NextGen - SESAR
State of Harmonisation

Third edition

Federal Aviation Administration

NextGen – SESAR
State of Harmonisation

Contents

About

Next Generation Air Transportation System (NextGen)

In the United States, the Next Generation Air Transportation System (NextGen) is the complete modernization of the national airspace system (NAS). It is a comprehensive suite of upgrades, technologies and procedures that improve every phase of flight and enable aircraft to move more efficiently from departure to arrival. NextGen will use satellite technology to enhance navigation and surveillance, deploy digital systems for communication, and improve information management. NextGen replaces automation systems and adds more operational capabilities to the NAS. The Federal Aviation Administration (FAA) continues to validate NextGen benefits through demonstrations, trials, and initial deployment of new systems and procedures. NAS operators and users, particularly participants in demonstrations and trials, are already benefiting from NextGen. Information gained from the demonstrations provides direct measurements of the ways specific NextGen capabilities can benefit NAS stakeholders and the public. Overall, NextGen expects to deliver USD 160.6 billion in benefits through 2030.

Additional information on NextGen is available at the website:
www.faa.gov/nextgen

Single European Sky ATM Research (SESAR)

SESAR is the technological pillar of the broader Single European Sky initiative aiming to modernise and harmonise Europe's air traffic management (ATM) system. SESAR's goal is to define, develop and deploy the operational solutions with technology enablers needed to increase the performance of Europe's ATM system. The SESAR lifecycle is composed of three parts: definition, development, and deployment.

Established in 2007, the SESAR Joint Undertaking (SESAR JU) is responsible for coordinating and concentrating all ATM relevant research and development efforts in the European Union (EU). It is a public-private partnership between the main public stakeholders (European Union - represented by the European Commission - and Eurocontrol represented by its Agency) and European aviation service and manufacturing industry.

The SESAR JU is also responsible for the definition of SESAR objectives and priorities through the European ATM Master Plan, which represents the common roadmap driving ATM modernisation in Europe.

Established in 2014, the SESAR Deployment Manager (SESAR DM) is responsible for the implementation of SESAR Solutions that require synchronised deployment as part of a "Common Project" mandated by EU law. The SESAR DM plans, coordinates, synchronises and reports on the implementation of Common Projects. Complementing these tasks, the SESAR DM is also the Data Link Services implementation Project Manager in Europe. The SESAR DM is a not-for-profit international association established under Belgian Law, composed of leading airlines, airports and air navigation service providers, selected by the European Commission to perform the SESAR DM function.

Additional information on SESAR is available at the website: www.sesar.eu

NextGen – SESAR collaboration

In 2011, the U.S. and the EU signed a Memorandum of Cooperation (MoC) on Civil Aviation Research and Development (R&D). In December 2017, the MoC was amended to cover the full lifecycle of SESAR and NextGen programmes, including deployment under a new Annex 1 for ATM modernisation containing three appendices on: R&D (appendix 1), performance measurement (appendix 2) and deployment coordination (appendix 3). The aim of the cooperation is to ensure the necessary harmonisation of the two programmes and to secure global interoperability, in particular for airspace users. Each appendix is implemented through coordination plans detailing terms of reference, goals and the activities to be undertaken under the MoC. These coordination plans also help to mitigate identified risks and allow for the engagement of stakeholders as part of the process.

Message from the Co-Chairs of the US–EU MoC Annex 1 Executive Committee (EXCOM)

As global air traffic has grown in both volume and complexity, the dependency on modernising while increasing safety and efficiency is vital for both the United States and Europe. Advancements in technology have led to improvements on local and national scales; however, a fully interconnected aviation system demands global solutions.

The United States and Europe are working together to ensure we are not only harmonising NextGen and SESAR, but are also a global example of how two complex ATM systems can work together to achieve harmonisation and interoperability to fulfil the ideals of the ICAO Global Air Navigation Plan (GANP). Together we are working to design and implement solutions that not only work for us but also can work globally.

This document is a product of years of work between subject matter experts from both the United States and Europe. We may have different approaches; but we work hard to realise harmonisation. This involves meeting together multiple times per year from the executive to the subject matter expert levels.

We still have much work to do as we look to the future. Exciting advancements and innovations require us to work closer than ever before. We will continue to do that as we strategise and advance not only our two complex systems, but also a globally interconnected system that brings unparalleled levels of safety and efficiency.

Dan Elwell, Acting Administrator and Chief NextGen Officer, Federal Aviation Administration, and Co-Chair of the Executive Committee (EXCOM)

I n 2017, we celebrated 10 years of the EU-US Open Skies agreement, bringing together the world's two largest aviation markets and linking more than 800 million people on both sides of the Atlantic. The agreement has led to a flourishing transatlantic aviation market that now serves 55 million passengers each year. Thanks to these collaborative efforts, 6.4 million more passengers have been able to fly to more than 52 city-pairs since the agreement was signed.

The U.S.-EU MoC is a key enabler to this growth, seeking to ensure harmonisation between two major ATM modernisation initiatives, NextGen in the U.S. and SESAR in Europe. When the MoC was conceived, the two programmes were both in their R&D phases, which meant that the cooperation initially focussed on research, development and validation activities.

Our joint efforts have now reached a high level of maturity and delivered important results in terms of promoting the global interoperability of ATM systems. This is why in 2017 we decided to extend the scope of the MoC to include deployment activities from both sides of the Atlantic, thereby addressing the full lifecycle of ATM modernisation.

The third edition of the NextGen/SESAR State of Harmonisation report reflects the wider scope of the MoC illustrating cooperation activities that are taking place also on deployment. This latest edition also provides updates on the major areas of current focus, notably in the areas of data communications, system-wide information management (SWIM), unmanned aerial systems or drones, and cyber security.

This document serves the purpose of reminding us of what can be achieved when two of the leading regions in aviation join forces. However, these efforts are far from self-serving since they will be fed into global discussions on interoperability and harmonisation at ICAO's Thirteenth Air Navigation Conference in October 2018.

Maurizio Castelletti, Head of Unit, Single European Sky, DG MOVE, European Commission, and Co-Chair of the Executive Committee (EXCOM)

Executive summary

The purpose of this publication is to provide a summary of the current state of progress towards achieving the necessary level of harmonisation and global interoperability between NextGen and SESAR.

More broadly, the publication reflects the current and planned collaboration efforts by the U.S. and the EU to harmonise and secure the modernisation of ATM not just across the Atlantic but globally in support of the International Civil Aviation Organisation (ICAO) Global Air Navigation Plan (GANP) and its Aviation System Block Upgrade (ASBU) programme.

Both NextGen and SESAR recognise the need to integrate the air and ground components of their respective ATM systems. This requires greater efficiency in the planning and execution of flight trajectories and the seamless and timely sharing of accurate information. The U.S.-EU harmonisation work aims to ensure that modernisation in air navigation systems worldwide supports a high-performing aviation system over time, based on global cooperation leading to seamless operations and safe and efficient practices for the airspace users and the travelling public.

NextGen and SESAR have together made significant progress in several critical areas since the publication of the first edition of the State of Harmonisation in 2014 and second edition in 2016. This third edition provides an update on each of these areas and reflects the broadening scope of the MoC, which was expanded in December 2017 to include all aspects of the ATM modernisation lifecycle, from planning to development and deployment.

The principal areas in which progress has been achieved are as follows:

▶ Coordination in support of ICAO - The U.S. and Europe are supporting ICAO in developing the next edition of the GANP in preparation for the 40th ICAO Assembly in 2019. This includes collaboration on a high-level trajectory-based operations (TBO) architecture and on the vision, conceptual roadmap and performance ambitions which will be included in the executive part of the GANP.

