

WAAS, GBAS, and APNT Program Status

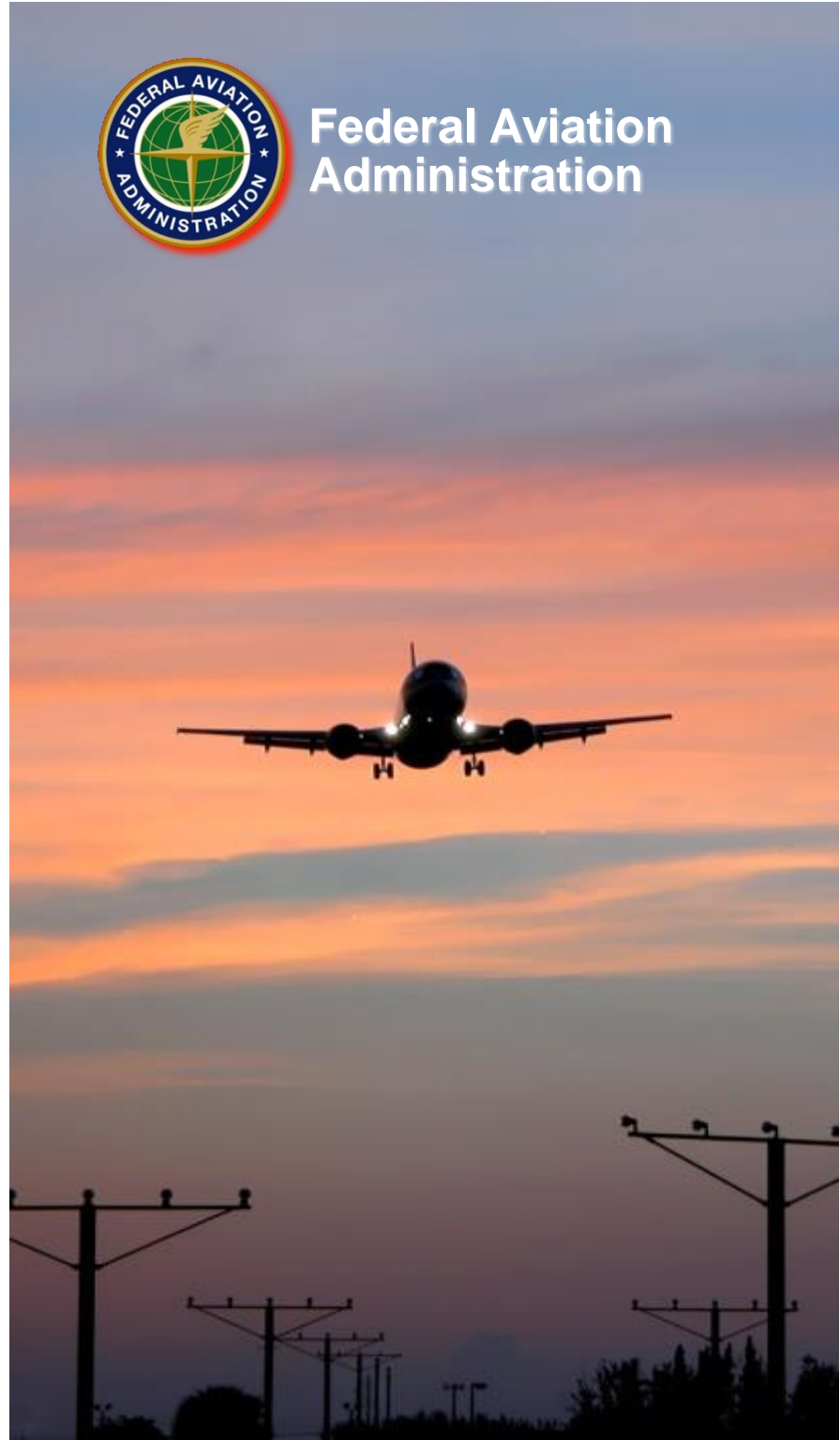
**Presented by: Deane Bunce, FAA Manager
of SBAS Team**

