

ELEVENTH AIR NAVIGATION CONFERENCE

Montreal, 22 September to 3 October 2003

Agenda Item 6 Aeronautical navigation : issues

A GLOBAL STRATEGY FOR GNSS — THE EUROPEAN PERSPECTIVE

(Presented by Italy on behalf of the European Community
and its Member States²)

SUMMARY

Satellite navigation is playing an increasing role in civil aviation. With the introduction of Galileo and the modernisation programme planned for GPS and GLONASS this role is expected to increase further as anticipated in the ICAO strategy for CNS/ATM systems.

This paper discusses the potential benefits that the future GNSS can bring and recommends that ICAO takes action to develop a global navigation strategy and transition plan to coordinate the gradual transition from existing navigation aids to the increasing use of satellite navigation services.

It has been prepared jointly with the Eurocontrol Agency and the European Space Agency.

The European Community and its Member States request the Conference to recommend that ICAO continues its activities that set the basis for a transition to a future worldwide navigation service centred around the use of GNSS.

Action by the conference is in paragraph 6.

¹ English, French and Spanish versions provided by Italy.

² The European Community comprises the following States: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom.

1. INTRODUCTION

1.1 The current ICAO strategy for the introduction of advanced communications, navigation, and surveillance/air traffic management (CNS/ATM) systems envisages a gradual transition from the current terrestrial navigation infrastructure to the increased use of a satellite navigation infrastructure. The initial step of this transition has been supported by the development of ICAO Standards and Recommended Practices (SARPs) for the global positioning system (GPS), the GLObal NAVigation Satellite System (GLONASS) and the satellite and ground based augmentation systems, satellite-based augmentation system (SBAS) and ground-based augmentation system (GBAS).

1.2 The United States GPS is already being used onboard many aircraft, in particular, in Europe, as a means of compliance with basic area navigation (RNAV) requirements. SBAS is coming on-line with the developments of the United States wide area augmentation system (WAAS), the European Global Navigation Overlay Service (EGNOS) and the Japanese Multi-Functional Transport Satellite Augmentation System (MSAS) and India are also planning to implement a SBAS. GBAS developments are progressing, initially to support Category 1 precision approach, and ultimately to support Category II/III operations.

1.3 There have been concerns expressed, both at a legal and institutional level due to the single State ownership and control of GPS, and at a technical level due to the vulnerability to interference of a single frequency system. However, the United States is planning to further develop GPS by the addition of a second signal.

1.4 Europe is now developing Galileo, a constellation of navigation satellites, independent but fully interoperable with GPS. Galileo will be based on the same technological principles as GPS and GLONASS and is being developed specifically for civil and commercial purposes, based on state-of-the-art technology and aiming to be highly reliable. With these evolutions and the expectation that a GNSS providing a robust global navigation capability will be a fundamental component of the worldwide CNS/ATM system, there is a clear need for a worldwide strategy for international aviation community navigation. Such a strategy must be developed at a global level under the auspices of ICAO.

2. OPPORTUNITIES FROM GNSS EVOLUTIONS

2.1 The addition of new satellite navigation signals and systems will provide increased robustness technically, operationally and institutionally. With the combination of signals from different constellations a significant improvement in navigation capability can also be expected.

2.2 The new GNSS signals will be more resistant to interference due to their higher power, better signal structure and wider bandwidth. These signals will also be placed in frequency bands set-aside for joint aeronautical and radio-navigation services and will thus benefit from improved spectrum management protection. As has been noted by the ICAO GNSS Panel, frequency diversification is also a very effective mitigation against unintentional interference.

2.3 The availability of multiple independent constellations reducing the dependency on any one system provides protection against institutional concerns such as service denial, potential withdrawal of

financial support for one system, and reduces the possibility of a major failure affecting the whole infrastructure.

2.4 The introduction of the Galileo system will also bring new guarantees for the civil aviation community. Indeed, it is foreseen that Galileo will be operated by a civilian operating organisation, responsible for the service performance delivered to users. This will open the possibility of a formal contractual guarantee scheme for interested users with consequential liability in the event of a breach of contract. A separate paper presented by the European Organisation for the Safety of Air Navigation (EUROCONTROL) will provide details of the proposed contractual framework, which moreover will encompass the associated regulatory aspects. In addition, the decisions to modify any features of the system and the operating policy will be undertaken following an open and auditable process, which will give extra confidence to the user community. Finally, the system design will be sanctioned through an independent certification process that will issue relevant safety demonstration files for user communities' own purpose such as the development of a safety case for a particular operation.

