EUROCAE

TECHNICAL WORK PROGRAMME

Public version 2022

EUROCAE Technical Work Programme

Edition 2022

Public version

Approved by the EUROCAE Council on 10 November 2021

Prepared by the EUROCAE Technical Advisory Committee

TABLE OF CONTENTS

1. INTRODUCTION

The purpose of this document is to provide an overview of the ongoing technical standardisation activities currently undertaken by EUROCAE together with the anticipated standardisation activities to be potentially undertaken by EUROCAE during the next five years, in order to illustrate the extent of the current and future EUROCAE work.

The foreseen future activities cover

- new or revised tasks to be allocated to existing WGs in the short term - a 2-year time frame
- the establishment of specific new working groups (WGs)

This document is intended to be used as an input to the EUROCAE Business Plan and TAC work programme for starting new and strategically relevant working groups in order to appropriately guide and size the future of EUROCAE activities.

In early 2020, the worldwide aviation was suddenly brought to a halt by the COVID-19 pandemic. This virus spread rapidly and resulted in outbreaks and fatalities worldwide. To stop the further spread of the disease, travel restrictions, sanitary measures as well as a more or less complete shut-down of the global economy were imposed. Entire fleets of aircraft were grounded, empty airport terminals were shut down and air traffic decreased by over 90% as travel came to a complete halt in the first half of 2020. Predictions for recovery vary in optimism, but all foresee several years before reaching again the traffic levels of 2019. Large state-aid programmes have been set up to support the aviation industry, including airlines, airports as well as the manufacturing industry.

As the TWP is being prepared, in the fall of 2021, EUROCAE still observes with great preoccupation the impact of the COVID-19 disease on the aviation sector, which is visible in all areas of the business.

EUROCAE was able to immediately shift all WG activities to a fully virtual mode, supported by the IT infrastructure we put in place some years ago. Nevertheless, there are some shortcomings due to experts being unavailable, member organisations changed priorities, the inability to meet in person to discuss the more difficult points. Overall though, the impact on the current activities is relatively limited.

COVID-19 might have longer-term consequences, e.g. if it delays the introduction of new technologies. On the other hand, it might offer opportunities as resources become available which were previously used on other projects.

Looking ahead, the community is defining strategies how to move on and is turning to post-COVID-19 activities, looking at opportunities this hard re-set might offer. Some of the pre-COVID-19 priorities need to be re-evaluated as issues have shifted dramatically. Whilst capacity limitations are not a prime driver for the next few years, the ATM network resilience, achieved through e.g. automation, digitalisation, efficiency, flexibility, new technologies, as well as the impact on the environment will become more prominent. This may also lead to a shift in the standardisation needs as perceived by the industry. The TWP attempts to anticipate this shift in activities in line with inputs received from the various stakeholders.

EUROCAE has been able to rapidly initiate activities aimed at facilitating recovery of the aviation sector, such as on aircraft cleaning and disinfection or the thermal recognition of passengers potentially carrying COVID-19 or the handling of infectious passengers by air ambulances. Other areas of potential standardisation activities are under review.

One particular area of changes impacting EUROCAE is for sure the increased importance of environmental factors, moving towards a more sustainable aviation in the future. The European Green Deal is a visionary policy: the use of new energy sources, the travelling public's preference for other modes of transport (trains), "flight shaming" and other aspects could impact aviation and hence the standardisation activities. Some of these were already raised at the 2019 EUROCAE Symposium, and are reflected in more detail in this edition of the TWP.

2. TWP DEVELOPMENT CONTEXT

This Technical Work Programme (TWP) has been developed by the Technical Advisory Committee (TAC) with the support of the EUROCAE General Secretariat, the outcomes of the Council strategy session (#314) held in June and in view of being presented to and approved by the EUROCAE Council as essential input for the Business Plan.

2.1. TWP CONTENTS

This document encompasses:

- Status of ongoing technical standardisation activities, provided by the EUROCAE General Secretariat;
- Anticipated technical standardisation activities to be initiated in the future by EUROCAE are resulting from an analysis performed by the Council and the Technical Advisory Committee of the overall aviation environment based on inputs provided;
- Description of Working Groups in the frame of their activities;
- Contribution from the General Secretariat through its participation to a number of various events (workshops, conferences, etc.) and working relations with partners;
- Taking into account the main takeaways from the annual EUROCAE symposium.
- Views of the Technical Advisory Committee (TAC) members together with the support of their parent organisations;
- This edition also includes a new chapter: Looking into the future.

This document is structured according to the following domains:

- Avionics (Non-CNS)
- CNS (Communication, Navigation, Surveillance)
- ATM
- Airports
- Services (SWIM, datalink, AIS/MET and ACDM)
- Security
- UAS, General Aviation and VTOL
- Aircraft electrical systems
- Artificial intelligence
- Miscellaneous

The following highlights of this update should be noted:

- Taking into account the increasing importance of greener and more environmentally-friendly aviation, Chapter 8 was enhanced significantly to address sustainability. It can be expected that additional standardisation activities will be launched in the coming year/s in this important domain. The Secretariat will also reinitiate the liaison with the CleanSky / Clean Aviation programme and Joint Undertaking to better understand any potential standardisation needs arising from their work.
- Another important focus area is space. For the first time, the European Commission Directorate-General for Defence Industry and Space (DG DEFIS), which develops and implements the European Commission's policies in the Defence Industry and Space sector, has reviewed and contributed to the TWP. A particular focus of their contributions is on the European GNSS strategy, Galileo and EGNOS.
- A new paragraph has been inserted to address frequency spectrum, as the appropriate use of the spectrum by aeronautical services is under scrutiny. A new spectrum WG is proposed to be created in 2022 (see CWP 315-5 for more details), jointly with RTCA, to develop good practice and guidance on the use and management of spectrum.

- In addition to European R&D programmes such as SESAR, CleanSky, H2020 projects, some national R&T projects have been initiated and are now reflected in the TWP.
- Several important initiatives to support the Covid recovery have been launched in 2020/21, which are now reflected in the TWP 2022 as well.
- A future-oriented Chapter 5, which was added in TWP 2020, is presenting a series of new elements that will influence EUROCAE work in several domains for the mid-term/long term. Some of these elements have been updated and added, and will be distributed to the respective domains when the situation has evolved sufficiently.

2.2. EUROCAE STRATEGY

This TWP has been developed according to the EUROCAE strategy, which delineates the scope of standardisation activities to be undertaken by EUROCAE.

EUROCAE covers standardisation activities in aviation in all areas. EUROCAE has its roots in Europe, nevertheless EUROCAE is an internationally recognised Standard Developing Organisation (SDO), known for its high quality, safety critical standards. EUROCAE's focus was initially the development of standards for aircraft equipment/system. This scope is no longer confined to electronic systems and does include any aviation related equipment, system, services or process aspects.

EUROCAE also has activities to develop standards for aviation-related ground systems and equipment for both ATM and airports, services, and many other areas.

Therefore, the scope of standardisation activities considered in this TWP relates to airborne, ground and space systems, covering operational and functional considerations, systems architecture, hardware, software, databases, process, service and operational aspects. EUROCAE also serves new entrants like UAS, VTOLs or others in aviation in a broader way. The activities are here often to serve the regulatory and certification frame with a full set of standards, aim to be recognised as acceptable means of compliance (AMC).

In addition, two important domains have raised and been added to this edition of the TWP: end-to-end assurance and environmental considerations.

2.2.1. End to End Assurance

With the ever-increasing complexity of the ATM Systems and operations being reliant on the interconnection of individual systems and constituents across physical and logical boundaries, the dependence upon the performance of the individual systems in ensuring the overall performance and operational acceptability is of great importance. End to End assurance that the performance of the total systems is being obtained is important to ensure continued operations.

In addition, the service-oriented approach under development for ATM operations emphasises the need for open and flexible architectures where the performance from the user perspective is in fact dependent upon the end-to-end assurance process.

It is therefore imperative that not only is the total End to End performance defined in a measurable manner, but the performance of the individual systems and supporting constituents are also defined in a measurable manner. When standardising new systems and/or new services that are to improve the overall level of ATM operational performance, EUROCAE is in a unique position to ensure that the defined characteristics that enable the performance are measurable.

2.2.2. Environmental considerations

Environmental considerations are of increasing importance on a political, social and technical level to aviation and therefore to EUROCAE standardisation activities, which could support the efforts in this important area.

According to several international studies, air transport contributes to 4.9 % of human-caused climate change, including emissions of carbon dioxide and other greenhouse gases, and with air transport further growing there is a greater need to evaluate measures aimed at reducing its potential damaging effects on the environment. A major

contributor to global warming is kerosene, a fuel used to power aircraft engines, which is not only a scarce resource but also emits carbon dioxide.

At the focus of discussions regarding the carbon footprint are therefore new, more performant engines, increased use of electric energy, hybrid propulsion or other alternative and sustainable sources of energy. Efficient and direct flight routings, combined with an efficient climb and decent profile, but also emissions during ground operations are all areas, which could contribute to reducing emissions.

In addition, noise pollution is a second important environmental factor, where airports and the surrounding infrastructure have an essential role to play.

ICAO is also very active on this subject: Their activities in the field are primarily focused on those problems that benefit most from a common co-ordinated approach, on a worldwide basis, namely aircraft noise and emissions. Most of this work is undertaken through the ICAO Council's Committee on Aviation Environmental Protection (CAEP), which consists of Members and Observers from States, intergovernmental and non-governmental organizations representing aviation industry and environmental interests.[1]

Considering the increased focus on sustainability, the relevant sections of the TWP have been significantly enhanced.