**Presented to: Civil GPS Service Interface
Committee (CGSIC)**

Date: September 2014



**Federal Aviation
Administration**



Agenda

- **Wide Area Augmentation System (WAAS) Update**
- **Ground Based Augmentation System Update (GBAS)**
- **Alternate Positioning, Navigation, and Timing (APNT)**
- **Questions**

Wide Area Augmentation System (WAAS) Update

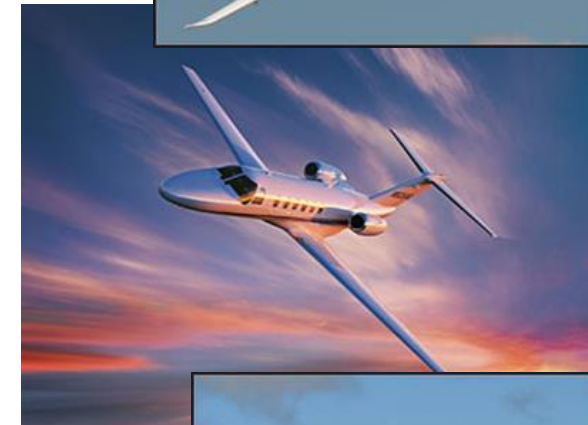


WAAS Dual Frequency Operations

- **Current WAAS uses L1 and L2 P(Y) signals to provide single-frequency (L1) service**
- **WAAS will implement use of GPS L5 in accordance with GPS modernization**
 - Supports the USG Federal Register Notice announcement regarding ‘sunset’ of L2 P(Y) signal use in December 2020
 - Establishes WAAS baseline that will support new future dual frequency L1/L5 service
 - Improves overall WAAS availability and continuity
 - Implementation divided into two Segments
 - Segment 1 - Develop infrastructure improvements to support use of L5 (5 year effort)
 - Segment 2 - Implementation of L1/L5 user capability (5 year effort)
- **GEO sustainment will occur throughout WAAS lifecycle**
 - Maintain minimum of dual coverage over WAAS service area
 - GEO Sustainment currently planned until 2044

WAAS LPV/LP Equipped Aircraft August 2014 (Estimated)

- **8 Vendors producing WAAS certified receivers**
 - Garmin
 - Universal
 - Rockwell Collins
 - Honeywell/CMC
 - Avidyne
 - Genesys Aerosystems (Chelton)
 - Innovative Solutions & Support (IS&S)
 - Thales
- **Multiple Type and Model Ratings**
- **Majority of receivers installed in General Aviation and Business Jet Aircraft**
 - Helicopter and Commercial airframes increasing in equipage
- **TOTAL Estimated WAAS LPV Equipped Aircraft – 76,115**



Recent Accomplishments

- **Obtained approval of a Final Investment Decision (FID) for WAAS Phase IV Dual Frequency Operations – Segment 1 from the Joint Resource Council (JRC) May 2014**
- **Conducted Critical Design Review (CDR) for the GEO 5 satellite in July 2014**
 - SatMex 9 service vehicle launch scheduled for late CY15
 - Will provide coverage over entire WAAS service area
- **Executed the second purchase order on the G-III production contract March 2014**
 - 47 addition G-III receivers ordered bringing product acceptance and delivery to 100 units
- **ARAIM Draft Milestone IIB report completed in July 2014**

