

Authorization and Operation of GNSS Aviation Services in Non-Core Constellation States

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Disclaimer: Contains No Official EUROCONTROL Policy Statements

Introduction

- GPS: It's great and it works!
 - Available globally and reliably free of direct user charges
 - Most aircraft equipped
 - Fully enables all Nav Specs of Performance Based Navigation
 - Benefits airspace capacity and efficiency
- *So just use it – what's the problem?*
 - Air Navigation Service Provision is sovereign responsibility
 - Terrestrial navaids: needs cross-border agreement
 - Service and equipment needs certification basis in Europe
- Why care?
 - So far U.S. GPS is the main global “game in town” for aviation
 - Russia first with Multi-constellation experience
 - Want to make multi-constellation benefits available! Thus:
 - **ALL States will need to resolve “authorization issue”**
 - Includes continued operational aspects

ICAO Plan for GNSS

- Doc 9750 Global Air Navigation Plan (4th Edition)
 - Updated at recent 12th Air Navigation Conference
- *“Multi-constellation, multifrequency GNSS has clear technical advantages that will support the provision of operational benefits. To realize these benefits, ICAO, States, ANSPs, standards bodies, manufacturers and aircraft operators need to **coordinate activities to address and resolve related issues.**”*

ICAO Basis for Air Navigation Service Provision

- Article 28 of Chicago Convention (1944)
Air navigation facilities and standard systems
Each contracting State undertakes, so far as it may find practicable, to:
a) **Provide, in its territory**, airports, **radio services**, meteorological services and other air navigation facilities to facilitate international air navigation, in accordance with the standards and practices recommended or established from time to time, pursuant to this Convention;
- What is an Air Navigation Service Provider (ANSP)?
 - ATS – Air Traffic Services (incl. ATC & ATM)
 - CNS – COM, **NAV**, SUR Services
 - MET – Aviation Weather Services
 - AIS – Aeronautical Information Services (incl. AIM)

ICAO Charter on GNSS

- **ICAO Assembly Resolution 32-19 (1998)**
- *“Charter on the rights and obligations of States relating to GNSS Services”*
 - Core constellation service is **NOT an ANS under Article 28**
 - To respect sovereignty of States
 - Instead *“provide navigation aid signals **for use in aircraft positioning**”*
- Annex 10 definition of GNSS
 - *“A worldwide position and time determination system that includes one or more satellite constellations, aircraft receivers **and system integrity monitoring**, augmented as necessary to support the required navigation performance for the intended operation”*

ANS with GNSS

Core Constellation Service

- GPS
- GLONASS
- Galileo
- Beidou

+

Augmentation Service

- ABAS
- SBAS
- GBAS

=

ICAO Air Navigation Service

CCS Provider

- NOT an ANSP
- Standards in Annex 10

Augmentation Service Provider:

- ANSP with limited scope
- Falls under Article 28
- May include GEO SV

“Aeronautically used” RNSS per ITU

Augmentation and Sovereignty

- GBAS: Almost like a terrestrial navigation aid
 - VHF Data Broadcast IS a terrestrial service
 - Ground station and operator can be certified under existing processes
 - Still relies on assumptions about core constellation performance
- SBAS: If service for single State, similar to GBAS
 - Multiple State service requires associated agreements
 - In place for EGNOS
- ABAS: Relying on individual aircraft avionics certification
 - Mutual recognition of certification?
- All Augmentation Schemes make assumptions about CCS
 - Associated high level requirement in Annex 10 for GPS and GLONASS: **max of 3 major service failures per year**

ANS in Europe – Single European Sky

- Single European Sky (SES) Regulations
 - Require certification of ANSP
 - Regulation No 550/2004, Article 10
 - Regulation No 2096/2005, Annex I, Paragraph 7, a.1.3
- Agreement SES Committee Meetings 36 & 37 in 2010
 - CCS exempt from SES Regulation (Minutes)
 - Mitigated by safety assurance oversight of ANSP
 - Work on Regulation Update & Implementation ongoing (NSG18/IP10)
- ICAO GNSS Manual, Doc 9847

“By approving GNSS-based operations, a State or regional safety oversight organization (RSOO) accepts responsibility to ensure that such operations meet accepted safety Standards. States can either provide GNSS signals or can authorize the use of signals provided by other entities. In the latter case, the State retains the responsibility to oversee the safety of the service.”