2.2.3. Global Navigation Satellite System (GNSS)

The European Commission, Directorate-General for Defence Industry and Space (DG DEFIS), has a strategy regarding the European Global Navigation Satellite System (EGNSS), along the following lines. Some EUROCAE WGs are implementing this strategy by performing relevant standardisation activities (see details in chapter 4).

Legacy aviation standards addressing GNSS are predominantly based on the use of a single GNSS constellation and a single frequency, namely GPS L1. The deployment of Galileo and the introduction of a new civil signal in the L5 aeronautical frequency band, brings improvements in terms of robustness and navigation performance. The upcoming declaration of the full operational capability of Galileo makes it the key enabler of Dual Frequency Multi Constellation (DFMC) new capabilities and benefits supported by the evolution of EGNOS towards augmenting GPS and Galileo dual-frequency. It is expected that avionics standards will embrace these new and updated systems to take advantage of the improved robustness and navigation performance. Standardisation activities are already in progress addressing DFMC including Satellite Based Augmentation System (SBAS) and Aircraft Based Augmentation System (ABAS) augmentation and DFMC antennas. In the upcoming years Ground Bbased Augmentation Systems (GBAS) are expected to evolve to support Galileo and dual-frequency. Other applications that can directly benefit from DFMC capabilities in both EGNOS and Galileo include:

- IFR rotorcraft onshore and offshore operations by enabling new operations and improving the navigation performance of others,
- ADS-B by exceeding the 99.9% availability for the 3 and 5 NM separations, enabling more demanding ones, and as an acceptable means of compliance of the SPI Regulation as per CS-ACNS,
- Aircraft tracking and distress, by exploiting the enhanced positioning accuracy and the provision of a search and rescue service by Galileo, and,

- on the UAS side, GNSS technology is considered as an enabler of e-registration, e-identification and geo-fencing foundation services for UAS at a first stage while tactical geofencing and tracking services can benefit as well from the precision and integrity provided by EGNOS and Galileo at a second stage.

2.2.4. Frequency spectrum

In January 2021, RTCA has initiated a discussion regarding the development of a special committee focusing on the usage and management of spectrum. An ad hoc group gathering PMC and other interested parties has met over the past few months to

[1] https://www.icao.int/environmental-protection/Pages/default.aspx

discuss of this project. In parallel of this discussion, EUROCAE TAC has also initiated a reflexion on the relevance of developing activities on spectrum in the European context. The drafting and definition of a proposal for a dedicated WG is progressing well and would be intended to be a joint activity with RTCA.

Dedicated spectrum resources are traditionally allocated to aeronautical use at no cost to support safety. In a context of resource scarcity and high market value associated with spectrum exploitation by other users, the appropriate use of the spectrum by aeronautical service is under scrutiny. The intention behind the development of a spectrum WG is to develop good practice and guidance on the use and management of spectrum. The resource is intended to support other WGs developing standards with spectrum aspects.

2.2.5. Next Generation Aviation Professionals (NGAP) Programme

The Next Generation Aviation Professionals Programme is an initiative, which was introduced by ICAO in 2009 to ensure that sufficient qualified and competent aviation professionals would be available to operate, manage and maintain the future international air transport system. EUROCAE launched their own NGAP Programme in 2020, but was forced to put it in hiatus, as priorities shifted during the COVID-19 pandemic. This programme aims to attract professionals into aviation and encourage students to pursue a career in the aviation industry.

EUROCAE is currently identifying suitable stakeholders and obtaining their concerns, needs, and expectations regarding hiring, retention, and attracting talent in aviation, as well as their views on gender equality and how education and training must evolve to adapt to future technologies. This programme will have a diverse set of stakeholders, ranging from industries across various domains in aviation, universities, research institutes, SDOs, and regulators. It aims to perform activities that would positively influence our stakeholders, students, and general public.

The NGAP Programme is immensely important in this time despite shifting priorities and the COVID-19 pandemic. Technological advancements continue to occur, and it is important to train personnel to cope with these changes and attract competent youth into the industry to ensure continuous workflow and avoid the forecasted shortage of personnel in the future. This is critical, given that a large contingent of the current generation aviation professional will soon retire, access to affordable training and education is increasingly challenging, and aviation competes with other industry sectors for highly skilled professionals. Based on this proposal, EUROCAE is keen to understand our members' needs and willingness to support such an activity.

2.3. EUROCAE TECHNICAL ACTIVITIES

The main EUROCAE technical activities consist in developing standards:

- in support of future regulatory requirements (e.g. ICAO, EASA, EU, FAA….)
- which could be recognised as Acceptable Means of Compliance AMC within the Aviation Safety Regulations
- which could be used as Acceptable Means of Compliance in support of SES Regulations
- in support of the ATM research, development and validation in Europe and globally
- in support of the industrialisation and deployment of SESAR and other R&D solutions
- in support of the European and global aeronautical Industry

Activities captured in this TWP are addressing those needs.

The expected start time of the work has been classified as:

- Current (meaning that a Working Group is currently active)
- Short Term (meaning that a Working Group is expected to be formed within one year)
- Medium Term (meaning that a Working Group is anticipated to be formed within five years)

2.4. EUROCAE DOCUMENT TYPES

The types of document produced by EUROCAE are defined in the latest edition of the EUROCAE Handbook, the ED Development process and supporting documentation.

Guidance documents are available for the drafting of EUROCAE deliverables in the Toolbox (accessible via the EUROCAE Workspace).

3. MAJOR STAKEHOLDERS SHAPING THE ENVIRONMENT OF EUROCAE TECHNICAL ACTIVITIES

The technical standardisation activities to be initiated in the future by EUROCAE have been identified from inputs coming from a number of different sources, namely:

- ICAO
- European Commission
- EASA
- International cooperation
- Standardisation in support of R&D, industrialisation and deployment
- European Standard Coordination Groups
- EUROCONTROL
- Standard Developing Organisations (SDOs)
- Aeronautical Industry (aircraft manufacturers, new entrants, airborne and ground system manufacturers)
- Air Navigation Services Providers (ANSPs)
- UAS Service Providers
- Airports
- Accident investigators (such as BEA, NTSB, TSB)
- JARUS
- Military organisations (e.g. EDA)
- Airspace users.

More generally, all concerned aviation stakeholders, and in particular EUROCAE Members, are free at any time to propose initiatives for EUROCAE technical work. These may result in additional inputs from industry, airspace users, service providers and regulators. Those proposals for new EUROCAE activities are submitted as Discussions Papers (DP). These are reviewed by the TAC and may result in amending existing standards or activities of existing WGs or in recommendations to the EUROCAE Council to set up a new WG. In the recent past, we observe more and more non-members approaching us to initiate standardisation activities, these organisations normally join EUROCAE as member during the process.

4. ONGOING AND FORESEEN EUROCAE TECHNICAL ACTIVITIES

4.1. AVIONICS (NON-CNS)

4.1.1. Purpose & Scope of activities of this domain

This Domain encompasses all standardisation activities, which are related to on-board equipment and systems without those in interaction with the external world (which are part of the CNS Domain). In addition, this Domain also encompasses standardisation activities related to the various system development activities.

Scope of activities therefore includes:

- Architecture and Networks
- Safety Systems
- System Engineering
- System Safety Assessment
- Environment.

4.1.2. Avionics Architecture and Network

Current activities of this sub-domain

EUROCAE WG-96 Wireless On-Board Avionics network is already active in this sub-domain. For details on the deliverables please consult the table in the annex.

Vision of future EUROCAE activities in this sub-domain

Following EASA and FAA's update of their IMA guidance, it may be appropriate to upgrade the IMA standard ED-124/DO-297 in the medium term.

4.1.3. Safety Systems

Current activities of this sub-domain

A number of activities are currently in progress to support the safety improvements these being:

- WG 76 AIS/MET Datalink Services (see 4.5.5)
- WG-98 Aircraft Emergency Locator Transmitters.
- WG-110 Helicopter Terrain Awareness and Warning Systems (HTAWS).

The lack of timely, accurate information on runway friction conditions in adverse weather conditions has been attributed a significant contributing factor to landing overrun accidents in slippery conditions. WG-76 is currently working on the specification of a datalink service providing such information to the flight deck. FAA is sponsoring research to develop feasible methods of using data from landing airplanes and report real-time runway friction conditions to air traffic controllers, airport personnel and flight crews of subsequent arriving airplanes (see 4.5.5).

WG-98 has developed

- ED-62B MOPS for Aircraft Emergency Locator Transmitters and
- ED-237 MASPS for Criteria to Detect In-Flight Aircraft Distress Events to Trigger Transmission of Flight Information.

The WG has continued its work to develop a MASPS for Return Link Service. The Return Link Service (RLS), which provides acknowledgment messages to distress beacons equipped with a Galileo receiver, through the Galileo L1 signal). The MASPS was published in February 2021. This activity is integrating EGNSS, therefore exploiting its enhanced positioning accuracy through the Search-And-Rescue service provided by Galileo. The use of GNSS improves the localisation of aircraft and the timely provision of rescue services. In particular, the integration of Galileo into COSPAS-SARSAT improves the system by:

- enabling nearly real-time detection and localisation of distress signals from anywhere in the world, significantly improving the latency between the beacon activation and distress localisation,
- making it easier to find the source of a signal by significantly boosting precision in comparison to the current situation,

- increasing availability and improving the detection of signals in difficult terrain or weather conditions thanks to the use of multiple satellites, and
- introducing a return link that the SAR operator can send back to the beacon to let people know that their distress signal has been received and a rescue mission has been initiated.