Upcoming Actions

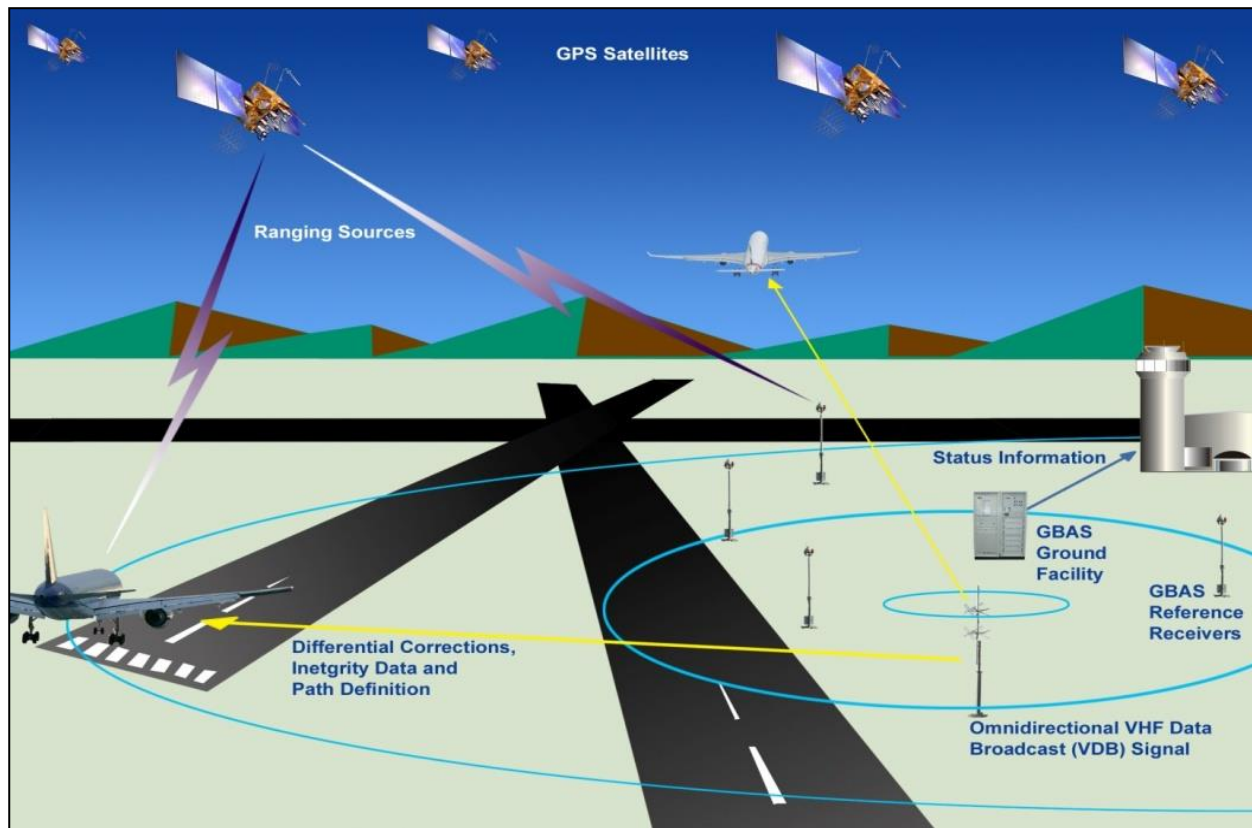
- **WAAS Dual Frequency Operations (DFO) Contract award by September 2014**
- **Complete initial stages of G-III/Comm Cutover for Network 1 & 2 (Cores & OCCs) in FY 2015**
- **Sustain existing GEO availability through execution of option year/years for Inmarsat (AMR) GEO in FY 2015**
- **Developing Draft RTCA MOPS in support of use of GPS L5 and multiple constellations**
 - App A & J projected to complete by September 2015
- **Complete G-III Installation at first Wide-area Reference Station (WRS) by September 2015**
- **Complete Environment Stand up for WAAS Dual Frequency Operations by March 2015**

Ground Based Augmentation System (GBAS)



Ground Based Augmentation System

- **Ground-Based Augmentation System (GBAS) provides an internationally harmonized satellite-based alternative to the Instrument Landing System (ILS) for precision approach and landing**
- **GBAS is the only GNSS solution/alternative for Category III precision approach**



