



# Towards a multi constellation GNSS in aviation

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# EUROCONTROL, the European organization for the Safety of Air navigation

- A civil and military organisation with **38 Member States**.
- **Ensure safety** building a seamless, pan-European Air Traffic Management (ATM) system to cope with capacity needs and environmental aspects.
- Core business :
  - ✓ A “Single Sky” in Europe.
  - ✓ Development of European ATM Network
  - ✓ Pan-European functions (e.g. Flow Control, Central charging)
  - ✓ Provision of regional ATC services
  - ✓ SESAR: R&D on the future air traffic management (ATM) network across the European continent.
  - ✓ Support to EU regulation and system performance review
- Partnership with European and international stakeholders (e.g. EC, ICAO, FAA,ESA...)
- More information: <http://www.eurocontrol.int/>

# EUROCONTROL role on GNSS

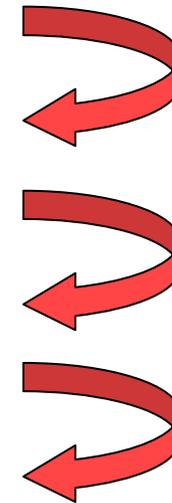
*25 years contributing to GNSS addressing safety, technical, operational, standardisation, economical, institutional and legal matters.*

**Common strategies and policies for Europe**

**Aviation user requirements for GNSS**

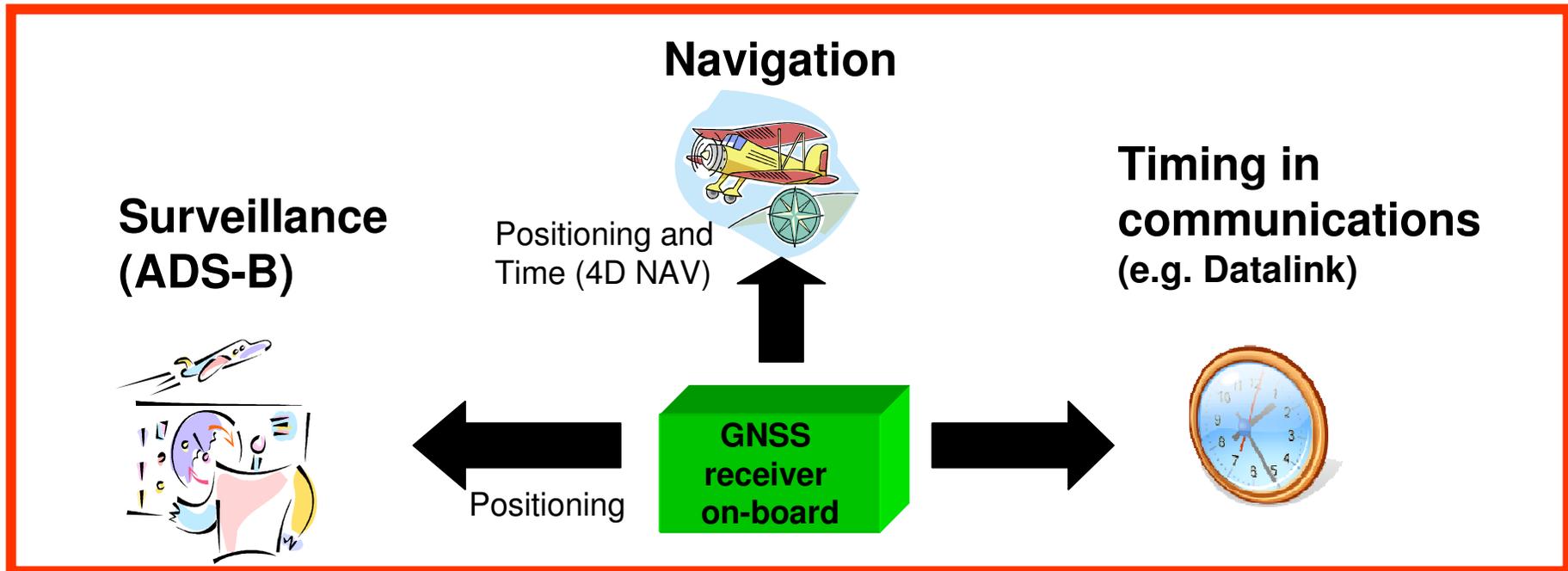
**Operational validation of GNSS performance**