▶ Harmonsation risk management - A new joint harmonisation risk issue opportunity management (HRIOM) framework has been established, to provide a strategically-aligned view of organisational,

institutional and structural challenges to achieving NextGen
and SESAR goals with respect to global harmonisation and
interoperability.

▶ Air/ground data communications - The first joint U.S.-EU air/ground
data communication strategy supported by industry from both
sides of the Atlantic was delivered, clearly identifying targets, risks,
and concrete actions on mitigating divergence and enabling the
transition.

▶ SWIM - An initial joint U.S.-EU SWIM strategy has been developed.

▶ Navigation - There has been progress in developing on a joint U.S.-
EU navigation systems roadmap.

▶ UAS/Drones - Collaborative has been established on the
harmonisation and interoperability aspects related to the integration
of unmanned aerial systems, or drones.

▶ Cybersecurity - Harmonisation activities on cybersecurity have been
initiated, aimed in particular at the development of a common trust
framework enabling secure interoperability for the exchange of
information.

Introduction

The U.S. and Europe are modernising their ATM systems through the NextGen and SESAR programmes respectively that develop new capabilities introducing new enabling technologies and operational procedures. Specifically, these modernisation efforts are enabling a move from a ground-based ATM system, using radar and voice communications, to an integrated air-ground aviation and ATM system using satellite-based navigation and digital data communications. The goals on each side of the Atlantic are to improve overall aviation and ATM system performance, particularly in the areas of flight efficiency and the environment, while also meeting expected demands for increased capacity and continuing to maintain the highest levels of safety.

In order for airspace users to reap the full benefits of these modernisation initiatives, it is essential that the new systems established in the U.S. and Europe are harmonised and interoperable. This means that flights will be able to operate in both U.S. and European ATM operational environments with the same set of capabilities in the on-board equipment to navigate, communicate and report their position. Failure to meet this global demand for harmonisation and interoperability would burden airspace users with the need to carry different types of equipment and capabilities, increasing cost and training requirements and resulting in overall ATM system inefficiency.

Ultimately, the collaboration between the U.S. and Europe is not just about achieving transatlantic interoperable standards but to support the broader goal of achieving global harmonisation and interoperability as articulated in the ICAO GANP and ASBUs. For that reason, much of the collaboration work described in this document directly supports global ICAO and industry standardisation efforts. The U.S. and Europe are for the same reason also supporting and engaging in initiatives of industry standardisation bodies, such as the RTCA and EUROCAE.

This third edition of the NextGen-SESAR State of Harmonisation document builds on the two earlier editions published in 2014 and 2016. It provides a summary of the current state of progress towards securing harmonisation and interoperability between the two modernisation programmes, and by incorporating deployment encompasses the full lifecycle view. The document serves as an outline for consideration of the current issues at stake and the challenges ahead. It demonstrates that differences are recognised and actions are taken to address them where necessary to ensure interoperability.

U.S.-EU collaboration in a global context

As two of the world's most significant aviation modernisation programmes, NextGen and SESAR have a shared interest in harmonisation as a means of ensuring interoperability. Both initiatives have identified common challenges and have adopted a performance-driven approach to modernisation. It is widely understood and accepted that the systems cannot be completely identical. However, harmonisation is necessary to:

1. Ensure that flights or aircraft can operate seamlessly between systems;

2. Ensure that common standards are available where needed;

3. Minimise costs and identify synergies by sharing results and efforts.

The scope of what should be harmonised is derived from the requirements expressed by airspace users through the consultation processes of both modernisation initiatives. Before harmonised and interoperable solutions and standards are agreed, a number of collaborative steps, such as comparing and validating concepts and identifying risks, need to be taken.

Global implications

While NextGen and SESAR are the two largest ATM modernisation efforts in the world, there are parallel initiatives being implemented in other regions. ATM modernisation is a complex task, but aviation industry stakeholders seek to harness the benefits of all of these initiatives, especially as traffic levels in civil aviation increase and new demands are placed on the system. In order to provide the greatest operational and performance benefits, these modernisation initiatives must harmonise to achieve seamless operations on a global basis. ICAO is supporting the modernisation and standardisation requirements of NextGen and SESAR and recognises them as global leaders of ATM modernisation, while maintaining its commitment to the broader global civil aviation community. These complex and comprehensive initiatives are therefore ensuring alignment with the GANP and supporting the ASBU programme.

Extension of MoC to full ATM modernisation lifecycle

The collaborative harmonisation work between the U.S. and the EU is executed under an MoC signed in March 2011. In the original MoC, the first annex addressed "SESAR-NextGen cooperation for global Interoperability", while a second annex was added to address "collaboration on ATM performance measurement". This annex provided the framework within which the FAA and Eurocontrol have published regular reports comparing operational ATM performance in the U.S. and Europe.

In 2011, the NextGen and SESAR programmes were each in their R&D phases, which justified the initial focus of cooperation on research, development and validation activities. Since then, cooperation under the MoC has reached a high level of maturity and has delivered important results in terms of promoting global interoperability of ATM systems. This, together with the fact that both programmes have moved into their implementation phases, led to an agreement to extend the scope of cooperation to include topics relating to the deployment of ATM systems.

Following negotiations between the U.S. and EU, an amended MoC was signed on 13 December 2017. Under the amended MoC, an Annex for ATM Modernisation was created with an Executive Committee established to govern and oversee the activities of three appendices dealing respectively with:

1. SESAR-NextGen cooperation for research, development, validation and global interoperability;

2. Collaboration on ATM performance measurement; and

3. SESAR-NextGen cooperation for deployment activities and global interoperability.

This State of Harmonisation document covers the activities of the first and third appendices, which both relate to NextGen-SESAR cooperation. In the future, the aim is to integrate the work on performance measurement more fully into the cooperation between NextGen and SESAR in order to provide a more comprehensive view of this collaborative ATM modernisation arrangement.

Harmonisation status

 A.Transversal activities

A1 | ICAO Global Air Navigation Plan (GANP) and Aviation System Block Upgrades (ASBU)

Description

Transversal activities are those strategic activities that cross all harmonisation work areas. They cover areas such as standardisation and joint work in support of ICAO initiatives, as well as operational concepts and architecture.

Both the U.S. and Europe were instrumental in supporting ICAO initiatives in the development of the GANP and the ASBU programme. The ASBUs provide a series of measurable, operational performance improvements, organised into flexible and scalable building blocks, modules and elements. The elements can be introduced as needed and implemented as each individual State and/or Region determines feasible based on their respective needs, capabilities and resources. The ASBUs provide the basis for ICAO's GANP 15-year outlook, and are arranged as five-year time increments starting in 2013 and continuing through 2028 and beyond. These dates indicate when the standards and regulations need to be in place in order to support regions and States in modernising their own aviation and ATM systems, thereby contributing to the modernisation of the global aviation system.

Rationale for harmonisation

The establishment and maintenance of the ICAO GANP provides the vehicle by which the U.S. and Europe are able to harmonise their plans and global approaches with other regions of the world to promote and support modernisation. The key aim for the U.S. and Europe is to continue to ensure that the language in the GANP is broad enough to encompass the needs of NextGen and SESAR, while allowing for regional and national implementation.

Status

The U.S. and Europe are supporting ICAO in developing the next edition of the GANP in preparation for the 40th ICAO Assembly in 2019. The GANP 2019, including the supporting ASBU framework, is being restructured into a layered plan. The U.S.and Europe coordinated with each other to help develop the vision, conceptual roadmap (providing the scope of ASBU Blocks 3 and 4) and performance ambitions, which will be included in the executive part of the new GANP. A high-level TBO architecture has also been developed and will be included in the ASBU framework.. In parallel, the U.S. and Europe work together in the Panel Project team to restructure and detail the ASBU framework.

