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ASSEMBLY — 35TH SESSION

LEGAL COMMISSION

Agenda Item 36: Report on the establishment of a legal framework with regard to CNS/ATM systems including GNSS

RESOLUTION OF THE LEGAL AND INSTITUTIONAL ASPECTS ASSOCIATED WITH THE GLOBAL IMPLEMENTATION OF GNSS

(Presented by the International Air Transport Association (IATA))

SUMMARY

The IATA member airlines recognize the importance Satellite Navigation will play in the development of the CNS/ATM development and the benefits it can bring to the aviation community as a whole. However political or specific geographical economic interests could significantly hinder the early usage of presently available services and might lead to an undesired increase of ANS infrastructure costs.

This paper urges ICAO to resolve the legal and institutional aspects associated with the global implementation of GNSS in order to provide for an efficient service optimizing benefits to airspace users.

Action by the Assembly is in paragraph 4.

1. INTRODUCTION

1.1 The CNS/ATM concept relies largely on the implementation of satellite technology since only satellite technology has the ability to provide a homogenous service over large areas, not restricted by physical or geo-political boundaries. Satellite navigation constellations provide a transparent global positioning service not only to aviation but also to society as a whole.

1.2 Considering the societal rather than focused benefit of satellite navigation, some governments have decided to provide the service at no cost to users, whilst others are examining institutional frameworks to recover costs from specific user groups.

1.3 From the airspace users' perspective, the optimum scenario is one that allows the user to determine the best mix of services from which a navigation performance requirement for a particular airspace volume or route of flight can be met. This is entirely consistent with the ICAO concept of Required Navigation Performance – RNP. (Reference Appendix: IATA Navigation Policy and User Positions).

2. DISCUSSION

2.1 Traditionally, aeronautical navigation services have been mainly provided by Air Navigation Service Providers directly, or under contract with specialized agencies. However the global nature of GNSS would require bilateral or multilateral contracts between States to settle liability, interference and other legal principles related to the provision satellite services.

2.2 The lucrative global market of satellite navigation receiving equipment and the potential added value of improved navigation are incentives for States or Regions to subsidize the development of navigation satellite services, with an expectation of return of investment. This has the potential to create an environment where the regulatory authority of a State or group of States may be used to mandate the use of a particular satellite solution set, artificially enlarging the user base, and creating an unbalanced charging regime.

2.3 The aviation community, operating globally, but subject to the sovereign requirements of the States through which they operate, can be easily targeted as a potential source of financing, forced by State legislation to use and or pay for a specific service to operate within a specific airspace where other adequate freely available services are in place.

3. CONCLUSION

3.1 Any changes to the existing legal framework or policies regarding GNSS for the provision of air navigation services, should include the following principles:

a) airspace users will have freedom to choose from all available GNSS services provided ICAO global technical and operational standards are met and the aircraft is appropriately certified;

b) States/Regions providing satellite navigation services for the purpose of use by the air transport community should provide a minimum guarantee for the satellite navigation services;

c) aeronautical augmentation should only be considered from a safety and service efficiency aspect taking due consideration of aircraft on-board navigation capabilities; and

d) operational procedures should not be limited to those requiring specific technologies. Other options should be permitted to allow optimization of aircraft on-board navigation capabilities.

4. ACTION BY THE ASSEMBLY

4.1 The Assembly is invited to request the Council to include the principles described in paragraph 3, when considering any change to the legal framework and policies regarding the use of GNSS by civil aviation.

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APPENDIX

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POLICY

POLICY ON NAVIGATION

1. In the evolutionary improvement of the aeronautical navigation infrastructure to support current and future air traffic management, the following requirement set must be met:

   a. The navigation system will continue to allow air transport aircraft to operate within all airspace, at least to the level of individual system performance currently provided by ground-based navigation aids, GNSS, and/or self-contained navigation equipment;

   b. The navigation system mix[1] will be capable of supporting justifiable[2] en-route navigation requirements based on ICAO specified RNP values (Attachment 3, no. 3 refers);

   c. Aircraft with lesser individual navigation system capability will be allowed to operate without unreasonable penalty[3], subject to conditions defined by appropriate regulatory authority or service provider;

   d. The navigation system mix will support gate-to-gate all-weather operations including non-precision and precision approaches, straight-in and/or curved, to justifiable minima.

   e. Where justified, the navigation system mix will support
      - Taxi in low visibility conditions
      - Takeoff in low visibility conditions
      - Departure procedures with flight paths that support airspace deconfliction and capacity benefits
      - User-preferred routing between major airport pairs
      - Arrival procedures with flight paths that support airspace deconfliction and capacity benefits
      - Approach operations that provide continuous stabilized descent to all runway ends
      - Landing and Rollout in low visibility conditions

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[1] "navigation system mix" refers to the set of navigation aids or sources used to provide or derive navigation guidance.

