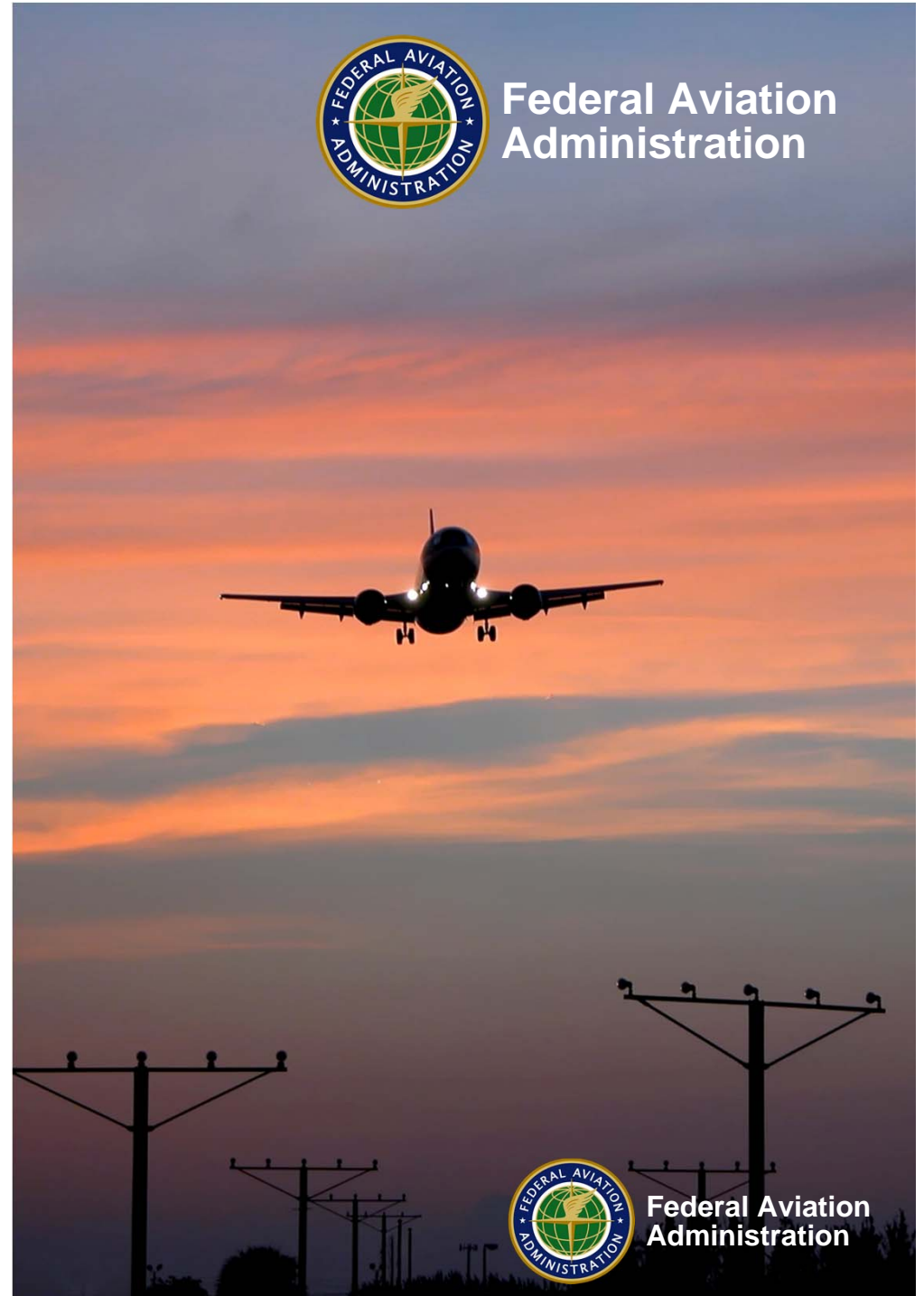


FAA GBAS Program Update

Presented to: **ICAO NAM/CAR/SAM
Carlos A. Rodriguez
August 15-17, 2016**

By: Date:



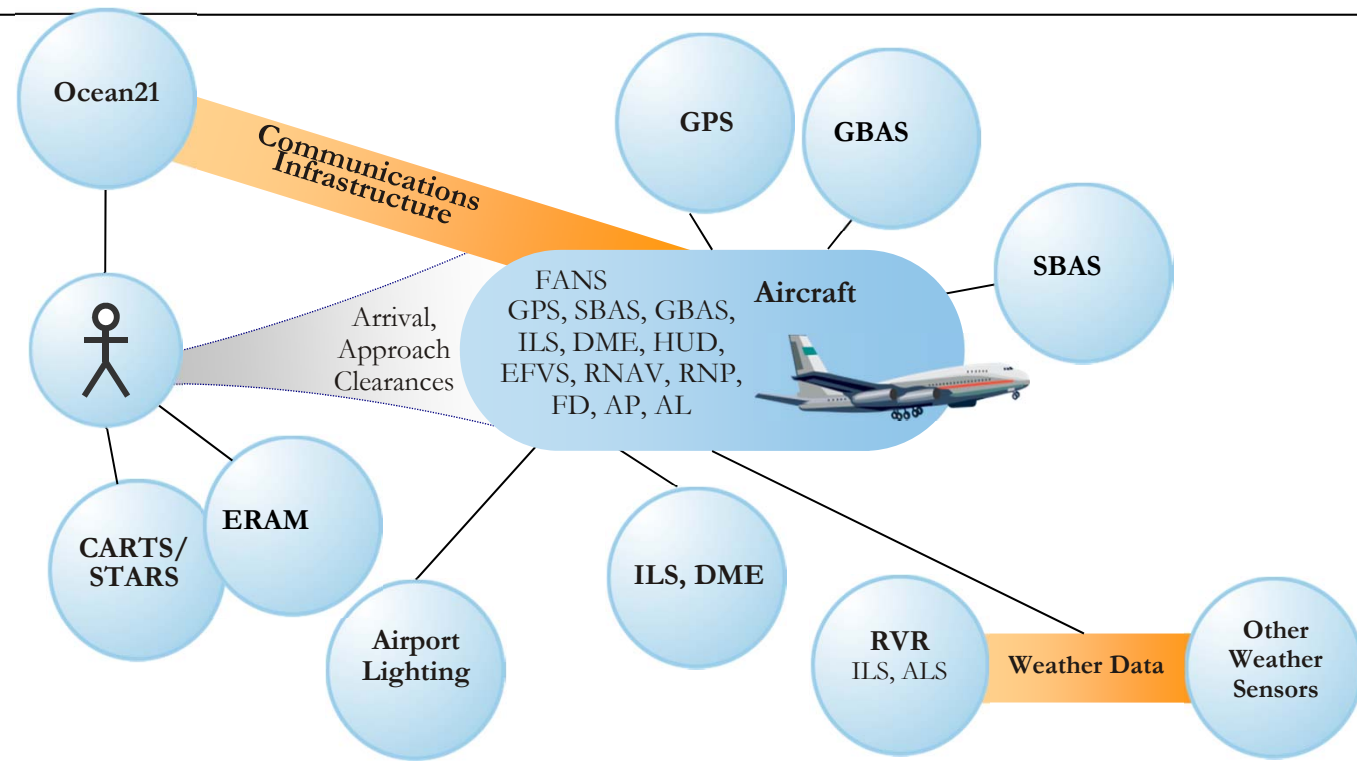
Overview

- **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.

