The ADS-B Webinar

ICAO
MID & EUR/NAT

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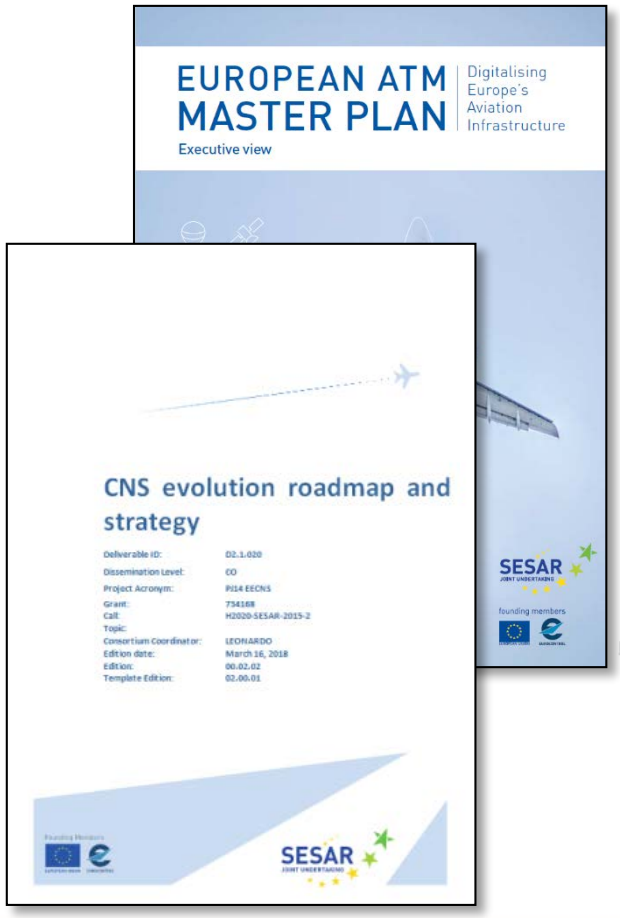
ADS-B strategy and progress in Europe

Content

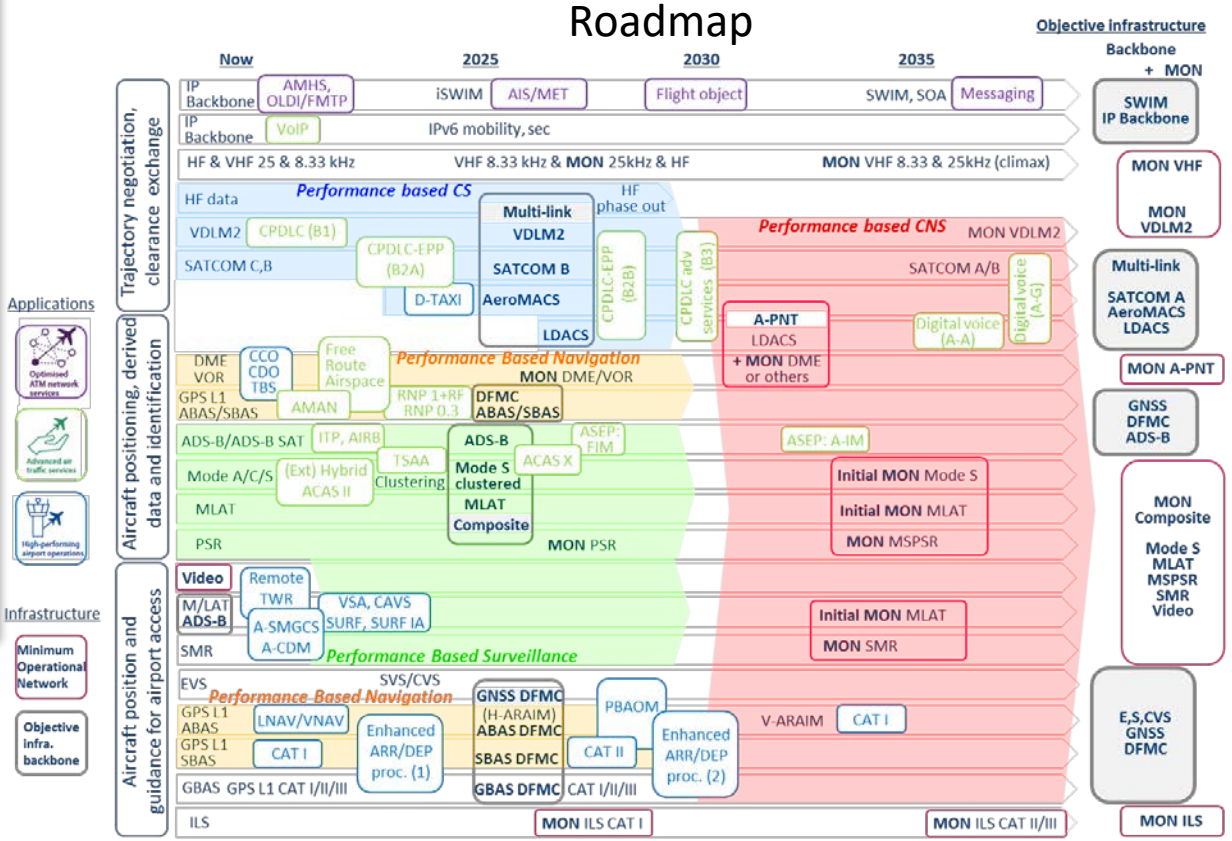
- Strategic view
- Implementation progress
  - Airborne view
  - Ground view
  - Space view
- Future Developments

SESAR ATM Master Plan Strategic View

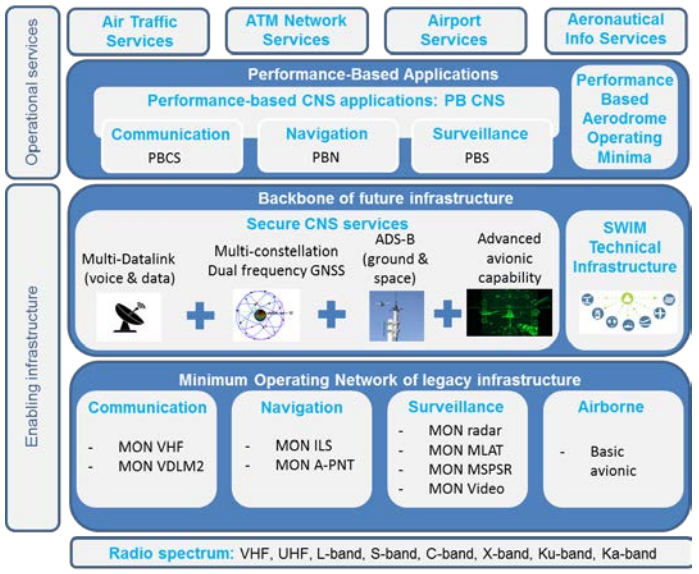
SESAR JOINT UNDERTAKING



Roadmap



Target Architecture



SUR MON currently being revisited

MON – Minimum Operational Network

ADS-B Benefits

- ADS-B enables a wide range of benefits which can be explored in various implementations/environments e.g. including:
  - Global Coverage
  - Performance Enhancements
  - Safety
  - Capacity
  - Cost Efficiency (sensor optimisation)
  - Flight Efficiency
  - Improved 1030/1090 Spectrum use (incl. reduced trp. load, spectrum occupancy)
  - Improved ACAS
  - Environmental Sustainability