Next steps

The update of the GANP for 2019 has commenced. This next update is expected to provide more detailed definitions of ASBU Blocks 2, 3 and Block 4. Coordination between the U.S. and Europe is ongoing to support the GANP update for 2019. It is important for these developments to remain aligned with the NextGen Implementation Plans, the European ATM Master Plan, and the SESAR Deployment Programme in order to reflect the needs of the U.S. and European systems.

A2 | Joint harmonisation and interoperability strategies - communications, navigation and surveillance (CNS) infrastructure and SWIM

Description

The U.S. and the EU have each established roadmaps for the development and implementation planning of communications, navigation and surveillance (CNS) capabilities and SWIM. These roadmaps, based on their respective ATM modernisation programme results, business and operational performance needs, and budgets, have been developed in consultation with stakeholders and in accordance with their required regulatory arrangements. The joint harmonisation and interoperability strategies balance short, medium and long term requirements in order to understand the interoperability risks related both to current deployment plans and to the options for developing and implementing solutions in the medium and longer term.

Rationale for harmonisation

Harmonisation is important in the areas where interoperability between regions is either required or desired, and for airspace users operating in or across both regions. There is also a need to identify jointly any challenges and opportunities regarding harmonisation and interoperability, in particular in response to the operational performance needs of the CNS infrastructure within the target trajectory-based environment.
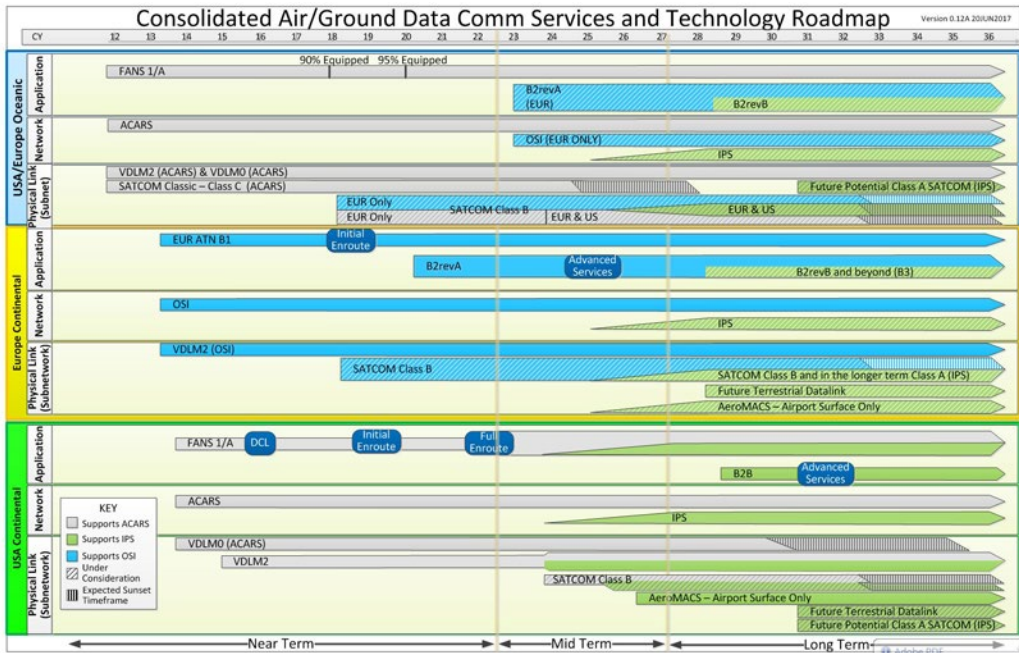
Status and next steps

Air-ground data communications strategy

Work under the MoC on a joint U.S.-EU air/ground data communications strategy was launched in 2016 and led to the delivery of an agreed strategy document to the Executive Committee in December 2017.

An updated version of the joint U.S.-EU air/ground data communications strategy has been developed. This updated strategy clearly identifies the harmonisation targets and risks, proposes concrete actions to mitigate risks of divergence, and considers transition aspects. Standards development organisations from the U.S. and Europe are together developing the standard for aeronautical telecommunication network using internet protocol suite (ATN IPS) work which is expected to be completed in 2020. Implementation risks, issues and opportunities related to the accommodation of future air navigation system (FANS), ATN open systems interconnection (OSI), and ATN IPS will be fully engaged once the standard is complete and there is more concrete timing for the introduction of avionics and its influence on the timing requirements for supporting the protocols. (See section D2 for more details on data communications.)

Navigation strategy

The joint navigation systems roadmap is being updated to align with NextGen and SESAR current capabilities and future strategies. The roadmap describes the expected and planned sustainability and evolution of the ground-based and satellite-based navigation infrastructure to support performance-based navigation (PBN) and precision approaches in both regions. (See section D3 for more details on navigation.)

Consolidated Air/Ground Data Comm Services and Technology Roadmap

Surveillance strategy

Discussions are ongoing regarding the possibility of developing a joint strategy that would provide a holistic view of surveillance infrastructure needs and capabilities. The strategy would build upon already positive coordination efforts between NextGen and SESAR on potential new surveillance technological enablers and associated key applications. The implementation of ADS-B on both sides of the Atlantic will be the focus of the collaboration. (See section D4 for more details on surveillance).

SWIM strategy

Following the successful development of the air/ground data communications strategy, it was decided to develop a similar strategy for SWIM. The intent is to articulate the NextGen and SESAR positions over the short, medium and long term, addressing improved and interoperable global ATM data and information exchange for the benefit of the airspace user operations.

Currently work is underway in ICAO's Information Management Panel (IMP) to harmonise SWIM. Anticipating further global harmonisation needs, a U.S.-EU SWIM strategy is under development, which will provide the U.S-EU harmonisation and interoperability perspective on a number of related topics, including roles within the global SWIM community, the required standardisation for SWIM, potential requirements for service management and an information (exchange) trust framework. An initial draft U.S.-EU SWIM Strategy has been prepared, and this will be further refined and developed over the coming months.

A3 | Separation provisions: Wake vortex/ Re-categorisation (RECAT)

Description

New modernised wake vortex separation provisions developed in the U.S. and Europe are yielding significant improvements in efficiency and throughput at airports, especially those with capacity constraints. The U.S. and Europe have been collaborating on an initiative called RECAT to "re-categorise" wake turbulence separation standards as a contribution to the ICAO Wake Turbulence Working Group (WTWG). Currently, this work is split into three phases:

▶ RECAT-1: Introduction of a new categorisation scheme, optimising the existing ICAO wake turbulence separation classes;

▶ RECAT-2: Deployment of a static 'pair-wise' regime, whereby each aircraft pair has its appropriate wake turbulence separation minima; and

▶ RECAT-3: Dynamic pair-wise separation, where actual conditions, such as aircraft mass and atmospheric/meteorological conditions, are considered when establishing the required wake turbulence separation minima. An example is time-based separation (TBS).

Recently, en-route wake has become a major and visible issue at ICAO. The U.S. and Europe will develop an approach to this topic in the 2018 work programme.

Rationale for harmonisation

This work involves coordination through ICAO on standards, regulatory roadmaps, and implementation planning of the related ASBU modules, and identification of the main challenges to the deployment of related results. In particular, ICAO will require guidelines to support the proposed 7 category RECAT solution.

Status

Both the U.S. and Europe have implemented RECAT-1 which divides the current ICAO heavy and medium categories into two sub-categories and sees the creation of a new super heavy category (different variants exist in the U.S. and Europe). Benefits from 3% to 17% additional throughput have already been achieved.

The U.S. has also implemented RECAT-2 at four sites, increasing the benefits above those

Definition Development Deployment

achievable with RECAT-1 through the use of categories that leverage pair-wise separations to better optimise RECAT for airport fleet mix. Meanwhile in Europe, RECAT-EU will be deployed with TBS in 2018, a first step towards RECAT-3.

