is possible to fly
  RNAV (GNSS) approaches in an ILS look-alike way:
    - With geometric vertical guidance  
      (no issue with QNH setting error and baro VNAV in cold temperature)
    - Down to LPV minima  
      (performance equivalent CAT I ILS: down to 200 ft)
Airbus xLS concept:
GBAS capability / Focus on GLS

- Technology based on differential GPS to fly **GLS approach** in an **ILS look-alike** way down to **CAT I minima with Autoland**

- **GLS Cat 2 Extension – European project:**
  - GLS Autoland trials performed with Lufthansa & DFS with specific GBAS Cat 1 ground stations fitted with SBAS receivers in order to get GLS Cat 2 Airworthiness approval by 2019

- **GLS Cat 3:**
  - Airbus has completed R&T and standardization for **GLS CAT II/III**
  - *GAST-D stations needed to reach Cat 3
  - Hardware provisions in new MMR

- **Momentum is now on ground side…**
Airbus Fleet Readiness review for A320/A330/A350/A380

SLS & GLS: Two complementary Satellite Based Autoland capabilities

Future

SLS Cat I & Cat II with autoland
GLS Cat II & Cat III with autoland

2008: GLS Cat I with autoland
2014: SLS Cat I
2009: GLS Cat I with autoland
2014: GLS Cat I with autoland
2019: GLS Cat II with autoland
2019: Five SLS autoland performed on A320NEO
2020: SLS Cat I
2021: SLS Cat I
2021: Five SLS autoland performed on A320NEO

GBAS & SBAS are GNSS
GLS: GBAS Landing System
SLS: SBAS Landing System

Beluga-XL: 2020: SLS Cat I
Airbus Fleet Readiness review for A320/A330/A350/A380

GBAS & SBAS Implementation Workshop
<table>
<thead>
<tr>
<th>GBAS/SAAS Implementation Workshop</th>
<th>Airbus Fleet Readiness review for A320/A330/A350/A380</th>
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<td>ILS With Autoland</td>
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<td>GLS Cat I (With Autoland)</td>
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<td>SLS</td>
<td>2020 Option</td>
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<td>FLS</td>
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Landing Capabilities Roadmap: What’s next?

Airport Commissioning roadmaps are key

Aircraft ready with xLS Concept

Airport Commissioning roadmaps need
**Critical mass is key for Airspace users to equip**

*e.g. GBAS Alliance project launch*
Landing Capabilities Roadmap: What’s next?
GBAS Alliance project

- **GBAS Technology is ready but Deployment is a challenge**
  - Indisputable benefits but collective effort is required to deploy the technology

- **GBAS Alliance project proposal:**
  - Airbus, Indra, DFS, ENAV, ENAIRE and PANSA are proposing to build a *deployment project* of GBAS in Europe CAT II/III for Europe
  - Objectives:
    - Deploy a critical mass of GBAS CAT II/III ground stations;
    - Develop the business case for airspace users to equip their aircraft based on incentive mechanisms
    - Setting up a regulatory framework for both air and ground actors

*Kick-off discussion June 2019*
Landing Capabilities Roadmap: What’s next?
SLS and GLS evolutions towards DFMC GNSS (Dual Frequency Multi-Constellation)
Landing Capabilities Roadmap: What’s next?
SLS and GLS evolutions towards DFMC GNSS (Dual Frequency Multi-Constellation)

From GBAS Cat I to Cat I/II/III autoland

DFMC GNSS towards 2020-2030

From SLS Cat I to Cat I/II autoland

GBAS alliance enables solid GBAS technology adoption by airports accelerating aircraft equipage

SBAS becomes a true worldwide system using a unique industry standard, harmonized regulations and States mutual acceptance

SLS is usable worldwide with SBAS recognized autoland capable
A220 Fleet Readiness Review
Reminder of A220 fleet

- The first A220 was delivered to SWISS in June 2016 LPV certified
A220 Fleet Readiness Review
SBAS & GBAS equipage

• A220 is currently **SBAS capable**, supporting LPV type of approaches.
  – baseline on all aircraft.

• A220 is **NOT GBAS capable** yet.
  – Some of existing customers interested in getting GBAS landing capability - **Under study**
ATR Fleet Readiness Review
Reminder of ATR fleet

Important Note: presentation is made on behalf of ATR

- ATR Point of contact: Michaël JOBARD – Avionics Specialist
ATR PBN CAPABILITIES SUM UP

- GBAS is **NOT AVAILABLE** on ATR
- No plan to develop GBAS capability, considering PBN implementation & Regional Aircraft specificities

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Thank you