ADS-B Requirements

European Commission

- 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

EASA European Aviation Safety Agency

EUROCAE

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)

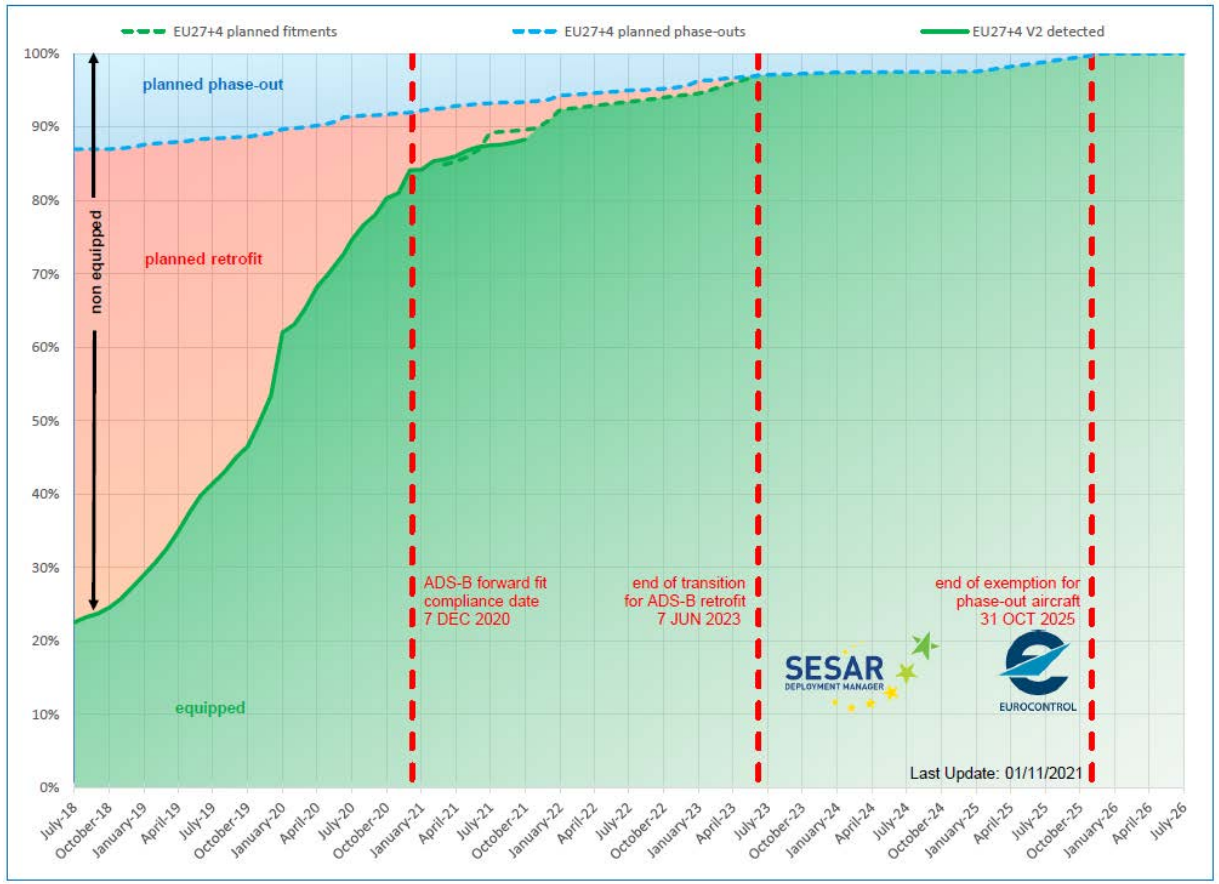
⇒ ICAO DOC 9994 Manual on Airborne Surveillance Applications
⇒ ICAO PANS-ATM, PANS-OPS
⇒ ICAO Annex 10

Airborne Equipage progress

October 2021:

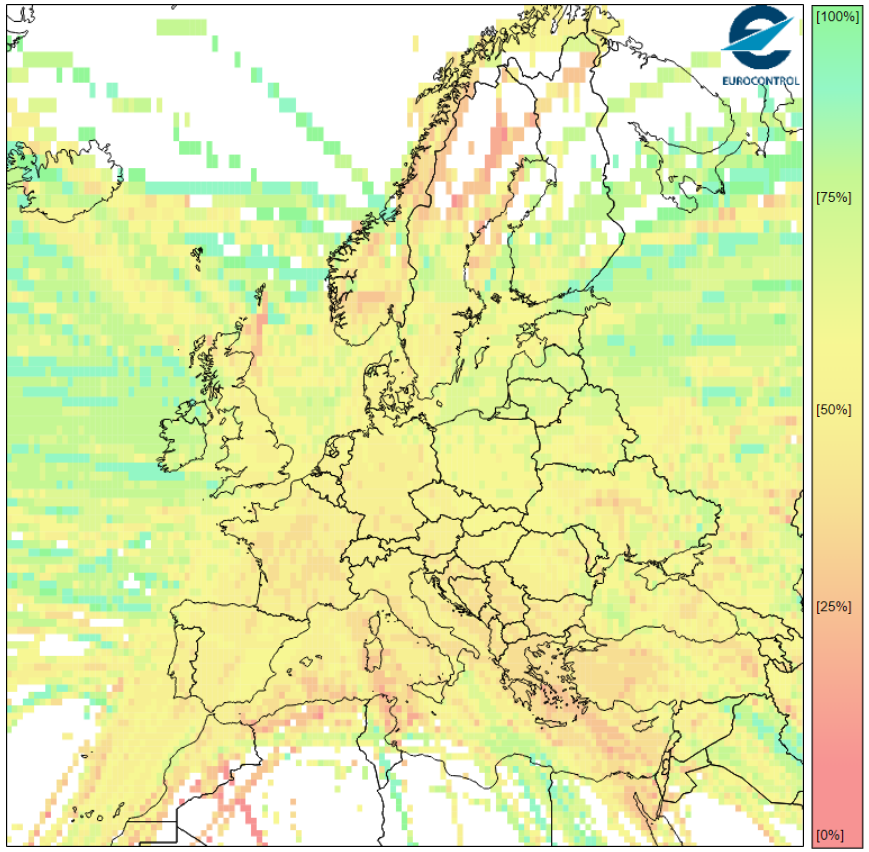
- ~90% of mandated fleet and flights equipped with ADS-B v2
- ~95% with all ADS-B versions
- 80+ TMAs (of top-200 airports) with more than 90% of ADS-B v2 operations