Following several offshore helicopter accidents, CAA UK started research to improve the Helicopter Terrain Awareness (HTAWS) function. The results of the research have been published in CAA UK CAP (Civil Aviation Publication) 1519, 1538 and 1747. As a result of this and in support the action within the EPAS, WG-110 has been tasked to develop MOPS for HTAWS “Classic modes” focusing on the need of offshore operations. The use of IFR for rotorcraft operations increases their utility and safety and constitutes an essential requirement for certain operations such as offshore operations, rescue operations in hard-to-reach areas (mountains or open waters) and in Helicopter Emergency Medical Services (HEMS). EGNOS is a key enabler of safety critical IFR rotorcraft onshore and offshore operations by enabling new operations and improving the navigation performance of others. WG-110 completed their Work Programme with the publication of ED-285 Minimum Operational Performance Standard for offshore Helicopter Terrain Awareness and Warning System (HTAWS) on 22 March 2021. After completion of ED-285, WG-110 identified the need to launch a new activity concerning HTWAS for onshore operations. The new Task Sheet (TS) was approved by TAC as well as an updated Terms of Reference (ToR) by the Council. The work on the new deliverable started in September 2021 and it is expected for fall 2023.

WG-118 has taken up the task to update of ED-112A, more particularly Section 3 on deployable recorders. This work has started in May 2020 with the intent to bring the standard in line with ESTO-2C517. Criteria for the installation of deployable recorders have been introduced in CS-25 at amendment 24.

Vision of future EUROCAE activities in this sub-domain

Depending on technologies maturity, there could be a need for the following EUROCAE standardisation activities:

- MOPS on Deployable ELT linked to FDR (joint with RTCA): Short Term, interested parties: Industry, Airworthiness Authority and Accident Investigator;
- Update of MOPS on Deployable FDR: Short Term, interested parties: Industry, Airworthiness Authority and Accident Investigator.
- Update cockpit voice recorder MOPS (ED-112) to include audio quality guidance Short Term, interested parties: Industry, Airworthiness Authority and Accident Investigator.

All activities respond to safety recommendations received from accident investigators.

The ELT and FDR related activity is linked to ICAO recommendations and corresponding European requirements.

4.1.4. System Engineering

Current activities of this sub-domain

EUROCAE working group WG-97 Interoperability of Virtual Avionics Components is already active in this sub-domain. For details on the deliverables please consult the table in annex.

WG-97 is developing a Technical Standard for Virtual Interoperable Simulation for Tests of Aircraft Systems in virtual or hybrid. The first release of the standard covered main avionics interfaces and was followed by a revision A released in Feb 2020 to expand the scope of avionics interfaces and functionalities, while defining interoperability conditions and, as much as possible, ensuring backward compatibility; a revision B is planned to complement the expected set of functionalities.

With the aim to identify how ED-12 could apply to the small UAS community, a joint EUROCAE/RTCA working group has delivered a report. As a result, WG-117 has been established to identify development assurance methods appropriate to UAS low risk applications, as well as system and safety conditions enabling the re-use of COTS software for UAS solutions.

In 2012, EUROCAE and RTCA established the Forum for Aeronautical Software (FAS). Purpose of this forum is to provide a platform for the exchange of experiences and best practices to stakeholders involved in aviation software development. The work is being published as FAS Topic Papers (FTPs). To be in line with EUROCAE´s standards development processes, the FAS will be restructured and transitioned to a dedicated Working Group.

Vision of future EUROCAE activities in this sub-domain

As far as software and hardware assurance processes are concerned, work is performed on high-level objectives allowing the justification and use of alternate standards to ED-12 or ED-80. In parallel some research activities are performed, looking into alternate approaches for development assurance demonstration. This may lead to an update of the corresponding standards to benefit from those developments.

In parallel, some activities are performed at ASTM to develop specific versions of similar standards in the software and hardware development assurance domain specifically tailored for the General Aviation /UAS community and there may be benefit for some joint activities to maintain consistency.

WG-117 mainly focuses on software aspects. Guidelines on system engineering for UAS might be needed. The Pre-Defined Risk Assessment (PDRA) proposed by EASA is an interesting approach to start UAS System Engineering, with Safety Analysis being a key driver to UAS architecture. As far as “Interoperability of Virtual Avionics Components” (WG-97) is concerned, no standardisation activity is foreseen to date beyond the current plan.

This activity supports efficiency gains for industry and authorities.

Interface management remains a cornerstone of the system engineering. For more than a decade, the generalization of A664 part7 network offering a much wider bandwidth capacity while ensuring latency determinism, has contributed to a large increase of data exchanged. Data coding, formerly standardized through A429, now appears more flexible on A664p7 for product suppliers; at system engineering level, it however led to expand data concentration and conversion effort, adding significant integration risks to interconnect products and match each systems expectation (in terms of rates, range, resolution, validity, ...).

Standardization of A664p7 data commonly exchanged would contribute to mitigate integration risks and reduce development effort at system engineering level, while restoring more balanced effort on interface management between product and system engineering.

4.1.5. System Safety Assessment

Current activities of this sub-domain

EUROCAE working group WG-63 is already active in this sub-domain. For details on the deliverables please consult the table in annex.

Industry has requested to EASA and FAA to extract the objectives from ED-79/ ARP-4754. ED-79/ARP-4754 is accused to be too prescriptive and to contains best practice instead of defining objectives. This led to the development of a first version of a new standard (ED-268 / AS7209; to be pursued as ER-023/AIR-7209).

In the same time, a revision B for the ED-79/ARP-4754 is being developed to clarify some revision A recommendations that were misapplied or misunderstood, while aligning the standard with the upcoming ED-135/ARP4761A recommendations.

Vision of future new EUROCAE activities in this sub-domain

There is probably a need to monitor MBSE processes so as to be ready for standardisation activities when mature enough.

As SORA will start to be applied for UAS under the new EASA regulations, attention should be given to potential difficulties and possible needs for guidelines.

4.1.6. Environment

Current activities of this sub-domain

EUROCAE working groups WG-14 Environment and WG-31 Electromagnetic Hazards are already active in this sub-domain.

WG-31's scope includes the development of regulation and the certification of aircraft in relation to Electromagnetic hazards such as lightning protection, electromagnetic compatibility (EMC), High Intensity Radiated Fields (HIRF) etc.

For details on the deliverables please consult the table in annex.

Vision of future new EUROCAE activities in this sub-domain

Climate change may lead to update the weather standards to be taken into account, as for hail for instance. WG-14 will probably need to consider these new elements.

It is expected that WG-31 will initiate activities on the use of simulation in support of compliance demonstrations.

The integrated modular avionics concept and the qualification of sub-component on circuit-board level may drive the need to have standardised environmental qualification guidance for those sub-components as the current guidance addresses only the equipment/box level. There may be a need to develop packaging standards to support this activity.

4.2. CNS

4.2.1. Purpose & Scope of activities of this domain

This Domain encompasses all standardisation activities which are related to on-board and ground equipment and systems which are in interaction with the external world for Communication, Navigation and Surveillance (CNS).

Scope of activities therefore includes:

- Integrated CNS evolution
- Navigation services & sensor enablers
- Surveillance
- Communication means.

4.2.2. Integrated CNS evolution

Until recently, it was possible to develop implementation roadmaps for COM, NAV and SUR systems which could be aggregated to capture key technological improvements as well as potential impact on avionics architecture and spectrum (i.e., aeronautical frequencies used for COM, NAV and SUR).

These distinct roadmaps could not describe the technological and/or functional synergies across the COM, NAV and SUR domains enabled by common system/infrastructure capabilities. In addition, the identification of common modes of failure was only achieved at the safety assessment for each system.

European strategy is promoting a performance-based approach supported by a backbone composed of GNSS, ADS-B, Data Link/PENS and the common services associated to NAV, SUR, COM. CS-ACNS (Airborne Communications, Navigation and Surveillance) Issue 2 was published in Q2 2019 to provide a new regulatory framework for navigation systems, reinforcing in the same time the safety requirements for some PBN approaches.

ICAO has launched the Integrated CNS and Spectrum Task Force (ICNSS TF), which has 2 main objectives:

1. Draft a roadmap of CNS and Spectrum (CNSS) evolution in the medium and longer term
2. Define a new CNSS standardization framework
    - new/streamlined SARPs and standards framework
    - a voluntary technical specifications (VTS) framework, including process for direct referencing into SARPs

EUROCAE is actively supporting both streams of this activity.

The evolution to common support services modifies the system approach to functional approach and enables to reconsider the supporting infrastructure at a regional level rather than at a national level.

The performance-based approach is rendered possible because of the introduction of satellite technologies (e.g. GNSS) and is resulting in a shift from physical assets ("systems") to data provision to functional requirements ("ATM operations"). The performance-based approach is also necessary in the SES context where ATM performance must be enhanced and measured, introducing new actors in the business models (such as data service providers, communication service providers, satellite service providers).

In parallel, the need to improve the overall performance is also visible in the activity promoting rationalisation of the infrastructure at the European level. It may impact the work programme of several working groups.

Last but not least, it is anticipated that a specific CNS-strategy for a large number of UAS would be needed.

On the avionics domain, in 2021, ARINC Systems Architecture and Interfaces (SAI) Subcommittee has released A678 developing Next Generation Radio (NGR) architectures with a new distribution of RF transmit/receive sensor, part of specific CNS equipment and system processing hardware parts, in order to provide benefits such as, reduced cost of equipment, size, weight, installation constraints, wiring and power reductions.

