Australian Government
Civil Aviation Safety Authority

GBAS/SBAS IMPLEMENTATION **CHALLENGES**

System Development Certification and Implementation

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INTRODUCTION

- focus = CHALLENGES
- layout
  - GENERAL CHALLENGES
  - GBAS
  - SBAS
  - RELATED NAV/SUR

GENERAL CHALLENGES

- GAIN SUPPORT FROM PAYING USERS
- SYNCHRONISED ACTION OF STAKEHOLDERS
- OVERCOMING UNFAMILIARITY w/TECHNOLOGY

GBAS – Background

- 2000s = Company developing first-of-type GBAS
- FAA starts certification of such GBAS
- FAA team structured around two broad areas:
  - Compliance with the relevant standards.
  - Novel technical risk.

GBAS – Addressing the challenges (1)

- Priorities Reorganized
  - Australian airline = strong supporter
  - Airservices = ANSP = strong interest
  - CASA supports
- Most effective/efficient
  - Small Regulatory Team observes FAA certification
  - Small Professional Team leads implementation

GBAS – Addressing the challenges (2)

- Activities beyond FAA system certification
  - Local ionospheric study
  - TIFP Design and Validation
  - Airline Staff Training, Airline Operational Approval
  - ANSP Staff Training, ANSP Operational Approval
  - General Industry Education and Communication

- Result = Regulator, ANSP and Users cooperated along journey to ‘commissioning’

SBAS – Background (1)

- SBAS expected to:
  - Enhance vertical positioning of aircraft
  - Reduce Risk of Controlled Flight Into Terrain (CFIT)
  - Benefit regional airports that may never be equipped with Instrument Landing System (ILS)

SBAS – Background (2)

- SBAS Expected to:
  - Mitigate against ILS outages
  - Improve ability to land in a greater range of conditions particularly where cloud cover is low or visibility compromised
  - Reduce delays, diversions, and cancellations with benefits to aircraft operation costs and passenger time lost

SBAS – Addressing the challenges (1)

- SBAS will <u>service sectors other than aviation</u>
- <u>Aviation will not be the main user</u>
- Government decides to acquire a SBAS
  - Geoscience Australia = lead
  - Airservices Australia = ANSP
  - CASA = Safety Regulator
  - Program Executive Board + Technical Leadership and Assurance Groups

SBAS – Addressing the challenges (2)

- PRN and service name = reserved
- SBAS Test Bed to verify:
  - availability, accuracy, integrity and coverage
  - compatibility of SBAS signals with current generation avionics in operational context.
  - safety/efficiency benefits of SBAS instrument approach procedures

SBAS – Addressing the challenges (3)

- SBAS Test Bed Challenges:
  - Suitably equipped aircraft
  - TIFP designed
  - TIFP Design Organisation
  - Fly on VMC

SBAS – Addressing the challenges (4)

- CASA Approval Process:
  - CASA will observe process from the beginning
  - Safety Cases to be presented progressively
  - Safety Cases => solid results; traceable application of tailored Systems Engineering Process (SEP)

SBAS – Addressing the challenges (5)

- CASA Approval Process (ctd):
  - Systems Engineering Process (SEP):
    - tailored to maturity of final product/service
    - starting with top level performance needs
    - cradle to grave, fully integrating, stakeholders, criteria, disciplines, etc.
    - as advised by ICAO Global ATM Operational Concept Annex F (Doc 9854)

SBAS – Addressing the challenges (6)

- Activities expected beyond 'system' certification (similar to GBAS):
  - TIFP Design and Validation
  - Airline Staff Training, Airline Operational Approval
  - ANSP Staff Training, ANSP Operational Approval
  - General Industry Education and Communication

- Expected Result = Regulator, ANSP and Users cooperate along journey to 'commissioning'

RELATED NAV/SUR (1)

- GNSS/ADS-B Mandate Challenges
  - Note: This is not an SBAS mandate.
  - See below
- Navigation Rationalization Project:
  - industry support
  - joint action,
  - overcoming unfamiliarity

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RELATED NAV/SUR (1)

- Backup Navaid Network (BNN) Challenges:
  - forecast evolution of overall navigation system
  - weaknesses to back-up against
  - most/effective backup
- PBN Challenges:
  - Not be a mere overlay of the past

- GENERAL CHALLENGES
  - GAIN SUPPORT FROM PAYING USERS
  - SYNCHRONISED ACTION OF STAKEHOLDERS
  - OVERCOMING UNFAMILIARITY w/TECHNOLOGY
  - CONSIDER GBAS/SBAS WITHIN BROADER ATM/CNS SYSTEM

END

SPARE SLIDES

SBAS – Test Bed Characteristics (1)

- SBAS Test Bed:
  - began transmitting an RTCA/DO-229D-compliant L1 SBAS signal on the 1 June 2017,
  - uses Message Type 0 (MT0) instead of MT2 for fast corrections to prevent users engaged in Safety-of-Life (SoL) operations from using the service.

SBAS – Test Bed Characteristics (2)

- SBAS Test Bed:
  - uses PRN 122 (temporary allocation ended in 31 Jan 2019, subsequently extended to 31 Jan 2020)
  - SBAS Service Provider ID (SPID) of 8, the first spare SPID in Appendix B, Section 3.5.4.4.1 of Annex 10.
  - MT27 is used instead of MT28.

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SBAS – Test Bed Characteristics (3)

- SBAS Test Bed (ctd)
  - began transmitting Dual Frequency Multi Constellation (DFMC) L5 SBAS based on the draft ICD v1.4 developed by the SBAS Interoperability Working Group.
  - The DFMC service makes use of all available Galileo E1 and E5a signals, and GPS L1 ranging signals.

SBAS – Test Bed Characteristics (4)

- SBAS Test Bed (ctd)
  - due to the low number of L5-capable satellites deployed in the GPS constellation, the testbed relies on a L1/L2 codeless method to perform the ionosphere-free solution.

SBAS – Test Bed Characteristics (5)

- SBAS Test Bed (ctd)
  - clock and ephemerides corrections are broadcast on L5.
  - transmits Precise Point Positioning (PPP) corrections on L1 and L5 for non-aviation applications using a proprietary format developed by GMV.