[2] In the context of this policy and associated position statements, the words **justify, justified**, and **justifiable** have the following meaning: *"able to transparently demonstrate net positive benefit [cost and/or safety] to the air transport user community – or a section thereof - either directly, or peripherally, and, where applicable, without imposing undue penalty on other sections of the airspace user community, in accordance with basic principles of equity and access".*

[3] the operation of lesser equipped aircraft should be accommodated where there is no substantial impact on the operations of equipped aircraft. Service providers should not impose blanket exclusions, or practices which restrict the operation of non-equipped aircraft, *unless it can be shown that such measures are required for overall safety or overall economic benefit.* Notwithstanding, when developing procedures to support equipped aircraft, efforts should be made to either encourage or incentivize greater fleet equipage, or to accommodate non-equipped aircraft in special time bands, level bands, or other such processes.

- Missed approach, including straight out and flight paths intended to support airspace deconfliction and capacity benefits
- Advanced surface movement guidance and control subject to local assessment of user need and technical risk

f. The system mix will be capable of providing availability and continuity of service such that current requirements for navigation guidance to alternate aerodromes are met or exceeded (Attachment 1, no. 2 refers);

g. The navigation system mix will be capable of supporting Automatic Dependent Surveillance [ADS] – [including ADS-B: refer IATA policy 13.03.10 Implementation of ADS-B] requirements at aerodromes and in controlled airspace globally; and

h. The navigation system mix will be harmonized with other elements of the global ATM system.

2. Where the evaluation of navigation requirements determines that a number of elements in the navigation mix are no longer required by the air transport community, costs associated with the continuation of those elements should immediately be removed from air navigation charges to the air transport community. Due notice should be given to the various airspace users to enable them to plan the transition.

3. The evolving navigation mix should, to the maximum extent possible, make use of free and freely available public navigation services to satisfy the requirements above. There may be no need or justification for additional aeronautical augmentation and integrity systems built into the satellite system, which carry additional costs.

4. Basic radio navigation satellite services should be provided free of charge.

5. Currently available navigation services, including standards and radio spectrum should be protected until such time as alternative navigation services become available, which provide at least equally safe and cost effective service to the user as present navigation services (Attachment 2, no. 2 refers) and the majority of operators are suitably equipped.

6. As there is no justification for revalidation of the signal-in-space, airspace users should not be charged in cases where a State chooses to exercise its sovereign right in this regard.

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7. States should not require a specific navigation mix or preclude aircraft certified combinations; the only requirement should be that the combination meets the RNP requirements (Attachment 3, no. 1 refers).

8. Airspace users should not be constrained for institutional reasons to the use of specific GNSS services when alternatives are available.

9. When designing or modifying airspace structures, air routes, transition procedures and approach/departure procedures to take advantage of emerging navigation capabilities, the design authority must take into account the net benefit of the changes, the ability of the airspace user to effectively use the procedures, and the ability of the service provider to effectively apply the procedures. Early consultation at operational level with users and service providers **must** be undertaken, and users **must** be included in all aspects of design work to ensure that outcome best meets the intended objectives.

10. Information on system degradation or outages related to the underlying navigation infrastructure, including localised and regional effects, must be provided in a timely manner and a user-friendly format.

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ATTACHMENT 1 :
POSITIONS ON GNSS AND THE TRANSITION TO GNSS

1. States should - in collaboration with airspace users and subject to cost benefit analyses – move in a timely and coordinated manner from the current ground-based system to a harmonized, compatible, cost-effective and interoperable space-based radio-navigation system capable of being used in all airspace during all phases of flight. States should implement GNSS procedures, with a view to achieving as soon as possible worldwide navigation capability from departure, through en-route to justified minima.

