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WORKING PAPER

ASSEMBLY — 38TH SESSION

TECHNICAL COMMISSION

Agenda Item 35: Air Navigation — Implementation Support

MITIGATING GLOBAL NAVIGATION SATELLITE SYSTEM VULNERABILITIES

(Presented by 54 Contracting States[2] , Members of the African Civil Aviation Commission (AFCAC))

EXECUTIVE SUMMARY

This working paper examines the challenge of fully implementing the Aviation System Block Upgrade APTA on "optimization of approach procedures including vertical guidance" in some regions of the world.

Action: The Assembly is invited to request ICAO to address implementation strategy in the regions where there is not yet a universal augmentation system (SBAS, GBAS), including assisting in the search for funding, in cooperation with relevant stakeholders.

Strategic Objectives:	This working paper relates to the Safety and Environmental Protection and Sustainable Development of Air Transport Strategic Objectives.
Financial implications:	The cost may be substantial and it is expected that the activities referred to herein will be undertaken through the resources available in ICAO's 2014 – 2016 Regular programme budget and/or from extra budgetary contributions.

[1] English and French versions provided by AFCAC.

[2] Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Ivory Coast, Democratic Republic of the Congo, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Swaziland, Togo, Tunisia, Uganda, United Republic of Tanzania, Zambia, Zimbabwe.

References:	Assembly Resolution A37-11, Performance-Based Navigation Global goals (Doc 9958) APIRG 17, Conclusion 17/29, Need for an independent SBAS cost-benefit analysis APIRG 18, Conclusion 18/30, Updated AFI GNSS Strategy APIRG 18, Conclusion 18/32, Funding of AFI SBAS cost-benefit analysis by ICAO AN-Conf/12 Recommendation 6/5 – ICAO work programme to support global navigation satellite system evolution (Doc 10007) AN-Conf/12 Recommendation 6/7 – Assistance to States in mitigating global navigation satellite system vulnerabilities (Doc 10007) AN-Conf/12 Recommendation 6/8 – Planning for mitigation of global navigation satellite system vulnerabilities (Doc 10007) AN-Conf/12 Recommendation 6/9 – Ionosphere and space weather information for future global navigation satellite system implementation (Doc 10007) Doc 9750, *Global Air Navigation Plan* (Fourth Edition)

1. INTRODUCTION

1.1 The 12th Air Navigation Conference (AN-Conf/12, Doc 10007) laid down the roadmap to support harmonization and interoperability leading to a global air traffic management (ATM) system. The roadmap is contained in the Fourth Edition of the Global Air Navigation Plan (GANP) that will be adopted during this Assembly.

1.2 The Aviation System Block Upgrades (ASBUs) and associated technology roadmaps are an integral part of the GANP and therefore the effective implementation of the relevant Blocks by all States, within the set time frame is paramount to achieve enhanced global safety, efficiency and other benefits.

1.3 However, the 12th Air Navigation Conference highlighted key challenges towards a global implementation. This paper calls for urgent resolutions of some of these challenges to be able to realize fully, all the benefits of the 4th GANP.

2. DISCUSSION

2.1 The Block Upgrades are organized in five-year time increments starting in 2013 and continuing through 2028 and beyond. This structured approach provides a basis for sound investment strategies. The block upgrade is organized around modules and the implementation is flexible: module implementation will be fine-tuned through regional agreements in the ICAO planning and implementation regional group (PIRG) process. Less essential Modules will be left to the discretion of national planning.

2.2 Nevertheless, there are some elements of the Global Plan that will need to be considered for worldwide applicability. The Block Modules on optimization of approach procedures including vertical guidance should be considered for implementation by all ICAO Member States in the near-term. These Block Modules (B0-APTA and B1-APTA) are the steps toward universal implementation of global navigation satellite systems (GNSS) based approaches.

2.3 The B0-APTA and thereafter the B1-APTA relies on the GNSS facilities. The GNSS include the space segment and the augmentation systems, where available. The use of GNSS for safety critical applications requires augmentation systems to complement core GNSS signals in terms of availability, integrity, accuracy and continuity.

2.4 The 12th Air Navigation Conference recognized the existence of vulnerabilities to the GNSS and recommends ICAO to assist States in mitigating global navigation satellite system vulnerabilities. Some of those vulnerabilities are associated with radiofrequency interference, ionosphere and space weather aspects. The effectiveness and efficiency of a collaborative approach to address the mitigation of ionosphere vulnerabilities was recognized.

2.5 This ionospheric issue referred to above is amplified in countries from the equatorial region. It is necessary to recall that it is also that region which does not benefit from any augmentation system and at the same time does not have an extensive conventional Navigation Aids network.

2.6 The use of augmentation systems is definitely part of the strategy of mitigation.

2.7 There are three possible types of augmentation systems: Aircraft-Based Augmentation System (ABAS), Ground-Based Augmentation System (GBAS) and Satellite-Based Augmentation System (SBAS). Currently, SBAS systems such as WAAS in North America, EGNOS in Europe and MSAS are operational; while other SBAS systems are currently under development (such as SDCM in Russia and GAGAN in India) or under study such as SACCSA project in Latin -America. In regions where there is no SBAS or GBAS, the implementation of blocks APTA can be realized only with aircraft equipped with ABAS. However, GNSS vulnerabilities due to ionosphere are not addressed with ABAS. Overall, without an SBAS or GBAS, the full implementation of Block APTA cannot be realized as planned.

2.8 The provision of SBAS over the AFI Region is being considered in the framework of Africa European Union Strategic Partnership. The extension of European Geostationary Navigation Overlay Service (EGNOS) to Africa was integrated in the African Union (AU) - European Union (EU) Joint Statement and Common Framework and Plan of Action on Cooperation in Aviation.

3. CONCLUSION

3.1 In light of the above, the Assembly is invited to recognize the existence of an implementation strategy gap of the Blocks B0-APTA and B1-APTA at the global level.

3.2 This implementation strategy gap should be addressed urgently by ICAO taking into account the efforts undertaken by the SACCSA project in Latin America, the AU-EU Common Plan of Action in Africa, the ANSPs local or sub- Regional initiatives.

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