Evolution of technology in microelectronics, microprocessors, radiofrequency and software design, have enabled the avionics industry to develop highly integrated digital avionics under software control that could result in splitting the RF standalone units into new Radios separating RF sensor part on one hand and the processing part (or at least the MMI part of the processing) on the other hand that could be hosted on an IMA (Integrated Modular Avionics) platform. Next release of this new standard could result in the need to update current versions of EUROCAE MOPS supporting these CNS RF systems as well as revisiting the guidelines to qualify these units such as ED-14.

Future new EUROCAE activities envisaged in this sub-domain include:

- CNS services
- CNS requirements to support new concepts
- Urban CNS

4.2.3. Navigation services and sensors enablers

Current activities of this sub-domain

The following EUROCAE working groups are already active in this Sub-Domain:

- Supporting PBN including Approach & Landing:

  WG-28 Ground Based Augmentation Systems, WG-62 GALILEO, WG-107 DME Infrastructure supporting PBN Positioning are active in this domain while WG-85, 4D Navigation has been reactivated in coordination with RTCA SC-227. WG-62 is now a joint WG with RTCA SC-159 WG-2 to develop a joint DFMC SBAS MOPS as an update to ED-259 released in December 2019.

- Supporting Approach & Landing:

  EUROCAE WG-28 Ground Based Augmentation Systems is already active in this sub-domain, developing EUROCAE standards relating to GBAS ground sub-systems. The group contributes to the development of the multi-constellation multi-frequency concepts using Galileo in the frame of ICAO DFMC GBAS ad-hoc group. The group supports the identification of GBAS needs with regards to Galileo Open Service performance. The group develops ED-114B change 1 ("MOPS for Global Navigation Satellite GBAS Ground Equipment to support Category I/II/III Operations using GPS L1"), also known as GAST C and D, to reflect the ICAO Annex 10 Amendment that includes the GAST D elements. ED-114B change 1 is aimed for December 2022. The group also covers the elaboration of a report providing the status of GBAS multi-constellation multi-frequency developments in SESAR, which is intended to outline the scope of the changes needed in order to incorporate DFMC GBAS in ED-114() and accommodate Galileo signals. The report is aimed for December 2022.

  EUROCAE WG-62 Galileo is also active in this sub-domain, developing EUROCAE standards relating to Galileo and SBAS airborne equipment. The

group currently works in the development of ED-259A ("Minimum Operational Performance Specification for Galileo / Global Positioning System / Satellite-Based Augmentation System Airborne Equipment") in a joint configuration with RTCA SC-159. ED-259A is aimed at early 2022. This MOPS addresses the development of Galileo E1/E5a, GPS L1/L5, and multi-constellation multi-frequency SBAS L5 airborne equipment. It is intended to support the ETSO/TSO production and certification of the receivers for aviation use. It will include integrated DO-229F requirements for class Beta, Delta and Gamma receiver classes, DFMC SBAS E1/L1/E5a/L5 requirements, ADS-B out requirements, DFMC SBAS Approach Concept (developed by ICAO NSP to leverage additional capacities of DFMC SBAS compared to SBAS L1 service), jamming detection requirements with enhanced testing procedures compared to DO-229F, GPS L1 and/or L5 RAIM FDE requirements, and an initial set of requirements addressing spoofing mitigation. Its update, ED-259B, is intended for mid-2023. ED-259B targets Cat I/II autoland, LPV 200 support in equatorial regions, SBAS authentication (upon ICAO SARPs completion), non-GEO SBAS (pending ICAO SARPS completion), H-ARAIM requirements, management of institutional scenarios, and complete requirements for spoofing mitigation. Finally, the group considers also the development of a Galileo OS receiver MOPS at a later stage which could be an extract of the GPS/Galileo/SBAS MOPS.

EUROCAE WG-79 EVS & SVS is already active in this Sub-Domain, working in coordination with RTCA SC-213. Focus of the Working Group has been on standards for Vision Systems in Helicopter applications with ED-255, "Minimum Aviation System Performance Standards (MASPS) for a Combined Vision System for Helicopter Operations" published in January 2019.

Enhanced and Synthetic Vision Systems are technologies which are progressively introduced on various types of civil aircraft (Business jets, helicopters, Air transport, ...).

An Enhanced Vision System (EVS) is an electronic means which provides the flight crew with an image of the external scene through the use of imaging sensors such as forward-looking infrared cameras, millimetre wave radar, and / or low-level image intensifying.

A Synthetic Vision System (SVS) is an electronic means which provides the flight crew with a computer-generated image of the external scene topography. This image is derived from aircraft attitude, aircraft navigation solution, high accuracy database of terrain, obstacles and other relevant features.

A Combined Vision System (CVS) is a combination of Synthetic and Enhanced Vision systems.

EFVS (Enhanced Flight Vision System) is an Enhanced Vision System (EVS) coupled with Head-Up Displays (HUD).

Except for EFVS, there are no established standards for the approval of these type of systems which justify the current activities of the Working Group 79.

In a short timeframe and beyond the MASPS published by WG-79, main trends affecting this sub-domain are driven by:

- a desire to obtain some operational credit at reaching minima reduction with SVS and/or EVS, with Head-Down or Head-up/Head-mounted displays. Then, an updated operational concept should be established.

As a consequence, a new version of the TORs has been approved for the development of the following standards by Q4 2021 jointly with SC-213:

- MASPS for a Combined Vision System for Helicopter Operations for Low Visibility Operational Credit
- MASPS for SVS/SVGS/CVS
- MASPS for EVS/CVS/EFVS
- Safety, Performance and Interoperability Requirements Document Defining Take-off Minima by Use of Enhanced Flight Vision Systems

In November 2020, the leadership of the committee determined that the work which had been done as part of the new EVS/EFVS MASPS to gain industry and regulatory agreement on how to test for Quantified Visual Advantage would be useful as a published stand-alone ED-291 which was published in May 2021. The work has been developed as part of the joint work of EUROCAE WG-79 and RTCA SC-213. This content was intended to be an appendix in the joint EVS/EFVS MASPS and will be referenced in the final MASPS already in the deliverables table.

- Supporting Altimetry performance for RVSM and Approach & Landing: EUROCAE WG-68 Altimetry was disbanded by Council decision after ED-140 Revision A was published in March 2019.
- Supporting the need to reopen ED-30 MOPS for Radar Altimeter to ensure compatibility of current and future Radar Altimeter, taking into account the new Radio Frequency environment such as 5G Telecommunications network deployment and WAIC, a new WG-119 has been launched jointly with RTCA SC-239 to develop a Radar Altimeter MOPS ED-30A/DO-155A planned for December 2022.

For details on the deliverables please consult the table in annex.

Vision of future new EUROCAE activities in this sub-domain

<u>GNSS</u>

There is a need for EUROCAE to conduct activities:

- Dual-Frequency/Multi-Constellation (DFMC) GNSS GBAS CAT II/III, addressing Ground station and Airborne equipment.
- MOPS on GPS/GALILEO Dual-Frequency SBAS for airborne equipment

Whilst GNSS interference, in the form of jamming, may cause the loss of GNSS data, GNSS spoofing may cause the output by GNSS avionics of erroneous data, by using counterfeit signals. There is a growing demand from Regulators to address this threat in future Dual-Frequency/Multi-Constellation. It can be expected that future standards will provide recommendations and/or requirements against these threats, including threat characterisation and scenarios, test procedures and mitigations techniques, not necessarily limited to the GNSS receiver.

The future activities considered are:

- Update of MOPS for the GBAS ground subsystem to support precision approach and landing in the context of GBAS CATII/III L1: Medium Term;
- Standard on GBAS Cat II/III multi-constellation/ dual-frequency System level (potentially joint with RTCA SC-159): Medium term;
- Update of MOPS for the SBAS airborne equipment potentially including new requirements such as Cat I/II autoland (with VMC below 100 ft), SBAS authentication, and non-GEO SBAS pending ICAO SARPS completion on these topics and H-ARAIM requirements (joint with RTCA SC-159);
- Development of MOPS for the GBAS ground subsystem to support precision approach and landing in the context of GBAS CATII/III multi-constellation/dual frequency Ground Station;
- Development of MOPS for the airborne equipment to support precision approach and landing in the context of GBAS CATII/III multi-constellation/dual frequency (potentially joint with RTCA SC-159).

<u>Vision-based Navigation for Approach & Landing</u>

There is an EASA Rulemaking Activity and an FAA activity related to CS-AWO. Relevant SESAR activities might result in needs for standards.

<u>Computer Vision</u>

Computer Vision refers to techniques used by a computer to extract useful information from pictures. Autonomous vehicles and robots may use computer vision to locate themselves, avoid obstacles, map their environment or more generally get information used as inputs in decision-algorithms.

Unlike other systems where active emitters transmit information, computer vision relies by-nature on complex (visual) signals that require analysis, making it more sensitive to false interpretation or performance reduction.

The current rapid development of Urban Air Mobility (UAM) and more autonomous air vehicles will lead to functions of higher safety levels relying on computer vision in critical flight phases. In other applications like Remote Virtual Towers (RVT) or Single Pilot Operations (SPO), computer vision systems might also be used to replace or complement humans. With respect to airport operations, computer vision can be used to create timestamps of processes along the ground process of the aircraft and optimize the turnaround process of aircraft, feed input into complex flight planning and scheduling systems and track the supply chains.

Standardisation activities might be required to define minimum performance and AMC for computer vision systems used in both ground-based and aircraft systems.

Air Data sensors

One potential field is the development of a specific standard for air data sensors using LIDAR technology. Several initiatives perform R&D, looking at industrialisation of this technology at an attractive cost while demonstrating equivalent or better performance than current air data probes technology. A specific standard will be needed for such equipment, probably in coordination with SAE.