2. Basic radio navigation satellite services should be provided free of charge.

3. IATA urges States to undertake the transition to a cost-effective, beneficial, harmonized and seamless satellite-based navigation service [IATA policy on "User Charges Aspects of CNS/ATM" refers]. Benefits include:

   - Increased safety, including a reduction in CFIT risk
   - Reduced flight time, operating cost and fuel consumption
   - On-time operation
   - Enhanced position and situational awareness for pilots
   - Reduction in user charges through a rationalization of the navigation infrastructure

   Such Cost/Benefit analysis must take into account the full costs of airborne equipage for airspace users and not be based solely on reduction of costs of service provision.

4. Minimal safe terrestrial infrastructure should be retained until sufficient experience has been gained to validate GNSS in terms of safety, efficiency and cost-effectiveness. The frequency bands allocated to ILS/GLS[4]/MLS shall be protected.

5. The withdrawal of ground based navigation aids should allow a reasonable period of transition. The full benefits of GNSS-based applications will only become available when a majority of airspace users has assessed and agreed to equip. The business case for decommissioning ground based navigation aids should include the cost of early depreciation/decommissioning of aircraft equipment and functionality, and retrofit of equivalent GNSS-based equipment & functionality. Air navigation service providers, should

[4] GLS – an abbreviation for GNSS-based Landing Systems. This term is not yet in common use.

be encouraged to enter into early operational assessment programs to provide early benefits to interested operators. [IATA policy on "User Charges Aspects of CNS/ATM" refers].

6. Interoperability between various different satellite constellations is required, with no common mode of failure. The aircraft GNSS receiver should be able to produce a navigation/time solution output that is independent of the GNSS (and GBAS/SBAS) constellation used system [IATA policy 13.04.05 Global Harmonisation and Interoperability refers].

7. The increased number of navigation signals and services, and their potential combinations require careful management at a user level. The ways that the different elements can be combined must be limited to a manageable number.

8. When evaluating means of enhancing safety, or reducing minima associated with approach operations, Barometric VNAV [Baro-VNAV] procedures, taking advantage of existing equipment, should be immediately considered as an alternative augmentation, particularly in areas of the world where ground based navigation aids are unreliable or non-existent.

9. Any introduction of new augmentation systems should be justified, and where required must be amortized over the entire user community, not just the aviation or airline sector, considering that augmentation systems are already available – both autonomous (RAIM, AIM, IRS filtering) and external (GBAS).

10. In considering the business case to retrofit/equip for SBAS or GBAS, airlines will take into account that future constellations, like Galileo and modernized GPS, may alone or in combination provide advanced services without costly augmentation. The business case to retrofit/equip for SBAS or GBAS will take into account the complexities of integrating the capability into aircraft systems (e.g. displays, alerting, maintenance, etc.).

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ATTACHMENT 2:
POSITIONS ON NON-VISUAL AIDS FOR CATEGORY II AND CATEGORY III APPROACH AND LANDING

1. The long-term goal of IATA Member airlines is implementation of globally harmonized, compatible and interoperable navigation procedures supported by GNSS for all phases of flight, including CAT II/III operations, provided the latter are demonstrated to be efficient and cost effective.

2. States should collaborate with airspace users to determine if improvements in efficiency and cost effectiveness can be realized, taking into account the costs of airborne equipage for all operators that use the airfield, before taking action to decommission ILS CATII/III facilities. States should continue ILS service to the highest sustainable category until such time as the majority of operators are equipped with the GNSS Landing System.

3. Considering the potential complexity of GBAS architecture to support CATII/III, airlines and service providers will need to assess user need, achievable schedule and technical risk.

4. States should ensure there is no degradation of services related to non-visual aids for approach and landing during the transition phase.

5. States should take action against interference caused by construction and radiating sources in close proximity to airports in order to extend the lifecycle of ILS CAT II/III operations.

6. States should only consider MLS/GLS implementation in specific cases where existing ILS CAT II/III cannot be maintained or where MLS/GLS operational and/or economic benefits are proven Implementation of MLS/GLS alone should not be a justification for any reduction in services to aircraft that are not MLS-equipped.

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ATTACHMENT 3:
POSITIONS ON REQUIRED NAVIGATION PERFORMANCE (RNP)

1. Airspace users support global implementation of the RNP concept originally developed by ICAO and amplified by the aviation industry, in order to provide a seamless environment and standard aircrew procedures. RNP will allow the most efficient operations based on navigation performance of available sensors rather than assumed worst-case performance.

2. The choice by a State or Region of ICAO specified RNP route or airspace values/requirements must, in all cases, be benefit driven. States and Regions should only select RNP values in accordance with those promulgated in Annex 11. Where other values are considered, they must be justified [refer page 1, footnote 2].