ICAO GNSS Charter Obligations

- “States recognize that in the provision and use of GNSS services, the **safety** of international civil aviation shall be the **paramount principle**”
- “**States shall cooperate** to secure the highest practicable degree of uniformity in the provision and operation of GNSS services”
- “Every State providing GNSS services, including signals, or under whose jurisdiction such services are provided, shall ensure the continuity, availability, integrity, accuracy and reliability of such services, **including effective arrangements to minimize the operational impact of system malfunctions or failure**”
- “...State shall ensure that the services are **in accordance with ICAO Standards**. States shall **provide in due time aeronautical information** on any modification of the GNSS services that may affect the provision of the services”

Obligations by CSP to ICAO ?

- Letter to ICAO by Providing State (GPS 2007)

“The U.S. Government maintains its commitment to provide GPS SPS signals on a continuous worldwide basis, free of direct user fees, enabling worldwide civil space-based PNT services (to include GPS SPS augmentations), and to provide open, free access to information necessary to develop and build equipment to use these services.”

- But: Letter is *“political commitment in lieu of an agreement”* and
- *“Commitments subject to the availability of funds”*
- Situation will not be different for Galileo, GLONASS & Beidou

ANS Requirements for GNSS: Performance & Standards

- Letter of commitment to ICAO
- Standardization of key performance aspects of the core constellation elements in Annex 10 SARPs
- Guidance material in SARPs as required to correctly interpret SARPs definitions (such as “major failure”)
- Reference in Annex 10 to a publicly available Service Definition Document or Performance Specification
- Receiver standards showing in particular how the required integrity levels are achieved taking into account failure modes
- Cooperation arrangements as necessary to enable the mutual recognition of receiver standards and certification

ANS Requirements for GNSS: Operational Service Aspects

- CCS Information Center
 - Provision of necessary aeronautical information services
 - Contact center if abnormal performance is encountered
- GNSS Service Monitoring (Safety Oversight Function)
 - Significant positive margin between guaranteed and actually achieved performance desirable
 - Know what to do when monitor goes off: appropriate group of experts
 - Building of service history

GNSS Authorization: Where are we?

- A lot is already in place! Especially for GPS!
 - *In line with GNSS Charter Obligations*
- More work needed: Oversight through Monitoring

- ICAO ANC/12:

Recommendation 6/6 – Use of multiple constellations

That States, when defining their air navigation strategic plans and introducing new operations:

b) publish information specifying the global navigation satellite system elements that are approved for use in their airspace;

c) adopt a performance-based approach with regard to the use of global navigation satellite system (GNSS), and avoid prohibiting the use of GNSS elements that are compliant with applicable ICAO Standards and Recommended Practices;

ITAR-TASS News Agency

29 April 2014, <http://en.itar-tass.com/world/729948>

MOSCOW, April 29. /ITAR-TASS/. When flying over Ukraine, air carriers should be ready to use navigation systems not based on GPS, Russian aviation watchdog's (Rosaviatsia) representative told ITAR-TASS.

The agency has confirmed that it has sent notifications to the air carriers about interference with operation of onboard GPS receivers. "Rosaviatsia has notified the air carriers to **be ready to use alternate navigation means** when performing flights over Ukraine," the agency's representative said.

Rosaviatsia's representative stressed that "incidents that involve recurring interferences are considered by the ICAO (International Civil Aviation Organization) as threatening flight safety, which can lead to accidents caused by GNSS (Global Navigation Satellite Systems) failures."

The aviation **agency asked air carriers to notify it about all cases of navigation failure.**

ITAR-TASS reported earlier that Rosaviatsia had registered the failure of GPS onboard navigation system in a civil airliner flying over Ukraine's territory.

Dealing with “International” GNSS RFI

- Most problematic in areas of conflict (also Incheon, Korea)
- State may not have approved the use of a particular GNSS
- Information Flows: IATA, Eurocontrol, others ???
- ICAO / ITU MOC
- Reports only, verification difficult to impossible

- Justifies need to retain Alternate Terrestrial NAV Means
- Aviation does not have good mechanisms in place to deal with Internationally relevant Environmental GNSS Issues

Conclusion

- Multi-constellation GNSS
 - Significant benefits
 - Increased robustness
 - But need to deal with non-aviation element
 - Build on and extend current practices!
- **PROPOSAL** (Eurocontrol Paper to ICAO Navigation Systems Panel WGW Nov 2013, WP36):
 - **Formalize interpretation of obligations under ICAO GNSS Charter in line with established practices**
- **GOAL:** Seamless, interoperable system at reasonable cost...