The future activities will be determined in coordination with other standardisation organisations in particular in domains where EUROCAE has competencies.

This activity supports strategic development in EASA in response to recommendations from accident investigations.

Additional comments

Standardisation activities in the area of navigation need to be based on international ICAO requirements and guidelines and support European ATM Network developments as well as global interoperability needs.

Coordination between different EUROCAE WGs will become even more important as the European ATM network moves towards more advanced and integrated applications, functions and enabling technologies, to ensure that navigation capabilities remain well coordinated and consistent with the other ATM domains.

EUROCAE TAC needs to monitor the progress of the work in SESAR Programme 2020 & 3, as it unfolds, as well as any need for standards in support of implementation activities, that could arise from possible future common projects, in order to maintain the content of this section up to date.

This activity supports strategic development in the domain of cooperation with other SDOs and RTCA and SESAR Deployment.

As indicated in §4.2.2 Integrated CNS evolutions section, a new standardisation activity has been launched by AEEC which aims to develop Next Generation Radio (NGR) architectures with a new distribution of RF transmit/receive sensor part of specific CNS equipment and system processing hardware parts in order to provide benefits such as, reduced cost of equipment, size, weight, and power consumption. One of the enablers includes new Radios separating RF sensor part on the one hand and the processing part on the other hand that could be hosted on an IMA platform. This new standard could result in the need to update current versions of EUROCAE MOPS supporting these CNS RF systems as well as revisiting the guidelines to qualify these units such as ED-14.

4.2.4.Surveillance

Current activities of this sub-domain

In the Surveillance Subdomain six EUROCAE WGs are active:

- WG-41 A-SMGCS
- WG-49 Mode-S Transponder
- WG-51 Automatic Dependent Surveillance-Broadcast (ADS-B)
- WG-75 Traffic Alert and Collision Avoidance System (TCAS)
- WG-102 GEN-SUR SPR

- WG-103 Independent Non-Cooperative Surveillance Systems

For details on the deliverables please consult the table in annex.

Vision of future EUROCAE activities in this sub-domain

As ground ATC surveillance is being composed of conventional radar and Mode S multi-lateration technology and supported by ADS-B as well as Mode S enhanced surveillance information, there is the need to ensure that future needs (e.g. airport ground traffic safety nets, new tactical controller tools etc.) are equally supported by airborne data. Therefore, coordination with WG-41 and close coordination between WG-49 and WG-51 is necessary to e.g. develop new versions of transponders as the concept of operations is evolving. To facilitate this cooperation, a Combined Surveillance Committee (CSC) has been created in which WG-49 and WG-51 together with the respective RTCA counterparts SC-209 and SC-186 have worked together and developed a new revision of the Transponder (ED-73F/DO-181F) and ADS-B MOPS (ED-102B/DO-260C). Following the publication of these documents there were some observations and “lessons learned” which will result in the development of a Change 1 document by early 2022.

A top-down approach for supporting the 3/5 NM separation requirements in TMA and en-route areas has been developed with the GEN SUR SPR standard within WG-102.

This standard relies on both an operational and a scientific approach and it is agnostic from the sensor technology. The EUROCONTROL SSTF (Surveillance Standard Task Force) has been re-activated in cooperation with WG-102 for adapting the EUROCONTROL ESASSP standard as mean of compliance to the GEN-SUR-SPR. A new edition ESASSP V2 is under development.

Concerning the UAS Collision Avoidance capability, WG-75 TCAS has taken that task into its remit, working together with WG-105, coordinating with RTCA SC-147. WG-75 has also to ensure that with the emergence of a number of distinct collision avoidance systems (TCAS II, ACAS Xa/Xo, Collision Avoidance for UAS (ACAS Xu, ACAS sXu) and for rotorcraft (ACAS X_R)) any two collision avoidance systems interoperate effectively. For this purpose, WG-75 in cooperation with RTCA SC-147 has developed an Interoperability MASPS (ED-264).

A European led initiative (Airbus, Honeywell Europe) is ongoing towards the development of a function called SURF-A which uses the processing of ADS-B messages from surrounding transponders to inform the flight crew of an intruder on a Runway.

Satellite-based ADS-B is already deployed and the data is available for use through service providers. The expected/achieved performances of such a system are considered satisfactory to improve procedural separation in oceanic/remote airspace, or to support the NM planning processes but are not able to support separation services in continental airspace.

This activity supports strategic development in the domains of stakeholders, in particular ANSPs and military organisations.

<u>Electronic Conspicuity</u>

In uncontrolled airspace – that is, airspace where an Air Traffic Control (ATC) service is not provided – pilots and other airspace users have long operated on a principle of ‘see and avoid’. In other words, it is their responsibility to look out for other airspace users and avoid them. It is possible that the use of Electronic Conspicuity could reduce the risk of mid-air collision (MAC) where no ATC service is provided.

Electronic Conspicuity is an umbrella term for a range of technologies that can help airspace users to be more aware of other aircraft in the same airspace. It includes transponders and radios. At the most basic level, aircraft equipped with an Electronic Conspicuity device effectively signal their presence to other airspace users, turning the ‘see and avoid’ concept into ‘see, BE SEEN, and avoid.’ Many Electronic Conspicuity devices also receive the signals from others. This then alerts pilots to the presence of other aircraft which may assist the pilot in being able to visually acquire the aircraft and take avoiding action as necessary

In the UK, the Electronic Conspicuity Working Group (ECWG) concluded that it would be possible to develop an industry standard for an Electronic Conspicuity device that

uses radio frequency (RF) and is based on ADS-B extended squitter (ES) technology, transmitting at low power, with position information derived from non-certified GNSS systems. This provides more useful information to other airspace users than other technical solutions, while offering low cost and low power consumption. The ECWG members considered that it might be possible to produce such a device at a cost that, combined with the potential safety benefits, could encourage a significant proportion of the GA community to adopt it voluntarily.

In addition to the technical work, the UK National IFF/SSR Committee commissioned a study to consider the impact of such Electronic Conspicuity devices on the 1090 MHz spectrum and concluded that it was acceptable. As a consequence, the UK CAA produced a Civil Aviation Publication (CAP 1391) that includes technical requirements for Electronic Conspicuity devices based on 1090 MHz and operational trials continue, both within the UK and under the aegis of SESAR.

As a follow-on to their national work, the UK CAA has held discussions with EASA to undertake European regulatory work, although this dialogue is ongoing.

Should these devices be approved for European use, it will be necessary to standardise the performance requirements for a new application and with a variation in system requirements for GNSS and 1090 MHz transponders. This will require additional work to be conducted by existing and/or new EUROCAE WGs.

4.2.5. Communication means

Current activities of this sub-domain

EUROCAE Working Groups WG-82 New Air/Ground Technologies, WG-92 VDL Mode 2 and WG-108 ATN/IPS are already active in this Sub-Domain. WG-78 Air Traffic Data Communications Services has been reactivated in 2021 to update the published data communication standards to reflect the experience gained during the first implementations and revenue flights.

For details on the deliverables please consult the table in annex.

Three components of the radio communication system have emerged during the last years and are in need of new technologies, identified at ICAO level and confirmed in the context of SESAR and NextGen.

The three components are the following:

- one component to cover the airport surface, that will be derived from the existing set of standards known as IEEE 802.16 (one profile currently in deployment being the WIMAX system): it will be a specific dedicated system (and associated standards) operating in the safety of flight C-band frequency allocation,
- one terrestrial component (LDACS) to cover the TMA and En-route areas, that will operate in the L-band (sharing the band with DME and Mode S),
- one satellite component to cover the TMA and en-route areas also in addition to the oceanic areas. The new solution (SATCOM class B) has been proposed by ESA and has been validated in the SESAR programme in 2017; this system operates in the current AMS(R)S spectrum allocation. The first introduction of service is foreseen in 2021 (based on EASA certification) which would complement VDL2 in a multi-link environment.

Regarding VDL Mode 2, the European Commission has issued the mandate EC 29/2009 for ATC communications. As the mandate relies on VDL Mode 2, and the dual-frequency mechanisms, the WG-92 updated ED-92 to support multi-frequency mechanisms. ED-92B has been issued.

In order to investigate evident Controller/Pilot Data Link Communications (CPDLC) performance issues, the Enhanced Large Scale ATN deployment (ELSA). In its final report, the project released its recommendations, some of which address the need for standardisation activities.

Through an exchange of letters, the European Commission and EUROCAE agreed on covering this need through WG-92 activities. As a result, WG-92 updated ED-92 and ED-92C has been approved & published in 2019. The companion document, ED-276, has been developed together with a report on future VDL2 standardisation activities. Based on this report, WG-92 is initiating the work on ED-92D (joint with RTCA).

In parallel, WG-108 work on ATN/IPS progressed well in particular for the development of MASPS and the finalisation of ED-262 IPS Profiles.

Mobile technology systems such as 3G, 4G, 5G, may complement dedicated technologies but should not be considered to be integrated in the multilink concept.

Vision of future EUROCAE activities in this sub-domain

In the mid-term timeframe, the terrestrial component of Air-Ground communication in L-Band needs standards.

For LDACS, the capacity study has demonstrated that the European ATM will require a new high bandwidth media around 2030. The solution is being developed under SESAR 2020 and will require EUROCAE work on standardisation aspects.

A second area of activities in mid-term timeframe would be standardisation of an RPAS Command and Control Datalink for which ICAO already agreed on the frequency spectrum in the C-Band.