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



Flight Equipage Evolution

01.10.2019



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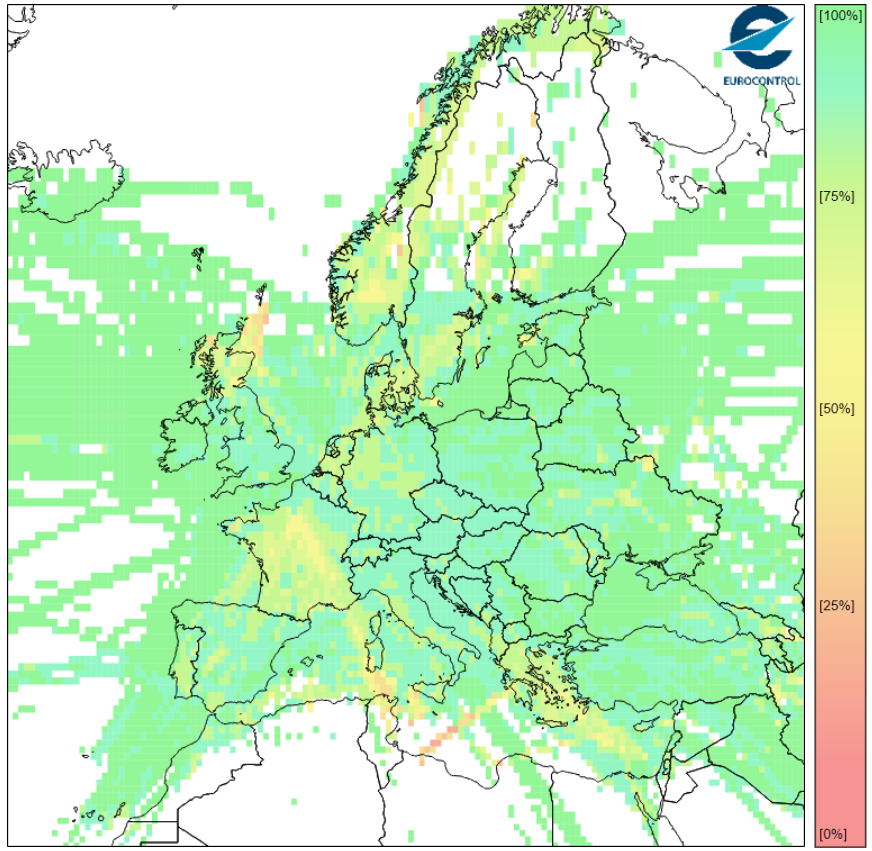

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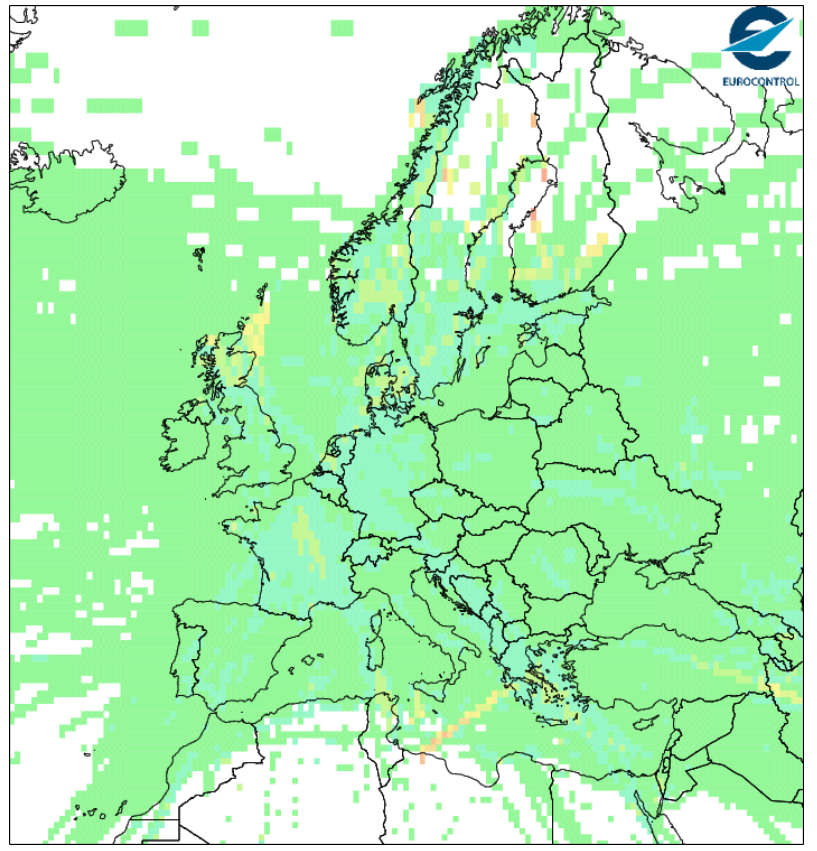


