Council of the
European Union

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'I/A' ITEM NOTE

From:	General Secretariat of the Council
To:	Permanent Representatives Committee (Part 1)/Council
No. Cion doc.:	WK 8574/2018
Subject:	ICAO - Coordination for the 13th Air Navigation Conference (9 - 19 October, Montréal) – Endorsement

1. In preparation for the EU coordination activities for the 13th ICAO Air Navigation Conference (hereinafter 'ANC') (9-19 October 2018), the Commission services have submitted 12 European Working Papers and 5 Information Papers. All these papers have already been endorsed by the European Civil Aviation Conference (ECAC) Directors for Civil Aviation, with only one minor modification to the Working Paper on conflict zones.

2. On 13 July2018, the Aviation Working Party examined the above-mentioned papers. Delegations expressed their overall support for them and the actions recommended to the ANC, and the Commission representative provided answers and clarifications to the questions raised by delegations.

3. In light of the above, COREPER is invited:

- to approve the text of the Commission Working Papers and Information Papers as set out in annex to this note and to endorse the actions recommended to the ANC contained in them;
- to forward it to the COUNCIL for approval in one of its upcoming sessions, so that the above-mentioned papers can be submitted to ICAO with a view to the upcoming Air Navigation Conference (Montréal, 9-19 October 2018).

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THIRTEENTH AIR NAVIGATION CONFERENCE

COMMITTEE B

Agenda Item 7.3 : Operational safety risks; other implementation issues

CONFLICT ZONES

(Presented by Austria on behalf of the European Union and its Member States[1] and the other Member States of the European Civil Aviation Conference[2] and by EUROCONTROL)

EXECUTIVE SUMMARY

In its ambition to remain as the world's safest mode of mass transportation, the international civil aviation faces many challenges. One of the challenges is the protection of civil aviation from the risks arising from conflict zones. This paper acknowledges and support the ICAO work programme on conflict zones and proposes the 13th Air Navigation to support and further prioritize the activities of ICAO on the issue of conflict zones, and to include specific items in the GASP, GANP and GASeP.

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

1 Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

2 Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

1. INTRODUCTION

1.1. The 2015 High-level Safety Conference (HLSC) and 39th Assembly (2016) recognized the necessity to provide accurate and timely information to States and airlines regarding risks to civil aviation arising from conflict zones.

1.2. The actions taken by ICAO in relation to conflict zones overall are supported. Further, actions on the subject has since been introduced as a result of the accident investigation on the downing of Malaysia Airlines flight MH17 on 17 July 2014. The final report of the investigation was published on 13 October 2015 with safety recommendations, with a view to prevent similar tragedy from recurring over or nearby conflict zones in the future.

1.3. The activities indicated in this WP relate to risk management, collection of information, responsibilities for publication of and adequate dissemination of information to avoid flying above or nearby conflict zones which represent risks to civil aviation, and to organize air traffic flow management to avoid such conflict zones.

2. DISCUSSION

2.1. Flying over or nearby conflict zones is related to both security and safety management and requires an integrated risk management process, as proposed by ICAO in the update and upgrade of Document 10084 as an activity for further development. Several steps have to be taken, as part of the continuous risk assessment cycle: 1) The collection of information and intelligence; 2) the subsequent threat analysis; 3) the security risk assessment; 4) the hazard identification; 5) the safety risk assessment; 6) the determination of the acceptable risk level and lastly 7) information sharing. Each mitigating action should be accompanied with the identification of (new) hazards as a result of unintended consequences of the risk assessment mitigating actions. ICAO has acknowledged these steps in the update of Document 10084, which is work in progress. ICAO is invited to develop this concept together with States, regional organisations and stakeholders of industry.

2.2. ICAO has also reviewed several Annexes and is working on amendments. This work requires an update of ICAO provisions, to optimize the chain of provisions in Annexes 6 (operation of aircraft), 11 (air traffic services), 15 (aeronautical information services), 17 (security) and 19 (safety management).

2.3. ICAO has already formulated obligations for its member States to disseminate information and to close their airspace or parts thereof in case of conflicts. Under the Chicago Convention, States are the sovereign authority over their airspace. By ratifying the Convention, States have the right to prohibit uniformly the aircraft of other States from flying over certain areas of their territories as deemed necessary for reasons of military necessity or public safety.

2.4. ICAO had introduced as a pilot a repository on information about conflict zones. The ICAO Council decided not to continue with this repository and to explore alternative options. The library with links from States about conflict zones was introduced instead. The ICAO Council decided on 6 November 2017 (C-DEC 212/5 10/11/17) in light of recent positive developments, to discontinue the ICAO web-library of risk-based information, and to devote increasing efforts to providing training and capacity-building initiatives in order to assist States to further develop their risk management capabilities as well as multilateral arrangements for the sharing of risk information.

2.5. In situations of conflicts not all States are in a position to adequately inform others. Additional actions to collect and disseminate information are often needed for States to protect their citizens and airlines. Aviation is a global business and people can fly with any airline. In addition, States should inform other States directly when they have relevant information about threats within foreign airspace. An initiative supporting such information sharing has been launched in Europe to facilitate the collection and sharing of information at regional level. Other States and regions are invited to act in a similar manner and to make this information available for other regions, in order to achieve the availability of information at global level.

2.6. In Europe the EUROCONTROL/Network Manager (NM) has been providing information on conflict zones in Europe and its vicinity in the crisis management portlet of the NM Network Operations Portal (NM NOP Portal).

To ensure its use by aviation professionals, only the registered users of the NM NOP Portal may access it, which is strongly supported by aircraft operators. The NM ‘Closures and Warnings’[3] portlet contains information on latest ICAO State Letters, NOTAMs, and EASA Safety Information Bulletins (SIB)/Conflict Zone Information Bulletins (CZIB). Since 2014 the NM has also been supporting EASA with the NM operational expertise and data in preparation and publication of the EASA SIBs/CZIBs on conflict zones. The European Commission facilitates an EU risk assessment process aiming at joining up intelligence sources available in the Member States of the European Union and the European External Action Service as well as the views on the conflict zone risk assessment capabilities. Abstracts are used in the EASA’s Conflict Zone Alerting System with its CZIBs, in order to reduce risk by raising awareness of all known conflict zones in one publicly accessible website, to enable the publication in a timely manner of information and recommendations on conflict zone risks, for the benefit of all European Member States, operators and passengers. It complements national infrastructure mechanisms when they exist, by adding, when needed, a European level common risk picture and corresponding recommendations. Europe is willing to share with other regions its experience in risk assessments and information sharing.

2.7. Risk assessment is key for airlines when developing their flight plans. IATA and ICAO are encouraged to continue cooperating, notably on the issue of including the work on risk assessment for conflict zones in the IOSA approach. IATA can play an important role to coordinate the formulation of the needs of airlines for adequate information and discuss with States, regional organisations and ICAO if and how clarification of ICAO provisions can be instrumental for that.

2.8. Collection of information and intelligence should be based on different sources, which make dealing with conflict zones different from preparation of flights taking into account other threats and hazards. It should bring together information from parties not always directly involved in civil aviation and in planning of flights, like intelligence and military services. Civil-military exchange of information should be further enhanced (see also the WP[4] on civil-military cooperation).

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3 - It was considered that the name ‘Closures and Warnings’ was more neutral, i.e. removed sensitivity related to the term ‘conflict zones’.

4 Reference to European WP civil/military

However airlines, where possible with support of air navigation service providers, should take their own responsibilities to collect information and to make their risk assessment. Cooperation between airlines and between air navigation service providers, facilitated by their organisations if possible, will help as well.

2.9. In order to alert the airspace users on the existence of information (within a huge amount of daily produced NOTAMs and other sources of information) and to make the content of this information suitable to the needs of airlines and other airspace users, it is necessary to explore possibilities to develop a specific conflict-zone related NOTAM format with structured and formalized content.

2.10. As risk-based information about conflict zones is not always developed for aviation purposes, or is often available from non-public sources, it is recommended in a first instance to promote the cooperation between government organisations to share this information. In parallel it will be also beneficial to promote a structured cooperation between government organisations and airspace users for sharing abstracts of that information in the public domain in order to support airspace users when making their risk assessment. Cooperation at regional scale is preferred. Interregional cooperation should also be promoted including development of traffic flow crisis scenarios between regions, supported by the availability of tools and data to facilitate the development of such scenarios.

2.11. In future special attention should be paid within System Wide Information Management systems and procedures and ICAO provisions, to include sharing of information relevant to avoid flying over or nearby conflict zones. See for this relation the European WP[5] on Flight and flow information for a collaborative environment (FF-ICE) and trajectory-based operations (TBO).

2.12. An important item is to organise air traffic flow management at regional scale, to assist airlines in planning flights outside and around conflict zones. Assisting in the avoidance of conflict zones by using alternative airspace is a task of Air Navigation Service Providers (ANSPs) and air traffic flow management (ATFM) units. More work should be done on making information available and encouraging the establishment of operational arrangements at regional level for flying safely by avoiding conflict zones.

[5] Reference to European WP on TBO

Regional platforms for cooperation should be established and facilitated by ICAO provisions. ICAO is invited to encourage and to facilitate this by bringing States, regional organisations and industry together at the right geographical level to address problems for ATFM caused by conflict zones.

2.13. We are four years after the tragedy with flight MH17. Experiences in aviation how to cope with conflict zones are growing, but many airlines and States lack the knowledge and have not developed steps as indicated in paragraph 2.1. Therefore it is recommended to describe existing provisions and practices and to share these. The results should lead to a review and upgrade of relevant ICAO Guidance Material.

2.14. In the coming years, the way States, regional organisations and the aviation industry are dealing with conflict zones should evolve with an ongoing focus on seeking to reduce related risks. ICAO should take this into account when performing safety and security oversight and continuous monitoring approach activities and facilitating the sharing of best practises.

2.15. The activities related to flying over or nearby conflict zones should get a placeholder in the update of the GASP and GASeP, so that progress and new developments are part of future reviews and part of the ICAO work programme to implement these strategic documents.

3. CONCLUSION

3.1. The Conference is invited to agree on the following recommendations:

That the Conference:

a) Request ICAO to finalize the existing work programme as soon as possible and to come with regular updates of Doc 10084 and further develop the concept of Integrated Risk Management with States, regional organisations and stakeholders from industry, dedicated to flying over or nearby conflict zones;

b) Request ICAO to support and facilitate work of States, regional organisations and operators on providing timely information relating to conflict zones and to support inclusion of these options in FF-ICE and SWIM;

c) Invite ICAO to promote information sharing about conflict zones at regional level including sharing of experiences across the regional boundaries;

d) Request ICAO to support the development of a network management concept, and in particular Air Traffic Flow Management at regional level to facilitate flying safely by avoidance of conflict zones and to support regional arrangements for cooperation on ATFM;

e) Request ICAO to include the work on avoidance of flying over or nearby conflict zones in the update of the GASP, GANP and GASeP.

— END —

International Civil Aviation Organization

WORKING PAPER

THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item 5: Emerging issues
5.4: Cyber resilience

STRENGTHENIG CONCEPTS FOR CYBER SECURITY IN AVIATION

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

This paper will briefly introduce the rationales why organisations should manage their individual cyber security risks, products and services by means of an Information Security Management System (ISMS), which takes into account the risks related to the organisation's interactions with other organisations or systems they operate.

The paper also focuses on trustworthiness, why it is needed and which benefits it provides to organisations to use an ISMS. In addition, the paper will also address why an equivalent level of cyber security performance, independent of time and location, of connecting systems is a crucial pre-requisite and how this can be achieved for ground/ground or

1 Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

2 Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

air/ground operations.

The paper further introduces into a common perspective of criticality for aviation and the benefits of information sharing.

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

1. INTRODUCTION

1.1. The availability of accurate information and the correct functioning of safety-critical systems are pre-requisites for a safe and secure civil aviation as the sector encounters further digitalization. The aviation system is highly integrated and information travels globally. Therefore, a holistic and end-to-end approach must be taken to cyber security initiatives in the aviation sector.

1.2. This paper highlights the advantages of the introduction of Information Security Management Systems (ISMS) in the aviation sector. Such management systems, preferably aligned or integrated with existing aviation risk management systems, assist both individual organisations and the sector as a whole to better prepare and respond to information security threats.

1.3. A common management system approach allows the coordination of measures throughout the sector, taking into account the fact that information is shared, that the same systems are common to many actors in the sector and that risks are shared.

1.4. In addition to an ISMS approach, this paper also elaborates on the notion of trust. In the aviation sector, trust - in addition to confidence - in each partner is paramount. A robust system of training, certification, oversight and double-checks ensures that for each flight, all partners traditionally had confidence in each other to fulfil their part of the aviation chain conscientiously and correctly.

2. DISCUSSION

2.1. **How to take advantage of an ISMS** - Existing concepts of ISMS are inherently limited to individual organisations. Civil aviation, however, is such a tightly interwoven System-of-Systems, comprising of interconnected products, people, and processes, including even connections with military systems[3], that an individual organization perspective is insufficient. As such, civil aviation will have to introduce ISMS with the notion of trans-organisational management of cyber security.

2.2. A globally coordinated ISMS approach is thus a key enabler for the civil aviation sector. Such a global framework would facilitate the coherent implementation of a number of supporting concepts, such as a globally interoperable and secure communication infrastructure, as well as a trust framework or other concepts to allow a future system based on the trustful exchange of information. As such future will not be built at one single time, individual evolution of organisations, States or regions will need to be facilitated. The existence of ISMS in all organisations will be pre-requisite to make those concepts a reality. Implementations of ISMS should be aligned with the existing management systems for safety (e.g. Annex 19) and aviation security risk management and ICAO provisions and industry standards as well as effective oversight mechanisms.

2.3. **The trustworthiness concept** - In civil aviation, a strong framework of confidence has been built over decades. Trustworthiness is now a formal concept by which one organisation - or a system it operates - can rely on the cyber security properties of another organisation - or a system it operates[4]. As trust is never absolute, the concept proposes multiple levels of trustworthiness, which should depend upon the impact (safety or service continuity, e.g. expeditious flow of traffic in a region) it will have upon the relying party.

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3 Reference to European civil/military paper

4 Information Paper XYZ will explain the concepts, and principles of ISMS, the Trustworthiness and Cyber Security Operating Conditions concepts, as well as the benefits of Information Sharing

2.4. For example, in aircraft certification most confidence about the airworthiness is derived from the assurance that the appropriate actions have been performed yielding acceptable results. Those actions have been designed to address the severity of impact of safety risks. Higher levels of severity of impact will need higher levels of scrutiny in the development process. For cyber security properties a similar concept is proposed. It is designed to reflect the effectiveness of protection against cyber threats. In essence, confidence in the absence of development errors and vulnerabilities and in organisations adequately protecting civil aviation is what will prepare the future of safe flight. The trustworthiness concept should be integrated into ISMS, which in turn should be aligned or integrated with existing management systems.

2.5. **Cyber Security Operating Conditions** - To take full advantage of the trustworthiness concept, the dynamics of the evolution of individual organisations and systems they operate, belonging to the globally interoperable, secure, infra-structure, needs to be covered as well. Pre-specified cyber security operating conditions are one way to address the challenge. For every connection between peers it will be essential that trustworthiness levels will be compatible among them, consequently requiring the definition of matching pairs. Certain pair combinations of trustworthiness levels will be permissible to connect, as they will meet cyber security objectives with acceptable risk levels. Other combinations may fail to meet the objectives. This will create incentives to reach agreements between peers about the conditions for compatible, yet diverging trustworthiness levels, which will ultimately lead to balanced approaches. Two levels of migration of connections between peers need to be distinguished: the one between organisations which connect their systems, and the one between air or space based vehicles and ground-based systems, which transition between connections at a fast pace. Their key discriminator is the speed by which their cyber security condition evolves

2.6. Slow evolution: On the one hand, ground systems in general – and ATM/ANS in particular - evolve on a comparatively slow pace. Changes in their operating condition is largely determined by changes either of their own cyber security posture or the one of the systems they are connected to. This allows for a closely coordinated adaptation of cyber security properties such that all connected parties meet the overall cyber security requirements. The concept of operating conditions is addressing the proper pairing of trustworthiness levels between connecting organisations.

2.7. Fast evolution: On the other hand, aircraft are migrating from one location to another at a comparatively high pace, while being connected dynamically to a large number of peers during a short period of time. Generally speaking, aircraft or ATM/ANS systems will not be in a matching state of cyber security at one given day. To keep them operational, migration on either side will be required. For cyber security the adaptation of the concept of Operating Condition could provide a response. For example, in the existing concept of operating conditions, horizontal separation requirements applicable within one airspace mandate a certain equipage of ground and aircraft systems to meet these requirements. Thus the concept of operating conditions could serve as a blue print for cyber security, responding to the requirements with respect to cyber security properties introduced by trustworthiness levels. Adequately paired trustworthiness levels between ATM/ANS and aircraft systems would allow for safe and secure airspace use.

2.8. **Information Sharing on Cyber Aspects –** Another aspect to be considered as part of an ISMS is the Sharing of Information. A global ISMS framework could also assist in creating a more coherent information sharing mechanism on cyber security risks. The Information Technology (IT) world has created the concept of Cyber Security Centre, which “handles” information about cyber security incidents, including collecting and maintaining databases of incidents, threats and vulnerabilities, provide analyses and guidance on successful practices about how to counter the actual incident to its constituencies. These tasks are associated with information sharing.

2.9. Internationally, Computer Emergency Response Teams (CERTs) and Computer Security Incident Response Teams (CSIRTs) have created a community, called Forum for Incident Response and Security Teams (FIRST). This forum could serve the aviation community as a blueprint for a concerted approach towards global information sharing with the objective of not only reacting to incidents, but also preventing future attacks becoming successful. In dealing with the discovery of new vulnerabilities, the information collected by CSIRTs will allow for a certain anticipation of emerging risks and consequently take preventive measures to limit detrimental effects on civil aviation. In summary, this objective aims at improving the awareness about cyber-threats and vulnerabilities of aviation systems. Once aviation CSIRTs coordinate among each other and their respective members, internationally aligned mitigation and defensive measures against cyber threats will be possible.

2.10. Cyber security threats exist beyond civil aviation, e.g. in other transport sectors but also non-transport related sectors (e.g. banking system, nuclear industry). They often share technologies and implementations, hence threats and vulnerabilities. It is therefore fundamental to share policies, intelligence information, and best practices with organizations from these sectors. An approach to cyber security in civil aviation should thus benefit from other national or regional cross-sectorial approaches and experiences. Further, close communication with governmental entities engaged in cyber security of other sectors will enhance the benefits for Civil Aviation Authorities of States.

3. CONCLUSION

3.1. The Conference is invited to agree on the following recommendations:

That the Conference:

a) Urge ICAO to support States to require organisations to manage cybersecurity risks of their operations, products and services, including their interfaces to peers, by means of an Information Security Management System (ISMS), based upon international industry standards and preferably aligned or integrated with existing management systems.

b) Request ICAO to encourage States to take appropriate measures such that globally interoperable infrastructure is in place, resilient against cyber-attacks. It shall meet interoperability and cyber security requirements to reinforce the holistic and higher-level goals with respect to safety and the expeditious flow of traffic.

c) Urge ICAO to develop, following a multi-disciplinary approach, provisions for inter-organisational trust, as part of a wider broader trust framework, and to encourage their implementation.

d) Request ICAO to encourage States to take measures, such that aviation operators establish and facilitate information sharing of operational cybersecurity related information through the appropriately designated channels, such as a global network of "trusted organisations".

e) Urge ICAO to facilitate the development of provisions for trustworthiness and cyber security operating conditions to allow such globally interoperable infrastructure to be securely operated.

f) Request ICAO to encourage States to expand existing or establish new reporting channels, for cybersecurity related facts, to better address new risks to aviation safety and security and to ensure the expeditious flow of traffic.

g) Request ICAO to call upon States to promote cross-sectoral governmental and non-governmental collaboration on cyber security between aviation domains and other domains.