FAA GBAS Program Focus

- **Validation of ICAO SARPS for GBAS Approach Service Type D (GAST-D) Requirements (CAT III)**
 - GAST-D to support approach and landing operations using CAT III minima by augmentation of the L1 single frequency service of GPS
 - Validation includes work producing commercial prototypes (ground system and avionics at FAA Technical Center) for overall program risk reduction
 - GAST-D Flight Testing at FAA Technical Center
 - SARPS Validation
 - Boeing-FAA cooperation for GAST-D validation
- **System Design Approvals (SDA) for GAST-C and GAST-D systems**
 - GAST-C (CAT I)
 - Honeywell CAT I SLS 4000 approved for operations by the FAA
 - GAST- C Block II changes address improving availability and additional operational improvements (projected completion in spring 2015)
 - GAST-D (CAT III)
 - Honeywell submitted design approval request for GAST-D in August 2013
 - GAST-D SDA completion estimated for mid 2018

FAA GBAS Program Focus **Cont.**

- **Limited CAT I implementation support / Operational data collection and lessons learned**
 - Gather operational experience with GBAS equipment installed within the National Airspace System (NAS) (Newark NJ, Houston TX, Moses Lake WA)
 - Coordinate data collection with airlines and airports
- **GBAS technical exchange – international cooperation**
 - Technical interchange effort with SESAR for GBAS standards development
 - Cooperation with Brazil on lower latitudes IONO threat model
 - Co-chair International GBAS Working Group (IGWG)
 - Last meeting: Eurocontrol Experimental Center in Bretigny, France (June 3-6, 2014)
 - IGWG Website - flyGLS.net

GBAS Operations in the US

- **Fully operational and FAA approved GBAS systems**
 - Newark NJ, Houston TX (public systems)
 - Moses Lake / Charleston (Private Boeing systems for production testing)
- **Airport Operations (Status: July 2014)**
 - 780+ GLS approaches to date (Newark/Houston)
 - United Airlines Boeing 737 and Boeing 787
- **United Airlines (operational)**
 - B 737 – 95 aircraft / B 787 – 12 aircraft
 - All new B 737 aircraft will be GBAS capable
- **Delta Airlines (Ops Spec in progress)**
 - Presently 34 B737 aircraft GLS capable
 - Total order of 112 GBAS B737 GLS capable aircraft
 - 45 A321 future deliveries being considered for GBAS
- **International Airline Operations in the US**
 - British Airways (BA) B787 with regular service to Newark since July 11, 2014
 - Emirates and Lufthansa plan on GLS at Houston (A380)



GLS is currently offered either as a standard feature or option on most production Airbus and Boeing aircraft

- **GLS certified aircraft**
 - A320 Family, A 330, A380 – Option,
 - B737NG / Max – Option
 - B787 – Standard
 - B747-8 – Standard
 - B767 tanker - Standard
- **GLS on new production**
 - A340, A350 aircraft - option
 - B777X aircraft -standard

Alternate Positioning, Navigation, and Timing (APNT)