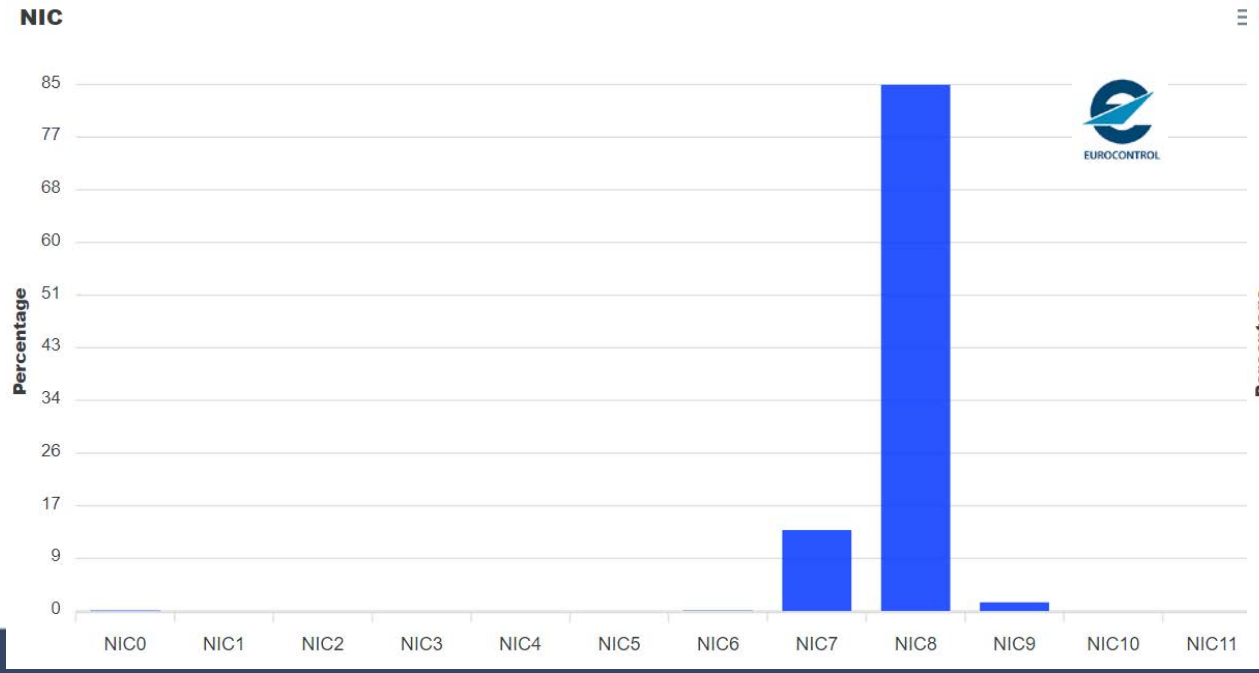
ADS-B Quality

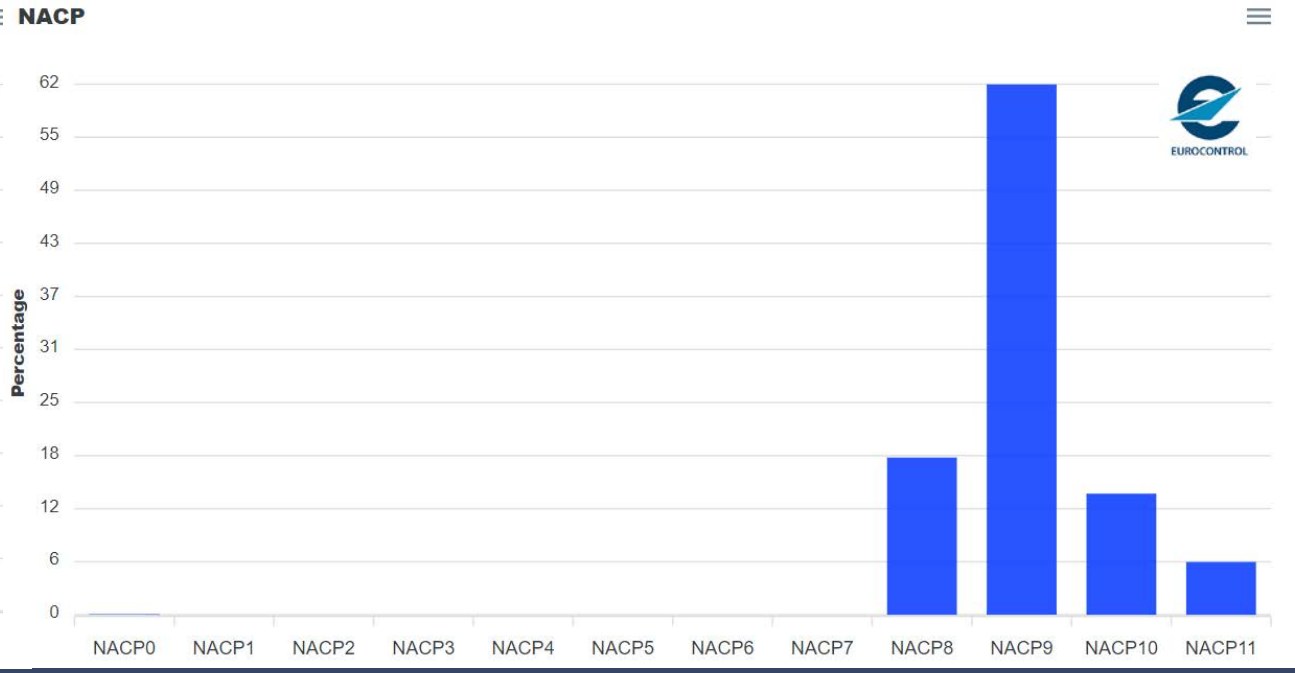
Separation minima	5NM		3NM	
Parameter / standard	NRA ED126	RAD ED161	NRA ED126	RAD ED161
NIC (nm)	4 (2)	5 (1)	5 (1)	6 (0.6)
NACp (nm)	5 (0.5)	7 (0.1)	6 (0.3)	7 (0.1)

- NIC & NACp ADS-B v2 (SPI IR, 6 months)
  - 99,898% target reports with NIC ≥ 6 (Airbus + Boeing: 99.953%)
  - 99,921% target reports with NACp ≥ 7 (Airbus + Boeing: 99.928%)

QI	Reports	(%)	(%) cumm.
NIC0	1 051 412	0.0923	100.0000
NIC1	5 535	0.0005	99.9077
NIC2	7 889	0.0007	99.9072
NIC3	12 753	0.0011	99.9065
NIC4	28 385	0.0025	99.9054
NIC5	53 252	0.0047	99.9029
NIC6	950 407	0.0834	99.8983
NIC7	149 415 187	13.1133	99.8149
NIC8	971 731 828	85.2831	86.7016
NIC9	16 109 734	1.4139	1.4185
NIC10	41 222	0.0036	0.0046
NIC11	11 302	0.0010	0.0010

QI	Reports	(%)	(%) cumm.
NACP0	809 606	0.0711	100.0000
NACP1	448	0.0000	99.9289
NACP2	728	0.0001	99.9289
NACP3	5 423	0.0005	99.9288
NACP4	4 586	0.0004	99.9284
NACP5	7 242	0.0006	99.9280
NACP6	70 074	0.0061	99.9273
NACP7	60 767	0.0053	99.9212
NACP8	207 728 238	18.2311	99.9158
NACP9	700 863 734	61.5106	81.6848
NACP10	160 002 611	14.0425	20.1741
NACP11	69 766 177	6.1230	6.1317