— END —

International Civil Aviation Organization

WORKING PAPER

THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item 1.1: Vision and overview of the sixth edition of the GANP

PROPOSALS FOR THE FURTHER DEVELOPMENT OF THE GANP

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

This paper supports the Global Aviation Navigation Plan (GANP) as a crucial strategic document, and calls upon a number of actions from ICAO to steer and nurture the transformation of ATM enabled by the digitalisation of aviation.

Action: The Conference is invited to agree to the recommendations in paragraph 8.

[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

[2] Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

1. INTRODUCTION

1.1. As air traffic is forecast to continue growing steadily in the decades to come, bringing global economic growth, prosperity and social development; aviation actors need to address the challenges of such growth through adequate modernization of their systems and infrastructures. In addition, they now also need to face and address the new challenges - and also opportunities - generated by the emergence of potentially hundreds of thousands of highly connected and automated air vehicles. All this must be achieved whilst at least maintaining safety and ensuring adequate security measures are in place; aviation's highest priorities. Only a proactive worldwide strategy, manifested by the Global Aviation Navigation Plan (GANP) and the Global Aviation Safety Plan (GASP), building on the agile development and deployment of new technologies will bring everyone along together, deliver performance improvements and realise the "promise of twenty-first century air traffic management"[3].

1.2. This paper supports the Global Aviation Navigation Plan (GANP) as a crucial strategic document, and calls upon a number of actions from ICAO to steer and nurture the transformation of ATM enabled by the digitalisation, built through an iterative process aligned with regional initiatives and through strong stakeholder interaction, and strengthened by robust implementation monitoring and maintenance processes.

2. NEED FOR A CLEAR VISION AND A CONCEPTUAL ROADMAP ON THE TRANSFORMATION OF ATM

2.1. The digital transformation that affects almost all domains of industry is also increasingly changing the aviation world. In fact, because of its global dimension, aviation should be in the vanguard to deliver this transformation, encouraging global deployment of existing digital technologies and fostering new digital enhancements.

2.2. The vision for the future is therefore the digital transformation of aviation that will allow the delivery of high-performing air navigation services in a context of long-term traffic growth whilst successfully accommodating new entrants and improving or at least maintaining safety and an adequate level of ATM security.

[3] GANP 2016-2030, Executive Summary.

This evolution and its deployment should be mastered by the GANP, aligned with the GATMOC and allow for regional or local adaptations to specific contexts.

2.3. The path towards this digital transformation vision should be built on improved information sharing (SWIM accessible to all aviation stakeholders, but protected against unlawful interference); gradual transfer of routine tasks to automation; interoperability of systems across borders and optimised use of airborne equipment for aircraft usage in different regions of the world; use of open connectivity technologies (cellular and satellite); modular and scalable systems, safe, secure and smooth integration of all air vehicles (including UAS); flight-centric Trajectory Based Operations (TBO) and a performance based approach, with a civil-military dimension as required.

3. A PERFORMANCE-BASED APPROACH

3.1. The delivery of high-performing air navigation services requires a performance-based approach, built on the endorsement of the vision and the critical path to achieve it, while leaving room for regional or local requirements, specificities and needs, to make sure that “no country is left behind” whilst the overall goal is still pursued. Such approach should also include the establishment of SARPS that are not too prescriptive.

3.2. To achieve this, progress towards the vision should be monitored through base lining, benchmarking and, where appropriate, target setting. Performance targets could be either of qualitative or quantitative nature, based on the existing ICAO indicators, adapted or completed at regional or local level as necessary.

4. ACHIEVING THE VISION WHILST ENSURING CONTINUOUS SAFETY IMPROVEMENT: THE GANP/GASP CONSISTENCY

4.1. The GANP needs to be developed in conjunction with the GASP. Both documents promote coordination of international, regional and State ATM modernisation programmes aimed at delivering an interoperable, scalable, safe, environmentally-friendly and efficient international civil aviation system.Alignment of these two documents is crucial to ensure that air navigation modernisation and continuous safety improvement progress in close coordination.

4.2. In line with its total system approach to aviation safety, Europe has been striving to ensure a common vision and alignment of objectives for the European ATM Master Plan and the European plan for Aviation Safety. A consistent and complementary approach to ATM, safety and security related matters, involving all civil and military aviation components, is deemed to provide greater efficiency in reaching safety and efficiency goals and may prepare the grounds for a unified aviation risk management framework.

4.3. Europe therefore invites ICAO to initiate a smooth alignment of the GASP and the GANP, starting with a smooth integration of RPAS and the mitigation of cyber threats. Furthermore, with the development of the Global Aviation Security Plan (GASeP), alignment is also necessary with global developments in security and the evolution of the threat picture in civil aviation.

5. ROLE OF THE HUMAN

5.1. The success of digital transformation of aviation also relies on the support by the professional staff that will have to operate it. Operations using increased automation and connectivity, will require different skills resulting more on the management than on execution of tasks.

5.2. A generic automation model would cater for clearly identifying the human operator element and would ease the transition towards the digitalisation and automation in aviation as foreseen in the GANP vision and conceptual roadmap.

5.3. Staff should be involved in this digital transformation to ensure technology serves their needs rather than becoming a barrier to progress. This will enable the early identification of social and change risks and opportunities that would feed change management strategy from the outset; the development of related ICAO guidance material supporting the development of change management and training policies is thus required to address the expected changes in competencies.

6. MAINTENANCE OF THE GANP AND STANDARDISATION NEEDS

6.1. The implementation and industrialisation of improved operation and digital transformation stemming from the GANP should be reinforced by the efficient maintenance of the GANP, ASBUs and basic building blocks (BBBs) framework. ICAO should establish an efficient system that defines and amends the ICAO provisions (SARPs, PANS and ICAO technical guidance material) in a manner that can support the GANP evolution and the ASBUs in a timely manner without being too prescriptive. The ICAO provisions should be developed ensuring pooling of adequate resources to develop coherent and global standards.

6.2. Furthermore, ICAO Assembly Resolution A39-22 instructs the Council, inter alia, to utilize, to the maximum extent appropriate and subject to the adequacy of a verification and validation process, the work of other recognized industry standards developing organizations in the development of ICAO provisions. The currently applied verification and validation process as requested by A39-22 is considered not sufficient and needs to be expanded and reinforced to ensure that technical specifications on a particular subject developed by different standards making organizations are interoperable, improve harmonization and consolidate development resources.

7. GLOBAL AERONAUTICAL DISTRESS AND SAFETY SYSTEM (GADSS)

7.1. The Global Aeronautical Distress and Safety System (GADSS) is the response to the tragedies of Malaysia 370 and Air France 447. Through the three main functions of GADSS the global effectiveness of SAR will be enhanced. The urgent evolutionary implementation of the GADSS functions is supported by ICAO provisions (Annex 6 and Guidance Material) and should be included as available means to enhance SAR effectiveness in a new GADSS thread in the sixth edition of the GANP.

8. CONCLUSION

8.1. The Conference is invited to agree on the following recommendations:

That the Conference:

a) Support the work of ICAO in developing the next edition of the GANP in coordination with States and industry, with a clear vision and conceptual roadmap on how to address the challenges and opportunities for the future, including the civil-military dimension as required;

b) Call upon ICAO to reinforce the performance-based approach development including provisions, with clear objectives or ambitions to allow States and industry to collaboratively develop, validate and deploy new technologies in a coordinated and cooperative way towards the common vision, including enhanced civil-military interoperability;

c) Request ICAO to intensify efforts in establishing a common vision for the alignment between the GASP, the GANP and the newly developed GASeP as well as to secure GANP and GASP are consistent and complementary, especially in the light of the planned ASBU evolution;

d) Recognise the rapid onset of digitalisation and automation of aviation and ATM, call upon ICAO to incorporate into the GANP change management principles noting the role of the human and to establish, in collaboration with States, regions and industry, a generic automation model based on experience from other industries for incorporation into the GANP;

e) Call upon ICAO to develop and implement a transparent and efficient maintenance process of the GANP and of the ICAO provisions and related industry standards, and to expand and reinforce its verification and validation process.;

f) Call upon ICAO to include a GADSS thread in the GANP in line with the ICAO provisions and the GADSS ConOps V6.

g) Encourage ICAO to continue and further reinforce an iterative approach where global strategic objectives feed, and are fed by, state and regional ATM modernisation programmes, experience and best practices.

— END —

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THIRTEENTH AIR NAVIGATION CONFERENCE

COMMITTEE A

Agenda Item : 3.5 Enhancing the global air navigation system and other ATM issues

NETWORK MANAGEMENT

(Presented by Austria on behalf of the European Union and its Member States[1] and the other Member States of the European Civil Aviation Conference[2]and by EUROCONTROL)

EXECUTIVE SUMMARY

This paper proposes an evolution from the existing concept of regional ATFM systems to establishing a network of interlinked regions. Through the development of regional SWIM aligned business-to-business (B2B) web services, all stakeholders in other regions can obtain all necessary flight data on traffic between regions. In addition, data received from other regions can be made available to all authenticated and authorised nodes within each regional network.

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

[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

[2] Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

1. INTRODUCTION

1.1. Air traffic flow management (ATFM) has been in existence for more than 30 years. The function commenced in the early 1980s in both North America and Europe. Both these systems cover large geographical areas. As an example, in the case of Europe the EUROCONTROL Network Manager system includes a centralised flow management function operating in close cooperation with national ATFM units in the airspace of 43 states.

1.2. Europe's own experience in applying ICAO *Standards and Recommended Practices* (SARPs) and *Procedures for Air Navigation Services* (PANS), complemented by Doc 9971, has led to an efficient deployment of cross border airspace structures and services, further integration of managing shared resources and ATFM, increased interoperability and development of common structures to address crisis management. These are key directions in which network management has evolved in Europe and should contribute to further developing solutions with a view to maximise the potential of using a network management approach on a global scale.

2. DISCUSSION

2.1 **Cooperative Traffic Management***: Integrated ATM Process from planning to execution*

2.1.1 Cooperative traffic management (CTM) includes interdependent activities to better use available capacity and is an important step towards time-based operations. In essence, it is the collaborative process of determining and implementing optimal solutions for network operations through the continuous information sharing of individual, local and network preferences, in both the planning and execution phases of ATM. In this context it should be noted that "network management" goes beyond ATFM, its goal is to enhance the network performance in terms of safety, capacity, cost effectiveness and environmental impact.

2.1.2 The CTM aims at optimising traffic delivery through a cooperative approach: the ATM network, ATC, flight operations and airports work together and, with the introduction of time-based processes, make for a smoother and more predictable sequencing of flights into ATC sectors and airports. This includes also more efficient airspace management and support tools.

2.1.3 CTM covers, *inter alia*: the introduction of target time operations to improve the delivery of traffic and to reduce the shortcomings of the current ATFCM by extending the management of time-measures into the ATC execution phase, located at the constraint itself, which would require addressing the ATCOs working methods.

2.2 **Cross border operations**

2.2.1 It should be noted that ICAO provisions already support the establishment of cross border operations. In accordance with Annex 11 – *Air Traffic Services,* paragraph 2.1.1, "...by mutual agreement, a State may delegate to another State the responsibility for establishing and providing air traffic services in flight information regions, control areas or control zones extending over the territories of the former." How and under which conditions this can be achieved is further explained in the associated note.

2.2.2 As can be observed from the note to Annex 11, paragraph 2.1.1, the State providing the services within the territory of the delegating State "... *will do so in accordance with the requirements of the latter* ...". In other words, the delegating State may e.g. require the provider State to deliver the services applying the provisions in a manner consistent with those of the delegating State. In order to facilitate cross border operations it is essential that ICAO recommends the consistent application of existing ICAO provisions with special focus on ATS, airspace management, management of scarce resources such as SSR codes, radio frequencies etc.

2.2.3 In order to meet the increasing demands for capacity it is necessary to develop efficient cross border airspace design and capacity management independent of State and FIR borders. For the network operations (NOPS) concept to become effective it is important to adopt a new way of thinking, across FIR borders, across national and regional borders. This can be achieved today through existing technology and States using to the fullest extent possible existing ICAO standards and recommendations.

2.2.4 In Europe, the implementation of free route concept has triggered the use of current ICAO provisions supporting cross-border operations, at their fullest. The experience gathered both in preparation of the deployment and the effective use of the free route airspace concept (FRAC) across the European network shows that the framework provided by current provisions could be used when supported by the appropriate level of integration (ATC, ASM and ATFM) and associated data-exchange flows. A good experience has been gained from the work between States, ANSPs and the Network Manager on these topics with the latter acting as an impartial body (honest broker)[3]. In Europe network functions led to ensure the sharing of a network vision and its performance by all stakeholders.

2.2.5. In addition to the above, this cross border approach, executed through network management functions, will support the implementation of appropriate airspace structures and flight operations of so called ‘New Entrants’ above FL600.

2.3 **Regional interoperability**

2.3.1 In order to meet users’ preferences interconnectivity between regions is needed. For example European implementation of concepts such as free-route airspace is supported by the ability to use, *inter alia*, common concepts, extended areas of interest, automated coordination and transfer and dynamic coordination points. This needs to expand across ICAO regions and be applied in a harmonised manner.

2.3.2. Predictability is key to the current and future effective network management functions, both within regions and across ICAO regions. A key enabler in supporting a global development and harmonisation of network management functions is the enhancement of cooperation and coordination between regions. It should therefore be ensured that operational data (e.g. flight data information, capacity information, other data as required) are exchanged not only within ICAO regions but across ICAO regions. Improved short term pre-tactical predictability for major traffic flows requires that real-time flight ATC activation departure planning information is available to each concerned ATFM/network management unit.

3 Reference to European TBO paper

2.3.3 Through the development of regional SWIM aligned B2B web services all stakeholders in other regions could obtain all necessary flight data on traffic between regions. In addition, data received from other regions could be made available to all authenticated and authorised nodes within each regional network.

2.3.4 Achieving such basic functionalities would require greater harmonisation of underlying operational concepts, both intra-regional and inter-regional, which in turn could drive particular requirements on supporting systems. Further integration of ATC, ASM and ATFM measures is, in Europe's experience, an effective way to implement effective network management solutions.

2.4 Aviation Network Crisis Management

2.4.1 In the context of this paper 'aviation network crisis' means a state of inability to provide air navigation services at the required level resulting in a major loss of network capacity; or a major imbalance between network capacity and demand; or a major failure in the information flow in one or several parts of the network following an unusual and unforeseen situation. It may be caused by, *inter alia*, volcanic eruption, nuclear incident, armed conflict, security threats etc.

2.4.2 Following ANConf12 recommendation 4/8 the ICAO EUR/NAT Office developed ICAO Crisis Management Framework Document (EUR Doc 031) which was published in November 2014. It supports crisis management arrangements at the national, sub-regional and regional level, provides guidance to States in their work to enhance their level of preparedness to threat scenarios and aims to harmonise crisis management approach across the European Region.

2.4.3 Aviation network crises impact various components of the network and at times can spill over national and regional boundaries. In most cases their impact is significant and can only be mitigated effectively through a coordinated response.

2.4.4 The need to maintain continuity of traffic flows between regions during crisis requires that the planning and execution of specific measures is given a global dimension. To achieve this, one must plan contingency scenarios between regions, coordinated at global level and supported by sharing/exchange of airspace and traffic data and simulation tools. This approach would enable a rapid reaction in deploying commensurate responses to unfolding crisis by executing pre-existing scenarios or developing solutions using available data and tools.

3. <u>CONCLUSION</u>

3.1 The Conference is invited to agree to the following recommendation:

That the Conference:

a) request ICAO to develop provisions supporting the implementation of a global network collaborative management, based on cooperative traffic management techniques that include further ATM integration in support of time and trajectory-based operations;

b) urge States to accelerate implementation of ICAO provisions in support of effective cross border operations with focus on the provision of efficient ATS and airspace and scarce resources management;

c) request ICAO to promote the evolution of network management measures and using FF-ICE flight and flow data exchanges from intra-regional to inter-regional applicability, and to develop the necessary provisions for the management of flows based on user-preferred trajectories;

d) request ICAO to launch the development of a global approach in support of crisis management using data-exchanges, processes and tools to deliver early warnings, situation awareness and effective recovery.

— END —

International Civil Aviation Organization

WORKING PAPER

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(Information Paper)
English only

THIRTEENTH AIR NAVIGATION CONFERENCE

COMMITTEE A

Agenda Item 2.1 : Aerodrome operations and capacity

TOTAL AIRPORT MANAGEMENT

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

This information paper describes the European perspectives regarding development and implementation of Total Airport Management (TAM) in Europe, integrating ACDM and Airport Operation Centres (APOC).

1. INTRODUCTION

1.1 Major European airports are increasingly focusing on a Total Airport Management (TAM) approach by removing barriers to information sharing, developing common situational awareness supported by shared processes and products to drive airport performance improvements.

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1 Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

2 Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

1.2 TAM brings together collaborative decision-making processes and integrates airside with landside operations to improve the efficient management of airport resources on an equitable basis.

1.3 Development work is supported by the Single European Sky ATM Research program, SESAR, and implementation by the SESAR Deployment Program.

2. TAM CONCEPT

2.1.1 Today, many airports remain constrained by lack of integrated processes in and between airside, landside and network systems, unclear roles and responsibilities, limited data sharing restricting collaboration and resulting in a poor understanding of overall airport resources and performance.

2.1.2 Traditionally, performance has been driven by independent stakeholder business processes, often in contradiction to other stakeholders needs, leading to inefficiencies and reactive decision making rather than shared and accurate predictive decision making, anticipating and solving issues in advance.

2.1.3 Furthermore, many airports are constrained by operations that rely on personal experience rather than shared, internalised and historic knowledge that can be used to drive performance through integrated business processes, data analytics and machine learning to support predictive decision making.

2.1.4 Within TAM, m any of these issues and challenges are addressed as airport processes, roles and products are defined and increasingly integrated with the Air Traffic Management (ATM) system and other stakeholder system components to ensure that the priorities of aircraft operators and the constraints of the airport and air transport network are known.

2.1.5 Airport processes from passenger check-in, security, baggage to aircraft turn-round are defined, integrated and work collaboratively with airside and network processes to improve the predictability of agreed departure times.

2.1.6 A key building block for TAM is Airport CDM (ACDM), where the efficiency of airport operations is improved through information sharing between the principal airport stakeholders. The focus of ACDM is oriented to aircraft turnaround on the day of operations. The AOP will expand A-CDM in time and scope with in an APOC, whilst TAM expands this concept further and is based on a holistic view of the entire airport, integrating passengers and baggage and in a performance-driven approach.

2.1.7 TAM is dependent on the Airport Operations Plan (AOP) which, ideally, is connected to ATFM functions (in Europe the Network Operations Plan of the Network Manager) and enriched by airport specific data. The AOP is a "local product" that requires continuous updating, agreed data definitions, actor roles and responsibilities and processes for managing the operations and related data.

2.1.8 The Collaborative management of airport performance is embodied in an Airport Operations Centre (APOC) that brings together different airport stakeholders who are in constant communication, helped by decision support systems, who co-ordinate, develop and maintain joint plans to drive airport performance and who then execute those plans in their respective area of responsibility.

2.2 Airport Collaborative Decision Making (ACDM)

2.2.1 ACDM is well documented by ICAO in the 3rd edition of the Manual on Collaborative Air Traffic Flow Management (Doc 9971) with regional variants currently being implemented. A European handbook developed by EUROCONTROL and aligned with ICAO provides the guidance for implementation.

2.2.2 ACDM resolves some of the identified inefficiencies through information sharing that supports stakeholders develop a common situational awareness and process synchronisation leading to improved decision making.

2.2.3 ACDM implementation is well underway in Europe with 28 ACDM deployments at major airports representing around 40% of European traffic. Another 17 airports have deployed a lighter version, "Advanced Tower" and further deployment is underway. This is driving airport and network performance benefits covering predictability, capacity, performance, resilience and efficiency.