**Support harmonised pan-European implementations**

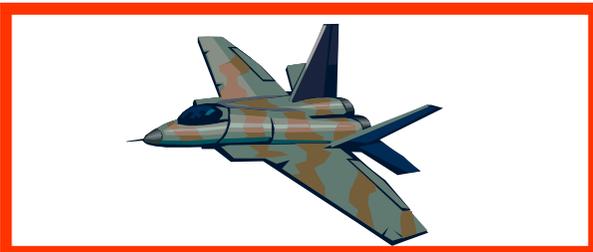


# Use of GNSS in aviation applications

## Civil domain



## Military domain (based on GPS PPS & Galileo PRS)



# Aviation needs for a Multi-constellation GNSS



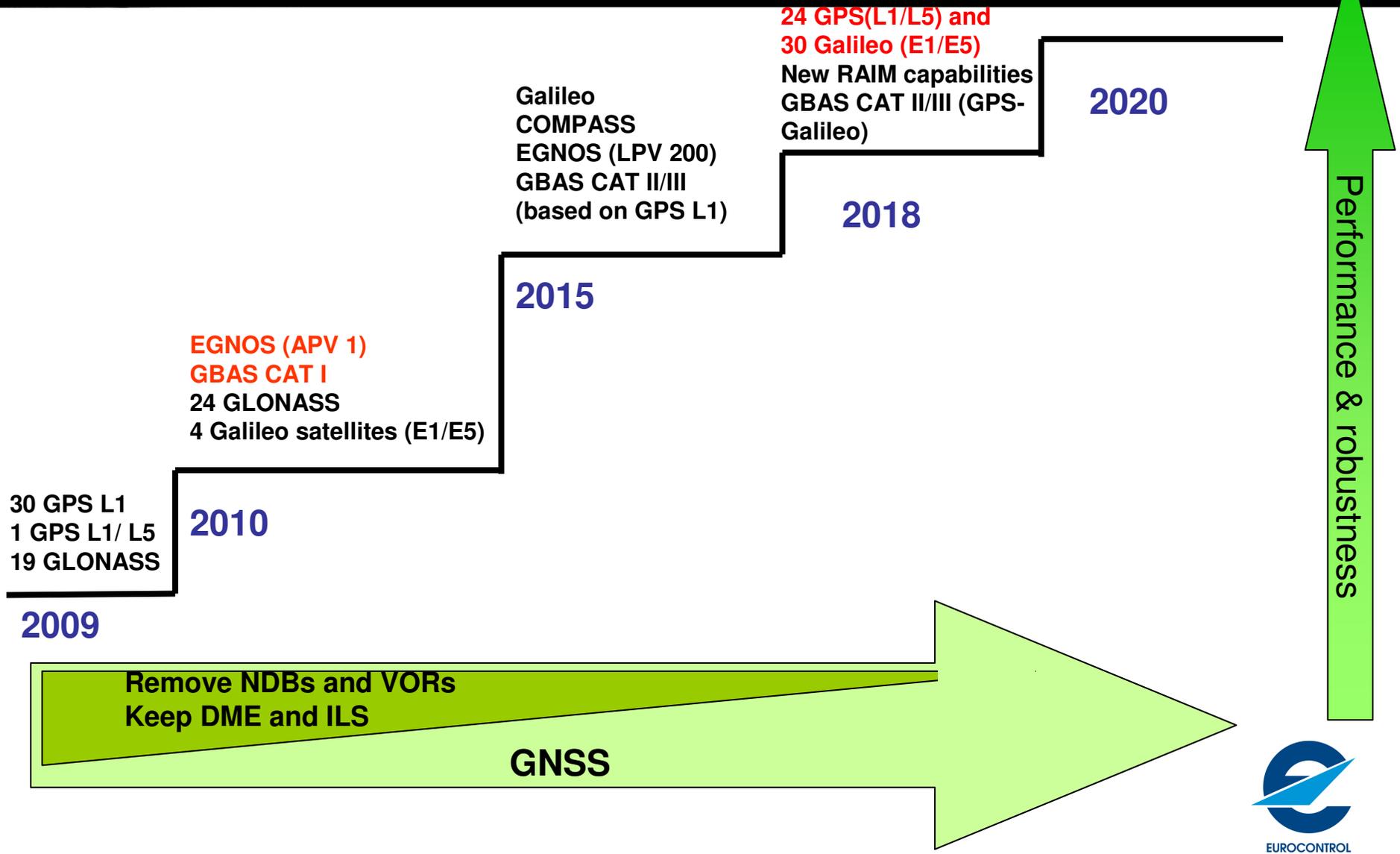
Better **Performance** for increasing number of more demanding applications (e.g. from 5 to 1 NM, LPV 200, ADS-B,..)