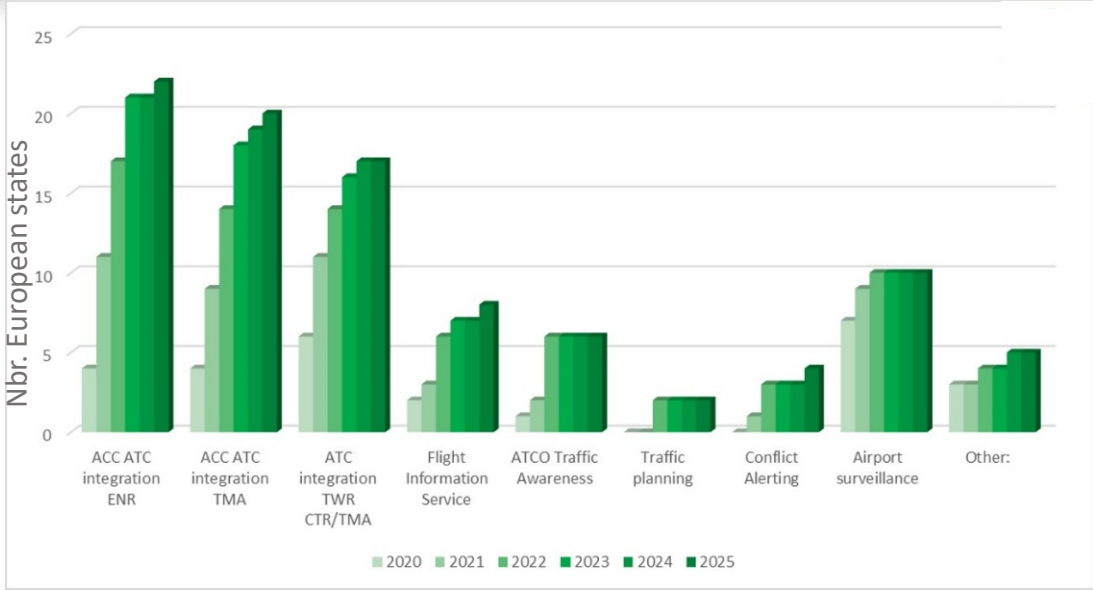


ADS-B Quality cont.

- ADS-B data quality processing considerations
  - Quality Indicator (QI) filtering (QIs are sensor based performance/integrity)
  - Non-Performance ADS-B Aircraft List (NPAL)
    - Aircraft presenting misleading ADS-B information that could compromise operational ATC use
    - Cover all ADS-B versions and all relevant aircraft sending ADS-B data qualifying for ATC services
    - Deployed where operationally needed
    - Coordination with: NAT-list, NSAL (FAA)
    - Currently: 27 aircraft of which 5 a/c ADS-B v2
  - Sensor and SDP Inconsistency detection and reaction [Improvements in progress]
- Monitoring
  - Anomaly Detection and Resolution
  - Avionics monitoring currently covering about 80% of aircraft (with FPL) and growing

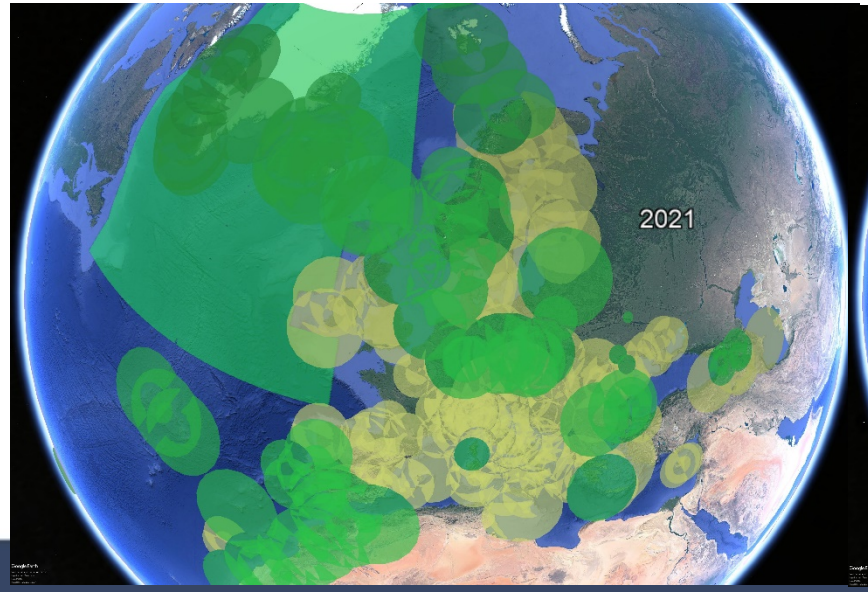
Ground ADS-B Implementation

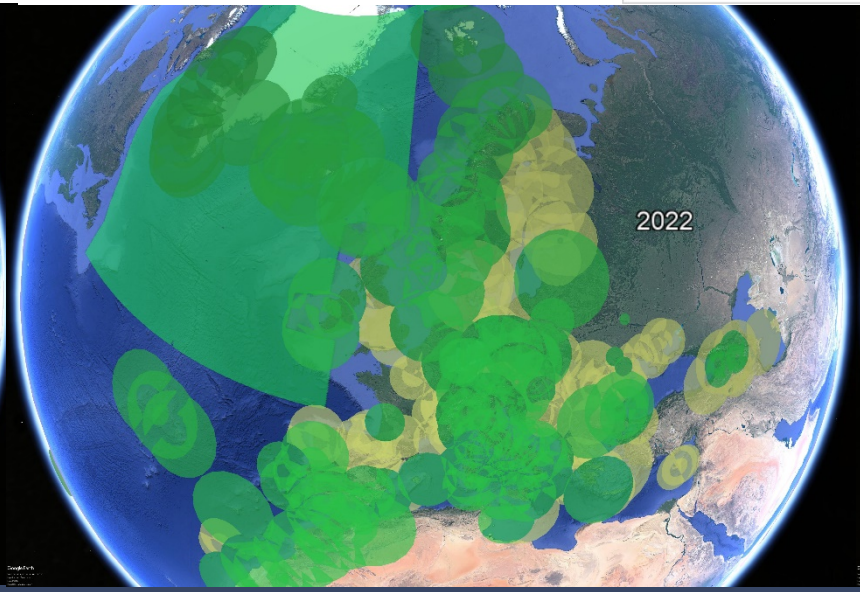
- Updates from Local Single Sky Implementation+ (LSSIP+) monitoring (by SDM and EUROCONTROL)