2.2.4 A 2016 EUROCONTROL study underlined the benefits, showing that ACDM supports strong taxi-out time savings of between 0.25 and 3 minutes per departure, average schedule adherence improvements between 0.5 and 2 minutes per flight and ATFM delay reductions with a strong tendency for generating more favourable slots for its customers, resulting in significant ground delay savings.

2.2.5 The increased predictability and reduced taxi out time brought by ACDM are reflected in fuel savings and a related positive impact on emissions.

2.2.6 The study suggests that ACDM provides a return on investment over 18 months and a cost benefit ratio of 7 over 10 years. Several CDM airports showed tactical delay cost savings amounting to €1 million in 2015 (study reference year). The standard deviation of take-off accuracy was shown to have reduced from an average of 14 minutes to around 5 at the ACDM off-block milestone.

2.3 Total Airport Management

2.3.1 TAM builds on ACDM and the AOP/APOC through an "integrated" airport management framework, adding land side processes where all major aircraft operators, airport, aerodrome ATC and ground handling, passenger, baggage and freight processes are conducted using common data sets linked through the AOP and agreed procedures within a collaborative environment.

2.3.2 In TAM an APOC provides key stakeholders with decision support systems and performance dashboards fed by multiple data sources and real-time monitoring of land and airside airport processes as well as network operations. APOC managers use these systems to steer monitor and manage airport performance with post operations analysis improving their decision making.

2.3.3 The processes incorporated into the APOC address airport demand / capacity imbalances, pre-departure sequence preparation, de-icing, stand management, coordination of airline flight priorities, passenger, baggage and freight handling services, passenger flow management through security and border control checkpoints, weather and adverse conditions, ground transport, infrastructure and power.

2.3.4 Airports and their stakeholders optimise the use of their resources supported by TAM, which provides airports, air navigation services and the network manager with improved predictive analytics, rather than reactive situational awareness, driving resilience to disruptions, cost efficiency, capacity, environmental sustainability and security.

2.3.5 European airports developing or implementing TAM and ‘Airport Operations Centres’ include: Amsterdam, Barcelona, Brussels, Dusseldorf, Frankfurt, Geneva, London Heathrow, Madrid Barajas, Munich, Paris CDG, Zurich.

2.4. Future Perspective

2.4.1 Big data, machine learning techniques and Artificial Intelligence are now being harnessed in TAM to internalise operational knowledge and further improve airport performance. These techniques and capabilities support analytics, predictive performance dash boards and what-if decision making supporting the ability to anticipate / manage abnormal situations, drawing on knowledge held in large historic data sets through machine and deep learning algorithms.

2.4.2 SESAR research and deployment are addressing the opportunities offered by tailoring and downsizing TAM to support regional airport operations and increased connectivity, encouraged by the European network manager.

3. CONCLUSION

The Conference is invited to note the progress of Europe in the implementation of TAM.

— END —

International Civil Aviation Organization

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WORKING PAPER

THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item 3.2: Flight and flow information for a collaborative environment (FF-ICE) and trajectory-based operations (TBO)

TRAJECTORY BASED OPERATIONS

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

This paper supports the TBO concept as the transformation of ATM accommodating the continuous evolution of demand including new entrants and the military. The paper requests for additional focus on the changing role of ATFM, the need for automation and consequential change of role of the human, need for expedited development and implementation of key enablers such as SWIM and FF-ICE in a way that takes account of Regional ATM developments.

Action: The Conference is invited to agree to the recommendations in paragraph 3.2

[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

[2] Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

1. INTRODUCTION

1.1 For many years, the global ATM Operational Concept (GATMOC) is a stable reference and target for the evolution of ATM driven by a continuous need to improve performance. The main conceptual paradigm change in the GATMOC is a seamless ATM using management by trajectory based on synchronised collaborative decision-making principles.

1.2 Although evolutionary steps have been made towards the GATMOC, the fundamental change of management by trajectory still has to be developed and implemented. This change will enable the synchronisation of decision making processes (or in GATMOC terminology, the integration of the concept components). It will be enabled by digitalisation of ATM; automation and information sharing which will be needed to provide the levels of performance to accommodate the increasing demand and to integrate and interface with management systems that manage operations of the new types of airspace users. TBO will also be instrumental for civil/military co-operation3 and managing operations of new types of airspace users operating above airspace used today for civil aviation.

1.3 To guide the way towards the paradigm change, the ICAO ATM Requirements and Performance Panel (ATMRPP) has detailed the principle of management by trajectory into the Concept for Trajectory Based Operations. The document has been developed through several iterations including peer Panel review.

1.4 ICAO AN-Conf/13-WP-7 presents the current situation and recommended steps to be taken on TBO and its key enablers. This paper supports and builds on this WP and emphasises the importance for TBO and focuses on additional steps to be taken.

2. DISCUSSION

2.1 It is important to recognise the TBO concept as a concept for all operational environments irrespective of traffic density since it will enable increased efficiency including integration of decision making processes into a global collaborative ATM environment. The GANP 2019 is expected to become the high-level ATM-wide TBO transition plan. In addition, provisions and implementation guidance need to be developed to guide transition and to further specify the relationship/dependencies between decision making processes.

[3] Reference to European civil/military paper

2.2 Synchronisation between and enhancement of decision making processes provides significant opportunities and challenges. The amount and complexity of information and overall of decision making will rapidly increase (e.g. optimizing individual flights balanced against network optimization in an equitable manner) and needs to be supported through appropriate levels of automation. This will also result in a shift of the role of the human. It is therefore necessary that the role of the human is addressed as in integral part of the TBO development. This should be done addressing change management right from the beginning and using a structured approach based on an automation model.

2.3 At network management level, regional and global interoperability will contribute to significantly improve the consistency and accuracy of the shared trajectory, resulting in a higher performance of ATFM, Demand & Capacity Balancing (DCB), Short Term ATFM measures and quality of information shared with airport and airspace users as shown by several large scale cross border demonstrations (e.g. Project NCM: Network Collaborative Management). Network management (planning) functions will also apply in the flight execution phase for the down-stream parts of the trajectory. Moreover, in environments with high fragmentation of ANSPs, there will be a need for an “honest broker” to ensure the equitable processing of sometimes complex combinations of incompatible needs. It is therefore necessary to further expand the concept for global collaborative ATFM as integral part of the TBO development.

2.4 In the execution phase, regional and global interoperability of flight data exchanges will improve safety and capacity by ensuring a permanent and consistent view of all flights, even though processed by different Flight Data Processing Systems. This will reduce ATCO workload thanks to a better anticipation of traffic, more efficient coordination compared with current inter-center coordination mechanisms (OLDI and AIDC) and more efficient negotiations with upstream and downstream units compared to current voice negotiations. Airspace Users will be continuously informed about the flight progress, deviations from the desired trajectory and any constraints (weather, hotspot...), which will allow them to optimize trajectories anytime.

2.5 Implementation of the first phase of FF-ICE, FF-ICE/planning, the modern flight plan format, should be given priority to enable a timely evolution of TBO. The use of SWIM information services relying on FIXM (Flight Information Exchange Model) will be key to share a rich flight description between airspace users, Computer Flightplan Software Providers (CFSP), Network Manager/ATFM, Airports and ANSPs, enabling the development of various applications and increased automation. As a transition step towards FF-ICE, the Military have chosen to develop a flight plan format, that includes the mission trajectory. This improved flight plan which captures airspace needs can be processed at network level and shared on a need to know basis to facilitate cross border IFR transits including RPAS.

2.6 In the perspective of the second phase of FF-ICE as a key enabler to seamless ATM, Europe has progressed on defining the IOP/Flight Object concept for the continuous exchange of flight information between various ANSPs and Network operations. This concept is based on a foreseen SWIM technical infrastructure targeted at supporting secured interactions in real-time with a very high availability. The Flight Object data structure is embedding clusters of data in a flexible way and will rely on SWIM and the underlying exchange model FIXM to ensure global information exchange interoperability. In particular, the use of flight scripts enables the sharing of constraints and clearances to build common and accurate views of 4D trajectories. It also offers advanced negotiation capabilities through the 'What If Flight Object' to probe trajectory changes across multiple centres. At any given time, the common flight reference dataset is managed by applying data management roles and responsibilities, ensuring updates and publication of flight information by the most appropriate system. Operational assessment and SESAR trials will lead to an update of standards expected in 2021 and Initial Operational Capability planned for 2023, allowing transition from OLDI to the IOP/Flight Object concept.

2.7 With information exchanges at the core of TBO, there is an urgent need to progress the actual implementation of SWIM at a global scale. Not only with provisions related to the technical aspects of SWIM (e.g. data models and infrastructure), but with all provisions required to support the stakeholders in their development of producing and consuming information services, including the appropriate and proportional governance arrangements. Through European implementations, a solid experience has been gained on the establishment of a collaborative approach supporting the deployment of SWIM in Europe.

It facilitates the development of early SWIM information services, as the ones already operationally used to improve ATM operations (e.g. Extended AMAN, enhanced ATFM functions). Yet establishing a collaborative approach supporting this deployment which is acceptable by all stakeholders is a time-consuming activity. The lessons learned and initial SWIM elements developed in this context (e.g. regional standards on SWIM, proportional governance arrangements) could be considered as inputs for ICAO to facilitate further global SWIM implementation as an enabler for TBO.

2.8 ATM will accommodate new types of vehicles and interface with traffic management ‘regimes’ in which these new types of vehicles operate. Common to all types of operation is that they are all based on trajectories and the sharing of trajectory information in support of traffic management processes. TBO is therefore the common denominator between all the traffic management regimes including ATM.

3. CONCLUSION

3.1 TBO further details the ATM wide concept of management by trajectory as outlined in the GATMOC. Through TBO the ATM system can make the paradigm change, achieve higher levels of performance than through an extrapolation of the current situation. Moreover it will be possible to integrated new types of airspace users in an overall Traffic Management System. To obtain all these benefits higher levels of automation will be necessary which also necessitate to pro-actively consider the role of the human in the system. TBO relies on the expedited development and implementation of key enablers notably FF-ICE and SWIM.

3.2 The Conference is invited to agree on the following recommendations:

That the conference:

a) Request ICAO to develop guidance material for global ATM-system wide TBO transition serving existing and new types of vehicles, including assessment of amendments to ICAO provisions;

b) Request ICAO to take benefit of existing State and regional ATM modernisation programmes on SWIM to expedite the progress on global SWIM provisions;

c) Request ICAO to facilitate early implementation of key TBO enablers in particular SWIM and FF-ICE ;

d) Request ICAO to recognise the need for increased levels of automation and collaborative decision making enabling TBO and promote the need to address the human dimension and change management processes in that context;

e) Acknowledge the need for a global interoperable TBO and seamless ATM environment and it is recommended to initiate the development of provisions to ensure a globally interoperable TBO environment taking account of regional developments.

— END —

International Civil Aviation Organization

WORKING PAPER

THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item	**5:**	**Emerging Issues**
	5.1	**Operations above Flight Level 600**
	5.2	**Operations below 1000 feet**
	5.3	**Remotely piloted aircraft systems (RPAS)**
	5.5	**Other emerging issues impacting the global air navigation system including unmanned aircraft (drones)**

NON SEGREGATED UAS OPERATIONS

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

This paper presents the key issues concerning the integration of UAS with manned aviation considered by the European Union to be important for ICAO to address. Since the work of the RPAS Panel is quite advanced regarding IFR RPAS integration, the paper highlights the issue which is considered to be the most urgent: Detect and Avoid. The paper then presents a range of issues needing consideration by ICAO to make the UTM concept a reality, and to support integration of operations above FL 600, and

[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

[2] Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

makes specific recommendations, including the need to review some of the fundamental principles of aviation.

The Conference is invited to agree to the recommendations in paragraph 6.

1. INTRODUCTION

1.1 Recent times have seen a significant growth in the demand for small unmanned aircraft systems (UAS) to be allowed to perform an increasing range of applications in unsegregated airspace. Many States in Europe and around the world have already produced their own regulations for the conduct of such operations, and the European Aviation Safety Agency (EASA) is taking an increasing role in relevant regulatory work. Notwithstanding this activity, there is a need for ICAO to take action in order to facilitate global harmonisation and standardisation of UAS Traffic Management (UTM)[3].

1.2 The introduction of non-segregated UAS will have an impact on many long-standing, fundamental elements of ATM, such as airspace classification, flight rules and automation. ICAO will need to take the lead in these areas, in collaboration with States and Regions, to ensure that any such changes meet the needs of the global aviation community.

1.3 The future of aviation will require manned and unmanned aircraft to integrate together within the same airspace, unlocking potential operations which will traverse both UTM and ATM environments. There are two distinct threads to UAS integration: IFR RPAS operations; and UTM. The IFR RPAS operations will be almost transparent to the ATM system. UTM services are anticipated to be initially deployed in airspace below 500 feet which, although largely in uncontrolled airspace, is not unmanaged. Consequently, UTM needs to safely and securely interface and integrate with ATM.

[3] In line with internationally-accepted conventions, the term 'UAS' is here used as the over-arching term to describe unmanned aircraft systems of all types. 'RPAS' is used specifically to refer to those UAS that will operate IFR, representing the focus of ICAO Panel efforts to date. Although not an officially-defined term, this paper uses the term 'drone' to refer to those typically small UAS that will operate below 500', remotely-piloted or otherwise, in receipt of UTM services. This is for convenience in this Paper and is not a recommendation for future adoption of that term.

This paper focusses on four areas and, for all four areas, it is essential that ICAO, in collaboration with State and regional ATM modernisation programmes, provide timely and effective provisions.

2. INTERNATIONAL COOPERATION

2.1 Many of the developments in the UAS domain are led by the new-entrant industries, and it is evolving very quickly, as was presented during the ICAO GANIS/SANIS 2017. In order to expedite the significant amount of work that will be necessary to enable UAS integration, and to ensure that full account is taken of the opportunities presented by these new entrants' industrial developments, it is at the same time necessary for ICAO to explore new opportunities for working with these new-entrant industries and industry associations, some of them new to aviation. To ease the inclusiveness of these new entrants in ICAO activities, ICAO would need to make the fullest possible use of links between these groups and ICAO to connect with activities planned and ongoing in State and regional ATM modernisation programmes. This would allow the facilitation of operational trials and validation of standards and ICAO provisions, exploring as well as in finding the full synergies offered by ICAO working together with civil and military industry, States and regions (see also WP[4] on GANP and civil-military cooperation).

3. UAS TRAFFIC MANAGEMENT

3.1 The UTM environment will be very different from the existing manned aviation environment. Although the concept is still being defined, the model will comprise a set of UTM services, provided by UTM service suppliers, supported by extensive automation on the drones themselves. The CNS technologies and radio spectrum required to enable this will combine established aviation technologies with those from other domains, such as the telecommunications and automotive industries (see also WP5 on integrated CNS).

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4 Reference to European WP GANP and civil/military cooperation
5 Reference to European WP integrated CNS

3.2 The environment in which drones operate is of key importance when considering how their operations should be managed. These operating environments should be defined and classified to support the definition of appropriate standards for operation in each environment making effective use of work that is already being done in existing programmes, such as the FAA's UTM programme and the U-space initiative in Europe[6] (see alos IP[7] on European integration of UAS).

3.3 Even if UTM services are provided in airspace below 500 feet, they cannot exist in isolation, since there are existing manned airspace users active in that airspace. Moreover, given that highest demand for UTM services will likely be in urban areas where most major airports are located, it is inevitable that there will be a demand for drone operations within controlled airspace. The interface between UTM and ATM is, therefore, of prime importance. With drones operating alongside manned aviation, this emphasises the need for aligning the principles of service provision in the same airspace.

3.4 Conflict Management for UAS resembles its ATM equivalent, but there are important differences. The need for strategic deconfliction and for Collision Avoidance (CA) are greater but, in principle, the same as for manned aviation. However, as the need for separation provision is less clear, the Detect and Avoid (D&A) performance will be of prime importance, especially if the UTM concept allows self-separation and CA to all hazards.

3.5 The introduction of such a disruptive concept as UTM will challenge the long-held fundamental principles of ATM. To mitigate any risks of implementing such fundamental changes, it is essential to review the current flight rules, altitude reference, airspace classification and automation principles, as well as the global economic impacts, including charging for such services.

3.6 It is very likely that small UAS will never be able to equip to full IFR specifications due to cost and size, weight and power constraints, and they will need to operate within a clearly-defined framework of rules, which may resemble a combination of IFR and VFR, although not the same as either one.

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[6] Helsinki Declaration, November 2017.

[7] Reference to European IP on Euroepan integration of UAS)

3.7 UAS operations will be enabled by a significant increase in automation, especially if the concept allows for the move from a one pilot/one UAS, to fleets of highly-automated drones managed by one or several operators. To support this, the nature and role of automation and autonomy in aviation needs to be standardised with a generic automation model (see also WP[8] on GANP and TBO), to ease the transition and to keep the human in the loop.

4. IFR INTEGRATION

4.1 One of the key elements needed to enable RPAS integration is D&A. The broad spectrum of D&A functionality across all UAS domains makes this a very complex problem to solve but, for RPAS medium-altitude, long-endurance (MALE) missions, the problem is more manageable. The key function needed is the Collision Avoidance (CA) function, as a safety net supports the pilot's responsibility for the safety of the flight, in all airspace classes, and requires a capability against cooperative and non-cooperative targets.

4.2 VFR pilots are responsible for remaining well clear of other aircraft, maintaining their own separation from IFR traffic. In some parts of the world, under some circumstances, the IFR pilot can perform a Remain Well Clear (RWC) manoeuvre against VFR traffic perceived as being a threat before speaking to ATC; this is not applicable in Europe. The definition of the Remain Well Clear function for RPAS requires international harmonisation to ensure that concepts and systems meet the needs of different regions. ICAO should prioritise the harmonisation and standardisation of D&A capabilities, specifically the CA and RWC functions and to seek to gain benefit from States and regional modernisation programmes, where the development of civil/military dual-use technology is actively pursued.

5. OPERATIONS ABOVE FL600

5.1 There is an increasing demand to enable routine operations by HALE UAS. These UAS typically have very poor climb and manoeuvring performance, and remain on station at very high levels, above FL600 (but below the Karman line), for days, weeks or even months.

[8] Reference to European WP GANP and civil/military cooperation

This type of operation presents new challenges for integration similar to other suborbital operations during the climb and descent and for the management of very long missions in airspace where there is currently very little or no standard application of ATM.

5.2 Many States and regions have considerable experience in trialling and operating these UAS with suborbital operations, often for State or military purposes, and ICAO should take advantage of the experience and lessons learned from these initiatives and thereby provide opportunities to support the evolution in the process of development of ICAO provisions and standards. [insert link to ICAO FL 600 Papers]

6. CONCLUSION

6.1 The Conference is invited to agree on the following recommendations:

That the Conference:

a) Encourage ICAO to make use of the new entrants' wider pool of UAS stakeholders beyond those stakeholders who participate at a State level in ICAO forum, and to closely collaborate with State and regional ATM modernisation programmes to facilitate trials and validations involving these new entrants.

b) Call upon ICAO to define and promote core principles for UTM and for interoperability between UTM and ATM. This shall include review of the applicability of current flight rules, altitude reference, airspace classification and automation principles, as well as the global economic impacts, including charging for such services.

c) Call upon ICAO to prioritise the harmonisation and standardisation of Detect and Avoid capabilities required by IFR RPAS, specifically the Collision Avoidance and Remain Well Clear functions.

d) Call upon ICAO to lead the development of ATM measures to enable unsegregated operation of high-altitude UAS with other high-level and suborbital operations at levels above FL600 but below the Karman line.

— END —

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THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE B

Agenda Item 8: Emerging safety issues
8.1: Measures to proactively address emerging issues;
8.2: Emerging safety issues

EMERGING ISSUES

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

The aviation system is always being confronted with new technologies, products, operations and new business models. This paper presents the need for ICAO and the international aviation community to co-operate and manage in a pro-active manner emerging issues in aviation to ensure the deployment of innovative solutions contributing to a safer and better performing aviation system. ICAO is invited to further develop the management of emerging issues and risks by establishing mechanisms that ensure that new technologies, products, operations and business models are addressed in a timely and inclusive manner.