Furthermore, working arrangements between the respective safety regulators (European Aviation Safety Agency, EASA, and FAA Flight Standards) on determining wake turbulence separation minima for new heavy aircraft have been discussed and are now moving forward.

In late 2017, the U.S. and Europe representatives developed a common proposal for a 7 category ICAO RECAT solution. A draft proposal for amendment (PfA) to ICAO Doc 4444 Procedures for Air Navigation Services – Air Traffic Management will be considered by the WTWG, leading to the initiation of an ICAO procedure for air navigation services (PANS) update to be delivered in 2020.

The existing European and FAA safety cases, coupled with deployment experience, form the basis for the proposed 7-category wake turbulence separation standard. The respective safety cases for RECAT-EU or the U.S. RECAT 1.5 support each separation minima, underpinned by operational experience and existing procedures drawn from the regulated European and US RECAT minima.

Next steps

Work will continue to support the ICAO 7 category deliberations and refinement process to ensure delivery of the PANS update by 2020. The next phases of work will include the pairwise (RECAT-2) and dynamic pairwise wake vortex separation concepts (RECAT-3, more commonly known as time-based separation or TBS).

RECAT-2 will require understanding the common metrics for developing separation minima that can be used to prepare a RECAT

proposal comprising a static pairwise matrix (for example 115 x 115 aircraft) of separation minima for RECAT-2, together with guidance on grouping aircraft into six or more categories that take into account specific airport mix (RECAT-1).

RECAT-3 will involve sharing of knowledge on controller decision support tools that can be used to support the predictable delivery of arrival and departure traffic using static pairwise separation minima and managing different operational and meteorological conditions.

An understanding of the en-route wake issue will be developed to prepare input to the ICAO WTWG with a view to developing mitigation procedures and system support.

A4 | Harmonising risk assessment

Description

The establishment of the MoC between the U.S. and EU has itself provided a successful means of identifying and managing the risks to interoperability arising from the NextGen and SESAR programmes. The MoC identifies the topics on which collaboration is necessary in order to secure interoperability and harmonisation. However, at the outset no formal risk management process was established. The U.S. and EU have now agreed to formally define such a process. The

joint Harmonization Risk Issue Opportunity Management (HRIOM) Framework provides the means to identify, classify and respond to risks, issues and opportunities associated with ATM harmonisation and interoperability objectives. This new framework will be integrated into the internal processes in each technical area of cooperation.

Rationale for harmonisation

When looking into the GANP and ASBU Block 2 and 3 timeframes, experts in NextGen and SESAR may identify possible interoperability risks, issues or opportunities. In such cases, an appropriate common response plan needs to be put in place. The NextGen-SESAR HRIOM is deemed an effective approach to addressing a wide spectrum of risks, issues and opportunities. It provides a strategically-aligned view of organisational, institutional and structural challenges to achieving NextGen and SESAR goals with respect to global harmonisation and interoperability. Specifically, HRIOM captures harmonisation risks and opportunities (RO); analyses and assesses impact on the objectives of both programmes; and then develops, implements and monitors response plans. The latter also extends to risks that become issues when response plans have not worked.

Status and next steps

Work is underway to define a common framework to identify ROs, assess their criticality and define appropriate response plans. An initial set of harmonisation objectives have been created to clarify the scope of the risks, issues and opportunities. Risks impacting research, standards development and deployment will then be identified and assigned to the respective coordination plans under the MoC. The goal is to have the framework fully in place and operational by the end of 2018.

A5 | Unmanned aerial systems (UAS)

Description

NextGen and SESAR work together on the integration of UAS - a growing and significant category of airspace users - into the aviation system. The purpose of the collaboration between NextGen and SESAR is to initiate, coordinate, and prioritise the activities necessary to support the evolution of all UAS categories as fully-integrated airspace users. The scope covers those remotely-piloted aircraft systems (RPAS) that need to operate seamlessly within the ATM system, usually as instrument flight rules (IFR) airspace users. In addition, it covers the development and integration of the rapidly-evolving smaller drone environment, where potentially thousands of drones will be enabled to operate through the implementation of an entirely new management concept: UAS traffic management (UTM)/U-space.

Rationale for harmonisation

To integrate all types of UAS into the existing aviation environment, it is necessary to address issues relating to UAS technology, operational procedures, certification, and regulation. A coordination plan is in place, which identifies and authorises necessary actions, and calls for periodic status reports in order to promote the safe, efficient, and harmonised integration

of UAS operations in ATM. This work involves coordination of content within relevant ICAO roadmaps, such as implementation planning of the ASBUs, and the ongoing activities of other interested bodies, such as EASA, Joint Authorities Rulemaking of Unmanned Systems (JARUS), EUROCAE and NASA. The focus is on developing strategies to address issues pertinent to full ATM integration from a harmonisation and interoperability perspective, both for individual RPAS as airspace users, and for the UTM/U-space concept as a whole.

Status

Collaboration between NextGen and SESAR is underway, aimed at building on the ongoing activities in the U.S.(FAA and NASA) and Europe to develop the UTM/U-space concept for civilian UAS operations in low-altitude airspace, as well as on the technologies and procedures needed to support integration of all IFR RPAS. The outcomes of the EU Drone Outlook Study identified the potential economic impact of growth in drone operations. It confirms the anticipated integration challenges, which need to be addressed in order to support the projected growth.

Next steps

The contribution from both the U.S. and Europe to ICAO panels and advisory groups in the area of RPAS and UAS are relevant and timely, given that dedicated and existing ICAO groups are addressing RPAS and UAS standards and guidance material. The U.S. and Europe have taken leading roles in developing standards and recommended practices (SARPS) and guidance for both international IFR operations of RPAS and domestic low altitude operations of UAS (UTM/U-space). The next steps will be to agree on how to integrate and coordinate both the more traditional IFR operations of RPAS and the emerging low altitude UAS operations to ensure safe operations with all other users of controlled and uncontrolled airspace.

A6 | Cybersecurity

Description

Cyber resilience remains a major challenge for both the U.S. and Europe. The fundamental issues are to protect information and reduce the danger of disruption in the cyber environment and the critical infrastructures that depend upon it in order to avoid damage to the ATM system.

Rationale for harmonisation

The ATM community increasingly depends on the exchange of timely, relevant, accurate, and quality-assured information in order to collaborate and make informed decisions. The development of a common trust framework enables secure interoperability for the exchange of such information.

Status

Harmonisation activities are underway related to the development of:

1. Common standards and use cases for identity access management (IAM);

2. Common security standards for internet protocol (IP) interoperability;

3. Common framework and guidelines for sharing cybersecurity information between aviation stakeholders;

4. Monitoring of the development of common standards and determination of their fitness for implementation into the respective FAA and SESAR infrastructures.

Additionally, some other ATM-related activities have been initiated, such as training and awareness, and enhancing governance arrangements at national and international levels, as well as the deployment of regional security operation centres.

Next steps

The aim is to make progress on a number of aspects, such as defining a possible common trust framework at ICAO level to secure the exchange of information relying on public key infrastructure (PKI) framework, which would be implemented regionally, and performing trials to demonstrate interoperability among regional PKIs. Activities to incept security at an early stage are conducted in the framework of Enterprise Architecture to secure by design future ATM systems.

This collaboration activity will also look into the potential for setting up structures and system tools to support cybersecurity information sharing between information sharing and analysis centres (ISAC), computer emergency response teams (CERT) and security operations centres (SOC) run by air navigation service providers (ANSPs), airport operators and airlines. In doing so, the aim would be to monitor the systems in order to detect and react to cyber threats. The sharing of best practices, intelligence on cybersecurity threats and coordinating responses to cyber incidents are other areas for future coordination work.