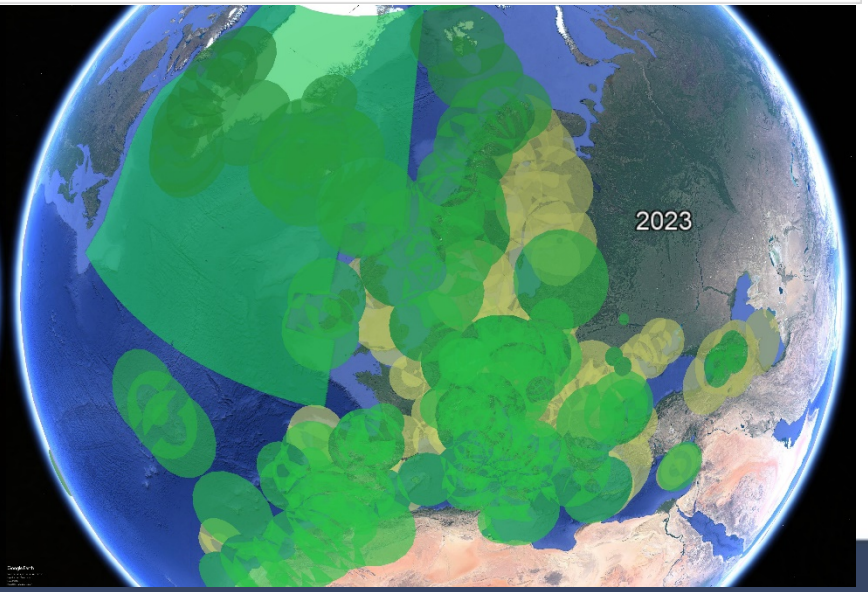


Operational

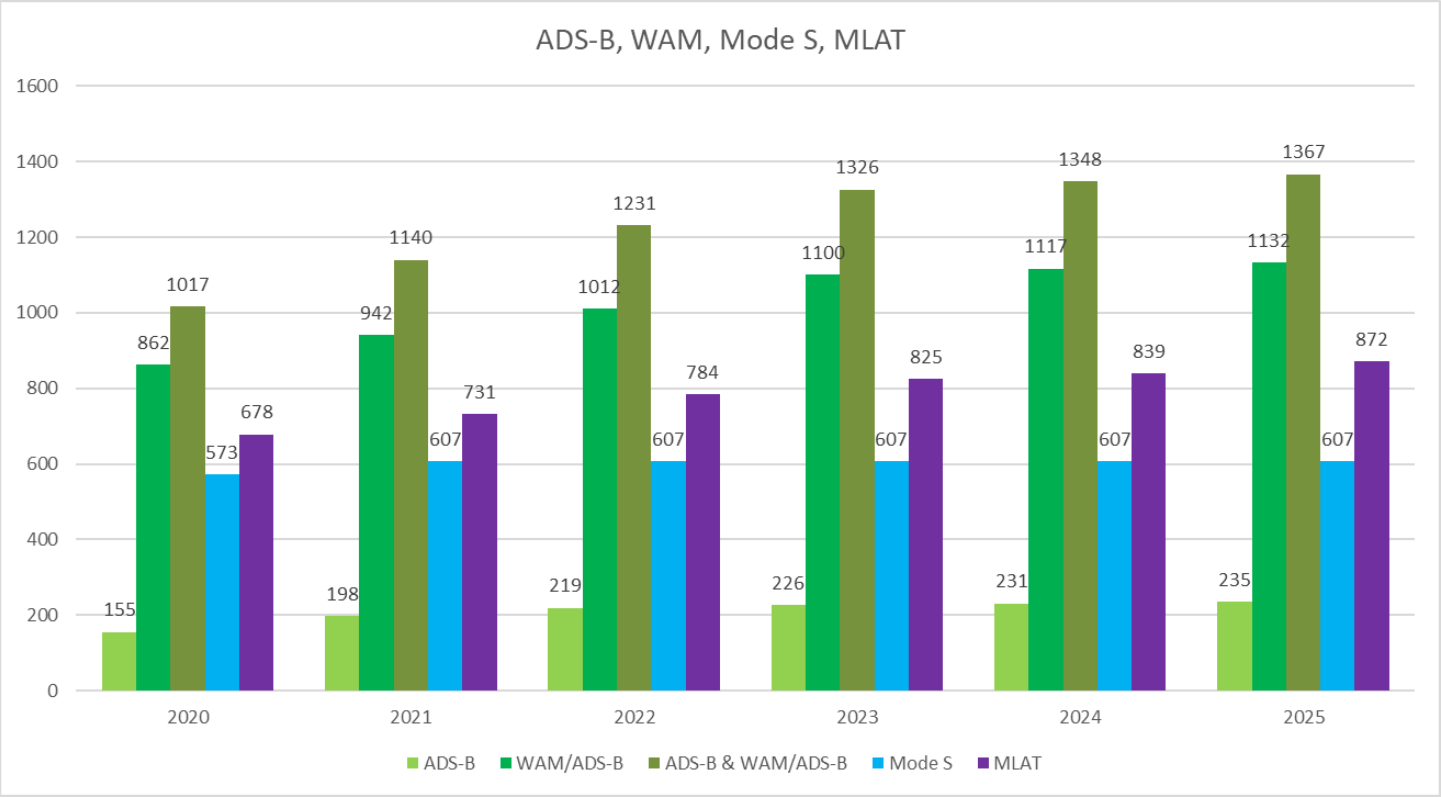
Deployed

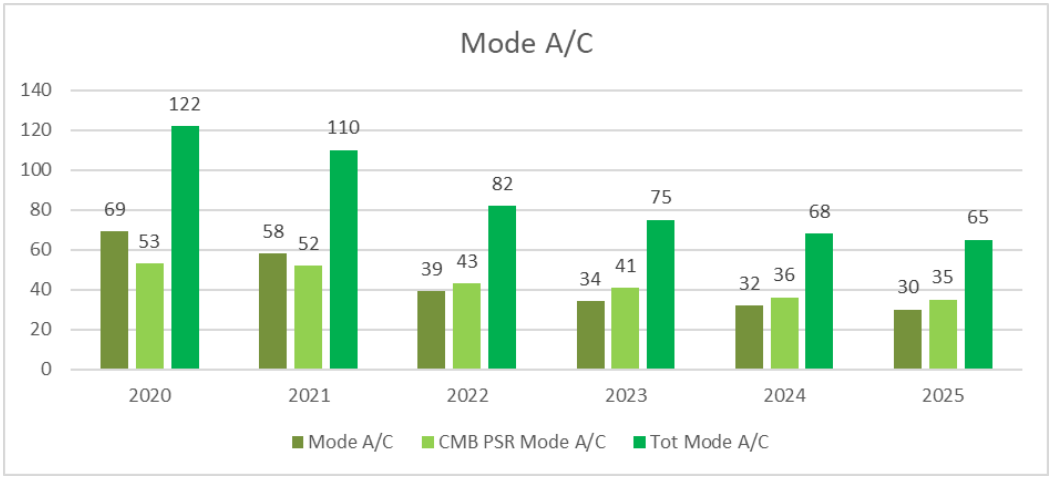


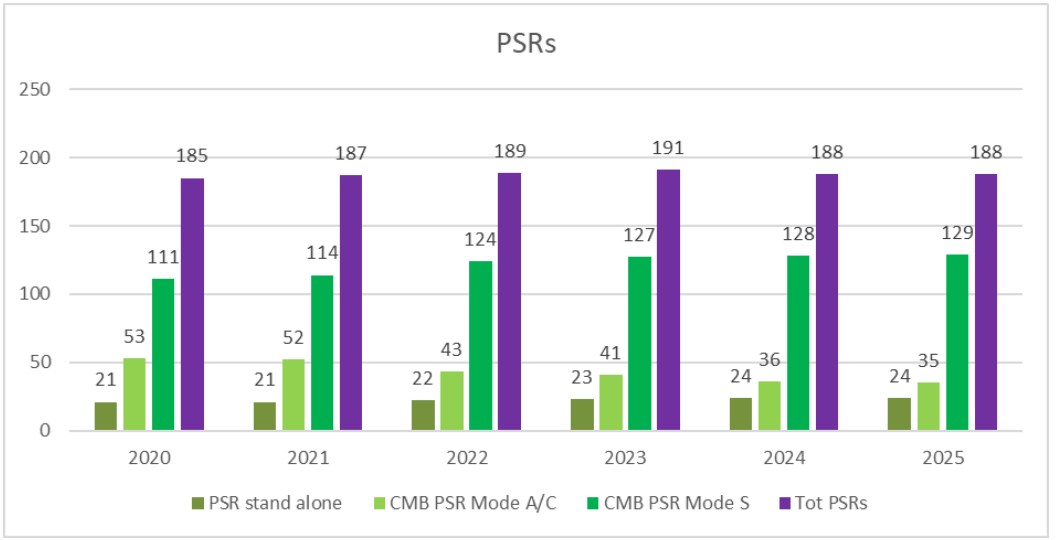




SUR Sensor Evolution

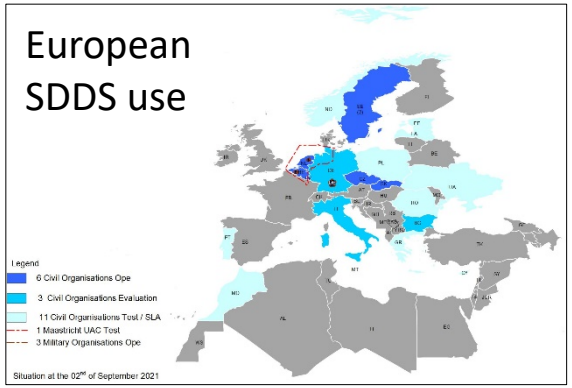


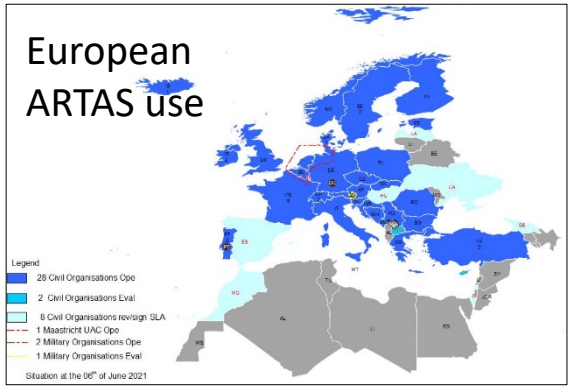


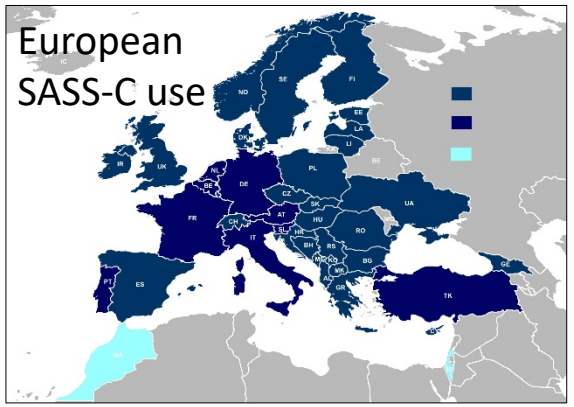


Surveillance chain supporting ADS-B integration

- Surveillance Data Processing (SDP)
  - ARTAS system used by most European states and some non-European
    - Operations since 1999
    - 52 Operational systems (45 Operational, 7 Fall-back) used by 32 ANSPs
  - 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
  - CAT021
  - CAT053 (new ADS-B Category under development)