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

1 Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

2 Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

1. INTRODUCTION

1.1 The aviation system is always being confronted with new technologies, products, operations and business models, and has developed its own strategies and mechanisms to cope with them. Introducing technical enhancements, addressing human and organisational factors, and moving to safety risk management and a total system approach in safety allowed aviation to develop over time, making it the safest mode of transport. ICAO is playing a fundamental role in assuring a globally safe aviation system through global provisions (i.e. SARPS and other ICAO guidance material).

1.2 The aviation system today is challenged with rapid developments in new technologies, products, operations and business models. Significant technological (e.g. space, augmented reality, virtualisation), environmental (e.g. new propulsion systems, climate change impacts), economic (e.g. new players and new types of air (hybrid) vehicles) and societal (e.g. urbanisation, digitalisation, passenger's expectations, traffic growth) transformations are to be expected in the coming years. At present, their impact on aviation safety and how to address these issues within the current aviation safety framework and with the existing tools is difficult to assess. The current SARPS development process and updates to their provisions are time consuming and lacking a holistic synchronised development by ICAO panels. The current ICAO instruments are not sufficiently adapted to respond to this dynamically changing environment and to ensure and enhance a safe and efficient aviation system.

1.3 Evidence shows that after the introduction of a disruptive change to the aviation system, for example glass cockpits, and despite significant safety and performance demonstrations, such changes have resulted in an increasing number of occurrences during an early stage, followed by a rapid and steady decrease of occurrences. In cases where several significant changes are to be introduced in parallel within the aviation system, the safety impact will require very careful consideration and review. Furthermore the successive and very rapid introduction of innovations coupled with their unknown interdependencies may no longer allow the system to maintain the high level of safety as expected.

2. COMMON APPROACH TO EMERGING ISSUES

2.1 The safety approach used so far was developed within a specific aviation environment. However, today's aviation system must be considered in a broader context of a connected world with open architectures and within new and rapidly changing environments. These environments could consist of the application of low cost off the shelves solutions (e.g. use of smartphones), complex systems of systems with potentially short life cycles (e.g. navigational applications) or further developing themselves (e.g. artificial intelligence), new technologies (e.g. augmented reality, virtualisation, electric propulsion) or new business models. They combine practices and ideas which could potentially disrupt today's aviation system.

2.2 To address this new challenging environment and to enable the quick uptake of innovative solutions (technical and operational) and new business models, whilst ensuring an even safer and more performing aviation system meeting the general public expectation, a number of preparatory actions should be taken by States and regional organisations. For example, States and regions could prepare by fostering safety research notably in the areas of human and organisational factors, safety intelligence tools, operational safety improvement methods, adapted certification methods, as well as new integrated safety and security approaches. International co-operation on safety research and application through Regional Safety Oversight Organisations (RSOO) cooperation serves the aviation community in a structured way.

2.3 However, States are more frequently facing situations where innovation seems ready for deployment or has even been introduced by industry in the absence of a clear regulatory framework, and based on limited understanding of safety impacts. One example is the integration of drones in controlled and uncontrolled airspace, where technologies develop at a fast pace, while at the same time there is a need for the appropriate approach to ensure safe operations.3

2.4 States and regions are currently facing the same or similar challenges in all parts of the world. There is a need to understand new technologies and concepts of operation, their possible impact, and the potential interactions within the aviation system.

[3] Refer also to WP xx UAS operations

Based on input provided by States and regional organisations, ICAO may consider ensuring a monitoring function, to collect intelligence and to identify emerging issues, and to carry out a preliminary assessment of any potential safety impacts. There is a balance to be established with respect to the application of safety requirements to avoid unnecessary burden for industry while maintaining and improving aviation safety. There may be new safety risks that emerge and that need to be analysed and addressed. Expertise beyond the aviation domain becomes essential notably with the increased use of digital technologies.

2.5 Emerging issues will affect the way oversight is to be conducted. The oversight system should be geared towards a system approach, focusing on clear organisational accountabilities, responsibilities and processes that ensure a safe outcome. It should include the systematic collection and analysis of data to implement a risk- and performance-based approach, which covers both regulations and oversight. Inspector qualifications need to be enhanced to include systematic data analysis and safety assessment skills as well as technical knowledge and auditing experience.

2.6 It is equally important that ICAO ensures collaboration between all relevant stakeholders, including the industry, from the beginning. This is essential if the new entrants have not been exposed to the aviation environment before. In addition to the aviation community, such collaboration should also involve representatives of the general public, to broaden understanding and acceptance of new developments, as well as non-aviation governmental agencies in case of transversal developments. In addition, ICAO should ensure collaboration with regional organisations such as RSOOs that have resources and thus can facilitate responding to emerging issues.

2.7 Further, successful risk management should aim for overall risk reduction in the aviation system, including but not limited to finance, environment, safety and security risks. All risks need to be appropriately managed to minimise any identified adverse consequence. This would require appropriate civil and military cooperation.[4] Traditionally, aviation industry developed different management systems to address distinct characteristics of each specific risk.

4 Refer also to WP xx Civil-military cooperation

Thus, for example, safety management systems were designed to be able to manage safety risks. However, in some cases, the management of a domain-specific risk (e.g. security) may affect other domains in unforeseen ways (e.g. safety). Circumstances such as last-year discussion on the carriage of Personal Electronic Devices (PEDs) in the passenger cabin have highlighted the need for performing an Integrated Risk Management - safety vs security risks, possibly expanded to environmental and financial risks. Integrated Risk Management cannot replace the objectives of specific risk management systems; it is a distinct multi-objective decision-making concept to leverage and balance the conclusions of specific risk management systems and provide holistic advice to achieve overall risk reduction. However, today, there is not enough guidance for States and aviation industry on how to balance the management of distinct risks. In addition, in most cases different risks are being managed by different government agencies or organisation departments without the existence of a formal function or official channels to ensure a collaborative risk management that also take due account of civil and military dimensions .

2.8 In summary, ICAO needs to play an essential role in the development of a common approach for States to deal with emerging issues. This common approach would aim at streamlining the development of ICAO provisions to optimise operational benefits stemming from new developments, e.g. through reducing time to market of new products and services, whilst reinforcing safety and efficiency. Where challenges to existing ICAO frameworks and traditional areas of competency are identified, ICAO should develop appropriate mechanisms in order to ensure appropriate levels of agility and adaptability, influence and involvement to address emerging international aviation issues in a timely fashion. Early assessment and planning for likely challenges to the existing ICAO remit would allow the international community to be proactive, rather than reactive, in responding to emerging aviation issues.5 Examples may include the need for ICAO to consider fully the impact of future commercial space operations on traditional aviation. Whenever possible, the chosen option should be performance based. This approach should also include the link with sister UN organisations on transversal issues and funding, for example the International Telecommunication Union, the World Meteorological Organisation and the World Bank Group.

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5 Refer also to WP xx GANP and WP xx GASP and data-driven decision highlighting the need to include emerging issues into the ICAO plans in a consistent manner.

2.9 Finally, it is important to monitor the developments and to review the new mechanisms and adapt them as necessary. Predictive methods of safety data analysis can provide additional insights on the potential evolution of emerging issues. In addition, a periodic post-evaluation of the initial provisions should be performed thereafter to conclude if the established provisions eventually have achieved the objectives for which they were designed.

3. CONCLUSION

3.1 ICAO is invited further develop the management of emerging issues and risks stemming from new technologies, products, operations and business models and that they are addressed in a timely and inclusive manner.

3.2 The Conference is invited to agree on the following recommendations:

That the Conference request ICAO to:

a) systematically collect information from States and regional organisations on new concepts of operations and initial implementations to assess and monitor their global safety impact;

b) raise awareness and provide guidance to States regarding emerging risks, recommending mitigation means, and balancing the integrated management of distinct risks; ;

c) establish a holistic and performance-based approach process to ICAO provisions developments, in response to these emerging issues and risks including a periodic post-evaluation of the initial mitigations to assess if the established provisions achieve the objectives for which they were designed;

d) provide guidance for the implementation of risk and performance-based assessment and oversight both at State and regional level;

e) provide a global inclusive civil-military cooperation mechanism to move from a reactive situation to a proactive and predictive holistic risk management towards emerging issues.

— END —

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THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE B

Agenda Item 6.1 Strategic plan

GASP AND DATA-DRIVEN DECISION-MAKING

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

This paper reflects on the experience gained in Europe with sharing intelligence and identifying common priorities at regional level that are documented in a European Plan for Aviation Safety. Many of the lessons learned in Europe can be used to inform future editions of the Global Aviation Safety Plan (GASP).

Action: The Conference is invited to agree to the recommendations in paragraph 6.

1 Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

2 Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

1. INTRODUCTION

1.1 The Global Aviation Safety Plan (GASP) is a high level, strategic, planning and implementation policy document developed in conjunction with the Global Air Navigation Plan (GANP). Both documents promote coordination of international, regional and national initiatives aimed at delivering a harmonized, safe and efficient international civil aviation system.

1.2 The GASP seeks to assist States and regions in their respective safety policies, planning and implementation by establishing the global safety priorities and objectives; providing a planning framework, timelines and guidance material; and presenting implementation strategies and a Global Aviation Safety Roadmap. The Roadmap is an action plan developed to assist the aviation community in achieving the GASP goals. The GASP sets specific priorities at both State and regional levels.

1.3 The GASP is reviewed by ICAO every three years. A Study Group was set up in 2017 to develop the 2020-2022 edition. This new edition will propose an aspirational goal to achieve zero fatalities in commercial operations by 2030 and beyond, supported by six specific goals, related targets and indicators. The 2020-2022 edition will recognise the importance of safety risk analysis at national and regional levels, promotes the establishment of cooperative regional safety programmes and values the key role that Regional Safety Oversight Organisations (RSOO) can play in the achievement of the GASP goals.

2. ALIGNING GLOBAL STRATEGIES

2.1 The GASP is an important instrument to achieve further safety improvement at global level to cope with the projected increase in traffic volumes, allow the safe integration of new technologies, and manage related threats and opportunities. ICAO efforts to ensure broad GASP consultation with States and industry organisations are recognised. The attempt to find the right balance between building the capabilities of States and addressing the operational risks to aviation safety is a very positive development. The updated Global Aviation Safety Roadmap with a series of Safety Enhancement Initiatives (SEIs) is of great added value in supporting States and regions to prepare for the challenges ahead.

2.2 In line with the total system approach to aviation safety, Europe has been striving to ensure a common vision and alignment of objectives for the European Air Traffic Management (ATM) Master Plan and the European Plan for Aviation Safety (EPAS). A consistent and complementary approach to ATM infrastructures and safety related matters, involving all aviation components, is deemed to provide greater efficiency in reaching safety and efficiency goals and may prepare the ground for a unified aviation risk management framework. Europe therefore invites ICAO to initiate an alignment of the GASP and the GANP, starting with the smooth integration of Remotely Piloted Aircraft Systems (RPAS) and the mitigation of cyber threats. Furthermore, with the development of the Global Aviation Security Plan (GASeP), alignment is also necessary with global developments in security and the evolution of the threat picture in civil aviation. This will help to assure optimal passenger safety where security and safety aspects of certain hazards could lead to a conflicting approach, e.g. where to carry lithium batteries or Personal Electronic Devices (PEDs), or the closed cockpit doors and the number of persons in the cockpit.

3. <u>RISK-BASED DECISION-MAKING</u>

3.1 Through its global vision on safety oversight (GASOS), ICAO communicated the role regional organisations should play. Europe, having gained considerable experience in managing safety and efficiency through regional cooperation and economies of scale, supports ICAO in these endeavours and outlines the added value that RSOOs can bring to their Member States, to industry and how they can support ICAO's initiatives, particularly in the implementation of the GASP vision and mission at regional level.

3.2 The EPAS creates a common focus on regional aviation safety issues as a continuation of the European work to improve aviation safety and to comply with ICAO Standards and Recommended Practices (SARPS). It also creates a common platform for the identification and sharing of positive safety practices. This regional approach complements national efforts offering a more efficient means to manage safety in the European aviation system. The ICAO Paris Office initiated the process to define a Regional Aviation Safety Plan for the European and North Atlantic (EUR/NAT) Region based on the EPAS.

3.3 At the European level, the identification of safety issues and mitigation of associated risks are carried out in coordination with States and industry, being part of one aviation system. The EPAS priorities are aligned with the ones identified in the GASP. At the core of this process is the sharing of safety intelligence at European level, in order to develop a common understanding of safety risks and implement a structured approach, combining the risk pictures of European States and industry, to inform decision-making at EU level. At a global level, a similar structured approach, combining national and regional risk pictures, is suggested to feed the GASP. Such safety intelligence should not just derive from traditional safety reporting systems, but also from automatic data capture systems including flight data analysis programmes. In addition, the GASP should provide a common framework for States to deal with emerging issues3.

3.4 The main enabler for actionable safety intelligence that will feed the EPAS and the GASP, is data collection and analysis. It is of paramount importance that the aviation community take advantage of new Information Technologies that make possible the collection and subsequent analysis of the massive amounts of data generated by the aviation industry. It is equally important to ensure that data collection and analysis is done in a collaborative manner while providing the required level of safety data and information protection (just culture principles). RSOOs, RASGs and the advent of regional data collectors (such as the Data4Safety programme in Europe) can be the trusted parties to collect and analyse raw data. The sharing of safety information (not of raw data) and safety intelligence could be supported by dedicated instruments developed by ICAO and could then be organised at an international level, feeding the GASP.

3.5 Finally, the approach proposed in the GASP, whilst promoting the ‘No Country Left Behind’ initiative, should be more ambitious in driving continual improvement in those States having achieved the near term 2017 objectives set out in the GASP 2017-2019. Such States should be encouraged to achieve goals at a faster pace to generate more short-term and long-term benefits for aviation safety. Moreover, this would yield more advanced systems and processes for aviation safety management, including valuable experiences and lessons learnt that could subsequently be shared with and adopted by other States under the ‘No Country Left Behind’ initiative.

[3] Reference European paper on Emerging Issues

More generally, a systematic screening process on identifying and sharing positive safety practices should be an integral part of the GASP.

4. ACCEPTABLE LEVEL OF SAFETY PERFORMANCE

4.1 The GASP encourages States to implement an efficient and sustainable State Safety Programme (SSP) in line with Annex 19 standards. As part of the SSP implementation, States shall establish the Acceptable Level of Safety Performance (ALoSP) to be achieved through their SSP. Notwithstanding the inherently circular definitions of safety performance, safety performance indicators and their associated targets as laid out in Annex 19, experience in Europe shows that States struggle with the ALoSP concept. In particular, the idea of defining an acceptable target rate of safety occurrences might be interpreted as if events involving damage and injury were acceptable. We therefore ask ICAO to work with States to further clarify the expectations on how this Standard should be implemented, in particular how the ALoSP relates to the GASP goals and targets, and how ALoSP can be demonstrated in a regional context, to promote a common understanding of safety performance, its measurement and management, globally.

4.2 In this context we ask ICAO to further develop, in cooperation with States, the Safety Margin concept. The Safety Margin should be based on a broader range of safety and exposure data, to provide for more robust prioritisation of safety actions.

5. A PERFORMANCE BASED APPROACH TO SARPS DEVELOPMENT

5.1 Prescriptive rules and the associated oversight have achieved tremendous results in the past. However, as the aviation system becomes increasingly complex in a dynamic marketplace, standards setting and oversight practices must evolve to become increasingly performance-based. This will support innovation which in turn may improve efficiencies and drive towards meeting or exceeding the GASP safety objectives.

5.2 With the introduction of safety management, competency based training and fatigue risk management ICAO is gradually moving towards a more performance-based approach to appropriately complement the existing prescriptive instruments. A system accounting for differences in performance levels and creating incentives for stakeholders to strive towards the highest levels of safety performance will support the implementation of new technologies and foster safety risk- and performance management capabilities in States and industry.

We therefore invite ICAO to continue the development of SARPS enabling a performance based approach and adapt the ICAO USOAP CMA accordingly.

6. CONCLUSION

6.1 The Conference is invited to agree on the following recommendations:

That the conference:

a) Acknowledge the work of ICAO in developing the 2020-2022 edition of the GASP in coordination with States and industry and highlight the added value that RSOOs can bring to GASOS, strengthening regional cooperation to foster States' safety oversight and risk management capabilities;

b) Request ICAO to intensify efforts in establishing a common vision for alignment between the GASP, the GANP and the newly developed GASeP as well as to secure GANP and GASP are consistent and complementary, especially in the light of the planned ASBU evolution;

c) Call upon ICAO to encourage those States having achieved the near term 2017 objective in the GASP 2017-2019, to continue to verify implementation regularly, keep their Safety Programmes and Plans updated, and strive for continual improvement;

d) Encourage States to share their risk pictures at a global level creating common understanding of risk pictures and implementing a structured approach for combining the national and regional risk pictures at global level;

e) Call upon ICAO to develop instruments enabling new regional Data Integrators within the RSOO or RASG to share safety information and intelligence at global level, to feed GASP priorities in the future.

f) Call upon ICAO to promote a common understanding of safety performance, its measurement and management; and in this context to further develop the Safety Margin concept introduced in the GASP, in cooperation with States;

g) Call upon ICAO to gradually move towards a more performance-based approach in terms of SARPs setting and universal oversight.

— END —

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THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE B

Agenda Item 6.3 Monitoring and oversight
6.3.1: The evolution of the Universal Safety Oversight Audit Programme (USOAP) continuous monitoring approach (CMA)

INCREASING THE EFFICIENCY OF USOAP

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

This paper proposes measures to increase the efficiency of USOAP in the light of the limitation of ICAO's own resources: making a greater use of the safety partners, including RSOOs, designees and integration of other recognised monitoring programmes into the USOAP. It also supports the recommendations and observations of the GEUSR and discusses the need to make the State Safety Risk Profiles visible to States and RSOOs.

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

[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

[2] Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

1. INTRODUCTION

1.1 Since its inception over 20 years ago the ICAO Universal Safety Oversight Audit Programme (USOAP) has proved to be the only objective global tool to measure the safety performance of the oversight systems of ICAO States. It has helped to improve global aviation safety and it is one of the key enablers on which the Global Aviation Safety Plan[3] is built and provides valuable information to the global community. In particular the USOAP provides the monitored State with an assessment of its level of compliance to the Critical Elements of their safety oversight system and a clear system for how to address the areas for improvement. Although it is not designed as an assistance tool it has helped to improve the implementation of the Critical Elements of safety oversight worldwide.

1.2 By the first quarter of 2018 ICAO had audited 185 States and one Regional Safety Oversight Organisation (RSOO) at least once. The introduction of the Continuous Monitoring Approach (CMA) in 2013 has improved the reactivity and relevance of USOAP. However, current available information shows that the audit results for 53 States is older than five years4 and for some 22 states the results date back to 2008 or earlier, therefore questioning their meaningfulness in a continuous monitoring approach.

1.3 The 39th Assembly mandated ICAO to "perform a structured review to identify adjustments to the USOAP CMA with a view to the further evolution and strengthening of the programme, taking into consideration ICAO's evolving safety strategy and States' progress in implementing Annex 19 – Safety Management, in particular, SSP requirements." Accordingly, ICAO Secretariat established the Group of Experts for a USOAP Structured Review (GEUSR). This group has made a number of recommendations in the areas defined by its Terms of Reference.

1.4 ICAO *Continuous Monitoring Manual*[5] describes the processes for the USOAP and defines roles. It mentions the determination of State Safety Risk Profiles, however, these profiles are not shared with all the States and RSOOs and the way they are used to prioritise USOAP activities remains undefined.

[3] Doc 10004, in particular section 4.3.3.
[4] https://www.icao.int/safety/Pages/USOAP-Results.aspx
[5] Doc 9735

2. DISCUSSION

2.1 In order to continue the successful implementation of the USOAP-CMA, the programme needs to keep providing robust and realistic assessments of the actual level of safety oversight in each State. To enable this, the Programme needs to be properly resourced. As ICAO resources (both financial and human) to execute CMA activities are limited, it would be wise to use them in States showing a lower EI[6], and with the greatest risk. Resources are also required to further develop the programme tools, and to support the States. It is therefore of utmost importance that appropriate resources are allocated as a part of the General Programme of ICAO.