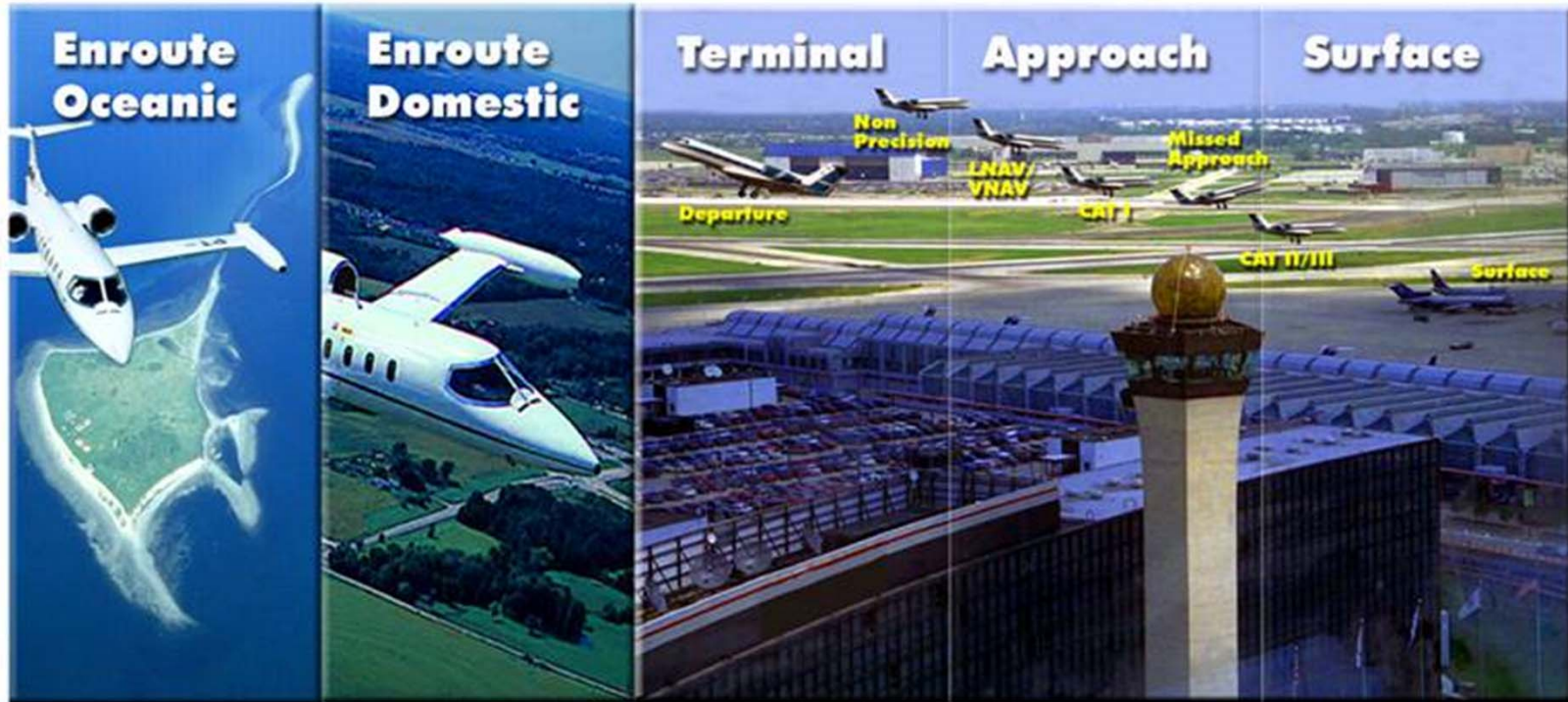


IaLowVis Capability
Expanded Low-Visibility Ops Using Lower Runway Visual Range Minima
OPDs Using RNAV STARs
Initial Tailored Arrivals
GBAS Category I Non-Federal System Approval
EFVS to 100 Feet
EFVS to Touchdown
GBAS Category II/III Non-Federal System Approval