3. RNP can be presently met using either GNSS, the current ground based navigation infrastructure, airborne self-contained systems or a combination of these. The choice of navigation mix to meet a specified RNP value/requirement should be at the discretion of the aircraft or operator, subject to assessment of the availability and continuity thereof. States and/or regions should not unnecessarily restrict the use of navigation solutions. Notification of the ability of an aircraft or operator to meet the prescribed navigation performance will be provided in the appropriate flight notification.

4. In light of the urgent need for global harmonization, ICAO should take the lead on RNP implementation issues and encourage States to develop all future procedures based on these standards. States should be encouraged to transition current procedures to conform to RNP standards.

Reasons

The aviation community requires a worldwide system providing services that are safe and efficient, globally harmonized, compatible and interoperable and do not require different avionics and procedures in different regions. Airspace users require benefit driven solutions.

Airspace users support global implementation of the concept of Required Navigation Performance (RNP) developed by ICAO. RNP creates a seamless environment that allows standard classification of airspace, standard aircrew procedures while allowing the most efficient operations based on navigation performance of available sensors rather than assumed worst-case performance.

RNP can be presently met using either GNSS, the current ground based navigation infrastructure, airborne self-contained systems or a combination of these. The choice of technology must, in all cases, be benefit driven, and selected in close collaboration with airspace users.

Without ICAO standards and guidance there is the potential for proliferation of differing requirements in States and/or regions, which may eventually result in additional burden on aircraft operators and service providers. ICAO should therefore designate a suitable body to act as the focal point for further development of Area Navigation (RNAV) and RNP. This activity should build on the experience of early operations and give strong consideration to the installed RNP functionality in a large number of modern air carrier aircraft and most new aircraft.

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ATTACHMENT 4:
BACKGROUND INFORMATION ON NAVIGATION

The aviation process known as navigation includes the functions of "determining position, planning a route to another pre-determined position, proceeding to that position in a predefined manner, and evaluating progress along the path between the two points". In the past, navigation systems have been established as dependent ground-air combinations, requiring aircraft to "navigate" between fixed infrastructure, and along fixed routes. Those systems include NBD/ADF combinations, VOR, DME, LORAN-C, ILS and MLS. As traffic increases on these fixed route structures, capacity suffers against the need to maintain adequate levels of safety. With increasing traffic levels around the world, pressure is being increasingly applied to improve route networks – both fixed and flexible. This requires enhanced navigation capability so as to maintain a high degree of safety with that flexibility.

There is an increasing demand for user-preferred trajectories [UPTs] amongst air transport operations, which utilize on-board self-contained navigation systems rather than relying on ground based infrastructure. Such UPTs will take aircraft increasingly out of the normal coverage areas for ground based navigation infrastructure. In many areas of the world, the provision of navigation services based on the continued or initial provision of ground based [terrestrial] navigation aids is not possible, due either to technical or economic reasons. In terms of safety, there is evidence from global accident and incident statistics, that many incidents have been due to a loss of situational awareness, which may have been prevented with better navigation data – and presentation.

The annual costs of navigation aid upgrade, operations and maintenance drive a significant portion of global user charges. Within the fiercely competitive world of commercial aviation, the provision of safe navigation infrastructure must be done in the harsh reality of economic efficiency. There is increasing pressure to lower costs associated with navigation services provision. This has been a driver in the pursuit of new and better systems to replace the existing terrestrial infrastructure.

GNSS is revolutionizing the way the public and aviation industry perceives navigation. The use of positioning data, and other natural by products of GNSS, such as precise timing and velocity, are opening new markets – such as aviation, maritime, survey, land navigation, security systems, etc. This must, however, be put into perspective. In order to meet stringent technical and operational requirements, GNSS must be enhanced using aircraft based, space based or ground based augmentation. These augmentations fundamentally provided signals to enhance availability and accuracy, integrity messages and warnings to improve integrity and continuity of service, and/or accuracy enhancing corrections [called differential services].

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Navigation Performance Definitions

Accuracy: the degree of conformance between the estimated or measured position [or other parameter] of a platform at a given time and its true position [or other parameter];
Availability: the ability of the system to provide useable service within the specified coverage area;
Continuity: the ability of the total system [comprising all elements necessary to maintain aircraft position within the defined airspace] to perform its function without interruption during the intended operation; and
Integrity: the ability of the system to provide timely warnings to users when the system should not be used for navigation.

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