Surveillance Evolution in Europe

Johan Martensson, Senior Surveillance Expert, EUROCONTROL
Content

• Strategic view
• Progress
  • Airborne view
  • Ground view
  • Space view
• Future Developments
• Roadmap
SESAR ATM Master Plan Strategic View

**Target Architecture**

- **Performance-Based Applications**
  - Performance-based CNS applications: PB CNS
  - Navigation: CNS (voice & data)
  - Surveillance: CNS (voice & data)
  - Airborne: CNS (voice & data)

- **Aeropsychological Info Services**
- **ATM Network Services**
- **Airport Services**
- **Aeronautical Info Services**

**Roadmap**

- **IP Backbone**
  - Now: Ethernet, IP, IPv4
  - 2025: IP, IPv6, IPv4/IPv6
  - 2030: IP Mobility, IPv6
  - 2035: SWIM, SDN

- **HF & VHF data**
  - Now: VHF
  - 2025: VHF, UHF
  - 2030: VHF, UHF
  - 2035: VHF, UHF

- **Performance Based CNS**
  - Now: SATCOM, AOC, ADS-B
  - 2025: SATCOM, AOC, ADS-B
  - 2030: SATCOM, AOC, ADS-B
  - 2035: SATCOM, AOC, ADS-B

- **Minimum Operational Network (MON)**
  - Now: MON
  - 2025: MON
  - 2030: MON
  - 2035: MON

**Objective Infrastructure**

- **MON VHF**
- **MON VOLM2**
- **MON VOLM2**
- **MON A-PRT**

**MON – Minimum Operational Network**

**Minimum Operating Network of legacy infrastructure**

- **VHF, UHF, L-band, S-band, C-band, X-band, Ku-band**

**SUR MON currently being revisited**
SUR Avionics Requirements

• EU Regulation 1207/2011 SPI IR (Amended)
  • ELS (IFR/GAT) + EHS & ADS-B (IFR/GAT >5.7t/250kts) from 7 December 2020
    • ADS-B version 2 required
    • EHS/ADS-B Transition until 7 June 2023
    • Provisions for: Aircraft with CoA before 7 June 1995, Maintenance, Export, End ops by 31 Oct 2025; State aircraft

• State AIPs

• Approval/Conformity
  • Airborne
    • EASA CS-ACNS (aircraft integration)
    • EASA CS-STAN (pre-approved installation on small aircraft)
    • EASA ETSO-C166b and ETSO-C112d (avionics component, in combination with GNSS ETSOs)
  • Ground
    • EASA AMC/GM
    • EUROCONTROL Specification for ATM Surveillance System Performance (ESASSP)
    • Sensors: EUROCAE ADS-B GS and WAM, EUROCONTROL Mode S
Airborne Equipage

• Mandated fleet under SPI IR
  • July 2022
  • ADS-B v2: ~92% Aircraft and NM Flights

Monthly ADS-B Equipage updates: https://www.eurocontrol.int/service/adsb-equipage
Airborne Equipage monitoring

• Equipage vs plans and milestones
  • Airspace user plans: Based on surveys by SESAR Deployment Manager (SDM)
  • Actual equipage: Based on SUR monitoring by EUROCONTROL

• Status mid-2022
  • ~92% of mandated fleet and flights equipped with ADS-B v2
  • ~95% with all ADS-B versions
  • 80+ TMAs (of top-200 airports) with more than 90% of ADS-B v2 operations
Equipage Evolution – Ratio of “NM flights”

01.07.2018  01.07.2019  01.07.2020  01.07.2021  01.07.2022

Monthly ADS-B Equipage updates: https://www.eurocontrol.int/service/adsb-equipage
Ground ADS-B Implementation

- Updates from Local Single Sky Implementation+ (LSSIP+) monitoring
SUR Sensor Evolution

### ADS-B, WAM, Mode S, MLAT

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Surveillance chain

- Surveillance Data Processing (SDP)
  - ARTAS system used by most European states and some non-European
    - Operations since 1999
    - Operational in almost all European countries
  - Various other SDPs are used as main and/or fallback

- Surveillance Data Distribution (SDD)
  - SDDS used by several ANSPs in Europe
  - ADS-B Server functionality

- Surveillance Analysis Support System for ATC Centres (SASS-C)
  - SUR evaluation system used by most European states

- ASTERIX incl.:
  - SSR Mode S: CAT048
  - ADS-B: CAT021 (CAT053 - new ADS-B Category under development)
  - WAM: CAT020