A7 | Exploratory research

Description

This activity serves as a clearing house to identify research topics that are currently missing from the MoC's collaboration in order that the activities span the full lifecycle, specifically from definition and early research to industrialisation and deployment planning. The activity builds on and fosters the good relationship already established between the U.S. and the European ATM modernisation initiatives and will endeavour to enhance this collaboration by further bringing together research organisations, academia and industry from both sides of the Atlantic that are relevant to NextGen and SESAR. Working with this long-established network community will raise awareness of the NextGen – SESAR exploratory research needs and will provide a deeper scientific perspective that will directly benefit the harmonisation and interoperability objectives.

Rationale for harmonisation

A shared understanding of respective exploratory activities in aviation supporting NextGen and SESAR goals is needed to support global interoperability. Bringing in the scientific perspective and support of respective research organisations and academia is essential to both SESAR and NextGen, especially in focussing on performance improvements. Specifically, this activity will help to harmonise concept development with relevant use cases verifying a common understanding and language, which will form a sound basis for future development activities, and act as a bridge for technology and information innovations towards higher levels of operational maturity.

The activity will also identify areas where a wider and/or more long-term scientific perspective may be needed (i.e. problem

statements) and establish priorities in relation to identified harmonisation and interoperability gaps where collaborative exploratory research would bring value.

The activity opens up the possibility for the U.S. and Europe for new opportunities and in enhancing the openness of R&D seminars/conferences to other global partners with a specific focus on NextGen - SESAR exploratory research results.

Status and next steps

NextGen and SESAR have together initiated technical interchange meetings (TIM) as a vehicle to identify research and improvement opportunities and to bring academic and industrial research from both sides of the Atlantic together. Two TIMs will take place in each year, alternating between locations in Europe and the U.S. The first TIM will be held in Brussels in September 2018 on artificial intelligence and machine learning. In addition to scientific exchanges, it is expected that TIMs will also help identify opportunities for further collaboration, e.g. secondment of researchers, access to data, models or software.

B. Information management

Description

The SWIM concept introduces a significant change in business practices regarding how information is managed and shared between the different ATM stakeholders during the lifecycle of an ATM system. The SWIM environment shifts the ATM information architecture paradigm from point-to-point data exchanges to system-wide interoperability. It also addresses the need to provide better data distribution and enables improved accessibility in terms of quality and timeliness, and therefore facilitates the provision of quality information to the right people at the right time. By sharing information and making joint decisions, the effectiveness of the ATM system will be increased.

SWIM consists of standards, infrastructure and governance enabling the management of ATM-related information and its information exchange among multiple parties. The focus of the harmonisation collaboration is on standards, policy, procedures, and controls as part of SWIM's overall governance. Standards harmonisation is focused on information models, information exchange service definitions, and technical interoperability standards for aeronautical, meteorological, and flight and flow information exchange. With respect to deployment, processes and requirements are intended to be harmonised as much as possible to support airspace users' global operations. Ultimately, the aim is to

avoid unnecessary complexity or unwanted duplication of SWIM-based information access and supportive administration processes.

Rationale for harmonisation

The goal is interoperability for the ATM stakeholders operating at local, regional and global level. SWIM harmonisation does not imply that all information exchange standards and infrastructure need to be harmonised. Globally applicable standards will focus on the information exchanges required between both air and ground-based global actors. Harmonisation of SWIM standards supports the needs of ATM stakeholders operating at a global level.

Status

Progress has been made on standardisation in a number of areas of SWIM. A SWIM concept of operations (CONOPS) was prepared in a joint effort to support ICAO's ATM Requirements and Performance Panel (ATMRPP), forming the baseline for the work of the ICAO Information Management Panel (IMP). Based on this CONOPS, SWIM is now further refined with major contributions from NextGen and SESAR, around the concepts of Services, Information, Technical Infrastructure and transversal considerations related to Cybersecurity and Governance. A next iteration of the ICAO SWIM Concept reflecting these new inputs is under preparation and its release is expected by early 2019.

Based on the ICAO 12th Air Navigation Conference (ANC/12) decision, significant work was conducted in creating the ICAO ATM information reference model (AIRM). A release candidate of the AIRM was made available to ICAO for their consideration by late 2017. The community of interest developing and maintaining the AIRM is in its definition phase and will be in a position to support ICAO with the AIRM by late 2018. An initial information

service development framework has been defined and, when further validated, will support the various communities of interest with a framework for developing the required information service overviews. Significant progress has also been made in aligning NextGen and SESAR registry requirements to align the respective ways of implementing information service overviews and to ensure interoperable registries supporting providers and users of information services.

The U.S. and Europe continue to collaborate making sure SWIM developments are jointly raised to the ICAO Information Management Panel (IMP) and ATMRPP, and Meteorology Panel (METP) when appropriate.

On specific data domains, the following progress was made:

Aeronautical information

Developed jointly by the U.S. and EU, the aeronautical information exchange model (AIXM) has become a de facto global standard for the exchange of aeronautical information through new digital aeronautical information management (AIM) systems that are now being deployed globally. Work has started on the development of AIXM 5.2 to include new concepts and improvements to the existing AIXM.

Meteorological information

The weather information exchange model (WXXM) developed jointly by the U.S. and EU, and the meteorological information exchange model (IWXXM), developed by ICAO and the World Meteorological Organisation (WMO) supported by the U.S and EU, cover all the latest ICAO requirements plus specific U.S.-EU needs. Both exchange models align with international standards for geospatial and temporal information, similar to AIXM version 5. New versions of IWXXM and WXXM will be released in Q4 2018/Q1 2019 to support the latest version of ICAO Annex 3.

Flight and flow information

A globally applicable baseline flight and flow information exchange model has been established in support of flight and flow information for collaborative environment (FF-ICE) Step 1. Referred to as the flight information exchange model (FIXM), this model was developed by global partners, reporting to the relevant ICAO panels for FF-ICE development, with leading contributions from both the U.S. and the EU.

SWIM governance

A joint SWIM governance policy is being developed to provide guidance for harmonised Service Lifecycle Management (SLM) and an interoperable public key infrastructure (PKI) architecture. This SWIM governance harmonisation effort ensures the ability for ATM stakeholders to commonly access different SWIM environments while maintaining interoperability and continuity in services.

Next steps

The evolution of the various data domain oriented information exchange models (AIXM, WXXM, IWXXM, FIXM) is a continuous effort and subject to ongoing coordination between U.S. and EU. Building on the U.S.-EU SWIM strategy, both programmes will continue to coordinate the further development of the SWIM standardisation framework including the relevant and appropriate governance in order to prepare and agree upon common positions to be presented at ICAO through the IMP or ATMRPP when relevant.

Building on ongoing exchanges regarding an information service development framework and a coordinated registry framework, discussions are also taking place on the further required definition of information services in support of global information exchange. These will be, where required, aligned and validated through future demonstration activities as described in Section E of this publication.

With respect to deployment, NextGen and SESAR will exchange and analyse information and work on harmonised processes and implementation frameworks where assessed beneficial. Further topics related to U.S. and European SWIM implementation cooperation that lead to common solutions and greater efficiency for ATM will be addressed. These include risks, opportunities, and lessons learned e.g. validation and verification procedures, public key infrastructure (PKI) and SWIM registry and stakeholder management.

C. Trajectory management

C1 | 4D Trajectory (4DT) Management

Description

Trajectory management aims to improve air traffic operations and increase the overall predictability to all users of the aviation and ATM system. This benefits all aviation partners and stakeholders alike.

