FAA GBAS Program Update

Presented to: ICAO NAM/CAR/SAM
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Overview

- FAA GBAS Program Overview & Goals
- GBAS CAT-I Implementation
- GBAS GAST-D (CAT III) ICAO Validation Activities
- GBAS CAT III System Design Approval (SDA) Activities
Improved Approaches & Low-Visibility Operations (IALowVis)

This portfolio supports optimizing approaches and improving operations in low-visibility conditions. The increments in this portfolio achieve success through a combination of effective procedure design and implementation, ATC training, and user equipage and approval. Some increments also require installation and certification of ground infrastructure.

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FAA Satellite Navigation Program

- SBAS
- GBAS

Enroute Oceanic
Enroute Domestic
Terminal
Approach
Surface

Federal Aviation Administration
GBAS Architecture

- One GBAS covers multiple runway ends – up to 48 approaches per system
- GBAS eliminates ILS critical areas
- Supports offset landing thresholds and flexible glide path angles to mitigate wake turbulence
- Contributing technology for high precision navigation services for
  - Closely Spaced Parallel Approach
  - Simultaneous Independent Approach
- Enabling precise positioning for terminal area navigation RNAV and RNP
FAA GBAS Program Goals

• Support Validation of ICAO SARPS for the baseline set of GBAS Approach Service Type D (GAST-D) Requirements

• System Design Approvals (SDA) for non-Federal GBAS
  – Technical reviews/Safety documentation

• CAT I implementation
  – Newark, NJ (EWR), Houston, TX (IAH) and Moses Lake, WA (MWH) ground-based performance monitoring and service predictions
  – Coordination of user/airlines GBAS activities and compilation of operational data

• International Coordination
  – International GBAS Working Group (IGWG)
  – Participation in ICAO NSP CSG
GBAS CAT I

- 2009 FAA granted System Design Approval of the Honeywell SLS-4000
- Honeywell SLS-4000 the only GBAS with FAA System Design Approval
- Newark (EWR) GBAS established Sept 2012
- Houston (IAH) GBAS established April 2013
- FAA cooperative agreements with Port Authority New York New Jersey and Houston Airport Systems
- Private GBAS Systems (Boeing)
  - Grant County Int’l Airport (MWH)
  - Charleston Int’l Airport (CHS)
GBAS CAT I – RFI Impact

• Original 2009-approved system (Block 0) was impacted by RFI near the EWR site near daily
  – EWR site is located near a major turnpike
• System update required to handle frequent RFI
• SLS-4000 Block II approved in 2012
  – New siting considerations & pre-installation data collection to determine RFI threat
  – Self-recovery from system alerts for RFI
  – Software and safety analysis changes to allow the system to operate thru some RFI events
• Since EWR went fully operational in 2012 with Block II, less than 4 minutes of outage due to RFI have occurred
  – Independent monitoring shows that the RFI still exists, but that the updated system is able to operate through it and/or self-recover
Operations & Equipage in the US

- **Airport Operations (Status: July 2016)**
  - Total 3151 approaches
    - Newark, NJ – 1519 Operations
    - Houston, TX – 1632 Operations

- **United Airlines Equipage**
  - B737-127 aircraft
  - B787-29 aircraft
  - All new B737 aircraft will be GBAS capable

- **Delta Airlines**
  - B 737 – 70 Aircraft
  - A 321 – 1 aircraft
  - Total of 200+ GBAS capable aircraft by 2020
  - Plans to equip Airbus (A350-900) fleet as well

- **American Airlines and Southwest Airlines receiving GLS capable aircraft**
Int’l Carrier GLS Operations in the US

• Regular monthly GLS operations

• Newark Liberty Int’l Airport (EWR)
  – British Airways - B787
  – Lufthansa  B747-8
  – Airbus A350 demo

• George Bush Intercontinental Airport (IAH)
  – Emirates - A380
  – Lufthansa - A380
  – Cathay Pacific - B747-8
Operations at EWR during winter storm Jonas

EWR’s SLS-4000 remained fully operational during Winter Storm Jonas in January while ILSs were NOTAM’ed Out of Service due to snow accumulation.

| GLS LANDINGS @ NEWARK (EWR) During Jonas |
|-----------------|-------------|----------|----------|
| DLH402          | 1/24/2016   | 18:26:40 | AC       | B748     |
| DLH402          | 1/25/2016   | 15:49:54 | AC       | B748     |
| UAL1105         | 1/25/2016   | 17:43:40 | AC       | B738     |
| UAL2096         | 1/25/2016   | 19:13:12 | AC       | B739     |
| UAL1929         | 1/25/2016   | 19:16:12 | AC       | B739     |
| UAL2018         | 1/25/2016   | 21:26:38 | AC       | B739     |
GBAS CAT I Implementation - Airborne