SAFETY PARTNERS AND DESIGNEES

2.2 One solution to the ICAO resource issue would be to make a greater use of safety partners and designees. A safety partner (although not currently defined in the ICAO Documents)7 is an entity supporting ICAO in its CMA activities (based on an appropriate agreement) and involves the seconding of personnel to perform certain CMA tasks for ICAO.

2.3 The scope of the activities performed is currently limited and expanding them to conduct a wider range of CMA tasks could help ICAO to focus its own resources on States and regions with the most urgent needs. Establishing a means to integrate other recognised monitoring programmes into USOAP-CMA should also be considered. This would also make the Programme more flexible and provide more up-to-date information, strengthen the risk-based approach and avoid duplication. In particular RSOOs have the ability to play a prominent role in supporting ICAO in the continuous monitoring of their Member States, which is likely to take place more frequently. RSOOs could also in the future perform defined USOAP tasks on behalf of ICAO. Evidently, for this to happen appropriate mechanisms ensuring the quality and reliability of the results of these tasks need to be developed and effective surveillance by ICAO put in place. In order to achieve this the current paragraph 4.5.2 (on the roles and responsibilities of RSOOs) in the *Continuous Monitoring Manual* should be further developed. It should also define the roles and responsibilities of safety partners and designees.

[6] Effective Implementation (of critical elements of safety oversight)
[7] This term is used by ICAO, cf. C-WP/14731.

2.4 A designee is an individual who is not a member of the ICAO secretariat staff. The individual has appropriate qualifications and experience, is free of conflicts of interest, and can perform certain tasks for ICAO on an ad hoc basis. A designee could bring the necessary flexibility required when the conducting targeted CMA activities and assist ICAO in performing these activities.

2.5 The proposed greater use of safety partners and designees shall be in line with the on-going work of ICAO on the Global Aviation Safety Oversight System (GASOS).

USOAP TOOLS AND PROCESS IMPROVEMENT

2.6 In order to increase the efficiency and effectiveness of USOAP and assist all stakeholders in the daily work as a part of USOAP-CMA the recommendations and observations of the GEUSR should be implemented as a matter of priority[8].

STATE SAFETY RISK PROFILE

2.7 The State Safety Risk Profile as described in section 3.5 of the Continuous Monitoring Manual (Prioritisation and conduct of USOAP CMA Activities) should serve as the basis for the prioritisation of CMA activities. It can also provide valuable information for the programming of assistance actions of ICAO, States, RSOOs and other stakeholders. Some elements of the State Safety Risk Profile are available through iSTARS, however, there is no comprehensive overview of the profile of states. Relying solely on the EI score of a state is not sufficient and can be misleading – the total safety risk profile is required.

2.8 Therefore it is recommended that ICAO develops measures to share the latest State Safety Risk Profiles with all States and RSOOs in a transparent manner. This should also show a clear link with CMA activity planning.

STATE SAFETY PROGRAMMES ASSESSMENT

2.9 The assessment of State Safety Programmes, will be introduced by ICAO in 2020. This provides an opportunity to test the proposals and recommendations in this paper and further develop the relationship between ICAO and safety partners, allowing the interchangeability of assessments by ICAO and by safety partners.

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[8] C-WP/14757

3. <u>CONCLUSION</u>

3.1 In order to improve the efficiency and effectiveness of USOAP, and to further enhance the robustness and consistency in the assessment of the States, the Conference is invited to agree on the following recommendations:

That the Conference recommend that ICAO:

a) Devotes appropriate resources to ensure the continuous monitoring of the States remains relevant and up to date;

b) Implements as a matter of priority the recommendations and observations of the Group of Experts for USOAP Structured Review (GEUSR)

c) Extends the range of activities that ICAO can delegate to a safety partner, including full and partial audits, and establishes a transparent framework for the accreditation of safety partners and possibly their monitoring programmes and designees in line with the work on Global Aviation Safety Oversight System (GASOS);

d) As a pilot case, use the opportunity provided by the imminent ICAO SSP assessment programme to test recommendation c) above.

e) Makes available to all States, RSOOs and safety partners the State Safety Risk Profiles in a transparent manner, showing clear link with CMA activity planning;

— END —

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THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item 3: 3.4: Civil/military cooperation

CIVIL-MILITARY COOPERATION

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

This paper promotes the mutual benefits to civil and military aviation of gradually moving from coordination to collaboration, from the Air Traffic Management (ATM) research and development stages to the implementation of the Aviation System Block Upgrades (ASBU) through military involvement in a rulemaking performance-based environment. In order to implement a safe and more interoperable performance-based global network, the involvement of both civil and military stakeholders in a collaborative decision-making process implemented at national, regional and worldwide level is no more an option but a key for success.

[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

[2] Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

The global aim is to enhance the civil-military collaboration in ATM and Communication, Navigation and Surveillance (CNS), notably by sharing best practices and addressing challenges as well as opportunities related to digitalization, security, flexible use of airspace and unmanned aircraft systems (UAS) integration. ICAO plays a vital role to achieve this goal and is encouraged in conjunction with Member States to continue developing mechanisms for collaboration with the military community to further minimize the gap between the civil requirement for predictability and the military need for flexibility.

Action: The Conference is invited to agree to the recommendations in paragraph 4.3

1. INTRODUCTION

1.1 The ICAO Convention became effective on 4 April 1947. Distinguishing civil aircraft operations from State aircraft operations was important enough to warrant the creation of Article 3, which states that the Convention shall not be applicable to State aircraft used in military, customs and police services. For the military aviation, the objective is to conduct operations and training related to security and defence.

1.2 In order for international aviation market to grow and operate as a safe and harmonious system, States have agreed to collaborate on a common regulatory infrastructure and, among others, have agreed on the air traffic services provided, including access to and use of airspace. It is considered that a safe and efficient use of airspace can be achieved through close cooperation between civil and military stakeholders.

1.3 ICAO should play an important role in enhancing the civil-military cooperation processes. Furthermore, it should develop common principles, reflecting the will of its Member States to promote the best practices identified, bringing about the creation of common concepts in aviation.

2. CIVIL AND MILITARY AVIATION HAVE COMMON INTERESTS

2.1 Civil and military aviation are both using the same airspace, which is a common resource

2.1.1 While civil aviation regulations do not apply to State aircraft, it is recognized that the global performance of aviation is improved when the needs of both civil and military interests, which are evolving in an airspace considered as a continuum, are met at regional level through greater cooperative practices. ICAO has embraced the principles of civil-military cooperation and understood the value of promotion and development of harmonized practices, adopting in this sense Resolution A 38-12, resolving that States shall take measures to ensure the common use of airspace in a safe, regulated and efficient manner. Furthermore, States are recommended to comply with ICAO Annex 2 when executing military activities, considering that the compliance weaknesses are mainly technical level issues.

2.1.2 The required level of connectivity between civil and military ATM systems will continue to depend on the level and complexity of the civilian and military traffic operating in the same environment.

2.2 From Air Traffic Management research and development (R&D) to deployment

2.2.1 Although ATM research and development programs objectives are not directly applicable to the military, their impact on them and other operators flying State aircraft are operationally and financially relevant, i.e. because the military may have to adapt their procedures and to upgrade their ground systems to identify all aircraft flying over the territory concerned.

2.2.2 Coordination moving to collaboration is paramount for State aviation authorities to plan the evolution of their fleet, equipage or control systems in view of increasing interoperability and airspace capacity for civil aviation. Furthermore, there is a need to inform military planning mechanisms of the requirements stemming from ASBU deployment and State/regional ATM modernization programmes with the aim to keep at the highest possible level the interoperability between systems.

2.2.3 For the military, the principle "as civil as possible-as military as necessary" is enhancing the interoperability at the lowest cost while providing performance benefits for the aviation community as a whole.

2.3 Toward the development of a performance-based environment

2.3.1 Harmonizing civil and military standards to the maximum extent possible is important in the processes to determine compliance/conformity. Standardisation helps the industry in designing systems that will fulfil safety/interoperability requirements. This can lead to important cost reductions and maximize synergies when deploying those systems.

2.3.2 In a performance based environment for aviation, it is important to have a better understanding on how civil and military operators are working in this domain (principles, procedures, lines of action, etc.). In the process of developing a performance-based environment, it is essential to remember that safety is the key principle to follow. As the market of aviation is growing, it is also important to constantly adjust the civil-military cooperation with the aim to take into account this evolution.

2.3.3 In this regards, as a follow-up of Assembly Resolution A 38-12, ICAO has an important role in promoting common concepts in the enhancement of civil-military cooperation with the main objective to achieve a seamless airspace and a globally harmonised ANS/ATM system.

2.3.4 At regional level, solutions have been identified that can inspire best practices, such as EUR Doc 032. National regulations may have indirect impacts on the military. Therefore, there is a need to find adequate solutions, notably to facilitate safe access to airspace for State aircraft at regional and global level.

3. <u>GRADUALLY MOVING FROM CIVIL-MILITARY COORDINATION TO COLLABORATION</u>

3.1 The global aim of gradually moving from civil-military coordination to collaboration is to involve the military upfront with the aim to enhance the civil-military collaboration in ATM and Communication, Navigation and Surveillance (CNS), notably by sharing best practices and addressing challenges related to digitalization, security, flexible use of airspace and unmanned aircraft systems (UAS) integration in non-segregated areas.

3.2 Such an evolution is of nature to reinforce the development of civil-military synergies thanks to an effective collaboration starting from research and development to deployment of interoperable systems.

3.3 Involve the military from the outset and develop civil-military synergies could reduce costs

3.3.1 Civil and military aviation share the same objective of reducing costs to the maximum extent possible while improving operation efficiency and safety. Common R&D, eg. on UAS, can develop civil-military synergies and interoperability, can reduce duplication of work and capitalize on existing experiences and expertise. Furthermore, the development of common standards where applicable and possible are considered beneficial to all stakeholders.

3.3.2 Moving to collaboration, means notably that the military should be more involved in the development of ICAO's Global Air Navigation Plan (GANP) and ASBU through an adequate involvement in developing aviation strategies and visions for example recognition of military R&D projects related to Medium Altitude Long Endurance drones. Military expertise and experience may be useful added-value for future ICAO activities, especially integration of unmanned aircraft in non-segregated airspace.

3.4 Promote an efficient use of airspace with the aim of optimizing the global performance of aviation

3.4.1 The performance of the Global Route Network can only be achieved in a peaceful and secured environment and the military aviation will continue to provide and further improve, effective security and defence in the changing context of the civil aviation sector, having due regard for the safety of civil air traffic.

3.4.2 Implementing the Advanced-Flexible Use of Airspace concept, Trajectory Based Operations including Mission Trajectories and Unmanned aircraft systems Traffic Management (UTM) implies that States take a balanced consideration of civil and military operational needs. This to achieve the highest possible levels of efficiency to optimize the use of the airspace and resources available to any given State and to maintain safety level at its highest, including for general and military aviation at low level.

3.4.3 Enablers to achieve this objective are the full involvement of the military in State airspace management cells, and the use of automated Business to Business (B2B) systems. In this context, the military contribution to release training areas for improving the performance of the network, and how the civilian stakeholders use this released airspace shall be measured through relevant indicators, eg. through indicators like CURA (Civil Use of Released Airspace) as used in Europe.

3.4.4 It is also essential for the aviation sector to enhance cooperation in data collection for the optimization of global performance of aviation as well as raising the level of safety, for example when collecting information from the risks arising from conflict zones[3].

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[3] Reference European paper on Conflict Zones

3.5 Encourage a performance-based environment is beneficial for both the civil and military aviation

3.5.1 The civil aviation laws may have indirect impact on access to airspace by military flights, as it is the case in the non-Reduced Vertical Separation Minima (RVSM) environment. This can be mitigated thanks to military involvement upfront at Global, Regional and State levels, i.e. through implementation of mechanisms done in conjunction with Member States; and by associating the military in relevant groups to implement interoperable solutions. It is considered as key that recommendations and Regulations at global and regional level should request performance target objectives rather than equipage requirements.

3.5.2 Ad hoc technical measures, such as acknowledging that military systems may offer in some specific cases levels of performance that is equivalent to civilian systems, would guarantee a safe access to airspace for manned and unmanned state aircraft and ensure that performance of the global, regional and State levels remain at its highest. The civil and military coordination on certification and standardisation are also improving flight safety and interoperability.

3.6 Facilitate information sharing through a resilient and a robust network

3.6.1 The implementation of a global Air Traffic Management (ATM) network, i.e. SWIM shall allow data sharing among all relevant civil and military stakeholders ensuring appropriate levels of interoperability, cyber resilience, cyber protection and confidentiality, integrity and availability of mission critical information according to local needs.

3.6.2 Developing an appropriate level of cyber resilience and confidentiality for civil flights and military missions as well as preserving critical systems and infrastructures are deemed necessary, as a cyber-attack may have an indirect impact on safety.

3.6.3 Data sharing shall be through robust means to encourage the establishment of necessary principles of trust and transparency, as well as rules for dissemination of sensitive information and relevant cyber protection & resilience measures. In this domain, capitalizing on existing experiences and expertise could be an added-value for the entire aviation chain.

4. CONCLUSION

4.1 The global evolution of the ATM system as foreseen by the Global Air Navigation Plan (Doc 9750) requires global, regional, and national cooperation between civil and military State aviation authorities. Gradually moving from civil-military coordination to greater collaboration upfront is beneficial to both the civil and military aviation.

4.2 In order to implement a safer, more interoperable and performance-based global network, the collaborative involvement of both civil and military stakeholders at State, regional and global levels is no longer an option but a key for success.

4.3 The Conference is invited to agree on the following recommendations:

That the conference:

a) Urge States to agree with the strategic approach developed in paragraph 3 moving from civil-military coordination to collaboration,

b) Request ICAO to provide appropriate guidelines on the strategic approach, and;

c) Encourage ICAO to develop together with States mechanisms to collaborate with the military community at global and regional levels;

d) Request ICAO to reinforce the development of civil-military synergies thanks to an effective collaboration starting from research and development to deployment of interoperable systems;;

e) Encourage ICAO to undertake a proactive role in the promotion of best practices strengthening civil-military cooperation.

— END —

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THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item 2: Enabling the global air navigation system
2.2: Integrated CNS and spectrum strategy

Integrated CNS and spectrum strategy

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

SUMMARY

This paper advocates a shift from the traditional technology-based segregated communication, navigation and surveillance (CNS) infrastructure to a cross-domain integrated CNS architecture and performance-based framework which combines physical infrastructure and the delivery of CNS through services to enable key operational concepts such as Trajectory Based Operations (TBO), whilst maintaining and enhancing safety and security.

The CNS enabling services and infrastructure evolution need to strengthen the development of civil-military cooperation and interoperability, the integration of new entrants such as Unmanned Air Systems (UAS) and sub-orbital operations and to enable full cross-fertilisation and synergies. This should be ensured through an efficient and

1 Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

2 Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

effective ICAO-facilitated global collaboration with States and regional modernisation programmes from R&D to deployment of interoperable systems.

The realisation of this change of path benefits all aviation stakeholders, whilst delivering performance-based and cost-efficient infrastructure services that can support the expected traffic growth. Furthermore, it allows for the development of a pro-active global aviation radio spectrum strategy with the aim of ensuring a safe and efficient use and long-term availability of adequate radio spectrum embracing new opportunities in line with the needs of the GANP/ASBU evolution.

The Conference is invited to agree to the recommendations in paragraph 5.

1. INTRODUCTION

1.1 The current Communication, Navigation and Surveillance (CNS) infrastructure has evolved in silos on the traditional principle that the Communication, Navigation and Surveillance constituents should only meet at the controller and pilot to avoid single points of failure. The introduction of GNSS and its use in all three domains has challenged this principle in the sense that integrated CNS systems, where one system supports functions from more than one domain, can be considered allowing synergies between the various domains to be leveraged.

1.2 At the 12th Air Navigation several recommendations laid the foundation for the development of a new globally harmonised air traffic management system upon which this Conference can further build.

1.3 The benefits in terms of tangible operational improvements are expected to include increased safety, airspace capacity, improved flight profiles, cost savings for aircraft operators and service providers, equitable access to airspace for all users, sustainability (e.g. cybersecurity, service resilience and reducing environmental impact), clearly defined and integrated roadmaps for communication/navigation/ surveillance/spectrum (CNSS), and a flexible migratory path that addresses regional needs and that ensures no country is left behind.

2. A GLOBAL VISION FOR INTEGRATED CNS

2.1 As part of the GANP evolution, an integrated and consolidated vision spanning across CNS domains that looks beyond current state and regional modernisation programs is now needed. This would require the development of a comprehensive CNSS strategy with a roadmap showing a stepped evolution of airborne, space- and ground-based C, N, S capabilities and associated radio spectrum requirements. Such a vision needs to accommodate the seamless integration of new entrants, such as unmanned aircraft and suborbital flights, whilst delivering a performance-based and cost-efficient infrastructure that can support the expected growth in traffic, whilst reducing the overall environmental impact.

2.2 Access to radio spectrum is a vital underlying enabler for all CNS capabilities and it is widely acknowledged that spectrum is a scarce resource. In order to retain or gain further access to new allocations, aviation must compete with other spectrum users that equally provide visible societal benefits. For aviation to ensure access to suitable spectrum allocations it needs to ensure its systems are spectrally efficient, avoid unnecessary duplications supported by robust and evidence-based arguments. It is therefore a necessity that ICAO together with States, regions and aviation stakeholders develop and maintain a pro-active global aviation radio spectrum strategy which supports the safe and efficient use and long-term availability of adequate radio spectrum as well as embracing new opportunities in line with the needs of the GANP/ASBU evolution.

2.3 Aviation's demand for existing radio spectrum access continues to outpace frequency availability in busy regions. Civil aviation operates with old and sometimes inefficient technologies that need to evolve for a better usage of protected spectrum. Therefore, modernisation of aviation Communication, Navigation and Surveillance systems is essential for sustainable growth, and to continue meeting the high standards of safety, which is the fundamental principle and expectation of the aviation system. This need was acknowledged already at AN Conference/12. Since then, the European States have continued investing and engaging in close cooperation with ICAO and the ITU, recognising that aviation CNS systems will need to evolve in the medium and long terms to increase efficiency in the interest of the entire user community. Nevertheless, transition from legacy to new systems continues to be a challenge for the entire civil aviation sector.

So far, it has been established that technical measures alone, such as greater use of bandwidth efficient systems, are unable to meet projected future aeronautical demands. It is therefore a need to collectively investigate alternative measures to optimise aviation's spectrum footprint, including CNS infrastructure rationalisation. Improvements have to be made in the processes of allocation, the release of frequencies, the deployment of newer and more efficient technologies in the current bands, and in exploring the potential future use of other frequency bands for aeronautical purposes.

2.4 All radio systems are vulnerable to interference and may also be subject to cyber threats and attacks. The impact of interference on space-based systems could, for instance become very significant. CNS resiliency and robustness will need to specifically mitigate such vulnerabilities through a combination of short- and long-term technical and operational measures.

3. <u>THE NECESSITY FOR A UNIFIED PERFORMANCE BASED FRAMEWORK</u>

3.1 The development of a performance-based CNS framework is expected to support the sustainable evolution of the Air Navigation Service Provision business, as it enables the adaptation of business models that best suit the needs of the different States and regions. The framework would also benefit the airlines by enabling the rationalisation of some airborne systems providing for the suitable aggregation of airborne CNS capabilities.