FAA Satellite Navigation Program

•SBAS

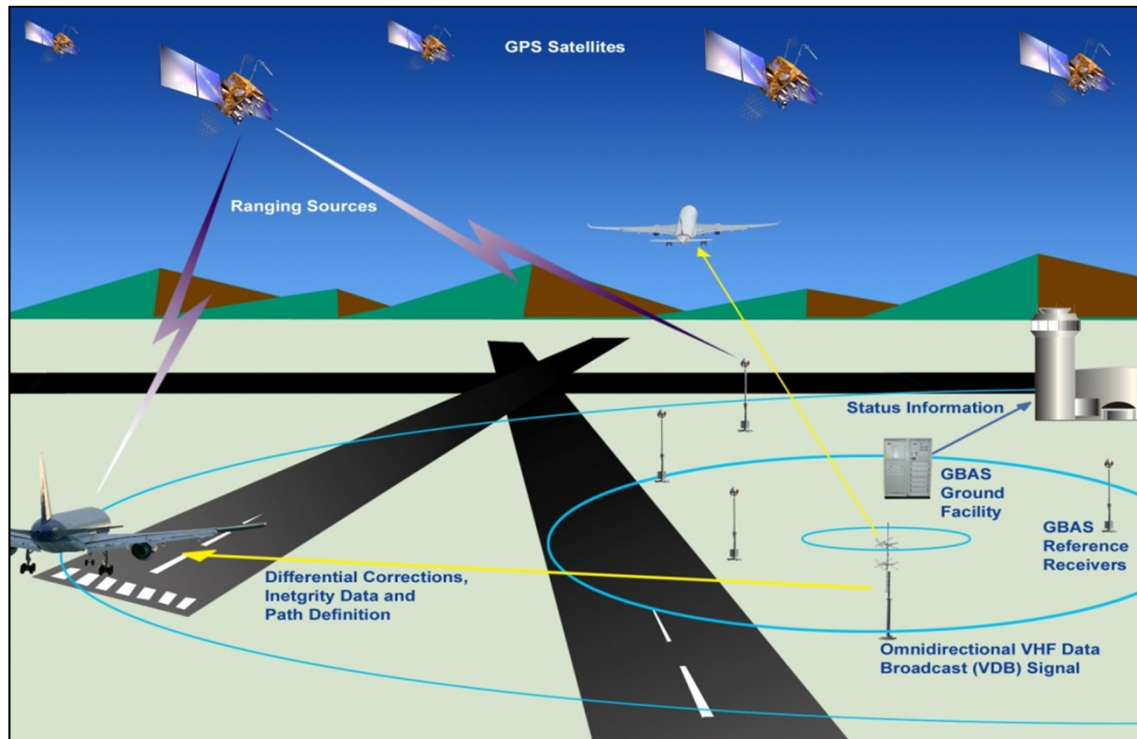


•GBAS



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



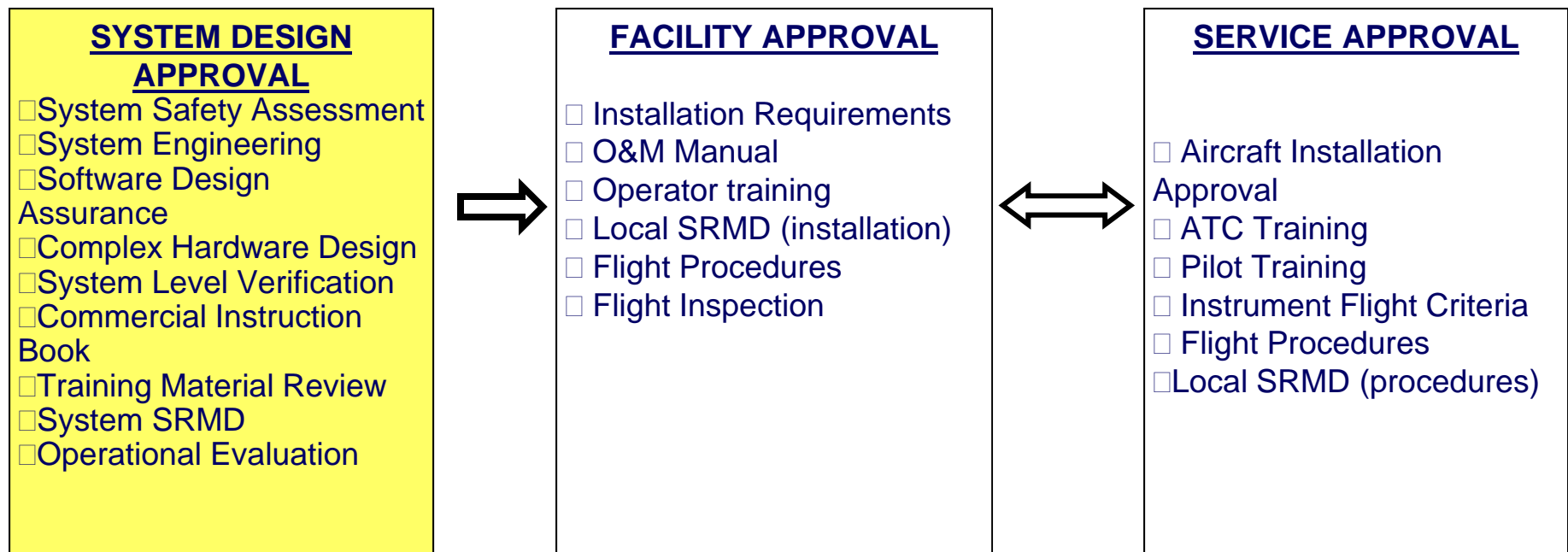
GAST-D/CAT III Requirements Validation

- **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?