This activity supports strategic development in SESAR Deployment and cooperation with RTCA.

The future activities considered are:

- MASPS on L-Band Air Ground Communication, System: Medium Term
- MOPS on System level, L-Band Air Ground Communication System, Ground System: Medium Term
- MOPS on L-Band Air Ground Communication System, Airborne Equipment: Medium Term
- MOPS on VDL Mode 2 Avionics Equipment: Medium Term

In the long-term, “Beyond Line of sight” communication means in the C-Band may also be considered for use.

“The Future Aviation Spectrum Strategy and Vision” could also result in some new standards or updates in particular with role and place of satellite link as complement to terrestrial link(s).

Mobile technology systems such as 3G, 4G, 5G, may complement communication technologies but should not be considered to be integrated in the multilink concept. In any event, specific attention is needed for 5G deployment to reduce the potential risk of interference with aeronautical systems e.g. radar altimeters.

4.3. AIR TRAFFIC MANAGEMENT (ATM)

4.3.1. Purpose & Scope of activities of this domain

In the ATM Domain the following EUROCAE WGs are concerned:

- WG-59 Flight Data Processing (FDP) Interoperability
- WG-67 Voice on Internet Protocol (VoIP) for ATM
- WG-81 Interoperability of ATM Validation Platforms
- WG-122 Virtual Centre.

WG-59 objective is to issue a new release of ED-133 (Flight Object Interoperability Specification) aligned with the outcomes from SESAR specification & validation activities. This release is the baseline for implementation of the Flight Object Interoperability within SESAR Deployment.

WG-67 has published ED-137C (including Change documents to Volumes 1,2, and 4) and proposed activities to be conducted in 2021. Work started on a revision A of ED-136 and ED-138 to be available middle of 2023. ED-136 will be published in two Volumes, Volume 1 the OSED (Operational Services and Environment Description) and Volume 2 containing the SPR (Safety and Performance Requirements).

WG-81 has completed its work on ED-148 and submitted the document to Open Consultation in August 2021. The objectives were to identify the overall process and associated activities allowing two or more ATM Validation Platforms to interoperate. The WG further developed a new revision of the Interoperability of ATM Validation Platforms ED-147B which also went through Open Consultation in August 2021.

WG-122 has been established at the end of 2020 to start standardisation activities in support of the virtualisation of ATS units as anticipated in the ATM Master Plan Edition 2020. As an initial deliverable, WG-122 will concentrate on developing an "Internal Report: Virtual Centre Standardisation". This report, to be completed within 6 months, will be the foundation for the future work programme of standards to be developed. It will provide a comprehensive review of the current context and provide a detailed work programme for future standardisation activities, taking into account in particular the status of R&D activities, industrialisation and the stakeholders' needs.

4.3.2. ATM – Flight Data processing

Current activities of this sub-domain

EUROCAE Working Group WG-59 Flight Data Processing (FDP) Interoperability is already active in this Sub-Domain. For details on the deliverables please consult the table in annex.

In the past years, the SJU launched a series of activities both operational and technical aiming at achieving the required level of maturity (EOCVM V2) for the Initial IOP SESAR related solution, representing the baseline for the work to be done in SESAR2020 to validate (at EOCVM V3 maturity) the full IOP solution.

The SJU has performed two exercises (IOP-EXE1 and IOP-EXE2) to validate the requirements that are intended to be used in ED-133A. Following IP-EXE1, WG-59 has prepared an intermediate version of ED-133A. The transfer of the material from the SESAR documentation into ED-133A has been achieved and the group is now working on the finalisation of the standard. Despite the removal of the Flight Object Interoperability from the Common Project 1 (CP1) the members of WG-59 are still determined to produce a high-quality document.

The revised timescale is reflected in the Rolling Development Plan of the EASCG.

Vision of future EUROCAE activities in this sub-domain

The main anticipated development is to support the implementation of the ICAO Flight and flow information for a collaborative environment (FF-ICE). ICAO expressed the need for global interoperable trajectory-based operations (TBO) and seamless ATM environment. Europe is proposing to initiate the development of provisions to ensure a globally interoperable TBO environment taking account of regional adaptations such as the European IOP/Flight Object concept.

4.3.3. ATM – Digital Voice communications

Current activities of this sub-domain

EUROCAE working group WG-67 Voice over Internet protocol (VoIP) for ATM is already active in this Sub-Domain and started work on the revision of ED-136 and ED-138. For details on the deliverables please consult the table in annex.

Vision of future EUROCAE activities in this sub-domain

The whole VoIP standard suite may need to be restructured for ICAO use, including new findings from worldwide (and European) VoIP implementation. In addition, SESAR work into virtualisation of ATS Units may express some new requirements.

A future activity considered is:

- Maintenance of the TS on Voice over IP Ground/Ground Communication (ICAO, SESAR): Medium Term, Interested parties: Industry, EUROCONTROL and ANSPs.
- Research is ongoing in SESAR into the use of VoIP as an air-ground digital communication. Such developments will ultimately need to be standardised. Digital voice must be developed to work in a multilink environment, where different digital voice airborne users may be connected to the ground though different communication means. This concept supports the geographically independent controller-pilot communications, as described in the Airspace Architecture Study (AAS) study report, e.g. section D.4.7. It will increase A/G connectivity and avoid that traffic growth be blocked due to the lack of availability of VHF frequencies; it will also support the virtualisation of ATS Units in line with a service-oriented architecture approach. The concept should also bring an

increase of the level of security compared to current operations, e.g. by using technical means to identify where a transmission comes from for authentication purposes.

4.3.4. ATM Simulators

Current activities of this sub-domain

EUROCAE working group WG-81 Interoperability of ATM Validation Platforms is already active in this Sub-Domain. ED-147B and ED-148A have been developed with several technical improvements including a new chapter in ED-147B aiming at filling the gap between logical concepts and target technologies. For details on the deliverables please consult the table in annex.

Vision of future EUROCAE activities in this sub-domain

ATM Validation Platforms from different domains will be the driver in SESAR 2020 projects to support validation activities. In order to provide the required functionalities those ATM Validation Platforms need to be interoperable and might require enhancement of the standards.

4.3.5. Virtual Centre

Current activities of this sub-domain

The European Airspace Architecture Study published in 2019 describes an evolving European ATM environment, making increased use of service providers who may not be located at the same place as the point of delivery of the service. It is possible, for example, for an ATC centre to comprise the capability of an ANSP to deliver ANS in a defined volume of airspace making use of services delivered to them by a number of external service providers, each of whom could be operating in a different country or even continent, and who could be providing similar services to multiple ANSPs. This concept is called virtualisation.

The standards that support the traditional model for delivery of ANS tend to focus mostly on the systems themselves, and their inter-connectivity. With the advent of a virtualised, service-based model, there is a need both to update existing standards and to create new ones to ensure delivery of services to agreed performance requirements. Indeed, the very nature of virtualisation demands a highly interoperable system of systems, which must be based on standards that would allow multiple service and system providers to work together.

As well as the delivery of services themselves, the new virtualised model adds additional complexity to the ANSP's systems engineers, who have been used to having direct control over systems used to deliver ANS in their volume of responsibility. New standards will also be required, therefore, to support the supervision and management of the performance of systems that are part of a virtualised solution.

Further to the stakeholder workshop held on 25 August 2020, in which over 60 experts gathered and engaged in a lively exchange on this important subject, confirming the need for standards and timeliness of this initiative, the EUROCAE Council has approved the creation of WG-122 Virtual Centre.

As an initial deliverable, WG-122 concentrates on developing an "Internal Report: Virtual Centre Standardisation". This report will be the foundation for the future work programme of standards to be developed. It will provide a comprehensive review of the current context and provide a detailed work programme for future standardisation activities, taking into account in particular the status of R&D activities, industrialisation and the stakeholders' needs.

The draft report maps current R&D and industrialisation status. It notes that some further R&D might be needed as prerequisite for future standardisation work. The SESAR multi-annual work programme is currently being drafted, but the ATM SRIA does include activities in the area of virtual centers. It was proposed that WG-122 should develop a rather short-term focused work programme moving towards the Y architecture and in parallel identify the pre-requisites to move to the other architecture models. This could mitigate the risk identified linked to an incremental approach.

Vision of future EUROCAE activities in this sub-domain

These considerations highlight a number of areas where EUROCAE currently has little standardisation activity but may be requested to support EASA and the EC in the certification process for the ADSP on

- Service definition, access to data, nature of the data
- Technical environment and infrastructure
- Interoperability issues (cross-border scenarios)
- Security issues

This will require additional work to be conducted by existing and/or new EUROCAE WGs.

4.3.6. Digital Sky Demonstrators

As described in the ATM MP 2020, there is the need to deliver the necessary Research and Innovation in an accelerated way and in addition to the SESAR innovation pipeline formed by Exploratory Research and Industrial Research & Validation, it is proposed to rely on Digital Sky Demonstrators in the SESAR3 Programme (2023-2027).

"The Digital Sky Demonstrator instrument will be closely connected to the standardisation and regulatory framework, and will provide a platform for a critical mass of "early movers" representing minimum 20% of the targeted operating environment to accelerate market uptake.