• Boeing /Airbus
  – Continued commitment to GLS
  – All new Boeing a/c GBAS capable either as option or standard equipment
    • Standard on B787, B747 -8, B737MAX
  – All new Airbus a/c have GBAS as option

• Airlines, Operational
  – US: United, Delta
  – Europe: TUIfly, Air Berlin, Lufthansa, Swiss Air, British Airways
  – Asia: Qantas, Cathay Pacific,
  – Middle East: Emirates

• Flight Test / R&D
  – JAL/ANA
GBAS US Airport Outlook

• Port Authority New York New Jersey - GBAS for JFK, LGA, TEB
  – Multiple letters of support for GBAS implementation (Delta, Emirates, Cathay Pacific)

• Houston Airport Systems (HAS)
  – Hobby

• Seattle Tacoma (SEA)
  – Supported by Delta, Southwest, Boeing

• Chicago O’Hare (ORD) & Midway (MDW)

• San Francisco (SFO)
  – Demo project with portable GBAS (Honeywell PortaBas) - Sept 2016
  – Delta, United, Southwest, Boeing
GAST-D/CAT III Requirements Validation

• Validation of ICAO SARPS for the baseline set of GBAS Approach Service Type D (GAST-D) requirements has been the FAA GBAS program’s priority for the past several years
  – Developed CAT II/III ground facility and avionics prototype to validate requirements and mitigate technical risk
  – ICAO Validation scheduled to wrap up in December 2016
  – Participation in ICAO/RTCA Ad-hoc groups to close final validation items
GBAS System Design Approval Process (SDA)

- To be approved by FAA, system or equipment must be shown to meet ICAO, FAA and/or other (e.g. RTCA) recognized standard.
- The baseline for the FAA GBAS CAT III is the ICAO SARPS
SDA: Honeywell SLS-4000 Block II

- Modification of the previously approved SLS-4000 Block I configuration intended to enhance system availability
  - Updates should alleviate nearly all of the constellation-based outages currently seen on the public EWR and IAH systems
  - Integrates an optional SBAS receiver for ionosphere monitoring
  - Updates to facilitate the use in low-latitudes (e.g., equatorial regions)
SDA: Honeywell SLS-5000 GAST-D

• GAST-D System architecture updates similar to what has been prototyped at the FAATC

• Critical Project Dependencies
  – SLS-4000 Block II design approval (GAST-C Block II) serves as the GAST-D design baseline
  – ICAO GAST-D SARPS validation effort

• Honeywell moving forward in parallel with completion of GAST-D SARPS/MOPS validation efforts

• Goal Date
  – Current Design Approval target date: mid-2019
GBAS Operational Discussions - US

• GNSS RVR reduction from 2400 to 1800 In Process
  – Operational Safety Review ongoing
• RNAV\RNP To GLS Final - RNAV/RNP to xLS criteria is in draft Order 8260.58A, Appendix C
  – RNP-ILS criteria are approved
• GBAS extended service volume with goal to incorporate any necessary changes into the GAST-D SARPS
• CAT II operations on CAT I GBAS – Equivalent level of safety (ELS) determination required for use of GAST C equipment below a 200’ decision altitude
• Increased glideslopes part of PARC benefit discussions and with Delta, Flight Standards for JFK procedure concepts
SFO Demonstration Project

• **San Francisco Int’l Airport (SFO)**
  – Demo project using a Honeywell ‘portaBas’ system
    • Portable GBAS
  – Effort led by Boeing, United & Delta Airlines
  – Target date August 26, 2016

• **Planned Flight Profiles**
  – Approaches to four runways (28R SOIA, 28R CSPO, 19R, 10L)
  – Precision approach where not available today (19R, 10L)
  – 3.2 and higher glide path (Noise mitigation)
  – Alternate touchdown/glide path approach (Potential wake mitigation)
  – RNP to GLS / Potential Established on RNP application to reduce turn on distance to runway

– **Final Report & Review**
  – Noise Reduction, Fuel Savings, Wake Turbulence Mitigation, Flyability of Approaches, Lowest minima available
International GBAS Working Group – Oslo (June 2016)

• 130 participants from 24 nations & 11 major airlines
  – ANSPs, industry, airlines and aircraft manufacturers
• Continued strong international commitment to GBAS
• Boeing and Airbus remain strongly committed to GLS with increasing GLS customer base and increased number of GLS equipped aircraft sales
  – Boeing reporting over 1500 equipped aircraft and 47% of customers (over 60 airlines) choosing the GLS option.
  – Airbus delivered GLS aircraft to 31 different customers and the possibility to activate GBAS on over 1100 additional fielded Airbus aircraft.
• Interesting Note:
  – Fraport who operates an approved CAT-I system and experimental CAT III system offered an incentive of 100€ per GLS approach; a 4M€ total budget for 2016-2018 timeframe. The motivation is based on lower noise from aircraft able to fly the 3.2° glidepath implemented at Frankfurt, reducing noise over densely populated areas.
Questions?