3.2 To implement an agile and performance-based CNS infrastructure, a full understanding of the overarching ATM architecture with clear (cross-cutting and combined) CNS and Spectrum requirements (CNSS) that recognise the needs of all airspace users and stakeholders is an essential pre-requisite. In practice, this requires the coming together of all the three disciplines to review assumptions and challenge the status quo. In an increasingly connected environment, a combination of dedicated CNS systems, automation, and commercial services will work together to deliver an infrastructure that can support the evolving key operational concepts whilst ensuring global interoperability, safety and security. This approach, together with requirements defined as performance statements, should support the acceptance of performance equivalence, inter alia, for military CNS systems.

3.3 To ensure that the evolving CNS infrastructure delivers the expected benefits, it will need to take advantage of new concepts, capabilities and applications in a flexible manner that meets demand and leverages inter-domain synergies whilst maintaining global harmonisation. It is expected that this will under the foreseen architecture involve higher levels of automation and full connectivity allowing for new producers and consumers of data and information. These trends will drive the underlying CNS services and infrastructure toward a digital and more collaborative environment that uses the minimum number of systems to achieve the overall mission. The migratory path to this target environment will need to be flexible, globally interoperable and respect the principle of no country left behind allowing regions to progress as appropriate, and avoiding unnecessary intermediate steps in line with the ICAO GANP and the ASBU framework.

4. BENEFIT AND SUSTAINABLE GROWTH FOR ALL REGIONS

4.1 If aviation is to succeed in sustaining the expected global growth in air traffic as well as to accommodate airspace access requirements from airspace users whilst reducing costs and environmental impact, the current CNS infrastructure needs to evolve. The global CNSS strategy and roadmap need to cater for civil-military interoperability and the optimum re-utilisation opportunities from State and military aviation technologies, new entrant technologies such as UAS and sub-orbital vehicles and the challenges and opportunities they present taking advantage of synergies where possible. ICAO has in this context an important role to play in working together with States and regional modernisation programmes to establish an effective collaboration from R&D through to deployment of interoperable systems.

4.2 A managed evolution to a performance-based CNS infrastructure will allow States and regions, air traffic service providers, manufacturers and aircraft operators to safely benefit from cost savings, improved airspace access and long-term planning certainty. To also ensure an efficient use of spectrum, such evolution will require that synergies between domains and market sectors are leveraged.

4.3 Following such an approach requires greater co-ordination and synchronisation between the CNSS components. An integrated CNSS strategy should be guided by the GANP vision and a conceptual roadmap and be flexible enough to accommodate States and regional differences where necessary, ensuring no-country-left-behind. Under a performance-based scheme, new services and infrastructure (with its underpinning technology components) can be deployed as and when necessary to meet the demands of local airspace. However, unless the performance framework is unified and harmonised, requirements for C, N and S will continue to evolve in silos.

4.4 Therefore, capitalising on the ICAO GANP vision, and new focus on operational improvements and ambitions for performance-based standards, an opportunity now presents itself for States, regions and aviation stakeholders to pool requirements for CNS and spectrum. We believe that ICAO has a pivotal role and a responsibility to facilitate this work. To achieve this goal, Europe advocates the establishment of a multi-disciplinary group of global experts from States and regional modernisation programmes working alongside the ANC Panel framework facilitated by the ICAO Secretariat. Supported with the necessary remit, the group can be tasked to deliver the initial vision and CNS and Spectrum strategy and roadmap for integration into ICAO's GANP & ASBU framework.

5. RECOMMENDATIONS

The Conference is invited to agree to the following recommendations:

a) Request ICAO to develop and maintain, in collaboration with States' and regional modernisation programmes (such as the European Sky ATM Research Programme/SESAR), an integrated consolidated communications, navigation and surveillance and spectrum strategy and roadmap illustrating the necessary transitions as part of the GANP evolution, enabling the implementation of key concepts such as trajectory based operations (TBO) whilst securing resilience and robustness, operational and economic benefits, as well as a coherent rationalisation of legacy CNS capabilities.

b) Request ICAO to work in a multi-disciplinary manner developing an integrated, consolidated and phased approach to a performance-based and service-oriented CNS framework in line with the GANP vision, by grouping and harmonising existing performance-based concepts enabling stakeholders to adapt to new business models for CNS services provision whilst fostering global interoperability.

c) Request ICAO, to develop provisions, in collaboration with States' and regional modernisation programmes; supporting increased civil/military interoperability and synergies with the optimum re-utilisation opportunities from State and military aviation technologies; opportunities arising from the new entrants, such as UAS at all levels and suborbital operators’ digital technologies and to enable the use of internationally recognised standards as means of compliance.

d) Request ICAO to develop and maintain a pro-active global aviation radio spectrum strategy which supports the safe and efficient use and long-term availability of adequate radio spectrum embracing new opportunities in line with the needs of the GANP/ASBU evolution.

— END —

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THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item 3: Enhancing the global air navigation system

3.4: Civil/military cooperation

CIVIL-MILITARY COOPERATION IN EUROPE

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

This paper presents the European best practices in bringing mutual benefits to both civil and military aviation by gradually moving from coordination to collaboration, and moving from the Air Traffic Management (ATM) research and development stages to the implementation of the Aviation System Block Upgrades (ASBU) through appropriate military involvement in the European rulemaking performance-based environment. To implement a safe and more interoperable performance-based global network, the involvement of both civil and military stakeholders is a key requirement for success.

The global aim of such involvement is to enhance civil-military collaboration in ATM

1 Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

2 Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

and Communication, Navigation and Surveillance (CNS) to drive the civil-military cooperation to enhance the aviation performance, notably by sharing best practices and addressing challenges as well as opportunities related to digitalization, security, flexible use of airspace (FUA) and unmanned aircraft systems (UAS) integration.

European Union (EU) institutions and European organisations, in conjunction with European States, play a vital role in encouraging the continuation of the development of mechanisms for collaboration with the military communities to further minimize the gap between the civil requirement for predictability and the military need for flexibility.

Action: The Conference is invited to take note of European best practices related to civil-military cooperation presented in this information paper.

1. INTRODUCTION

1.1 The Chicago Convention became effective on 4 April 1947. Distinguishing civil aircraft operations from State aircraft operations was important enough to warrant the creation of Article 3, which states that the Convention shall not be applicable to State aircraft used in military, customs and police services. For the military aviation, the objective is to conduct operations and training related to security and defence[3].

1.2 In order for the international aviation market to operate and grow as a safe and harmonious system, States have agreed to collaborate on a common regulatory infrastructure and, inter alia, have agreed on the air traffic services (ATS) provided, and access to and use of airspace. It is considered that a safe and efficient use of airspace can be achieved through close cooperation between civil and military stakeholders from the outset to avoid any negative impact on the performance of the European Air Traffic Management Network.

3 Source: Military Aviation Strategy (MAS) in the context of Single European Sky agreed by EDA and NATO member States

1.3 After the adoption of the Single European Sky package in 2004, and alongside with the States civil and military authorities, the European Institutions and organisations are actively involved in enhancing the civil-military cooperation processes towards collaborative decision-making processes at policy, management and technical levels, acknowledging the civil-military cooperation as a key enabler for the airspace optimization and management. The European Union advocates that what it considers to be best practices in these areas should be promoted by ICAO at global and regional levels.

1.4 Although ATM research and development programmes objectives are not directly applicable to the military, in practice military are impacted by civil ATM research and development programs, e.g. the military may have to adapt their procedures and to upgrade their ground systems to identify all aircraft flying over the territory concerned.

1.5 As the required level of connectivity between civil and military ATM systems depends on the intensity and complexity of the civilian and military traffic operating in the same environment, cooperation and collaboration with the military is a necessity, firstly in the governance structures and secondly at the management and technical level.

2. A STRONG CIVIL-MILITARY COOPERATION EUROPEAN CULTURE

2.1 AT THE POLICY LEVEL

2.1.1 At the policy level, within the EU, military aspects can be taken into account through appropriate stakeholder consultation, as well as expertise contributed by EU Member States within the legislative process, i.e. as members of the Council. Other forms of involvement concern the Single Sky Committee (SSC) chaired by the European Commission, which plays an important role in the adoption of more detailed rules. The Committee is composed of Member States representatives, but is also important to note that the European Defence Agency[4] has a status of observer. In this context, the Agency facilitates coordination notably with NATO and EUROCONTROL.

[4] EDA is an intergovernmental agency of the Council of the European Union (currently 27 countries) placed under the authority of the Council of the EU, to which it reports and from which it receives guidelines. EDA is the only EU Agency whose Steering Board meets at ministerial level.

2.1.2 The involvement described introduces military input at the earliest possible stages of SES development. Such input is also insured within the European Aviation Safety Agency (EASA) Rulemaking Groups, as well as in European Standardisation Organisations (ESO), e.g. in EUROCAE, be it in technical groups or in the European ATM Standardisation Coordination Group (EASCG).

2.1.3 From the point of view of ECAC, the military involvement is mainly ensured through EUROCONTROL, which is a civil-military pan-European intergovernmental organisation dealing with Air Traffic Management (ATM) and supporting the implementation of the Single European Sky, notably to sustain the civil and military developments at technical level. The best practices developed at the EUROCONTROL level include the provision of military and civil-military consultation mechanisms with its 41 Member States, developing civil-military solutions to enhance performance of the European Air Traffic Management Network (EATMN).

2.1.4 Within SESAR, military representation effected by the European Defence Agency (EDA) in both the Single European Sky ATM Research Programme Joint Undertaking (SESAR JU) Admin Board and the SESAR Deployment Manager Boards. At technical level, military requirements and subsequent civil-military coordination is conducted through the Military Engagement Plan for SESAR (MEPS), managed by EUROCONTROL in cooperation with its Member States and EDA, This ensures that the first reports to States on on-going and envisaged evolutions contain military views, helping to reach the right level of interoperability between the systems and to avoid potential adverse implications for defence.

2.1.5 From an operational point of view, the role of the Network Manager in Europe becomes more and more crucial as per described in European Regulations. The EU States recognized the need for civil-military cooperation with the intention to increase the performance of the European route network, while ensuring the highest level of safety and preserving the effectiveness of the military missions. The military is represented with two voting members in the Network Management Board.

2.1.6 The most appropriate example for an effective civil-military cooperation is the implementation of the ICAO FUA concept in Europe. This consists in the common recognition of FUA basic principles: collaborative decision mechanism, common understanding on operational needs, common sheer of the same air space, flexibility in air space allocation and release procedures. At the European level, FUA became mandatory for EU states through Regulation (EC) 2150/2005. The implementation status and FUA effectiveness is annually reported to EC, based on specific Key Performance Indicators. Since currently, FUA is considered a mature concept, fully adopted and implemented by EU states, the next stage – Advanced FUA, based on a more dynamic air space architecture and usage principles, is planned to be applicable within SES Programme.

2.2 AT THE MANAGEMENT AND TECHNICAL LEVEL

2.2.1 Comprehensive civil-military cooperation at management and technical levels permits a better integration of military requirements, and a better knowledge of what is at stake for civil aviation. Such cooperation in the end also benefits decision-making at policy level and allows the development of more pragmatic general orientations and concept of operation, e.g. the European ATM Master Plan, which is coordinated amongst all stakeholders, including with the military. The civil-military dimension is also represented within EASA advisory bodies as the Member States Advisory Board and the Technical Bodies, e.g. those for ATM/ANS and aerodromes.

2.2.2 In a "total aviation system" approach, and in order to achieve safety objectives to the full, both sides have to cooperate, rather than working separately. From a military point of view, the safety of air navigation will be promoted throughout the military community in line with international rules and regulations and without national bias regarding the regulation of State aircraft.

2.2.3 The involvement of the military in standardization, e.g. within the European ATM Standardisation Coordination Group (EASCG) and within the European UAS Standards Coordination Group Unmanned Aircraft Systems (EUSCG), both chaired by EUROCAE, helps the military to better know and implement civilian aviation standards and, in return, to inform civil aviation on potential standards currently being developed for the military aviation, e.g. detect and avoid systems developed with military funding and support to facilitate Remotely Piloted Aircraft Systems (RPAS) integration in controlled airspace.

2.2.4 The implementation of System Wide Information Management (SWIM), a global ATM network, shall allow data sharing among all relevant civil and military stakeholders; thus, ensuring appropriate levels of interoperability, cyber resilience, cyber protection and confidentiality, integrity and availability of mission critical information according to local needs. In example, there is military collaboration in SWIM governance projects for SESAR Deployment.

2.2.5 In a global ATM network, the involvement of the military at a technical level provides specific expertise to civil aviation and promotes the interoperability between systems. Furthermore, this could develop dual-use technologies and therefore reduce the acquisition costs.

2.2.6 Ad hoc technical measures, such as acknowledging that military systems may offer, in some specific cases, levels of performance that is equivalent to civilian systems, would guarantee a safe access to airspace for manned and unmanned State aircraft. A good example is the military involvement in airworthiness through the European Military Airworthiness Requirements (EMAR), and in the UAS domain thanks to their expertise in the operational domain validated by integration test flights.

2.2.7 The involvement of the military in SESAR deployment demonstrated a real opportunity to implement systems providing benefit to the performance of the Network. In this, incentivisation through EU co-founding is a strong enabler for the military authorities. The close coordination between the EDA and the SESAR Deployment Manager allows information sharing and gains buy-in from the implementing partners.

2.2.8 The civil-military dimension in rulemaking is undertaken through the identification of both civilian and military experts and is seen as being crucial for the development of a robust SES, e.g. Cyber, UAS, Data Link Services. A best practice is on the way the 8.33 kHz Voice Channel Spacing has been addressed, notably to identify the most efficient measure guaranteeing access to airspace to State aircraft while ensuring the best level of efficiency for the civil aviation. The main difficulty is to find the right consensus after a strong but sometimes very demanding coordination process, first launched at national before reaching the regional level.

2.2.9 In Europe, considering the foreseeable aviation technology changes, civil-military interoperability is a fundamental enabler to address the automation challenges and to ensure the required levels of civil-military connectivity and performance in a globally interoperable context, seamlessly accommodating military operations. In particular, civil-military and military-military interoperability is a paramount objective when trajectory-based operations are introduced, and satellite technologies become the norm with aircraft fully connected with the underlying ground infrastructure. Other important interoperability challenges for Europe are related to the integration of unmanned aircraft/drones in controlled airspace, increased automation support and enhanced data sharing through a secure and resilient network centric system-wide information management structure.

3. EXAMPLES OF BEST PRACTICES

3.1. A good example of the successful civil- military cooperation is the work done by the Baltic Sea Project Team (2015) and the ad-hoc civil military expert group for flight safety over the Baltic Sea (2017), hosted by Finland with support from ICAO Paris office and with participation from Baltic Sea coastal states (i.e. Denmark, Estonia, Germany, Latvia, Lithuania, Poland, Russia and Sweden, as well NATO, the European Aviation Safety Agency (EASA) and EUROCONTROl.

3.2 Prepared by the above-mentioned groups the following EUR-OPS, Bulletins have been published EUR OPS Bulletin 2015_002 “Guidelines to airspace users in order to raise their awareness on State aircraft operations especially in the High Seas airspace over the Baltic Sea”[5] from 2015 (prepared by the Baltic Sea Project Team).

3.3 EUR OPS Bulletin 2017_001 “Principles and best practices in case of air encounters, especially in the High Seas airspace commonly shared by civil & military aviation over the Baltic Sea”6 providing recommendations for operations in international airspace in the Baltic Sea region. The bulletin lists the general principles and best practices that should be followed in an airspace used by both civil and military aircraft. The purpose of these practices is to further enhance flight safety.

3.4 Examples for best practises at technical level developed by EUROCONTROL consist of the ASM handbook, the EUROAT7, the future military airspace requirements determination and a wide variety of publications, informing the military on important civil developments in ATM and aviation matters, as well as specifications, guidelines and other relevant deliverables for practical execution of civil-military coordination and cooperation. Along with the deliverables, support systems for coordination and cooperation, like LARA8, PRISMIL9 and CIMACT10 have been developed and deployed in many States with the aim to allow advanced- FUA by continuous data-sharing between civil and military.

3.5 On CNS, the civil-military interoperability roadmap, as well as dual approach, such as the reutilisation of military transponders to sustain ADS-B and the re-use of military avionics to support key 4D trajectory management functions, are also best practices.

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[5]https://www.icao.int/EURNAT/EUR%20and%20NAT%20Documents/EUR%20Documents/EUR%20OPS%20BULLETINS/EUR%20OPS%20Bulletin%202015%20002%20final.pdf

[6]https://www.icao.int/EURNAT/EUR%20and%20NAT%20Documents/EUR%20Documents/EUR%20OPS%20BULLETINS/EUR%20OPS%20Bulletin%202017_001.pdf

7 Harmonized Rules for Operational Air Traffic (OAT) under Instrument Flight Rules (IFR) inside controlled Airspace of the ECAC Area

8 Local And sub-Regional Airspace Management Support System, which makes full use of B2B Services for seamless communication and coordination

[9] Pan-European Repository of Information Supporting Civil-Military performance measurement, which facilitates the combined performance monitoring of civil-military airspace management processes in a transparent and consistent way

10 Civil-Military ATM Coordination Tool, which is an operational software package supporting the improvement of civil-military coordination and security

4. CONCLUSION

4.1 The global evolution of the ATM system as foreseen by the Global Air Navigation Plan requires a strong regional, and national cooperation between civil and military State aviation authorities. Gradually moving from civil-military coordination to greater collaboration is beneficial to both the civil and military aviation.

4.2 In order to implement a safer, more interoperable and performance-based global network, the collaborative involvement of both civil and military stakeholders at State, regional and global levels is no longer an option but a key for success.

4.3 The military can bring added-value to civil aviation under the condition that appropriate involvement is ensured at all stages, whether these pertain to policy making or technical issues. The expertise of the military is necessary in order to find dual-use solutions, in particular in areas where such expertise is very specific compared to expertise available to actors of civil aviation.

4.4 The Conference is invited to take note of European best practices related to civil-military cooperation presented in this information paper.

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THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item 3: Enhancing the global air navigation system
3.5: Other ATM issues

EUROPEAN EXPERIENCE IN NETWORK MANAGEMENT

(Presented by Austria on behalf of the European Union and its Member States[1] and the other Member States of the European Civil Aviation Conference[2], by EUROCONTROL)

EXECUTIVE SUMMARY

This information paper describes the evolution of the air traffic network management incorporating various functions, challenges and legal ramifications specific to the European context. It also presents European concepts on addressing ever-growing traffic and improving the performance of the network. It also describes interregional network management in Europe.

Actions: The 13th Air Navigation Conference is invited to take note of the European experience in network management presented in this information paper.

[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

[2] Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

1. INTRODUCTION

1.1 Air Traffic Flow Management (ATFM) has been in existence for more than 30 years. The function commenced in the early 1980s in both North America and Europe. Both these systems cover large geographical areas, in the case of Europe the ATFM system consists of a centralised central flow management function operating in close cooperation with national ATFM units in the airspace of 43 states. New ATFM services have been and are being rapidly deployed in many other areas of the world.

1.2 At the beginning of years 2000 ATFM was enhanced by including aspects of capacity management, hence the term Air Traffic Flow and Capacity Management (ATFCM) used in some regions. The addition of Capacity Management shifted the focus to providing required capacity in the parts of airspace where the traffic demand exceeded or was at the limits of the available capacity. Appropriate operational techniques have been developed such as use of various sector configurations, flexible rostering, 'cherry-picking', etc. ATFCM relied heavily on the exchange of information related to flight plans, airspace availability and capacity. Some mature ATF(C)M systems also use real-time data (surveillance and ATC activation information, and short-term airport departure planning information) to improve the predictability of demand, enabling the optimum use of capacity and the application of less penalising and more refined ATF(C)M measures that facilitate the user choices and minimise any negative performance impact.

1.3 Next phase in the evolution was development of the network management concept in parts of the European region ('Network Manager's area') in the years after 2009. The concept focuses on network performance and it incorporates various functions (e.g. ATFM, the design of the route network, scarce resources such as the coordination of radio frequencies and transponder interrogator codes) and activities (e.g. planning, provision of an alerting or alarming system). Network management concept also comprises coordination of management of response to crises that may impact aviation.