Four-dimensional (4D) trajectory management is a precise description of the aircraft path derived from the current flight plan (latitude, longitude, altitude) and the additional component of time. FIXM is the vehicle used to exchange 4D trajectory information. 4D trajectory management enables airspace users to plan and agree to fly an intended route, allowing for predictable target times within agreed and predictable time windows, while maintaining safety and taking into account weather conditions.

A major component of the 4D trajectory management concept is FF-ICE, which supports TBO through the exchange and distribution of information. NextGen and SESAR are leading efforts with global partners to coordinate work in the area of 4D trajectory management and FF-ICE.

Rationale for harmonisation

Global harmonisation is required for the trajectory management concept as well as for information and operational procedures. TBO is a key objective for NextGen and SESAR and harmonising 4D trajectory management is critical for the successful global adoption of this operational evolution.

Status

FIXM remains an integral component of the development of 4D trajectory management. Progress is being made on the inclusion of 4D trajectory management scenarios into FIXM. The U.S. and Europe have also made strong inroads in 4D trajectory management and FF-ICE development via ICAO panels, specifically the ATMRPP, and through work with the ICAO Secretariat. In March 2014, the ICAO ATMRPP panel initiated and are well under way with the development of a global TBO concept under the joint leadership of the U.S. and Europe.

The U.S and Europe are reaching agreement on the exchange of ground-to-ground and air-to-ground trajectories. Joint efforts have started to detail the scope of FF-ICE/execution (new term for FF-ICE/2). This includes the information exchanges and synchronisation between decision making processes. Intensive joint efforts continue to finalise the provisions for FF-ICE/planning (FF-ICE/1) and to develop detailed implementation guidance material in time for the planned applicability date of 2020.

The U.S. and EU have initiated technical discussions focusing on the exchange of information referring to arrival management (known as AMAN in Europe, and time-based flow management, or TBFM, in the U.S.) and PBN. This exchange of information will result in understanding conceptual and technical similarities and differences between these advanced arrival management approaches, in turn enabling the identification of opportunities to harmonise advanced arrival management operations. In this respect, TBFM and AMAN lexicons have been developed to ensure clear communications when discussing performance-based harmonisation and

collaborative efforts. Furthermore, the exchange of information has provided a better understanding of how each system works and how these systems relate and interact with each other. A particular area of focus of these exchanges has been to gain a common understanding of the approach to use PBN in conjunction with advanced arrival management capabilities, thereby enabling trajectory-based operations which can be used to improve the overall performance of ATM operations. Ongoing and future collaboration activities also include sharing lessons learned from the operational implementation of these capabilities.

Next steps

Joint work continues on the development of provisions and implementation guidance for FF-ICE/planning. The provision and guidance material are expected to be completed in 2018. Further detailing of the TBO architecture (as prepared for the GANP 2019) is needed to consistently direct the transformation of ATM

towards TBO. The development of use cases for FF-ICE/execution is an integral part of this joint effort.

The agreement of both the U.S. and Europe to support 4D trajectory management and FF-ICE on the IMP and other panels is fundamental for the development of several areas of the MoC. This work will require continued close transatlantic collaboration.

The next steps will be to agree on how to integrate and coordinate flight, aeronautical, and MET information exchange models into the overarching architecture of information management in relation to 4D trajectory-based operations, and to further study the impact of TBO on the cooperation of the MoC towards continued support for the collaborative work with ICAO.

D. Communications, navigation and surveillance (CNS) and airborne interoperability

The transition from current tactical operations towards TBO is a cornerstone of both the SESAR and NextGen initiatives. With TBO, the ATM system will facilitate gate-to-gate optimisations where flights can operate performance-based trajectories both in the air and on the ground. In this environment, CNS and avionics play a key enabling role. The transition towards TBO implies an evolution of the CNS and avionics infrastructure to ensure the foreseen services can actually be delivered in a TBO environment.

D1 | Avionics roadmap

Description

The joint U.S.-EU avionics roadmap, developed in collaboration with the aviation industry, aims to identify evolutions foreseen in U.S.-EU avionics technologies. This baseline roadmap identifies and provides timelines for development of aircraft capabilities for navigation, surveillance, communications, and information domain in line with the evolution of the airborne-ground integrated ATM concept and architecture.

Rationale for harmonisation

Many future air navigation systems and procedures will impact aircraft avionics. This collaborative work therefore seeks to identify the standards required for users to operate in both U.S. and European airspace.

Status

The joint U.S.-EU avionics roadmap was updated in 2016 to reflect the impact of latest regulatory guidance material. In parallel, operational capabilities are being addressed through joint RTCA-EUROCAE standards development activities.

Next steps

The roadmap will be updated to include new standards, including industry standards, as necessary when there are agreed results from other areas of U.S.-EU cooperation and in particular as a consequence of the air/ground data communications strategy.

D2 | Data communications (DataComm)

Description

Both NextGen and SESAR are continuing to develop procedures requiring the integration of added air/ground data communications (DataComm) capabilities. Harmonisation work has concentrated on datalink applications and datalink technologies. This includes, but is not limited to, very high frequency (VHF) datalink, satellite communications, aeronautical mobile airport communication system (AeroMACS), future terrestrial datalink and internet protocols for air-ground data communications. In addition to DataComm applications and technologies harmonisation efforts have focused on testing, benefits and metrics, end-to-end certification, monitoring and control, operational qualification, and operator and industry coordination.

Rationale for harmonisation

Air-ground DataComm is a cornerstone of U.S.-EU modernisation efforts and introduces services that allow the evolution from the current workload-intensive, voice-based air traffic control towards a data message environment with voice remaining to be used primarily for emergency and non-routine communications. The move to data communications will result in greater efficiency by reducing voice read-back, hear-back operations, and improved safety by reducing the possibility of errors. It also allows more complex and greater volumes of information to be communicated via data than can be provided by voice today. Airspace users are at the heart of this DataComm harmonisation process. Offering harmonised solutions to users will avoid a proliferation of different and non-interoperable options and should also facilitate and expedite deployment

of selected and harmonised technologies. Airspace users with operations in both the U.S. and Europe are set to benefit most since the harmonised technology solutions will translate into single/simplified equipage requirements. For this reason, the U.S. and EU aim to achieve interoperability and harmonisation to the level needed for airspace users to operate seamlessly in or out or overfly the airspace without the need for separate equipment for similar ATM capabilities.

Status and next steps

A new version of the joint NextGen-SESAR air-ground DataComm strategy was developed within the framework of the MoC's transversal activities (see section A2). The previous version of this strategy identified the target data communications environment that will ensure convergence between the U.S. and EU and also described possible combinations of three elements, namely applications, networks and physical links, which are required for enabling interoperability. The updated version confirms the harmonisation targets for ATM operations in respective continental and oceanic airspace based on:

▶ ATN/IPS for the network

▶ Baseline 2 (B2) services for the ATM operational service applications, and

▶ A mix of current VDL Mode 2, new high bandwidth SATCOM and a new terrestrial datalink.

In terms of the physical link element, while Europe looks to SATCOM and the new terrestrial data link to complement the VDL Mode 2 link when additional capacity or performance will be required in the future, the U.S. does not have the same requirement for either alternative at this point. However, in order to maintain harmonisation, the U.S. will support Europe on the development of global standards.

It is important to note that the agreed joint target of using internet protocol suite (IPS) standards for the network component in the medium and longer term will trigger interoperability and harmonisation opportunities that will need to be clarified and elaborated upon across all three abovementioned elements. IPS implementation is expected to start ramping up by 2030 leading to a 100% IP environment in the future. It will therefore be important to support the standards development and validation in particular for IPS (see also below), completion of which is targeted for 2020.