More **Robustness** against vulnerabilities (iono, interferences)



**Interoperability**, doing things better working together for a global aviation

# Towards a multi constellation GNSS

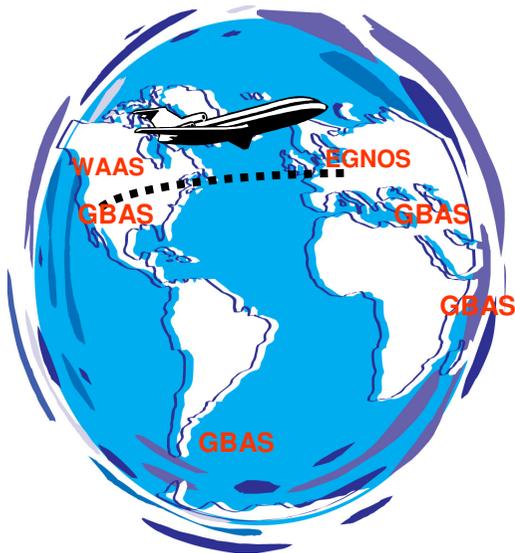


# Why interoperability is so important for aviation ?



Aviation is a global business and interoperability is a key element to enable:

- ✓ Global harmonisation
- ✓ Standardisation process
- ✓ Reduce avionics costs (installation, certification,...)
- ✓ Seamless navigation performance



**UN ICAO** standards (SARPS) ensure global interoperability of aviation systems like SBAS and GBAS:

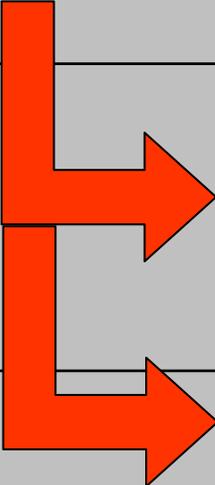
✓ A SBAS receiver that works in the US (WAAS) will work in Europe (EGNOS)

✓ Same aircraft can use a GBAS station in Australia, Brazil, US or Europe.

**UN ICG:** Extend interoperability from signals to integrity at core constellations levels.

# Towards a Multi constellation GNSS:

increasing robustness, performance and interoperability

| Today (around 60% of fleet)   | Tomorrow (all aircraft)   |
|---|---|
| GPS L1  | GPS, Galileo, GLONASS and COMPASS??<br><b>Performance:</b> Smaller and better characterised failures<br><b>Robustness</b> (against iono and interferences): Multi frequency<br><b>Interoperability</b> : Comparable commitments |
| GPS/RAIM: Horizontal integrity<br>2010 EGNOS (SBAS): Vertical integrity |  <p>Multi constellation RAIM: Vertical integrity?<br/>A light integrity channel, SBAS evolution ?</p>  |
| 2010 GBAS (GPS): CAT I  | GBAS (Multi constellation) : CAT II/III   |

# Summary

## European aviation needs:

- Gradual reliance on a multi-constellation GNSS for all phases of flight and many aviation applications.
- **Performance, Robustness and Interoperability.**

## EUROCONTROL work on GNSS is based on cooperation:

- European level: EC, ESA and aviation stakeholders
- Global level: ICAO and UN ICG

## Key areas of cooperation within UN ICG :

- Extend **interoperability from signals to integrity**
- Defining future **GNSS baseline** for European aviation (SESAR)
- Technical studies (e.g. SESAR, RAIM, ionosphere impact on aviation applications during next solar max)