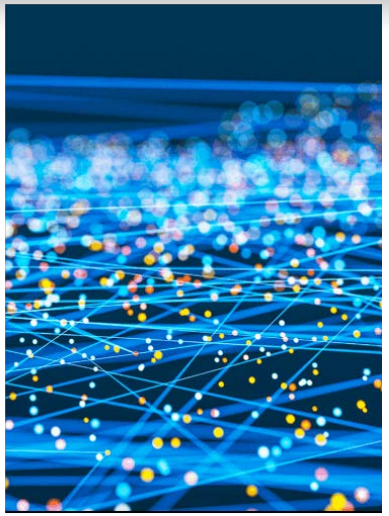




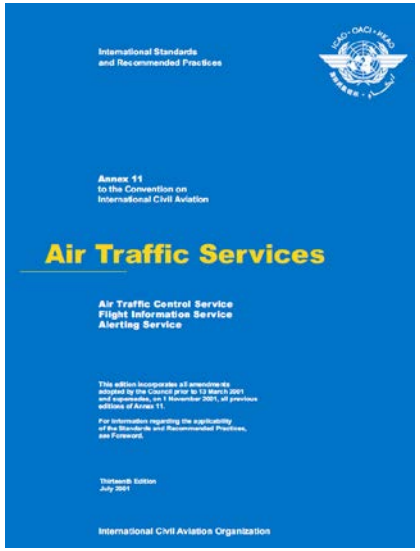


ASTERIX - All-purpose structured EUROCONTROL surveillance information exchange

ADS-B Implementation aspects

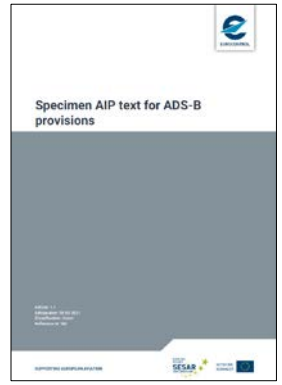


- General: ADS-B fused with other sensors e.g. Radar/MLAT
- Stand alone in specific environments (low density)
- All ANSPs use ADS-B v2, some are using all ADS-B versions
- For all types of Air Traffic Services: ATC, FIS, Alerting



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
- Privacy
  - Concerns raised by some Airspace Users (AU)
  - Mitigation options explored incl.:
    - Safeguarding Flight data, Improve AU control of data, Anonymize SUR data
- 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