The updated strategy addresses risks and proposes concrete actions to mitigate risks of divergence. It has been agreed that it is essential to act now to de-risk this convergence and prepare the grounds for it to materialise. Both the EU and U.S. need to support the definition, validation and standardisation of the required global aviation standards. Particular focus should be paid to the cybersecurity element, notably the definition of issues and mitigation actions.

The new version addresses the transition from now to full harmonisation, pointing to the network element (moving from ACARS in the U.S. and ATN/OSI in Europe to ATN/IPS) as the biggest challenge in this path, and describing some key scenarios ("do nothing" and "implement gateways"). Considering the investment implications and the global consequences of the transition, both the U.S. and Europe will continue to evaluate and clarify the transition options available.The future activities should focus on the technical aspects as well as determine likely implementation scenarios, including the deployment architecture, operational concepts and the economic impact for airspace users, as well as for the overall aviation community.

DataComm applications: datalink applications

Although there are similarities within the modernisation strategies for DataComm by both NextGen and SESAR, they do not completely align. Agreement has therefore been reached on a timeline for convergence towards a standard for baseline 2 (B2) DataComm services to facilitate wider stakeholder buy-in and commitment, all supportive of technology advancements. This timeline is subject to further review as there are evolutions (budget, readiness, avionics, etc.) in the plans on both sides.

The agreement resulted in an initial release of a standard to allow for the European implementation of initial 4D trajectory (i4D) operations. This first release of the B2 DataComm services standard was subsequently finalised and published by RTCA and EUROCAE in the first half of 2014. A second step allowing for the U.S. implementation was completed in April 2016 with the publication of a second and final standard for the full convergence towards common B2 DataComm services.

Specifically, this final standard:

▶ Allows for more advanced communications between the aircraft and ground ATM, making it possible to better plan and time slot arrivals;

▶ Enables more advanced communication regarding the use of satellite-based procedures, such as required navigation performance, thus providing increased flexibility to use more efficient routes;

▶ Allows controllers to convey detailed information to pilots about wind conditions along the path they are scheduled to fly;

▶ Addresses aircraft spacing.

DataComm technology: VHF datalink

Very high frequency (VHF) datalink mode 2 (VDL2) is a standardised technology in ICAO, EUROCAE, RTCA and AEEC, and is already deployed operationally in some areas including the U.S. and Europe. However, as the use of the system becomes widespread, the need for continued improvement in its defined characteristics is confirmed. One of the latest areas of work in the VDL2 standards concerns the so-called 'multi-frequency' capability, i.e. the operational usage of the planned capability of VDL2 to work in multiple channels. In this context, the coordination plan between the U.S. and the EU has allowed for exchanging best practices, findings (and associated contributions to standards bodies), capacity assessments, in service observations and future plans.

In addition, future terrestrial datalinks, as well as possible satellite communications systems, are being investigated to complement the VDL2 link when additional capacity or performance will be required in the future. While the U.S. does not have the same requirement for either alternative at this point, the U.S. will support Europe in developing and maintaining common and global standards.

The latest work undertaken on VDL2 standards is the so-called 'best-in-class' testing , i.e. additional clarifications about the optimal usage of VDL2 on multiple channels. Tests were performed on the European side to optimise the performance of the VDL2 network. In this context, the coordination plan between the U.S. and the EU has allowed for exchanging best practices, findings (and associated contributions to standards bodies), capacity assessment, in service observations and future plans.

DataComm technology: Satellite communication (SATCOM)

The RTCA, EUROCAE, ICAO and SAE/ AEEC have approved the initiation of

SATCOM standards development to support NextGen and SESAR requirements. These new standards are for new technologies, which are expected to be part of the future communications infrastructure underpinning ATM data communications. The SATCOM standards will indicate the system requirements necessary to achieve the required communication performance (RCP) for oceanic and continental airspace operations. The new SATCOM systems could supplement the VDL2 communications for domestic data communications.

With the completion of the standards, including minimum operational performance specification (MOPS), minimum aviation system performance standard (MASPS), SARPS, and SAE/AEEC standards for the new SATCOM systems, these documents will help to achieve harmonisation both for oceanic operations as well as for continental operations. Additional approval is required by each associated spectrum licensing authority to ensure that use of the new SATCOM systems is permitted in domestic airspace. SATCOM systems are leading the way in terms of offering broadband data channels that will interface to a variety of legacy and next generation avionics. During standards development, it is important to ensure commonality of interfaces and architectural provisions that facilitate both NextGen and SESAR concepts for domestic air traffic service data communication. The current work is focusing on the completion of the standards covering Class B SATCOM systems and in the future work will continue for Class A systems.

DataComm technology: AeroMACS

Aeronautical mobile airport communication system (AeroMACS) is the first of the new standardised communications enablers in the context of the future communications infrastructure required to support emerging operating concepts from NextGen and SESAR. Since very early on, the U.S. and

Europe have worked in close coordination to find synergies and avoid duplication on AeroMACS activities. This has resulted in the joint development of an AeroMACS profile (a selected subset of the capabilities offered by the worldwide interoperability for microwave access or WIMAX standard), which identifies the required features in order to support global interoperability. The profile has been published by both RTCA and EUROCAE, which have also jointly developed and published the AeroMACS MOPS. In addition, the ICAO SARPS technical manual is now complete as well as the ARINC AEEC form, fit and function avionics standards.

DataComm technology: Internet protocol for air-ground data communications:

RTCA, EUROCAE, ICAO and SAE/AEEC have agreed on initiating IPS development as part of the future communications infrastructure. The IPS standards will provide a more efficient protocol to that of the current aeronautical telecommunications network (ATN) open systems interconnection (OSI) protocol, which was specifically designed for aviation use. Moving to IPS standards will lead to reduced costs and improved performance.

There has been ongoing coordination and collaboration to this point in gaining approvals from the standards development bodies to carry out this work. Committees have been formed and in all cases work has been initiated. The end result will be a profile, MOPS, MASPS, SARPS and SAE/AEE standards for IPS, which will enable harmonisation between all future air-ground communications systems.

With respect to deployment, NextGen and SESAR will exchange and analyse information and work on harmonised communication processes to increase the visibility of the progress of the corresponding programmes and sources of information on both sides of the Atlantic. Further topics related to U.S. and European DataComm implementation

cooperation are risks, opportunities, and lessons learned, for example, in the areas of test and verification procedures, network performance monitoring and assessment of operational benefits.

D3 | Navigation

Description

A joint navigation systems roadmap is currently being updated, focusing on global navigation satellite system (GNSS) such as satellite-based augmentation systems (SBAS), ground-based augmentation systems (GBAS) (including GAST-D and multi-constellation/multi-frequency-based systems), and performance-based navigation (PBN). It also addresses the interoperability of the PBN infrastructure regarding the redundant or alternative system to GNSS.

Rationale for harmonisation

This aim is to ensure the harmonised development of avionics equipment and associated ground and satellite infrastructure in support of global interoperability. Efforts are also being conducted to ensure a consistency with ICAO's Navigation Systems Panel (NSP), RTCA and EUROCAE.

Status

The first version of a draft dual-frequency, multi-constellation (DFMC) SBAS MOPS is targeted for 2018. A short-term approach to provide alternate positioning, navigation and timing (APNT) based on distance measuring equipment (DME), to provide required navigation performance (RNP) without equipment changes, has been proposed through SESAR to several international fora. The FAA is planning to use a very high frequency omnidirectional range (VOR)/DME solution for near-term APNT needs.

Next steps

The navigation systems roadmap is being updated to depict current infrastructure along with planned capabilities and strategies for navigation evolution. The U.S. and Europe will continue efforts to coordinate standards development activities through RTCA and EUROCAE.

