



WORKING PAPER

TWELFTH AIR NAVIGATION CONFERENCE

Montréal, 19 to 30 November 2012

**Agenda Item 4: Optimum Capacity and Efficiency – through global collaborative ATM
4.2: Dynamic management of special use airspace**

**AVIATION SYSTEM BLOCK UPGRADE MODULES RELATING TO INTEGRATION OF
REMOTELY PILOTED AIRCRAFT (RPA) INTO NON-SEGREGATED AIRSPACE**

(Presented by the Secretariat)

EXECUTIVE SUMMARY

The 37th Session of the ICAO Assembly directed ICAO to increase its efforts to meet global needs for airspace interoperability while maintaining its focus on safety. To this end, a planning framework for global harmonization and interoperability named the aviation system block upgrades (ASBU) is proposed to the Conference for incorporation into the Fourth Edition of the *Global Air Navigation Plan*.

The ASBU framework includes modules over a series of blocks, supported by technology roadmaps, which serve to progressively enhance many aspects of civil aviation operations. This paper presents the modules relating to remotely piloted aircraft (RPA) and the associated components of the remotely piloted aircraft system (RPAS), which comprise:

- a) B1-90, B2-90 & B3-90 – Remotely piloted aircraft.

Action: The Conference is invited to agree to the recommendation in paragraph 3.

<i>Strategic Objectives:</i>	This working paper relates to the Safety Strategic Objective.
<i>Financial implications:</i>	The availability of global provisions for remotely piloted aircraft systems (RPAS – RPA and their associated components) is expected to facilitate development of required technologies and certification methods to permit the operation of remotely piloted aircraft (RPA) in non-segregated airspace and at aerodromes. Although cost to States associated with implementing new RPAS regulations based on ICAO provisions should be comparable to the cost for any other regulation, any delay in developing such provisions could lead to the implementation of a variety of interim, non-harmonized national provisions, with subsequent compliance issues. In this case the costs for industry could be much higher than necessary.
<i>References:</i>	Doc 9958, <i>Assembly Resolutions in Force (as of 8 October 2010)</i> Doc 9854, <i>Global Air Traffic Management Operational Concept</i> Doc 9750, <i>Global Air Navigation Plan</i> AN-Conf/12-WP/3

1. INTRODUCTION

1.1 The next edition of the *Global Air Navigation Plan* (Doc 9750, GANP) will be presented to the ICAO Assembly in 2013 for approval. The draft GANP, and the aviation system block upgrade (ASBU) strategy it establishes, proposes that future air navigation technology and procedure improvements are organized and based on a consultative strategic approach that coordinates specific global performance capabilities and the flexible upgrade timelines associated with each component.

1.2 The ASBU modules are organized into flexible and scalable building blocks that can be implemented depending on the operational need, while recognizing that implementation of a particular module is not mandatory in all areas or circumstances. The approach adopted is not limiting and recognizes that deployment in addition to the material described in the ASBUs may also take place or be necessary. The broad timescales associated with the ASBU framework (Block 0 = 2013, Block 1 = 2018, Block 2 = 2023, Block 3 = 2028) are intended only to depict the initial readiness of all components, including ICAO Standards and Recommended practices (SARPS), needed for deployment and do not imply a mandated State or regional implementation timeframe. The ASBU framework with supporting technology roadmaps ensures that State and regional implementation planning and deployment activities can be undertaken with the confidence that all components necessary for a particular deployment will be available within the ASBU dates mentioned.

1.3 Remotely piloted aircraft (RPA) are a new category of airspace user that brings many unique features to the civil aviation regulatory framework. Provisions in Annex 2 - *Rules of the Air* and Annex 7 - *Aircraft Nationality and Registration Marks* are now in place that amongst other things, require certification of the airworthiness of the RPA, approval of the remotely piloted aircraft system (RPAS) as a system, the licensing of the remote pilot and certification of the operator. Wide recognition exists that provisions to support RPAS will be necessary in virtually all ICAO Annexes, with the focus currently on the accelerated development of provisions for Annexes 1 - *Personnel Licensing*, Annex 6 - *Operation of Aircraft* and Annex 8 - *Airworthiness of Aircraft*. An RPAS planning thread, as described in the appendices to this paper and illustrated in the attached Figure 1, is proposed for inclusion in the ASBU framework.