The innovation pipeline should make it possible to transition more rapidly from exploration (low TRL) to demonstration (high TRL) and to the market. Demonstrators will take place in live operational environments and put to the test the concepts, services and technologies necessary to deliver the digital European sky. This will help create buy-in from the supervisory authorities and operational staff, providing tangible evidence of the performance benefits in terms of environment, capacity, safety, security and affordability. Typically, these activities address up to TRL8.") [2]

Instrument	Maturity levels	Effort share
Exploratory Research	Pre-TRL1 Scientific Research TRL 1 Basic principles observed and reported TRL 2 Technology concept and/or application formulated	3,5%
Industrial Research	TRL 3 Analytical and experimental critical function and/or characteristic proof-of concept TRL 4 Component/subsystem validation in laboratory environment TRL 5 System/subsystem/component validation in relevant environment TRL 6 System/subsystem model or prototyping demonstration in a relevant end-to end environment (ground or space)	44,75%
Digital Sky Demonstrator	**TRL 7 System demonstration in an operational environment** **TRL 8 Actual system completed and "mission qualified" through test and demonstration in an operational environment**	51,75%

As visible in the above figure, the expected maturity of solutions evaluated in the Digital Sky Demonstrator is high enough to also support validation of standards. This means that the process of standard development will start during the industrial research phase as in the current situation but will be pursued during the digital sky demonstrator phase.

Even if this instrument is used solely for solutions requiring a pre-operational/network-wide validation, there is probably the need to define/agree in advance the nature and

[2] According to SRIA Integrated ATM and/or SESAR HLPP

type of deliverables these demonstrators would provide, e.g., architecture, service, operational acceptability, cross border aspects.

While the SRIA for Integrated ATM (aka the SESAR3 Work Programme) is referring to DSD for nearly all flagships, it is expected that the priority will be given to Virtual centres & ATM Data Service Providers (ADSPs), Aviation Green Deal, and U-space & urban air mobility.

4.4. AIRPORTS

4.4.1. Purpose & Scope of activities of this domain

As airports are considered an important stakeholder in the ATM system, it is necessary to facilitate the integration of airports in the ATM system in support of the European concept of operations. Airports nowadays face many challenges that are economically, ecologically, politically or operationally driven. Those constraints drive the need to optimise procedures, systems and interfaces to enable safe, secure, efficient and customer-friendly aircraft operations. In addition, airports are key economical players in their region where their efficient operation requires the modernisation of their infrastructure, the digitalisation of their systems and at a maximum level of safety and security.

4.4.2. A-SMGCS

Current activities of this sub-domain

EUROCAE working group WG-41 Advanced Surface Movement Guidance and Control System is active in this Sub-Domain. For details on the deliverables please consult the table in annex.

Vision of future EUROCAE activities in this sub-domain

A-SMGCS is widely referred to in regulations (especially EU 2021/116 Common Project 1 “CP1”) and in the ATM Master Plan. The topic contains several sub-ATM functionalities, which is reflected in the existing EUROCAE EDs. The current update of ED-87 (to ED-87E), has defined a broad variety of requirements describing the A-SMGCS network, creating the demand to coordinate specifically with MLAT and other surveillance sensor standardisation as well as to arrange interoperability with other ATC domains such as ACDM or SWIM.

In addition to the CP1 elements, the ATM Master Plan prepared by SJU contains other standardisation needs related to new essential operational changes for airports:

- AMAN/DMAN integration including multiple airports,
- Airport Collaborative Decision Making (ACDM) evolution,
- Integrated surface management and network management.

Those standardisation needs will affect airport vehicles as well as the deployed aerodrome systems. The integration of surface management data link has to be coordinated with data link experts.

The A-SMGCS domain will in the future include new surveillance technologies like video tracking and any kind of potential non-cooperative surveillance. To support existing systems, EUROCAE’s role is to provide performance specifications and requirements to allow interoperability of those systems.

4.4.3. Airport Equipment

Current activities of this sub-domain

With airports becoming more integrated into the ATC network and new technologies available to support improving airport processes, EUROCAE is expanding its activities in this domain. Given the operating ICAO SARPS, particularly through Annexes 6, 14 and 15, the regulatory developments in progress and technical limitations of the current methods EUROCAE is tasked to develop standards to define the performance expected from airport systems and define the way of verification. The WGs will also consider other possible relevant information needed.

EUROCAE working groups WG-83 Airport Foreign Object Debris (FOD) Detection Systems and WG-109 Runway Weather Information Systems are already active in this Sub-Domain. For details on the deliverables please consult the table in annex.

Vision of future EUROCAE activities in this sub-domain

EUROCAE will monitor the development of new technologies and concepts of operations for enhancement of FOD systems that might not only cover FOD on runways but also FOD or unwanted small objects in the air (UAS, birds, etc.).

New systems and data protocols for runway friction measurement and the corresponding data exchange may require the creation of MASPS in this domain.

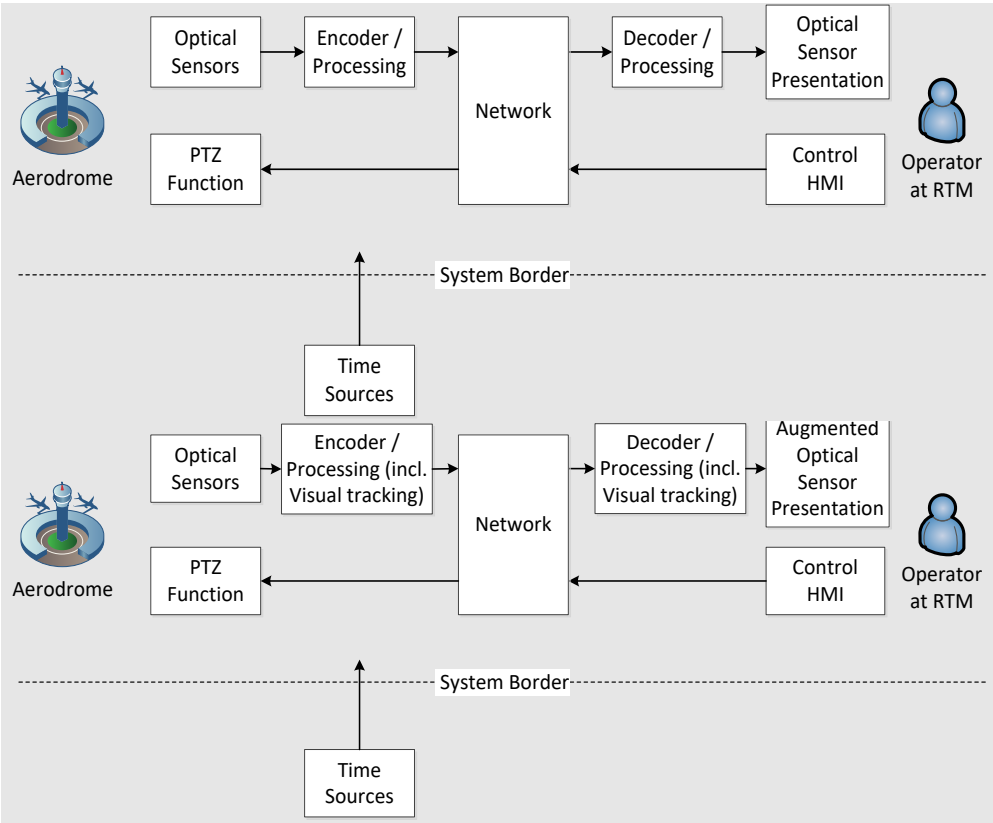
The evolution of the ATM system and the development of new technologies in all aviation related domains will require airports to provide innovative systems. Domains of concern could be the provision of ground stations for UAS, autonomously operating vehicles on the aerodrome surface or the provision of airport infrastructure for innovative flight handling, e.g. electric supply or hydrogen supply to airplanes using alternative power.

4.4.4. Remote and Virtual Tower (RVT)

Current activities of this sub-domain

EUROCAE WG-100 Remote and Virtual Towers (RVT) is already active in this Sub-Domain. For details on the deliverables please consult the table in annex.

The current WG-100 MASPS pertains to remote tower systems, which in their basic implementation level focus on optical sensors only. The standard describes the end-to-end performance of the optical sensor presentation, which is a type of visual presentation that displays video images from cameras to the operator, which could be infrared as well as visible spectrum devices. In November 2018, WG-100 published ED-240A, which updated the original MASPS to include remote tower optical target tracking technologies.



REMOTE TOWER OPTICAL SYSTEM CONCEPTUAL BUILDING BLOCKS (INCL. VISUAL TRACKING)

Vision of future EUROCAE activities in this sub-domain

More visionary concepts that could affect the work of WG-100 are technology solutions like ADS-B, which could revolutionise current optical remote tower solution, when becoming a mandatory, reliable, integer, cooperative surveillance sensor for ground operations.

Another technology vision that could reconfigure remote tower technology standards could be the transmission from sensor to the visual presentation with a broader bandwidth performance and or via radio, terrestrially or even via satellite.

The scope of work in the subdomain could possibly go into the supporting area of guidance on HMI standardisation and best practices.

Adaptation of presentation and HMI input technologies from other industries with full integration of all ATC tools presented on HUD or using Augmented Reality (AR) technology with safe and intuitive HMI input technology. With proven cost-effective optical and radar target tracking technologies and remote provision of ATS to Multiple Aerodromes, the application of artificial intelligence and increased automation are visionary concepts for RVT.

This activity supports strategic development in High Performing Airports as expressed in section 3.17 on Airport environment evolution.

4.4.5. Total Airport Management

Total Airport Management (TAM) is concerned with taking a holistic view of airport operations, including the three key processes (aircraft, passengers, baggage) and more importantly, the interaction between them, as it is the degree of coordination between these different processes which constitutes a significant contributory factor to punctual and predictable operations and passenger satisfaction.

Currently WG-111 Airport Collaborative Decision Making is reviewing the existing standards for CDM in order to update them and set the basis for interoperability of CDM to the network as a starting point for Total Airport Management standardisation activities.

