International Civil Aviation Organization

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WORKING PAPER

ASSEMBLY — 42ND SESSION

TECHNICAL COMMISSION

Agenda Item 25: Other issues to be considered by the Technical Commission

NEED TO REVIEW AND ALIGN THE ICAO ANNEX 11 AIR TRAFFIC SERVICES (ATS) AND DOC 9426 - ATS PLANNING MANUAL ON AIRSPACE AND ATS ROUTE DESIGN REQUIREMENTS WITH DOC 8168 – PROCEDURE FOR AIR NAVIGATION SERVICE OPERATIONS (PANS-OPS)

(Presented by South Africa)

EXECUTIVE SUMMARY

This working paper highlights the need to have a dedicated ICAO Annex document for airspace and flight procedures design. The ICAO standards governing the airspace and flight procedures are contained in various ICAO documents, which requires cross referencing of ICAO provisions to ensure the requirements are correctly applied. The design of airspace and associated flight procedures is a critical element of ensuring a safe and efficient operation of flights from gate to gate. The design, verification and validation of airspace and flight procedures is complex and takes time, but it remains the only critical element for safe operation of flight without a dedicated ICAO Annex.

Action: The Assembly is invited to:
a) review the content of the paper; and
b) request the Council to consider the consolidation of material related to flight procedure design.

Strategic Goals:	This working paper relates to *Every Flight is Safe and Secure.*
Financial implications:	ICAO to quantify pending the approval of this paper.
References:	Annex 6 — *Operation of Aircraft*, Part I —*International Commercial Air Transport - Aeroplanes,* Part II —*International General Aviation - Aeroplanes* and Part III — *International Operations – Helicopters* Annex 11 — *Air Traffic Services* Doc 9992, *Manual on the Use of Performance-Based Navigation (PBN) in Airspace Design* Doc 9906, *Quality Assurance Manual for Flight Procedure Design*, Volume 1 — *Flight Procedure Design Quality Assurance System, V*olume 2 — *Flight Procedure Designer Training,* Volume 3 — *Flight Procedure Design Software Validation,* Volume 5 — *Validation of Instrument Flight Procedures* and Volume 6 — *Flight Validation Pilot Training and Evaluation* Doc 9426, *Air Traffic Service Planning Manual* Doc 8168, *Procedures for Air Navigation Services – Aircraft Operations* Doc 4444, *Procedure for Air Navigation Service – Air Traffic Management*

1. INTRODUCTION

1.1 Airspace and flight procedure design are crucial for safe, efficient, and environmentally sustainable operations within the air traffic management (ATM) system. They encompass the planning and development of routes, procedures, and airspace structures to ensure aircraft can safely navigate from take-off to touchdown, especially in complex or low-visibility conditions. This process involves considering various factors like aircraft performance, airspace capacity, and environmental constraints.

1.2 Airspace requirements for an ATM system involve a complex interplay of safety, efficiency, and operational needs, encompassing both the physical airspace and the systems that manage it. These requirements include establishing airspace structures that facilitate safe and efficient traffic flow, implementing surveillance systems for tracking aircraft, and ensuring interoperability between different ATM systems. The fundamental principles of the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444) air navigation services procedures serve as the foundation for the creation of airspace and define the legal and physical limitations of how airspace can be used.

1.3 The *Procedures for Air Navigation Services — Aircraft Operations* (PANS-OPS, Doc 8168) present coverage of operational practices that are beyond the scope of Standards and Recommended Practices for designing instrument flight procedures (IFP) and other related operations. It recommends procedures for how to create and manage safe and efficient approaches, departures, and other flight procedures when instrument meteorological conditions (IMC) are present. En-route processes where obstacle clearance is considered are likewise covered by PANS-OPS requirements and focus on the specific routes and instructions used by aircraft within designated airspace.

1.4 Airspace requirements therefore establish the rules and boundaries, while flight procedure design creates safe and efficient navigation within those boundaries. Designing airspace and flight procedures should adhere to the guidelines established in ICAO Annex 11 — *Air Traffic Services*, Annex 6 — *Operation of Aircraft*, PANS-ATM, PANS-OPS and the *Air Traffic Services Planning Manual* (Doc 9426).

1.5 The first edition of PANS-OPS, Doc 8168 was approved on 26th June 1961 for applicability on 1st October 1961. Doc 8168 has had several amendments made to it since its initial applicability in 1961, expanding from one document into multiple volumes addressing specific areas of procedure design.