ASTERIX - All-purpose structured EUROCONTROL surveillance information exchange
ADS-B Applications

**ADS-B OUT Applications (EUROCAE/RTCA)**
- In Radar Airspace (ADS-B RAD, ED-161/DO-318)
- In Non-Radar Airspace (ADS-B NRA, ED-126/DO-303)
- Airport Surveillance (ADS-B APT, ED-163/DO-321)

⇒ ICAO PANS-ATM
⇒ ICAO Annex 10
⇒ (ICAO Circular 326)
⇒ (“ICAO PBS SG RSUR”)

**ADS-B IN Applications (EUROCAE/RTCA)**
- Aircraft Surveillance Applications MOPS (ED-194/DO-317)
- Interval Management MOPS (ED-236/DO-361)
- Enhanced Traffic awareness for Flight ops (AIRB, ED-164/DO-319)
- Enhanced Traffic awareness for Surface ops (ED-165/DO-322+323)
- In Trail Procedure (ITP, ED-159/DO-312)
- Visual separation on Approach (VSA & CAVS, ED-233/DO-354)
- Traffic Situation Awareness with Alerts (TSAA/ATAS, ED-232/DO-348)
- Interval Management (IM, ED-195/DO-328)

⇒ ICAO DOC 9994 Manual on Airborne Surveillance Applications
⇒ ICAO PANS-ATM, PANS-OPS
⇒ ICAO Annex 10
ADS-B Implementation aspects

• Generally fused with other sensors e.g. Radar/MLAT
• Stand alone in specific environments (low density)
• All ANSPs use ADS-B v2, some are using all ADS-B versions
• For all types of Air Traffic Services: ATC, FIS, Alerting
ADS-B Implementation aspects cont.

- ADS-B Flight plan indications
  - Improved provisions for ADS-B Out and ADS-B IN indications using item 18 SUR/
  - Under implementation

- Specimen AIP available
  - Prevent provision of misleading data and
  - Provide guidance for equipage for non-mandated

- Privacy
  - Concerns raised by some Airspace Users (AU)
  - Mitigation options explored incl.:
    - Safeguarding Flight data, Improve AU control of data, Anonymize SUR data
    - Privacy discussion paper available
    - Implementation guidelines under development

- Mixed SUR equipage
  - Limiting benefits, trade-off between AU impact (cost vs direct benefit) and enabling full ATM ADS-B benefits
  - Mitigating constraints, making it “easy” to equip
Developments

- Moving towards making all sensors using ADS-B
  - Mode S SSR, MLAT/WAM/LAM and ADS-B GS

- ADS-B version 3 considerations
  - Avionics MOPS ED-102B/DO-260C [chg. 1]
  - Ground System ED-129C: Basic 2022, ED-129D: full tbd
  - ASTERIX: CAT021 ed. 2.6, CAT053 (2022+)
  - Related Regulatory/Approval updates - initial drafting
Space-Based ADS-B - ATS

• NAT region - Separation minima using ATS surveillance systems where VHF voice communications are not available [ASEPS]
  • Shanwick (& Gander)
  • Santa Maria (currently Gnd, SBA under evaluation)

• NAT region
  • Reykjavik
  • Bodo (FIS, Alerting <FL100, higher alt. tbd)

• Other specific use cases under evaluation
Space-Based ADS-B - ATFM

• Integration of Space-based ADS-B data into ETFMS - Spring 2021
  • ADS-B complements CPR data in NM area
  • ADS-B provides a major predictability improvement of 20% in time
    • A significant part from better estimates for flights inbound to Europe

CPR – Correlated Position Reporting
ADS-B IN

• ADS-B IN Airborne Awareness applications are Operational since 2012

• Other ADS-B IN applications under development
  • Airport Surface applications
    • Focus on Runway Alerting
  • Interval Management (IM), etc.
# Surveillance Roadmap 1/3

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**Legend:**
- **✓** Indicates completion.
- **Orange** indicates ongoing development.

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**Notes:**
- ESASSP: EUROCONTROL standard for ATM Surveillance system performance
- CS-ACNS, CS-STAN: EASA certification specifications
### Surveillance Roadmap 2/3

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**Updated ToRs**

- ED-129D
- TBD
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Collaborative progress

• European and International Stakeholders
• Global Interoperability
• Civ-Mil coordination
THANK YOU

Contact:
surveillance@eurocontrol.int or johan.martensson@eurocontrol.int