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Agenda Item 2: Timely and safe use of new technologies
2.2: Addressing safety risks related to evolving aviation technologies

PHASING OUT LEGACY SYSTEMS

(Presented by Cameroon)

EXECUTIVE SUMMARY

This paper presents a call to attention as regards the approach of phasing out legacy air navigation systems as the use of performance-based navigation (PBN) and global navigation satellite system (GNSS) progressively gains grounds with the guidelines of the *Global Air Navigation Plan* (GANP, Doc 9750). It recalls the possible concerns as of the moment with full reliance on GNSS, and encourages the adoption of a rather conservative approach to the phasing out of legacy navigation systems.

Action: The Conference is invited to:
a) encourage States to elaborate comprehensive legacy systems rationalisation plans; and
b) encourage States to actively participate in collective efforts geared towards understanding and resolving operational concerns with the use of GNSS.

1. INTRODUCTION

1.1 In the context of continuous increase in demand on the aviation system with a practically geometric growth rate forecasted in the decade ahead, the aviation community is challenged to develop containment ability at same pace.

1.2 The GANP drives the evolution of the global air navigation system to meet these ever-growing expectations of the aviation community with the purpose of equitably accommodating all air space users' operations in a safe, secure and cost-effective manner while reducing the aviation environment impact and ensuring that no country is left behind. This requires the deployment of interoperable systems and harmonized procedures at all levels.

1.3 The benefits of the GANP will stem from the attainment of the GANP performance ambitions as outlined in 11 key performance areas of safety, security, environmental impact, cost effectiveness, capacity, flight efficiency, flexibility, predictability, access and equity.

1.4 The attainment of these ambitions requires adequate navigation facilities to support the global air navigation system as it develops to meet up with the fast-growing demand and technological

evolutions. The Future Air Navigation System (FANS) Committee in 1998 after studying the technical, operational, institutional and economic questions relating to the future potential of air navigation systems identified that, the then existing navigation facilities now referred to as legacy/conventional systems presented shortcomings essentially as regards:

a) propagation limitations of the line-of-sight principle used by these legacy systems;

b) limitation of air traffic capacity ang growth;

c) gas emission by aircraft due to the long routes; and

d) difficulties to implement legacy systems and operate them in a consistent manner in large parts of the world.

1.5 The conclusion of the work of the FANS Committee, presented the FANS concept also known as the communications, navigation, surveillance/air traffic management (CNS/ATM) concept, formally endorsed at the tenth Air Navigation Conference. This concept is principally reliant on satellite technology for the provision of navigation services in lieu of the legacy systems.

1.6 The global coverage of global navigation satellite systems makes it a choice option in comparison to the legacy systems as it offers a lot more optimisation opportunities which will facilitate the attainment of the GANP performance ambitions.

2. DISCUSSION

2.1 The core GNSS signal of existing constellations does not today permit a “fault free” sensor to compute navigation information to the precision that meets civil aviation requirements to guarantee safety of flights. Augmentation systems (aircraft-based, ground-based and satellite-based) are required to compute corrections in order to meet the precision and the integrity required.

2.2 The implementation of these augmentation systems requires the mobilisation of heavy financial resources combined with political decisions/support which may end up downplaying on the accessibility and equity performance ambition of the GANP. The need for mobilisation of these financial resources and political decisions may constitute a barrier to the seamless migration to GNSS on the global scale.

2.3 Besides, the ionospheric activity within the equatorial regions has so far proven difficult to master with appropriate models for the correction of ionospheric delays in satellite signal propagation within these regions. GNSS position errors can create errors of the order of a hundred meters while it is challenging to implement Category (CAT) II/III precision approach operations with satellite-based augmentation system (SBAS) and ground-based augmentation system (GBAS).

2.4 Furthermore, the number of cases of GNSS signal interference occurrences (spoofing and/or jamming) has been on the rise recently. The European Union Aviation Safety Agency (EASA) in safety bulletin No. 2022-02R2 presented an inexhaustive list of cases of GNSS spoofing and/or jamming. The safety concerns presented in this safety bulletin were not yet considered to constitute an unsafe condition and recommendations were formulated including amongst others, reliance on conventional systems as back-up.

2.5 In parallel, the United States Department of Transport Federal Aviation Administration (FAA) published Safety Alert for Operators No. SAFO 24002 in January 2024, presenting recent cases of GNSS jamming and/or spoofing as possibly posing an increase in safety of flight risks, as these disruptions could lead to loss of situational awareness, and increased pilot and regional air traffic control (ATC) workload. The FAA further calls on flight crews to pay more attention to aircraft equipment performance monitoring with the increasing number of GNSS disruptions.

2.6 Discussions on the subject of radio frequency interference at the recent ICAO EUR/MID Radio Navigation Symposium from 6 to 8 February 2024 led to the ICAO's State letter number E3/5-24/54, sharing recommendations similar to the those contained in SAFO 24002 and EASA SIB 2022-02R2 with the global aviation community.

2.7 Considering the above, States should consider with care their rationalization plans for migration to full GNSS, taking ample consideration of their operational and oversight preparedness.

3. CONCLUSION

3.1 It should be recalled that, the expectation of the GANP following the "think global, act local" underlying philosophy is not for everyone to implement everything everywhere. The expectation is rather that a seamless quality of air navigation services should be delivered worldwide.

3.2 States should therefore consider with care the rationalization guidelines contained in Attachment H of Annex 10 — *Aeronautical Telecommunications*, Volume I — *Radio Navigation Aids* and elaborate rationalization plans which clearly identify how much time they judge feasible for the progressive decommissioning of legacy systems, establish requirements for their minimum operational networks and state in those plans for how long they desire to have the co-existence of GNSS and the legacy facilities.

3.3 The outage of GNSS signals and its vulnerability to interferences (spoofing and/or jamming) must be taken in consideration to retain some legacy facilities as a back-up to GNSS.

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