1.6 The other supporting ICAO documents are the *Required Navigation Performance Authorization Required (RNP AR) Procedure Design Manual* (Doc 9905), RNP-AR 2nd Edition 2016, the *Quality Assurance Manual for Flight Procedure Design* (Doc 9906), Volume 1 — *Flight Procedure Design Quality Assurance System,* Volume 2 — *Flight Procedure Designer Training*, Volume 3 — *Flight Procedure Design Software Validation,* Volume 5 — *Validation of Instrument Flight Procedures* and Volume 6 — *Flight Validation Pilot Training and Evaluation*, etc.

1.7 South Africa presented an information paper at the Fourteenth Air Navigation Conference (AN-Conf/14)-WP/204.

2. DISCUSSION

2.1 ICAO, in its effort to continuously improve the quality of flight procedure design and associated functions, has introduced several documents dealing with pertinent ATM matters for a safe flight

operation. As highlighted in section one above, these various documents guide the development and design of airspace and instrument flight procedures, bringing together the air traffic services (ATS) and aircraft operations environments.

2.2 There are standards governing flight procedures in various ICAO documents which requires additional cross referencing of requirements including context of definitions used. Furthermore, this brings about confusions in certain instances in relation to the regulatory requirements to be applied. For example, Annex 11 applicability state that Annex 11 pertains to the establishment of airspace, units and services necessary to promote a safe, orderly and expeditious flow of air traffic. Annex 11 furthermore outlines the requirements for designation of the portions of the airspace and controlled aerodromes where air traffic services will be provided including the establishment and identification of ATS routes and significant points. The primary requirements for establishment of ATS routes are contained in Annex 11 with reference to the guidance for the establishment of such routes contained in Doc 9426.

2.3 Annex 11 contains multiple references to Doc 9426 in relation to airspace, including establishment of ATS routes and significant points. Annex 11 furthermore also contains references to Doc 8168 as applicable. When reviewing Doc 8168 (Volumes I, II and III), not one reference to Doc 9426 can be found which creates misalignment of guidance for states to incorporate into their national regulatory framework.

2.4 Annex 11, Appendix 2 furthermore defines the requirements for the establishment of significant points with a detailed explanation on the establishment of significant points used for reporting purposes. The establishment of significant point in alignment with Annex 11, Appendix 2 is not considered when applying the design criteria as contained in Doc 8168.

2.5 Doc 8168, Volume I, Section 3 contains the requirements for en-route procedures and states, that: En-route obstacle clearance procedures were added to Volume I in 1996 as a result of the tenth meeting of the Obstacle Clearance Panel (OCP). The procedures were amended in 2004 to include simplified en-route criteria. Doc 8168, Section 3, Chapter 1 state that “Procedures developed utilizing en-route criteria assume normal aircraft operations. Any requirements to satisfy Annex 6 aeroplane performance operating limitations must be considered separately by the operator.”

2.6 The current PANS-OPS design criteria do not include the considerations of new entrants such as unmanned aircraft systems (UAS), vertical take-off and landing (VTOL) including separation criteria to be applied, altitude limitations and distance from people and obstacles. The ATM system is continuously evolving to accommodate new types of aircraft and capabilities, requiring PANS-OPS to adapt and avoid hindering the ATM system's flexibility.

2.7 It is necessary for ICAO to consolidate the various requirements (airspace and procedure design) and introduce a dedicated ICAO Annex that will consolidate all the other existing documents into the implementation vehicle for the standards. This has proven to be a good, structured approach that ICAO follows, similar to PANS-ATM process where Annex 11 is supported by Doc 4444, and others.

2.8 A similar process was followed in 2013, when ICAO and Member States transformed safety management into Annex 19 – *Safety Management*.

2.9 The benefit of drawing together all the standards material from various ICAO documents into a single Annex is to focus States’ attention on the importance of integrating their flight procedure design activities and enhances the regulatory compliance with the flight procedures provisions. The table below summarises key differences between airspace requirements and flight procedure design.

Feature	Airspace Requirements	Flight Procedure Design
Purpose	Defines rules and constraints on airspace usage	Creates safe and efficient flight routes within airspace
Scope	Overall airspace regulations	Specific flight segments (e.g., SIDs, STARs, approaches)
Focus	Legal and physical limitations of airspace	Navigation and flight guidance for aircraft
Examples	Airspace classifications, altitude restrictions	SIDs, STARs, instrument approach procedures
Relationship	Flight procedure design must comply with airspace requirements	Airspace requirements shape the design of flight procedures

3. CONCLUSION

3.1 The review, unbundling and alignment of the standards from all the related flight procedure design documents including related ATM and other related operations to create an Annex will ensure alignment in the development of national regulations for the respective states.

3.2 PANS-OPS design requirements and other related ATM requirements must be consolidated and seamlessly integrated with the evolving ATM system to maximize efficiency and safety.

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