2. ASBU MODULES - REMOTELY PILOTED AIRCRAFT

Overall strategy

2.1 The end state following Block 3 deployment in full enables operation of RPA in non-segregated airspace. The certification requirements for RPAS, command, control and ATC communication (C3) capabilities and predictable behaviour in any operational situation are key elements of this strategy. RPAS should be able to make use of the ASBU operational improvements in the same way as manned aircraft, and the technologies and procedures developed to support RPA integration could provide benefits to manned aircraft operations.

2.2 Successful integration of RPA in non-segregated airspace and at aerodromes is linked directly to the regulatory arrangements and the maturity of supporting technology. Airborne “detect and avoid” algorithms should be mature and certified for operations allowing pre-set automatic response in any situation to provide both airborne separation and collision avoidance manoeuvres following, for example, failure of the command and control (C2) link. The integration of RPA into aerodrome operations must take into account the unique characteristics of RPA in the context of all constraints at an airport. Consideration may have to be given to the creation of airports that would support RPA operations only.

Incremental Development

2.3 While the initial enabling of access to non-segregated airspace, (i.e. airworthiness, operator certification, communication performance, spectrum, remote pilot licensing and detect and avoid technology performance provisions etc) should be catered for in Block 1, it may not be until the Block 2 phase that full integration is possible.

2.4 In the Block 2 phase, the procedures and requirements will be further developed based on accumulated experience and technology development whilst mitigating associated risks. Access, with minimal constraints, to most airspace is likely for specific airframes. Coordinated minimum aircraft system performance specifications (MASPS) development based on approved ICAO provisions are expected, along with provisions addressing unique RPAS features such as the in-flight handover from one remote pilot station (RPS) to the next. Communication performance requirements are being refined to support C2 and ATC communications, and detect and avoid technologies are being certified. The identification of designated frequency bands for RPAS is expected.

Technology requirements

2.5 The technology requirements and specifications needed to support RPAS are significant and may in consequence define the operational performance and safety requirements and, in turn, the procedures required. Several operational requirements such as detect and avoid and the C2 links, could prove to be very challenging for the certification processes. Technology requirements and the linkages between the various Blocks and modules of the ASBU framework are detailed in the Technology Roadmaps that constitute part of the draft Fourth Edition of the *Global Air Navigation Plan (GANP)* (AN-Conf/12-WP/3 refers)

Deployment considerations

2.6 The timely development of ICAO provisions directly related to RPAS should include at minimum:

- a) RPAS approval;
- b) certificate of airworthiness;
- c) operator certificate;
- d) remote pilot licence;
- e) frequency spectrum;
- f) communications (including C2 link failure); and
- g) detect and avoid capabilities.

2.7 Beyond direct RPAS matters, all safety matters concerning the mixed operating environment of manned and remotely piloted aircraft must be addressed and take into account the aggregate effect on the overall level of safety. This could include, for example, adjustments to operational procedures for manned aircraft, ATC procedures and phraseology and aerodrome markings in order to safely and efficiently accommodate mixed operations.

3. CONCLUSION

3.1 The ASBUs describe ways to apply the concepts defined in the *Global Air Traffic Management Operational Concept* (Doc 9854) to achieve local and regional performance improvements. The ultimate goal is global interoperability. Safety and efficiency demand this level of interoperability and harmonization, which must be achieved at a reasonable cost with commensurate benefits. The Conference is invited to agree to the following recommendation:

Recommendation 4/x - ICAO aviation system block upgrades relating to integration of remotely piloted aircraft (RPA) into non-segregated airspace

That the Conference:

- a) request ICAO, as a matter of urgency, develop the regulatory framework necessary to support the integration of a remotely piloted aircraft into non-segregated airspace and at aerodromes;
- b) request States to be cognizant of the recent amendments to Annexes 2 and 7 related to the remotely piloted aircraft system and to support the continuation of this work at ICAO;
- c) urge States to work closely with ICAO and each other to ensure harmonization of provisions if they have an urgent need to accommodate remotely piloted aircraft system operations;
- d) endorse the aviation system block upgrade module relating to remotely piloted aircraft included in Block 1, as presented in Appendix A, and recommend that ICAO use it as the basis of its work programme on the subject;
- e) endorse the aviation system block upgrade modules relating to remotely piloted aircraft included in Blocks 2 and 3, as presented in Appendices B and C, as the strategic direction for this subject; and
- f) request ICAO to include, following further development and editorial review, the aviation system block upgrade modules relating to the integration of remotely piloted aircraft into non-segregated airspace in the draft Fourth edition of the *Global Air Navigation Plan*;

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Figure 1. Block upgrade modules covered in this working paper