D4 | Surveillance

Description

Harmonisation work has continued in the areas of automatic dependent surveillance-broadcast (ADS-B), and the evolution of airborne separation assistance systems (ASAS) and applications that use ADS-B in the cockpit to support situational awareness, support airborne 'spacing' applications, and eventually the development of airborne 'separation' applications. Discussions are ongoing regarding the possibility of having a joint strategy that would provide a holistic view of surveillance infrastructure needs.

Rationale for harmonisation

Given the positive coordination between the U.S and EU on specific surveillance technological enablers and associated key applications (namely concerning ADS-B), it has become clear that sharing a joint strategic and holistic view on the surveillance infrastructure would benefit the community. As ADS-B is widely used for ATM application and as new surveillance enablers like space-based ADS-B are rolled out, a future opportunity to include a joint strategic activity on surveillance will allow both regions to compare plans, and harmonise performance requirements and services.

Status

Harmonisation has been well managed in the area of ADS-B applications and technologies, with the publication of numerous RTCA and EUROCAE documents in the areas of MOPS and safety, performance and interoperability requirements. Developments continue in this joint forum supported by NextGen and SESAR, including updates to the technical standards and development of further application standards. As part of the full lifecycle cooperation, the implementation of ADS-B is becoming a focus item for deployment cooperation.

Next steps

The U.S. and Europe will establish cooperation on deployment of ADS-B, mutual lessons learnt during implementation and related topics such as rationalisation of CNS infrastructure. Cooperation will continue with respect to standards development through RTCA and EUROCAE. Outcome of the work will be feeding the ICAO processes to establish a harmonised approach on global level.

E. Collaboration projects

Description

NextGen and SESAR work collaboratively on demonstration activities to show to global audiences the interoperability of new or updated technologies and procedures and the performance gains that can be achieved. The scope of these demonstrations may cover all phases of flight (planning, surface, departure, en-route and arrivals), with joint trials focussing primarily on flights between North America and Europe. As part of this activity, work consists of discussing joint, shared or supporting projects with common goals, accelerating the developments and/ or deployment of certain technologies and operational procedures contributing to global interoperability in support of ICAO's GANP and implementation of the ASBUs.

Rationale for harmonisation

It is key to demonstrate the interoperability of new technologies and capabilities and the benefits that they can bring in terms of operational and cost efficiency, the environment and safety, among other performance gains. These globally focussed demonstrations facilitate the accelerated development and implementation of technologies, operational capabilities, and procedures. Close cooperation ensures a consistent full life cycle approach, mitigating the risk for implementing stakeholders by the early identification of areas where information needs to be shared and subsequently where coordination may be required.

Status

A number of collaboration projects have been undertaken under the MoC, although no new projects are planned at the present time. Collaboration in the early years of the MoC focused on a number of operational activities through the Atlantic Interoperability Initiative to Reduce Emissions (AIRE) programme, a cooperative agreement between the FAA and the European Commission that promoted and harmonised environmental initiatives and procedures in European and North American airspace. AIRE flight demonstrations produced significant potential fuel savings and emission reductions.

Collaboration projects subsequently focused on activities where the early benefits of both NextGen and SESAR projects could be demonstrated, particularly efficiency and capacity gains. The FAA, SESAR and partnering organisations ran a number of global interoperability demonstrations on SWIM, namely the FAA's Mini Global in April 2016 and the SESAR SWIM Global Demonstration in June 2016.

Following the success of the FAA's earlier MiniGlobal I in 2014, MiniGlobal II looked at the 'cloud' infrastructure, and connectivity and data sharing using a global enterprise messaging service (GEMS) between multiple enterprise messaging services (EMS). The demonstration validated aeronautical and weather information standards by using additional datasets for complex use cases, and addressed the backwards compatibility of those global exchange standards.

Building on the positive outcomes of an earlier SESAR SWIM demo in 2013, the SESAR SWIM Global Demo in 2016 focused on demonstrating that global interoperability improves all ATM stakeholders' situational awareness and planning when information is shared and continuously updated via SWIM. The demonstrations exchanged data in real time between operators and stakeholders over secured connections. In several cases operational systems were used, thus demonstrating the global interoperability of SWIM.

Next steps

At the time of writing there are no specific plans for new collaboration projects, but the FAA and SESAR will continue to explore the possibility of performing collaborative validations and demonstration activities in fields that are complementary.

GLOSSARY

ADS-B	Automatic dependent surveillance-broadcast
AeroMACS	Aeronautical mobile airport communication system
AEEC	Airlines Electronic Engineering Committee
AMAN	Arrival management
ANC	Air Navigation Conference
AIM	Aeronautical information management
A-IM	Advance interval management
AIRE	Atlantic Interoperability Initiative to Reduce Emissions
AIRM	ATM information reference model
AIXM	Aeronautical information exchange model
ANSP	Air navigation service provider
APNT	Alternate positioning, navigation and timing
APV	Approach procedure with vertical guidance
ATN	Aeronautical telecommunications network
ATM	Air traffic management
ATMRPP	ATM Requirements and Performance Panel
ASAS	Airborne separation assistance systems (ASAS)
ASBU	Aviation System Block Upgrade
CCOM	Coordination Committee
CERT	Computer emergency response teams
CNS	Communications, navigation, and surveillance
CONOPS	Concept of Operations
DFMC	Draft dual-frequency, multi-constellation
DLS	Datalink services
DME	Distance measuring equipment
EASA	European Aviation Safety Agency
EMS	Enterprise messaging services
EXCOM	Executive Committee
FAA	Federal Aviation Administration
FANS	Future air navigation system
FF-ICE	Flight and flow information for collaborative environment

FIXM	Flight information exchange model
4DT	Four dimensional trajectory
GANP	Global Air Navigation Plan
GAST D	GBAS Approach Service Type D
GBAS	Ground-based augmentation systems
GEMS	Global enterprise messaging service
GNSS	Global navigation satellite system
HRIOM	Harmonisation risk issue opportunity management
i4D	Initial 4D trajectory
IAM	Identity access management
ICAO	International Civil Aviation Organisation
IFR	Instrument flight rules
IFPP	ICAO Instrument Flight Procedures Panel
IMP	ICAO Information Management Panel
IP	Internet protocol
IPS	Internet protocol suite
ISAC	Information sharing and analysis centers
JARUS	Joint Authorities Rulemaking of Unmanned Systems
NAS	National airspace system
NASA	National Aeronautics and Space Administration
NextGen	Next Generation Air Transportation System
NSP	ICAO's Navigation Systems Panel
MASPS	Minimum aviation system performance standard
MoC	Memorandum of Cooperation
MOPS	Minimum operational performance specification
OSI	Open systems interconnection
PANS	Procedure for air navigation services
PBN	Performance-based navigation
PfA	Proposal for amendment
PKI	Public key infrastructure
PPP	Public private partnership
R&D	Research and development
RECAT	Re-categorisation
RNP	Required navigation performance
RO	Risks and opportunities
RPAS	Remotely-piloted aircraft systems
RTCA	Radio Technical Commission for Aeronautics
SAE	Society of Automotive Engineers

SAI	AEEC Systems, Architecture and Interfaces Committee
SARPS	Standards and recommended practices
SATCOM	Satellite communications
SBAS	Satellite-based augmentation systems
SES	Single European Sky
SESAR	Single European Sky ATM Research Programme
SOC	Security operations centres
SWIM	System-wide information management
TBO	Trajectory-based operations
TBFM	Time-based flow management
TBS	Time-based separation
TIM	Technical interchange meetings
UAS	Unmanned aircraft systems
UTM	UAS traffic management
VDL2	Datalink mode 2
VHF	Very high frequency
VOR	Very high frequency omnidirectional range
WIMAX	Worldwide interoperability for microwave access
WMO	World Meteorological Organisation
WTWG	Wake Turbulence Working Group
WXXM	Weather information exchange model

Notes