1.4 In this concept the network includes airports, airspace and interfaces that connect them, and infrastructure, resources and capabilities of the ATM network that together serve the civil and military airspace users to meet their needs and requirements as well as the defined level of performance. The planning, design, operation, interoperability, interconnectivity and monitoring of these network components support the network optimisation and the achievement of the agreed local and regional performance targets.

1.5 Inter-regional cooperation in the field of network management is essential regardless whether regions operate an ATFM, ATFCM or network management system that includes cooperative airspace design and management of scarce resources. This will be facilitated by inter-regional data exchange, which is a concept that will optimise the use of capacity on a daily basis, and will also facilitate the collaborative management of traffic flows among regions and eventually regional and inter-regional network performance, in particular when security situations and other disruptive factors disturb or threaten to disturb normal traffic patterns.

2. CHALLENGES IN THE EUROPEAN CONTEXT

2.1 In the case of Europe the EUROCONTROL Network Manager system includes a centralised flow management function operating in close cooperation with national ATFM units in the airspace of 43 states. As regards the "network management system", in the EUROCONTROL Network Manager (NM) area, "network" is defined: "The airports, airspace and interfaces that connect them, air traffic management/communication, navigation, surveillance (ATM/CNS) infrastructure, resources and capabilities of the European ATM network that together serve the aircraft operators and military".

2.2 In the EUROCONTROL Network Manager's area the European air traffic management system is operated by Air Navigation Service Providers (ANSP) Designated by States to provide services in respect of national airspace blocks under their responsibility in the ICAO EUR region. The provision of services has been organised within 67 area control centres (ACCs) whose areas of operation are mainly contained within national Flight/Upper Flight Information Regions (FIRs/UIRs). While air navigation service provision remains fragmented in Europe with 38 different ANSPs for the whole ECAC airspace, the execution of the network management functions allows for a continuous evolution, optimisation and operational performance improvement, while connecting them at the level of the functions.

2.3 Network efficiencies need to be found through a collaborative approach towards airspace organisation and rapid implementation of new operational concepts supported by state-of-art technologies. The defragmentation of the European ATM system and the enhancement of its overall performance are at the core of the Single European Sky ATM Research (SESAR) Project and of the network management functions. Supporting the notion of trajectory based operations and relying on the provision of air navigation services in support of the execution of the business or mission trajectory — meaning that aircraft can fly their preferred trajectories without being constrained by airspace configurations. This vision of trajectory based operations is supported by digital technologies and enabled by a Free-Route airspace implementation, an evolution of the European ATM architecture, a progressive increase in the level of automation support, the implementation of virtualisation technologies and the use of standardised and interoperable systems.

3. SINGLE EUROPEAN SKY REGULATORY FRAMEWORK

3.1 In 2009 the network management functions and their execution by a single body – the Network Manager - were laid out in the Single European Sky II legislative package of the European Union. In particular, Regulation (EC) No551/2004 for the design and the use of the airspace in the single European sky provided the legal basis for the centralised network functions and the central AFTM in particular. The regulatory framework was detailed with implementing act focusing of the description of the functions and the related tasks of the Network Manager. The functions and the tasks are delivered on the basis of Cooperative Decision Making (CDM) process, whereby decisions are made based on a constant interaction and consultation with States, operational stakeholders and other actors as appropriate, so contributing to the network performance.

3.2 The Network Manager shall comply with various regulatory requirements, including to be certified by EASA as a competent authority for the provision of the functions as laid out in the implementing acts (Commission Implementing Regulation 2017/373).

4. KEY DRIVERS FOR THE FUTURE – EMPHASIS ON PERFORMANCE

4.1 The key drivers for the evolution of the European network management system are those related to the achievement of the strategic objectives of the SES in terms of safety, capacity, environmental impact and flight efficiency into operational and service provision requirements and ultimately implementation objectives.

4.2 These operational performance improvements will need to be addressed in the context of a continued traffic growth and the possible evolution of other types of users (e.g. RPAS, HAPS).

4.3 Historically, operational performance never anticipated the expected increase in demand and cycles of traffic evolution have not been used properly to deliver in anticipation operational improvements to address the future growth cycle. This was linked to a short term vision on how to immediately address cost-effectiveness concerns without evaluating in the longer term the required operational performance evolutions.

4.4 One of the key challenges of the evolution of the European network management system is to address current shortcomings and lessons learned from past evolutions. ATC capacity currently tends to be rigid while traffic demand is variable, both predictably and unpredictably. This results in considerable spare capacity and excess load at the same time. These capacity margins generate costs and capacity shortages generate delay costs, both of which are borne by airspace users. Savings in both capacity and delay costs can be achieved by better aligning capacity with demand. This requires seamless airspace design, improved prediction of traffic as well as the possibility to flexibly adjust capacity to match demand. Adequate margin would have to be maintained balancing the risk of over-delivery with that of capacity shortage.

4.5 It is paramount to establish operating conditions that would allow enhancing the cumulated cost of capacity and delays. However, if operating conditions change, e.g. if capacity becomes more flexible, demand more predictable, and/or both match better, it is possible to produce the required capacity at a lower cost, and to save on both capacity and delay costs. This results in a more favourable trade-off between capacity and delay costs.

At the new optimum, cost-efficiency would be significantly improved and delay marginally improved, with higher certainty of meeting the delay target as more flexible capacity yields better responsiveness to unforeseen traffic changes.

4.6 Improvements are expected beyond 2020, through enhanced seamless airspace design, delivery of new operational concepts through the network management functions and from R&D starting under SESAR 2020. Further progress is expected in particular from more flexible capacity in space (virtual centres) and more predictable demand (4D Trajectory Based Operations). The development and deployment of enablers will need to be encouraged as well as the development of tools to decrease ATCO workload.

4.7 The main improvements in flight efficiency are expected to have been already achieved during the period 2020 - 2025 and to be maintained afterwards as, currently, environment/flight efficiency targets are almost achieved. 4D trajectory based operations will better respond to expressed intentions by the airspace users. The approach towards en-route charging will need also to be addressed to facilitate appropriate trade-offs between capacity, cost-effectiveness and environment.

5. CHALLENGES OF THE INTER-REGIONAL NETWORK MANAGEMENT

5.1 Network management concept can deliver most effective results in an environment that respects the flows of traffic and is open for cross-border initiatives. New (cross-border) network management solutions need to be developed and deployed to accommodate the expected traffic growth in the coming years. Given the increased focus on performance in ATM (including cost-efficiency), on top of safety and operational priorities, network management solutions need also to take account of the economic/financial aspects.

5.2 Given its significant impact on the economy, establishment of a network management concept within a region requires strong political and legal support. In Europe it made possible implementation of the network management operational arrangements in the eighties in order to resolve significant imbalance between traffic demand and capacity and reduce delays. From 2010 the Single European Sky initiative raised ATFM rules to the level of legal requirements for European Union Member States.

There are some other regions involving a mix of smaller and bigger States, which are struggling to accommodate ever growing traffic increase, which however have not been able to reach a political agreement to implement a network management concept.

5.3 Another important element is ensuring equity within the network and across the networks, i.e. treating all flights in the same way regardless which region they are originating from. Adoption of equity as the global principle would pave a way for smooth deployment of the network management concept globally.

5.4 Network management concept is supposed to deliver an enhanced mobility of people and goods. Therefore, intermodal solutions might be required amongst different kinds of modes of transportation. Even though the multimodality is still in the process of being developed, if confirmed by the evolution, it might shift focus of the network management from flights to passengers and cargo in case of civil flights, or operational goals in case of military flight operations.

6. LOOKING INTO THE FUTURE

6.1 Europe will have to embrace a new era of innovation and digital technologies in line with the European Aviation Strategy. Its future European ATM system will be based on better airspace organisation, efficient service provision and the enabling infrastructure. The challenge would be to translate the strategic objectives of the SES in terms of safety, capacity, environmental impact and flight efficiency into operational and service provision requirements and ultimately implementation objectives, which would allow an effective evolution into the future.

6.2 Recent developments in ATM have shown the potential of new operational concepts to reduce the fragmentation of the European airspace. The European ATM Master Plan foresees for example free-route airspace, advanced flexible use of the airspace, dynamic and cross-border sectorisation, dynamic air traffic flow and capacity management, virtual centres would further optimise the use of airspace and the choice of preferred trajectories by airspace users.

6.3 The Network Management evolution in Europe (NM Area) will take into account SESAR-related operational concepts and technologies in view of defining a high-level deployment scenario to ensure airspace continuity and appropriate harmonisation of operational concepts and associated infrastructure. It would also support the development of a SES vision towards the 2035 horizon and associated high-level goals in particular with regards to the contribution to performance in terms of safety, capacity, environmental impact and flight efficiency, resulting in further updates to the European ATM Master Plan.

7. CONCLUSION

The 13th Air Navigation Conference is invited to take note of the European experience in network management presented in this information paper.

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THIRTEENTH AIR NAVIGATION CONFERENCE

COMMITTEE A

Agenda Item 2.1 : **Aerodrome operations and capacity**

RECATEGORISATION OF WAKE VORTEX SEPARATION MINIMA AND TIME BASED SEPARATION

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

This information paper describes European perspectives regarding implementation of recategorised wake vortex separation minima (RECAT-EU) and time based separation (TBS) in Europe.

The Conference is invited to take note of the progress of Europe in the implementation of the recategorisation of wake vortex minima RECAT-EU and time based separation (TBS).

1 Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

2 Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

1. INTRODUCTION

1.1 Continued growth in air traffic in Europe of around 2.3% per year and increasing runway congestion during peak hours is driving the need for operational improvements to safely increase runway throughput whilst addressing the challenges of wake vortex to reduce separation minima.

1.2 European airports have improved arrival and departure separation minima by implementing RECAT-EU, a 6 category wake-vortex separation minima.

1.3 Further capacity benefits have been achieved through the implementation of Time Based Separations (TBS) that mitigates the impact of wind on runway throughput.

2. RUNWAY THROUGHPUT IMPROVEMENTS

2.1 With the advent of large aircraft types, significant collection of wake vortex data and major advances in methods and metrics associated with wake analysis and definition of separation minima, Europe has developed and implemented reduced wake vortex separation minima for arrival and departure traffic.

2.2 A380 and B747-8 wake evaluation campaigns involving teams from EUROCONTROL, AIRBUS, BOEING and the FAA, led to an enhanced understanding of wake physics and how an aircraft generates wake and resists the impact of wake, setting foundations for change wake vortex separation.

2.3 A European wake data base was established with data captured in a number of measurement campaigns at Frankfurt, Paris Charles de Gaulle, London Heathrow, and more recently through partnership with Dubai. This data supported both RECAT-EU and TBS development.

2.4 Metrics and methodologies were developed to quantify the wake turbulence risk and establish the safety arguments to reduce wake separation. This knowledge was first used to deploy wake independent departure and arrival operations at Paris Charles de Gaulle and then to develop RECAT EU (Wake re-categorisation).

2.5 In 2001, EUROCONTROL developed a concept called Time Based Separation, commonly known as TBS. Today, this concept has been fully validated in SESAR and deployed at Heathrow airport. A further 16 airports are mandated for deployment in the SESAR Deployment program.

2.6 RECAT-EU

2.6.1 Initial work with the FAA was performed to elaborate a new six categorisation scheme that splits each of the ICAO HEAVY and MEDIUM categories into 2 parts (‘Upper’ and ‘Lower’) and includes Super and Light categories.

2.6.2 This split is based on aircraft type characteristics in terms of wake generation and wake resistance, enabling a reduction of separation minima for some leader-follower pairs of aircraft categories, therefore bringing a runway throughput increase whilst maintaining acceptable levels of safety.

2.6.3 RECAT-EU incorporates reduced separation minima for the Upper Medium (i.e. A320 Family / B737 NG Family / C-Series Family) behind Heavies (A330/A350 / B777 / B787) and behind A380 and A225, while separation minima for the Light category behind Upper Medium are kept unchanged.

2.6.4 The European Aviation Safety Agency (EASA) has agreed the RECAT-EU Safety Case, advising States and Air Navigation Services that it may be used as a basis to update their current aircraft separation schemes for approach and departure.

2.6.5 RECAT-EU is deployed at Paris CDG since March 2016 providing significant runway throughput benefits of around 5-10%. It fully incorporates reduced separation minima for the A380 aircraft type. RECAT-EU has subsequently been deployed at London Heathrow (in combination with TBS) in 2018 and a partial version covering predominantly operated lower heavy cargo aircraft at Leipzig-Halle. Further European implementation is underway.

2.6.6 RECAT-EU deployment typically brings runway capacity benefits, with additional movements in peak traffic periods, and / or reduced time to land or depart a traffic sequence. These benefits are expected to further increase over time as the overall fleet mix is forecasted to evolve towards larger aircraft – a mitigation for the lack of runway capacity foreseen in EUROCONTROL’s 2013 ‘Challenges of Growth’ study.

2.6.7 RECAT-EU also provides a rapid recovery from adverse conditions, helping to reduce overall delay and enabling improvements in ATFM slot compliance through the flexibility afforded by reduced departure separations.

2.6.8 The cost of RECAT-EU deployment is low, limited to local flight data processing system changes associated with the new wake vortex categories, and controller training. Some resources may also have to be dedicated to awareness of flight crews. There is no change to the ICAO Flight Plan format used by aircraft operators.

2.6.9 RECAT-EU deployment necessitates a collaborative approach involving all Stakeholders: Air Navigation Service Provider, Airport-based Airline(s), Airport Company and Authorities.

2.6.10 RECAT-EU, together with the US RECAT, has been used as a basis to develop a Proposal for Amendment of Document 4444 PANS-ATM, including enhanced wake separation provisions supporting capacity-constrained airports worldwide. This will be a 7 group categorisation scheme.

2.7. Time Based Separation

2.7.1 TBS addresses the negative impact of strong headwinds on runway throughput. Strong wind reduces aircraft ground speed during approach increasing the time elapsed between successive runway movements. This decreases the landing rate, resulting in delays. As an example, in Vienna this can result in 35 landings per hour instead of 41 under normal circumstances.

2.7.2 This negative impact is not only on capacity, but also on the predictability of operations leading to service disruption, particularly exacerbated if this occurs on the first rotation of the day, time and fuel efficiency, and environment (emissions). The impact on predictability for core hubs is particularly important with significant delay impact in the air navigation system at the network level.

2.7.3 TBS helps to maintain runway throughput and landing rate resilience to a range of headwind conditions on final approach by changing the separation metric on final approach from distance to time based separation.

2.7.4 This is witnessed by London Heathrow experience where delay due to headwind is reduced by 64% due to TBS and in simulations for Vienna where throughput is even increased beyond 41 landings.

2.7.5 The principle of TBS is to dynamically adjust the applicable minimum in-trail distance separation as a function of headwind, in order to maintain a constant time separation as observed in low headwinds, hence maintain a landing rate across the wind conditions.

2.7.6 TBS takes advantage of reliable predicted and real time wind data and an in-depth understanding of the impact of wind on wake vortex. The performance of aircraft on final approach is critical as aircraft speed profiles and behaviour need to be considered to avoid un-safe compression of aircraft spacing (catch-up) between leader and follower aircraft, particularly during the final 4 miles of approach.

2.7.7 Final Approach and Tower Runway controllers are provided with a TBS Separation Delivery Tool to support the controller accurately apply the time separation between arrival traffic pairs, and importantly to help monitor the compression effect.

2.7.8 The controller working methodology is comparable to today's radar vectoring so there is minimum impact on operational control techniques. A typical separation delivery tool will display a target chevron to the controller on the radar screen as a system aid to position the aircraft on the final approach axis, whilst a second chevron is used to identify the separation minima to be delivered by the threshold.

2.7.9 TBS automation brings consistency, increased resilience and safety by enhancing the controller's role without changing working methods, ensuring the controller is able to retain control in the event of reduction in system performance.

2.7.10 Since TBS automation supports the controller separation task, specifically optimised wake separation minima between aircraft pairs can now be used for reducing separation. New operational improvements such as reduced minimum surveillance separation, runway occupancy, final approach speed compression and advanced approach procedures such as increased glide slopes and displaced thresholds used for noise reduction and wake avoidance can be integrated into the separation delivery tool helping the controller deliver improved runway safety and throughput.

2.7.11 In 2018, RECAT-EU was implemented in TBS system at Heathrow providing additional runway throughput and the airport anticipates further benefits by updating to RECAT-EU-Pairwise in early 2020. TBS deployment is ongoing at Vienna and starting at Paris CDG.

2.8 Future

2.8.1 In the context of SESAR, a new set of optimised wake separation minima, RECAT-EU-Pairwise have been developed to provide separation minima between pairs of aircraft types. RECAT-EU-Pairwise will require a separation delivery tool such as TBS.

2.8.2 Weather dependent separations (WDS) will be ready for implementation from 2020. WDS mitigates crosswinds providing an expected increase in capacity and throughput proportional to the number of wake-constrained aircraft pairs. WDS will require a separation delivery tool such as TBS.

2.8.3 SESAR development of procedures and supporting technology to avoid wake and mitigate noise impact using displaced thresholds and adapted glide slopes is reaching maturity. The concepts use differentiated glide paths and displaced thresholds enabled by ILS and GBAS / SBAS technology to support the reduction of an aircraft noise footprint, moving the noise into the airport, whilst also enabling a reduction of separation between aircraft on final approach by ensuring reduced risk of wake turbulence.

3. CONCLUSION

The Conference is invited to take note of the progress of Europe in the implementation of the recategorisation of wake vortex minima RECAT-EU and time based separation (TBS).

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THIRTEENTH AIR NAVIGATION CONFERENCE

COMMITTEE A

Agenda Item 2.1 : **Aerodrome operations and capacity**

TOTAL AIRPORT MANAGEMENT AND THROUGHPUT

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

Airports are key nodes of the global air navigation system and are critical to the future safe growth of the air transport industry worldwide.

The Global Air Navigation Plan (GANP) and aviation system block upgrades (ASBU's) support strategic objectives that will enhance civil aviation safety, increase capacity and improve efficiency of global civil aviation as well as minimising adverse environmental effects.

A-CDM, WAKE and NOPS ASBU thread updates will bring performance benefits to airport and global ATM system operations.

This paper presents updates on industry based regional ATM improvements on of total airport management (TAM) incorporating airside and interfacing with land side, airport

[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

[2] Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

integration into the network, reduced wake vortex separation minima on arrival and departure, and the use of time instead of distance separation on approach, to increase runway throughput and mitigate the effect of headwind which provide an opportunity to enhance the relevant ASBU threads.

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

1. INTRODUCTION

1.1 Airports are key nodes of the global air navigation system and are critical to the future safe growth of the air transport industry worldwide.

1.2 Continued growth in global demand of around 4.6% per year, increases in operational constraints, greater environmental awareness and runway throughput congestion during peak hours is leading to airport and ATM delays and inefficiencies to the detriment of airspace users and passengers.

1.3 The Global Air Navigation Plan (GANP) and aviation system block upgrades (ASBU's) support strategic objectives that will enhance civil aviation safety, increase capacity and improve efficiency of global civil aviation as well as minimising adverse environmental effects.

1.4 Airports are increasingly focusing on a TAM approach to enable airport performance improvements, using collaborative decision-making processes, integrating airside and interfacing with land side operations to improve the efficient management of airport resources on an equitable basis.

1.5 As the GATMOC already accepts that "There is a dependency on landside operations where improvements are needed *to optimize aerodrome capacity. ….*" the ASBU ACDM thread should be updated to reflect land side activities whilst taking a TAM perspective.

1.6 Recognition of the airport as a key node in trajectory based operations (TBO) by integrating airports into network operations (NOPS) will improve predictability and efficiency and support a seamless TBO based air navigation system.

1.7 To address the issue of runway congestion and improve operational efficiency, major regional airports have improved arrival and departure separation minima by further expanding the existing three ICAO wake categories based on enhanced knowledge of wake-vortex resulting in significant throughput benefits of up to 17%.

1.8 Further capacity benefits have been achieved at regional airports through the implementation of Time Based Separations (TBS) together with optimised wake separation minima, to mitigate wind impact and increase runway throughput.