3. STANDARDIZATION

3.1 The increased number of signals and potential combinations of those signals requires careful management at a user level. The way that the different elements can be combined should be limited to a manageable number of combinations. Air navigation service providers, airspace users and industry must work together through the standardization bodies to match the capabilities provided by GNSS with the intended operations in order to maximise benefits and avoid a proliferation of different operational solutions in different regions. ICAO should take the lead in such standardization activities for aviation.

3.2 In Europe the European Organisation for Civil Aviation Equipment (EUROCAE) WG62 on Galileo is developing an operational concept for the use of future GNSS including a proposal on how the different systems can be used in combination with each other.

3.3 ICAO has been working on GNSS Standards over the last few years in order to speed up the operational introduction of GNSS for civil aviation.

3.4 With regards to Galileo, work has already started within the GNSS Panel to prepare the future standards. The initial work, supported by the European Commission and the European Space Agency, provided detailed technical information on the Galileo services and system baseline in order to collect feedback from the aviation community on desirable features for the Galileo system. The work is now continuing, and standards development is on the work programme of the GNSS Panel.

4. AVIATION SATELLITE NAVIGATION STRATEGY

4.1 The operations of many airspace users are, by their nature, global. The aviation community requires worldwide systems that provide safe and efficient services, that are compatible and interoperable and that do not require different avionics.

4.2 In the context of Galileo, the EUROCONTROL Organisation has coordinated the development of a common aviation position paper on GNSS which has been prepared with the participation

of airspace users and air navigation service providers. The ultimate goal expressed in this paper is that of a sole service concept, if this can be proven to be safe, secure and the most cost beneficial solution. From a European point of view, a programme of work has to be initiated to investigate the safety and economical aspects of such a concept. Galileo is an indispensable part of this concept, which includes GPS, GLONASS and their augmentations. This is not only because of the improved technical parameters of combined constellations, but especially because of the fact that Galileo will be a civil system providing service guarantees necessary to rely on it for safety of life services. It is essential that ICAO determines on a regional basis which residual systems and services will still be required in the future to support the user requirements and the objectives of safety, efficiency and for environmental protection. It is conceivable that in certain regions none of the conventional systems will be required to perform certain operations.

4.3 The further development should consider the leading role of ICAO and include key partners worldwide. A worldwide approach should address the following activities:

- a) sole service concept feasibility regarding safety requirements;
- b) technical, operational and safety requirements, calling for the development of a worldwide navigation satellite system that can be used, as the sole service for provision of positioning and timing data, for all phases of flight down to CAT II/III operations. Due consideration must be taken of regional and sub-regional specific requirements, but global interoperability and complementarity must be ensured;
- c) transition planning, calling for commitment for decommissioning of ground-based navigation aids, giving due consideration to global equipage implications and calling for commitment from users to equipage with appropriate GNSS avionics and calling for the establishment of an implementation plan. Such activities should be subject to satisfactory safety assessment and appropriate contingency planning and associated back-up;
- d) institutional requirements calling for worldwide resolution of legal and institutional issues and guarantees from the GNSS service providers; and
- e) cost allocation and charging requirements, calling for fair and equitable charging and cost-allocation between civil aviation and other user categories, between States and between phases of flight (en-route vs. approach/aerodrome).

5. CONCLUSION

5.1 The future GNSS made up of a combination of systems including Galileo, GPS and possibly GLONASS, with their respective augmentations, will become one of the enablers for advanced air traffic management services to be implemented anywhere around the globe. Multiple constellations providing navigation signals on several frequencies will provide a significant improvement in terms of robustness to failure over today's situation with GPS alone.

5.2 Galileo, as the European contribution to this future GNSS will be a key element in the realisation of the benefits GNSS has to offer. In particular, the system design has taken into account the requirements formulated by the aviation community from the outset.

5.3 With the advent of Galileo, modernized GPS and GLONASS, with their respective augmentations, the aviation community should be in a position to take the opportunities offered by GNSS in a safe, reliable and cost-effective manner.

5.4 In order that these opportunities can be taken in an efficient manner it is recommended that ICAO continue its activities to develop a strategy that sets the basis for a transition to a future worldwide navigation service centred around the use of GNSS.

6. ACTION BY THE CONFERENCE

6.1 The conference is invited to recommend:

Recommendation 6/xx —

That ICAO continue its activities that set the basis for a transition to a future worldwide navigation service centred around the use of GNSS for advanced air traffic management. These actions should investigate:

- a) sole service concept feasibility regarding safety requirements;
- b) the way forward to achieve all the technical, operational and safety requirements, for all phases of flight down to Category II/III operations;
- c) transition planning;
- d) legal and institutional requirements and guarantees from the GNSS service providers;
- e) cost allocation and charging requirements.

That the result of the above actions should be reflected in the next update of the *Global Air Navigation Plan for CNS/ATM Systems* (ICAO Doc 9750).

— END —