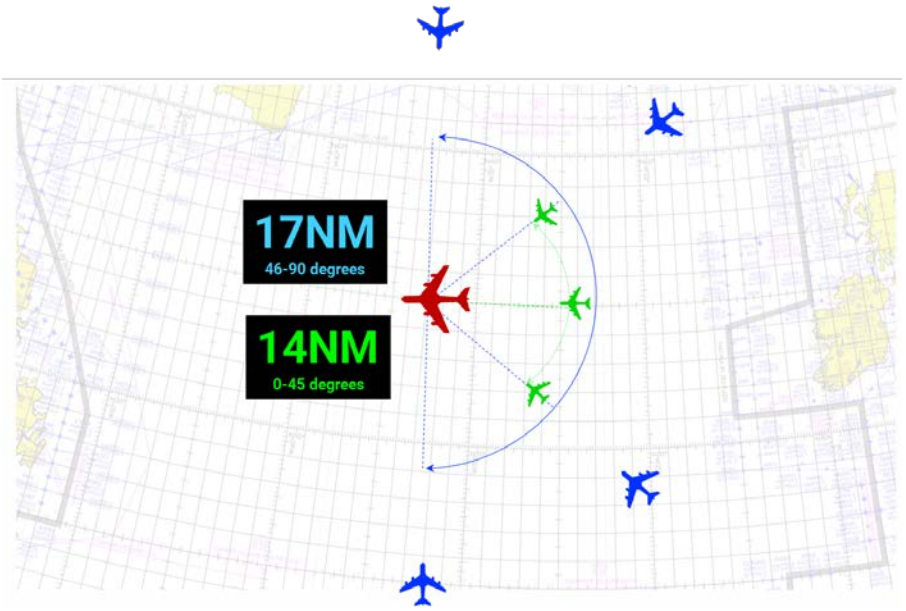


Space-Based ADS-B - ATS

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

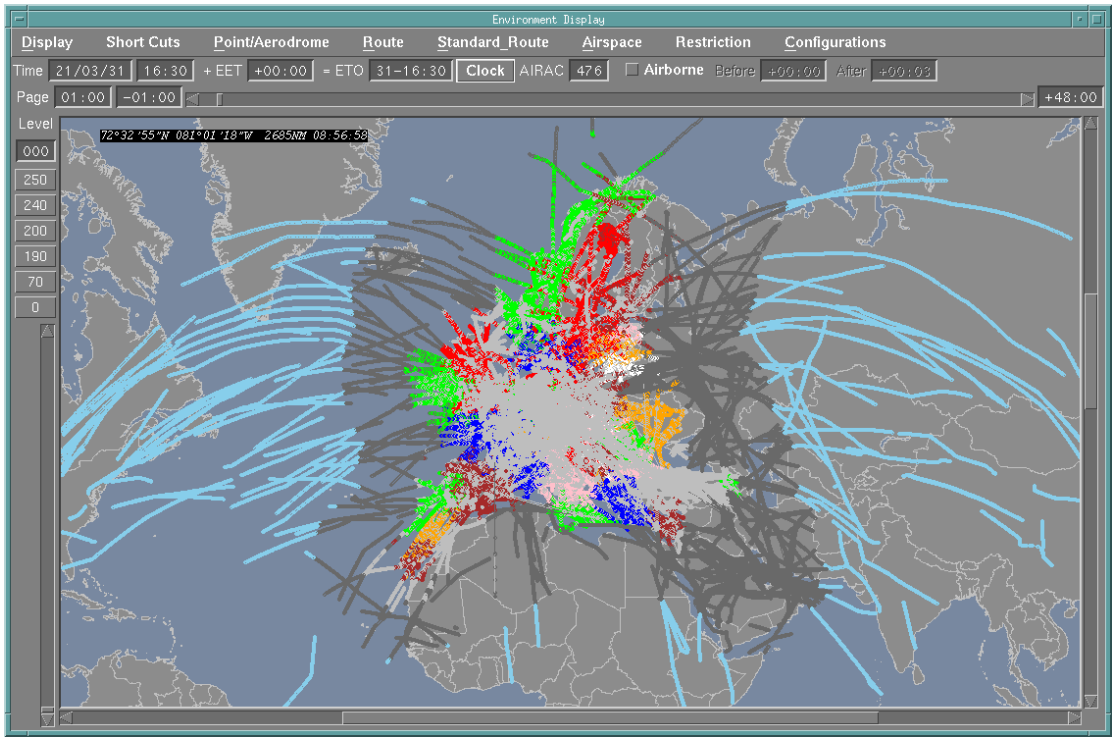
- NAT region
  - Reykjavik
  - Bodo

- 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

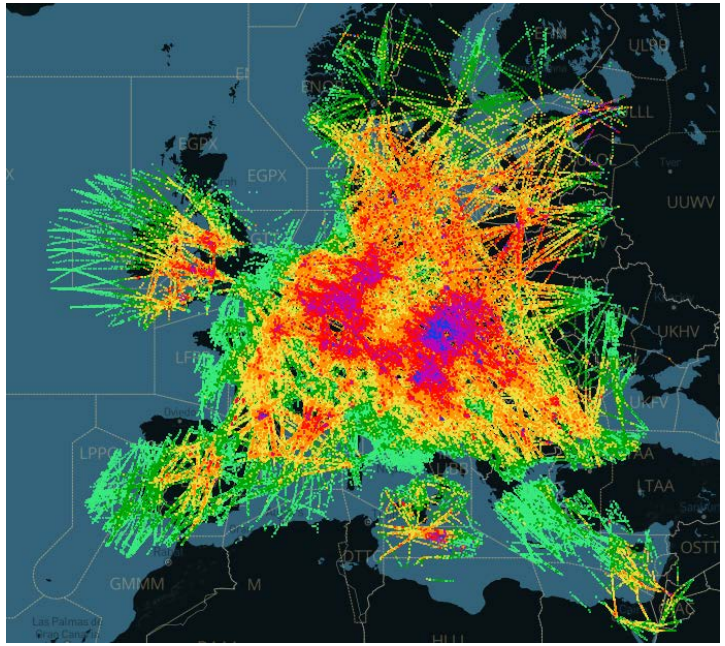


CPR – Compact Position Reporting

ADS-B Developments

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

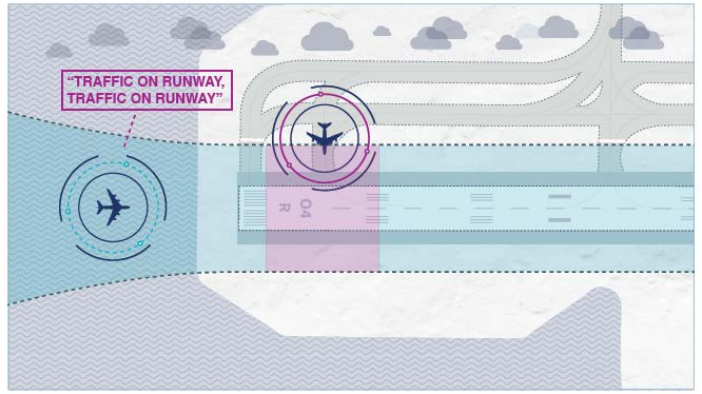
- ADS-B version 3 considerations
  - Avionics MOPS ED-102B/DO-260C [chg. 1] (end 2021)
  - Ground System ED-129C (Basic, 2022) [ED-129D (full, tbd)]
  - ASTERIX: CAT021 ed. 2.6 (2021), CAT053 (2022+)
  - Related Regulatory/Approval updates are under investigation



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.



Collaborative progress

- European and International Stakeholders
- Global Interoperability
- Civ-Mil coordination

THANK YOU

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