1.9 The ICAO Wake Turbulence Working Group (WTWG) recently proposed an alternative wake turbulence provision that expands the three existing ICAO wake categories into 7 groups optimising wake separation minima. The ASBU WAKE thread should be updated to reflect the 7 group wake separation minima together with provisions for TBS.

2. DISCUSSION

2.1 Total airport management

2.1.2 The 12th Air Navigation Conference (AN-Conf/12, 2012) acknowledged the importance of airport collaborative decision making (A-CDM), recognising that information sharing among stakeholders will improve predictability, capacity, performance, resilience and efficiency. Furthermore it recommended the standardisation of all elements to support CDM processes which is captured in the 3rd edition of the Manual on Collaborative Air Traffic Flow Management (Doc 9971).

2.1.3 Major airports are implementing ACDM and Airport Operations Centres (APOC) with dedicated Airport Operations Plans (AOP) connected to NOPS providing a network performance vision with greater predictability, efficiency, capacity and environmental benefits. This expands ACDM processes towards ATFM taking account of airport landside and network operational aspects.

2.1.4 TAM brings greater integration of airport and network stakeholder processes improving predictability and resilience, supporting future growth and consistent capacity at airports, in a seamless air navigation system. Integrated processes are a performance prerequisite together with full access to timely and accurate, cyber and confidentially secure data from all air navigation system stakeholders.

2.1.5 Key processes are built around CDM including airport and network capacity demand management, pre-departure management, surface and runway optimization. Increasingly, airport operation centres monitor ground transport and infrastructure, passenger, baggage and freight handling services, passenger flow management through security and border control checkpoints, to build confidence on terminal processes to drive airport and ATM performance.

2.1.6 Predictive A-CDM tools provide a wider and earlier perspective on actual and anticipated operational issues through performance dashboards and support a proactive response to the consequences of disruption i.e. active crisis and recovery management, supporting stakeholder decision making in the APOC. This collaboration is extended to network connectivity to monitor, act and agree on key airport and airspace performance issues.

2.1.7 TAM imposes no specific requirements on communication, navigation and surveillance (CNS) systems whilst integrating airports into the network can be achieved through Business to Business (B2B) systems which will improve the precision of information supporting the ACDM milestone approach. Implementing System Wide Information Management (SWIM) will ensure the availability of high-quality, updated and reliable information. SWIM, and its information domains, mainly meteorology, aeronautical and future flight and flow information for a collaborative environment (FF-ICE) will become increasingly important.

2.1.8 TAM enhances human operator performance, supporting tasks through access to shared up-to-date information, analytical and predictive decision support tools providing for common situation awareness and the ability to drive performance, anticipate and prepare for non-nominal situations.

2.2 Runway Throughput improvements

2.2.1 A joint proposal for the amendment of Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444) that incorporates new wake turbulence separation minima was made at the ICAO WTWG 10th meeting (Proposal for the amendment of PANS-ATM concerning wake turbulence separation minima WTWG/10-WP/Rev 20/12/2017).

2.2.2 Expanding the existing three ICAO wake categories and regrouping aircraft taking account of their wake vortex characteristics can optimise runway throughput and improve resilience for arrival and departure phases of flight. Regional versions of optimised wake turbulence separation groups have been implemented with significant throughput benefits of between 3% and 17%.

2.2.3 The WTWG wake separation proposal expands the current 3 ICAO wake categories to an optimum 7 group wake separation minima covering various traffic mixes at major global airport hubs, supported by existing regional safety cases and operational experience. This wake separation minimum responds to ICAO strategic performance objectives, driving safety, capacity and efficiency improvements at relevant capacity constrained airports having significant demand for medium and heavy aircraft types.

2.2.4 The A380-800 State Letter (TEC/OPS/SEP – 08-0294.SLG) is in practice treated as a 4th wake turbulence category. The WTWG proposed to recognise this by extending the ICAO PANS-ATM 3 category wake separation minima to 4 categories, incorporating “super” to cover the A380-800 and future comparable types.

2.2.5 Strong headwind conditions on final approach cause a reduction of aircraft ground speed resulting in reduced landing rates and ATFM delay. The negative impact on predictability of operations leads to service disruption, time, fuel and environment inefficiencies with significant delay impact at major airports and in the air navigation system.

2.2.6 TBS addresses this by improving runway throughput and landing rate resilience for a range of headwind conditions by changing the separation on final approach from distance to time based. Regional experience shows significant throughput benefits (including in low wind), delay reductions, increased resilience and safety with the automation support enhancing the air traffic controller role.

2.2.7 The ICAO 7 group wake separation minima and TBS impose no specific requirements on communication, navigation and surveillance (CNS) systems or aircraft avionics and flight management systems. Ground ATC systems will require adaptation or development to support such operations.

2.2.8 TBS automation brings consistency, increased resilience and safety by enhancing the controller's role without changing working methods, ensuring the controller is able to retain control in the event of reduction in system performance and manage new concepts supported by TBS. Significant performance can be realised by operating TBS with the ICAO 7 group wake separation minima.

3. CONCLUSION

3.1 Regional developments in TAM, airport integration into network operations, proposals to amend ICAO wake vortex separation provisions and regional experience with time based separation on final approach, address continued growth in global demand and runway throughput congestion, mitigating related airport and ATFM delays and inefficiencies for airspace users and passengers.

3.2. These industry based regional ATM improvements provide ICAO the opportunity to enhance the ASBU threads ACDM, WAKE and NOPS that serve States and other stakeholders to progressively advance their air navigation system capabilities.

3.3. The Conference is invited to agree on the following recommendations:

That the Conference:

a) request ICAO to update provisions and guidance on airport collaborative decision making (ACDM) by extending ACDM towards TAM and interfacing with airport landside operations;

b) request ICAO to update provisions and guidance in ACDM and NOPS by integrating airports into network operations to drive predictable air navigation system performance;

c) request ICAO to update provisions and guidance in WAKE and complete guidance for an alternative wake turbulence provision that expands the three existing ICAO wake categories into 7 groups and to formalise the recommendations of the 2008 State Letter on wake turbulence by adding a new category into the existing wake categories;

d) request ICAO to develop provisions and guidance on Time Based Separation in WAKE;

e) urge States to continue to implement ACDM and when appropriate, to extend ACDM to incorporate TAM and integrate airports into network operations.

— END —

International Civil Aviation Organization

WORKING PAPER

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(Information Paper)
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THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item 5: 5.2: Operations below 1000 feet
5.3: Remotely piloted aircraft systems (RPAS)
5.5: Other emerging issues impacting the global air navigation system including unmanned aircraft (drones)

UAS INTEGRATION IN EUROPE

(Presented by Austria on behalf of the European Union and its Member States[1], the other Member States of the European Civil Aviation Conference[2]; and by EUROCONTROL)

EXECUTIVE SUMMARY

With the rapid rise in Unmanned Aerial Systems (UAS) activities across Europe, the European Commission has taken active steps to coordinate research, development and deployment to promote safe UAS operations and the sustainable growth of this rapidly evolving sector. The Single European Sky ATM Research (SESAR) programme leads the research aspects and supports the overall European policy that adopted a two-pronged approach: IFR RPAS integration, and the initiation and development of the U-space concept to address UAS Traffic Management (UTM). This paper firstly describes the European approach to enabling IFR RPAS integration, including the coordination between the various European agencies, industries and operators. It also presents the U-space initiative, which brings together researchers, developers,

[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

[2] Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

regulators, manufacturers, operators and service providers in a harmonised approach to its development, demonstration and implementation. The paper explains the European approach to standardisation and regulation and its coordination with national and international agencies, for example in the United States, and how this is integrated into the European ATM Master Plan, which provides the R&D framework for the safe integration of all UAS in European airspace.

Action: The Conference is invited to take note of progress in Europe in integrating UAS of all kinds with manned aviation.

1. INTRODUCTION

1.1 The global increase in the demand for the capability to conduct business and operations using unmanned aerial systems (UAS) has brought with it challenges for States and regional regulators and other aviation authorities. Although steady progress has been made over many years regarding larger remotely piloted aircraft systems (RPAS), including the valuable work being conducted by ICAO's RPAS Panel. The recent big increased in the demand for use of smaller drones has necessitated an increased pace and prioritisation around the world to integrate this entirely new form of aviation management through the introduction of UAS Traffic Management (UTM)[3], in the EU called the "U-Space".

1.2 In Europe, the European Union recognised the need for a European approach to solving the challenges presented by UAS integration, and has launched a number of initiatives to ensure this harmonised approach throughout Europe. In parallel, coordination mechanisms have been set up between Europe and equivalent UAS development authorities around the world in order to promote global harmonisation.

[3] For the purposes of this paper, the term 'RPAS' is used to describe typically larger UAS that are intended to be operated IFR under conventional air traffic services, whilst the term 'drone' is used to describe those UAS that will operate under UTM services; 'UAS' is a general term used to describe all unmanned aerial systems. This convention is applied solely for convenience in this paper and is not suggested as an official ICAO distinction.

1.3 The future of European Air Traffic Management (ATM) is guided by the European ATM Master Plan[4]. In 2017, the SESAR Joint Undertaking initiated a yearlong consultation designed to bring together all European institutions and authorities and UAS stakeholders to agree the way forward for achieving a seamless UAS integration, allowing regional plans to build on the many activities already under way within member states. This consultation was performed through three working groups (WG):

- WG1: IFR Integration, chaired by the SESAR Joint Undertaking (SESAR JU);
- WG2: U-Space, chaired by the European Commission; and
- WG3: Standards and regulation, chaired by the European Aviation Safety Agency (EASA).

1.4 The output of this consultation was the 'Roadmap for the safe integration of drones into all classes of airspace'[5], which defined a two-thread approach: IFR RPAS integration and UTM. The roadmap envisages that, once initial research and deployment is underway in each thread, operations are becoming routine, and the regulatory environment matures, the whole aviation environment, including IFR RPAS and U-Space, will evolve together. All developments underpinned by a harmonised approach to standardisation and regulation. The roadmap will be fully integrated into the European ATM Master Plan during 2018.

2. IFR RPAS INTEGRATION

2.1 Over the years, there have been many national initiatives to enable the implementation of IFR RPAS integration, and there have been many regulatory advances in support of this goal. It is well recognised that considerable progress has been made through ICAO's RPAS Panel and other multi-national organizations such as EUROCONTROL and the Joint Authorities for Rulemaking on Unmanned Systems (JARUS).

[4] https://www.atmmasterplan.eu/.

[5] https://www.sesarju.eu/sites/default/files/documents/reports/European%20ATM%20Master%20Plan%20Drone%20roadmap.pdf.

In 2015, the SESAR JU defined how pan-European RPAS integration activities would be implemented and, in did in 2016; perform nine demonstrations[6] across Europe to demonstrate the state of the art and to help identify priorities for further developments on the operational, technological and regulatory elements. These initial demonstrations took place in Spain, France, Italy, the Netherlands and the United Kingdom.

Additional technological and operational research & development needs were identified, and the SESAR JU 2020 programme included three industrialisation focussed research projects looking at RPAS separation, collision avoidance and surface movement. Multinational consortia bringing together key European industrial entities and industries conduct these projects. The SESAR programme is closely coordinated with projects being undertaken by the military through the European Defence Agency (EDA), whose projects contribute significantly to issues such as Detect and Avoid, Command and Control (C2) automated landing and remote pilot workstations, amongst others. Military operators are likely to be the largest initial stakeholder group to operate IFR RPAS, so the decision by EDA's members to pursue, what in Europe is called a civil/military dual-use path has been invaluable to both accelerating the pace of developments and in ensuring harmonisation of standards, requirements and concepts across all European stakeholder groups.

2.2 The European UAS integration roadmap follows ICAO's steps of accommodation, integration and evolution. It is well recognised that it should be possible to enable non-segregated RPAS operations without requiring full integration but to enable this; special provisions would need to apply. The second wave call of the SESAR 2020 programme, currently under definition, is looking to aligning solutions with this philosophy to expedite the commencement of non-segregated RPAS operations. Once again, this approach is fully coordinated with the EDA, whose projects are designed to complement the SESAR programme in support of the European roadmap. Integration work will be conducted in parallel with accommodation studies, with a specific focus on accommodation as a first step, initial non-segregated operations.

[6] https://www.sesarju.eu/sites/default/files/documents/reports/RPAS-demo-final.pdf.

2.3 The importance of space-based technologies to UAS operations is fully recognised. Both the European Space Agency (ESA)[7] and the European GNSS Agency (GSA)[8] are both running their own UAS-related projects and contributing to other European UAS projects to cover the use of satellites for precision navigation and C2.

3. U-SPACE

3.1. In Europe, the need for coordinated and accelerated action to enable drone operations was adopted in a policy by the European Union following High-Level conferences in Riga (2015) [9], Warsaw[10] (2016) and Helsinki[11] (2017). Their respective declarations on drones have stimulated considerable activity in Europe.

3.2 In 2017, the SESAR JU published the U-space Blueprint[12]. This document, which builds on the groundbreaking work undertaken in the US by NASA and the FAA[13], described the vision for U-Space in Europe. This was followed by the European UAS roadmap, which elaborated more about the nature of U-space and the type of U-space services that would be required to deliver the vision, as well as the supporting technological, standardization and regulatory activity.

3.3 The first wave of research & development projects in support of U-space comprised nine exploratory research projects within the SESAR 2020 programme, each looking at a different aspect of UTM, including collision avoidance, airborne technology, ground technology, C2, information management and cyber-security. All of these projects coordinate with a central project[14], under the leadership of EUROCONTROL, to define a European concept of operations for drones in very low level (VLL) airspace. Since the pace of developments for U-space is so fast, SESAR JU has also initiated three very large-scale demonstration projects.

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[7] http://www.esa.int/Our_Activities/Telecommunications_Integrated_Applications/DeSIRE.
[8] https://www.gsa.europa.eu/newsroom/news/egnos-and-galileo-opening-door-new-drone-applications.
[9] https://ec.europa.eu/transport/sites/transport/files/modes/air/news/doc/2015-03-06-drones/2015-03-06-riga-declaration-drones.pdf.
[10] https://ec.europa.eu/transport/sites/transport/files/drones-warsaw-declaration.pdf.
[11] https://ec.europa.eu/transport/sites/transport/files/2017-drones-declaration-helsinki.pdf.
[12] https://www.sesarju.eu/sites/default/files/documents/reports/U-space%20Blueprint%20brochure%20final.PDF.
[13] https://utm.arc.nasa.gov/index.shtml.
[14] https://www.sesarju.eu/projects/corus.

These projects brings together drone manufacturers and operators, ANSPs, regulators, airports, software engineers and UTM service providers in a drive to push forwards the state of the art by actually flying multiple drones in urban, sub-urban and rural environments, as well as inside controlled airspace near airports. Demonstrations are taking place in France, Denmark, the Netherlands, Spain and Switzerland. A fourth demonstration is also about to start, focusing on geofencing. The impact of such all-inclusive projects is expected to be so high, that a second wave of U-space VLD projects is about to be awarded, to take place at demonstrator sites across Europe.

3.4 The Helsinki declaration, supported by the conference participants, called for the development of a network of drone demonstrator sites across Europe. There are currently many such sites being set up including, *inter alia*, sites in Denmark, France, Italy, the Netherlands, Poland Spain, Switzerland and the United Kingdom. The European Commission, with the support of EASA, the SESAR JU and EUROCONTROL, provides regulatory and operational support for many individual national initiatives on U-Space under the umbrella of the EU U-Space Demonstrator Network. The Union support should fasten the creation of the drone services market. Finally, as part of the European innovation partnership on smart cities and communities (EIP-SCC), and in line with the Helsinki declaration, the European Commission has initiated the set-up of a network of drone demonstrator sites, managed by EUROCONTROL, which, amongst other aims, will be able to support the implementation of Urban Air Mobility (UAM)[15].

4. SAFETY, STANDARDISATION AND REGULATION

4.1 The European UAS roadmap recognised that underpinning all drone-related activity in Europe is the need for a coherent and harmonised approach to safety, standardisation and regulation. In view of the adoption by the co-legislators of a new regulatory framework for aviation safety, which is set to include safety rules for UAS, the European Commission, with the active support of EASA, is working on a detailed regulatory framework[16] in the matter.

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15 https://eu-smartcities.eu/initiatives/840/description.

16 https://www.easa.europa.eu/easa-and-you/civil-drones-rpas/drones-regulatory-framework-background.

The current thinking is based on the so-called "operation centric approach", with three categories of drone operations: open, specific and certified. Considerable consultation has been undertaken, and EASA has elaborated draft regulations[17], containing the following elements:

- a framework to safely operate drones;
- technical and operational requirements for drones, including geo-awareness;
- Necessary elements of product legislation, involving CE marking; and
- Rules on Beyond Visual Line of Sight operations
- Provides a step in the direction of U-space by including requirements for Registration, E-identification and Geo-awareness that will need to be complemented in due course

The Commission is working towards adoption of the draft Regulations by the end of 2018.

4.2 Aviation industry standardisation in Europe is in principle organised by EUROCAE and their Working Groups (WG´s) cooperate closely with other regional industry standardisation developments organisations, such as the RTCA in the U.S. EUROCAE created WG105[18] to define European standards for drones. WG 105 have six focus teams: UAS Traffic Management (UAS); Command, Control, Communication (C3); Detect and Avoid (DAA); Design and Airworthiness Standards; Specific Operations Risk Assessment (SORA), in the latter case complementing work developed by the Joint Authorities for the Regulation of Unmanned Systems (JARUS); and Enhanced RPAS Automation (ERA). However, it was recognised that, such was the widespread interest in drones, including many stakeholders new to the aviation world, that contribution to drone standardisation would need to be conducted by a wider group than just EUROCAE members are. As a result, the European Union under the chair of EUROCAE established the European UAS Standardisation Coordination Group (EUSCG).

[17] https://www.easa.europa.eu/document-library/opinions/opinion-012018
[18] https://www.eurocae.net/about-us/working-groups/.

This group has created a UAS standardisation rolling development plan[19] that brings together all the European UAS standardisation activity under one umbrella, allowing this activity to progress in a coherent and integrated fashion, with contribution from the widest possible range of interested stakeholders.

5. CONCLUSION

5.1 Europe has a long and well-documented experience in the integration of unmanned aviation into the European Aviation System, and States have been involved with addressing the ATM integration problem for many years. Developments in technology have added impetus to the demand for more unmanned flight, and the increased demand for widespread use of UAS/drones has made it imperative that Europe adopt a harmonised and coordinated approach to the resolution of the problem.

5.2 The SESAR JU has published the roadmap for the integration of UAS into all classes of airspace, and this brings together all UAS activities from an R&D perspective into one coherent plan in the process of being incorporated into the all-encompassing European ATM Master Plan. It describes a two-thread approach, allowing separate developments in the fields of IFR RPAS integration, and U-Space. This distinction is necessary in the earlier stages of research and deployment, anticipating the whole aviation environment to evolve together as one.

5.3 European R&D projects on UAS are centred on the activities of the SESAR JU. The European Commission is providing regulatory and operational support to projects that are technologically mature, yet struggle with operational and regulatory issues. The EU Demonstrator Network is sharing the expertise of these projects. Many European agencies, ANSPs, industrial entities and operators are cooperating to deliver a comprehensive range of projects. Military activities form an essential part of this, allowing the military both to contribute to the European body of knowledge, and to benefit from the work of civil agencies. U-space is a key European initiative that is enabling the rapid development and deployment of U-Space services in Europe, with contributions from all interested stakeholders.

[19] https://www.eurocae.net/media/1514/version-10-rdp_17_02_2018.pdf.

5.4 The European Commission, with the active support of EASA, is leading the development of a regulatory framework suitable for all types of UAS operations, while the industry standardisation of UAS technologies and concepts is managed by the EUSCG, allowing all European UAS stakeholders to participate.

5.5 The Conference is invited to take note of progress in Europe in integrating UAS of all kinds with manned aviation.

— END —