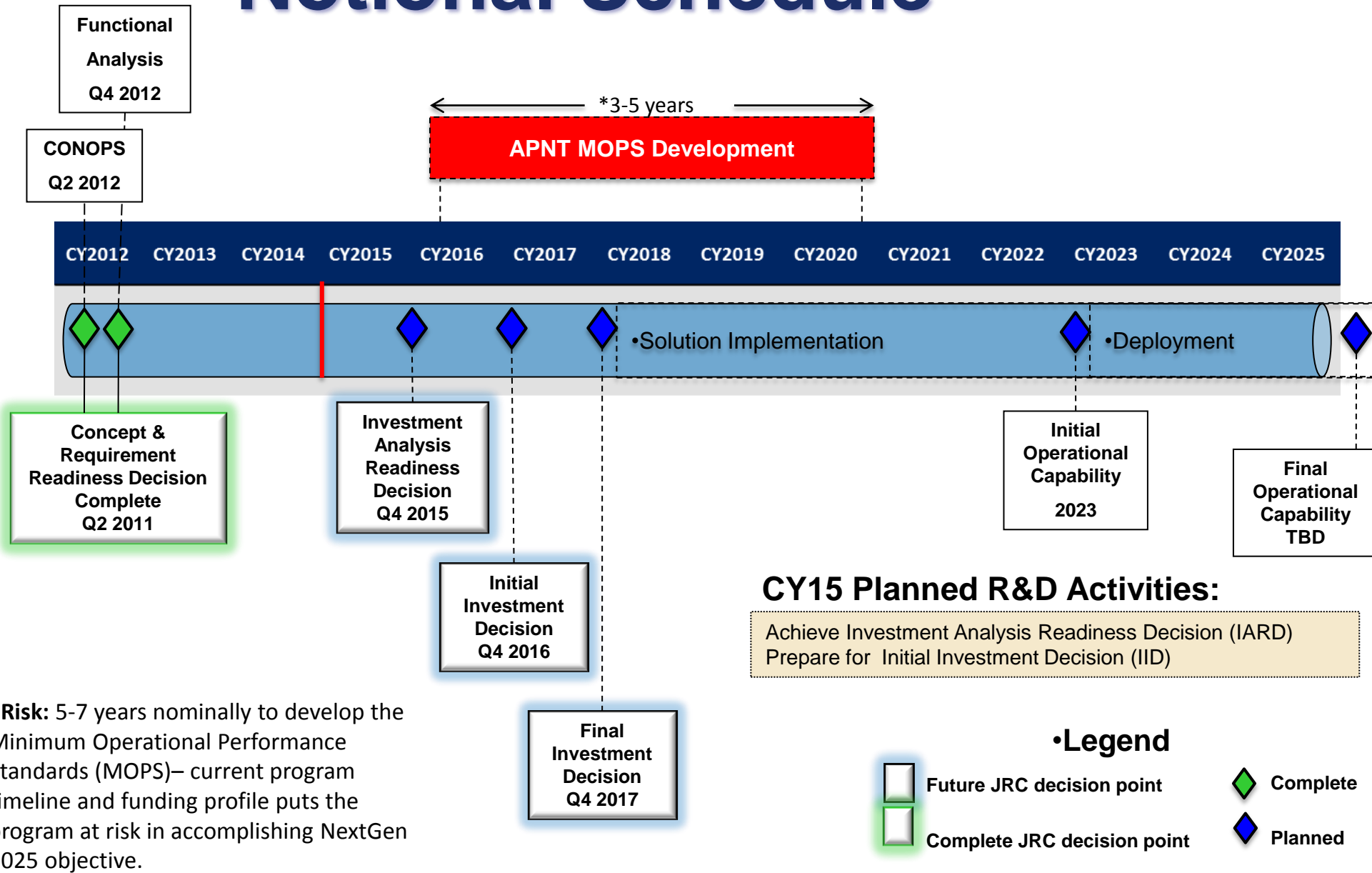
Why Alternate PNT?

- **Presidential Policy Directive 21 (PPD-21), *Critical Infrastructure Security and Resilience***
 - Advances a national unity of effort to strengthen and maintain secure, functioning, and ***resilient*** critical infrastructure
- **FAA needs to maintain aviation operations in the event of a Global Navigation Satellite System (GNSS) interference event or outage**
 - Maintain safety and security
 - Maintain a reasonable level of capacity and efficiency
 - Minimize economic impact

NextGen Alternate PNT

- **The Alternate Positioning, Navigation, and Timing project is investigating alternatives for providing higher precision back-up for Global Positioning System (GPS)-based position, navigation, and timing (PNT) services**
- **GPS PNT services are the enablers of performance-based navigation (PBN) and Automatic Dependent Surveillance Broadcast (ADS-B) services that, in turn, enable Trajectory-Based Operations (TBO), area navigation (RNAV), Required Navigation Performance (RNP), and other NextGen improvements**
- **NextGen APNT will provide a means for users to seamlessly continue RNAV and RNP operations**

Notional Schedule



***Risk:** 5-7 years nominally to develop the Minimum Operational Performance Standards (MOPS)– current program timeline and funding profile puts the program at risk in accomplishing NextGen 2025 objective.

Questions