The SESAR programme is undertaking research that provides the essential building blocks for collaborative management of airport performance. These additional building blocks will be fully integrated with the Airport Operations Plan (AOP) which is designed to be a single, common and collaboratively agreed rolling plan that will form the single source of airport operations information to all airport stakeholders.

Airside process monitoring and resource disposition will get more precise by keeping exact track of all handling processing e.g. by the usage of automated computer vision timestamping algorithms.

Research extends beyond the airside-operating environment and addresses more processes within the terminal infrastructure that have a performance impact on flight predictability and efficiency, such as monitoring the progress of passengers with reduced mobility and the baggage through the airport from check-in to the gate, and through the Baggage Handling systems. Monitoring data is stored in the AOP and allows stakeholders to increase their confidence around TOBT accuracy and stability.

Turn-round monitoring will be enhanced by the inclusion of landside collaborative decision-making information. This information is provided by the outputs of the passenger and baggage process chains but also by passenger flow monitoring using new state-of-the-art technologies to track passenger crows or measure queues and process duration in bottlenecks and congested areas. The output of these process-chains will directly affect the disposition of personnel and the usage of landside infrastructure and thus impacts the overall ATM performance.

In addition to integration of extended information relevant for Turn-round processes, TAM addresses the outline of how turn-round processes will evolve and specifically how the turn-round processes could be monitored by the APOC, enabling CDM and performance management.

TAM will enhance Post Operations by the provision of analytical tools that will serve to make reports in an automatic and *ad-hoc* way to ensure robust and continuous feedback and learning on the data management in the AOP. All changes to the data in the AOP,

performance metric levels, warnings/alerts and collaborative decisions are recorded for subsequent review by the Perform Post-Operations Analysis service as required.

Being a connected capability, TAM must be secure, so cyber-security issues will also need to be addressed.

It is expected that supporting standardisation will be limited to the definition of the interfaces between those specific data elements needed in the deployment TAM and with existing operational systems, as is the case for the EUROCAE (ED-145) interface regulation relating to A-CDM. TAM may therefore need a modification of existing data interface standards.

Any future Standard would therefore be developed with the aim of ensuring that a common approach to implementation can be achieved provided that actors adhere to the prescribed data exchange elements (for information exchange between stakeholders), that data is exchanged in the prescribed format (i.e. using SWIM); and the new airport performance services are introduced following the principle of achieving increased situational awareness and collaborative management of deviations from the operating plan.

4.5. SERVICES

4.5.1. Purpose & Scope of activities of this domain

This domain encompasses all standardisation activities which are related to services. The scope of the activities currently includes the current work on SWIM Services as well as AIS/MET and datalink services (WGs-104, 44, 76, 78). In fact, initial implementation of SWIM is required since 2016 as detailed in the Common Project 1 annex for

- common infrastructure components;
- yellow profile technical infrastructure and specifications;
- aeronautical information exchange;
- meteorological information exchange;
- cooperative network information exchange; and
- flight information exchange (yellow profile).

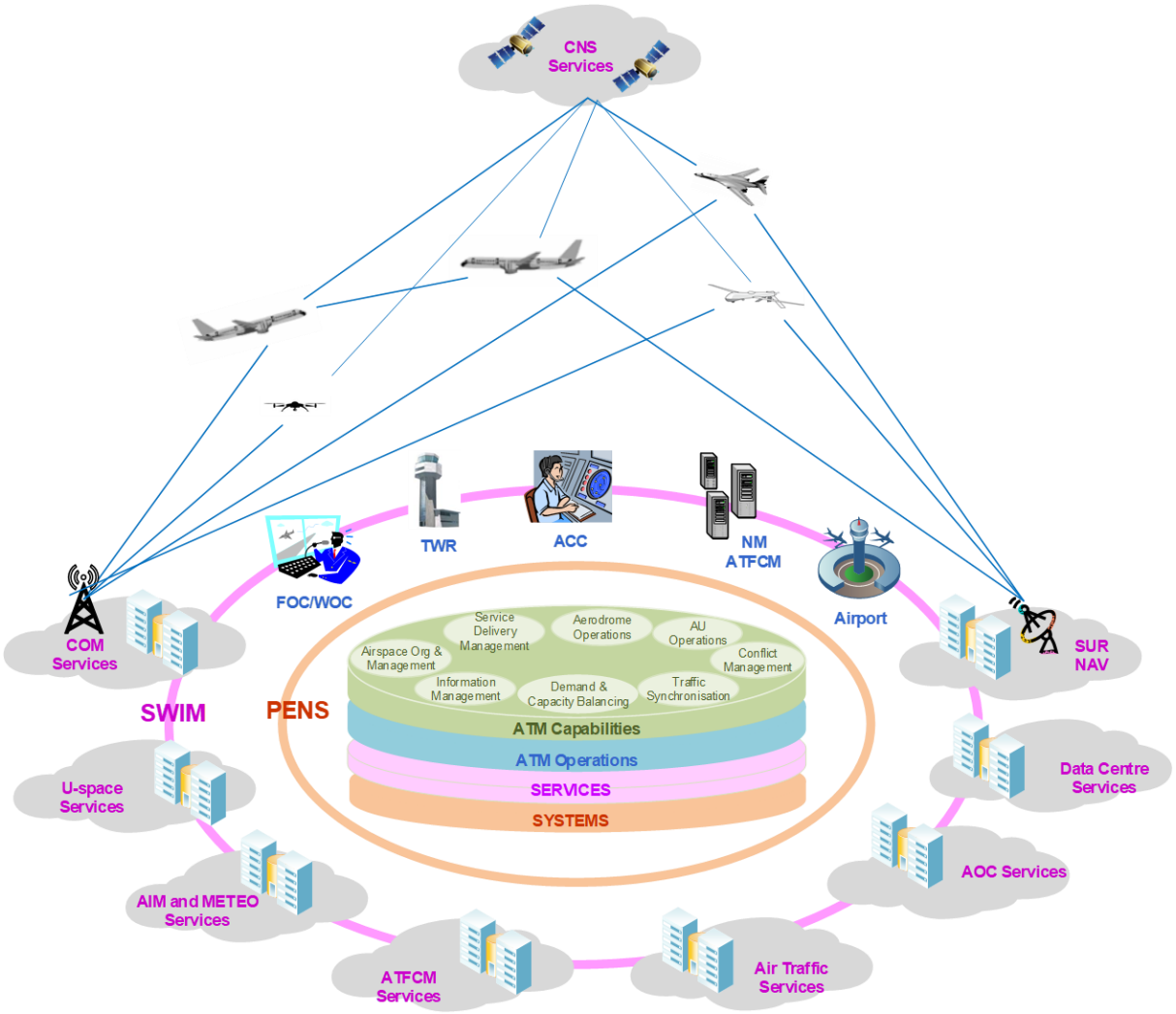


DIAGRAM ILLUSTRATING SERVICES[3]

4.5.2. System Wide Information Management (SWIM) Services

Through the SESAR programme, Europe has made great progress on defining, developing and validating SWIM.

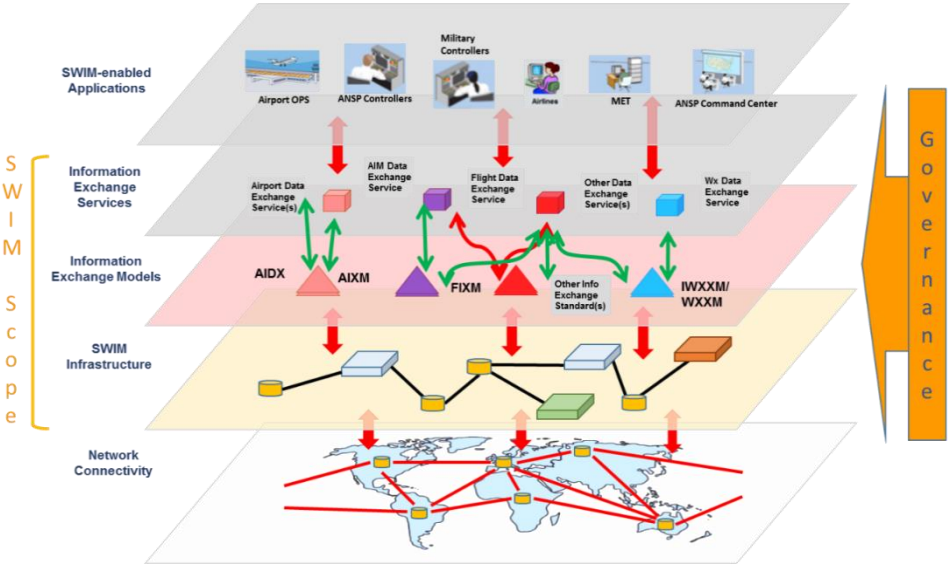
A key document hereby has been the SESAR SWIM Concept of Operations which includes the SWIM definition, SWIM principles, the rationale for change and the associated benefits. It also captures practical examples of SWIM pioneers (e.g. Network Manager B2B) that explain their gradual evolution towards SWIM. Some initial ideas on governance are described, covering the full lifecycle from participating in SWIM to providing or consuming services on SWIM. All this is documented with use-cases to better illustrate how SWIM works in practice.

The agreed SWIM definition is as follows: “SWIM consists of standards, infrastructure and governance enabling the management of ATM information and its exchange between qualified parties via interoperable services”.

This definition brings several elements:

- It structures SWIM (see also attached picture) into several layers: Services, Information and technical infrastructure.
- It focuses on the need to have standards for all layers.
- It identifies the need for governance.

[3] Diagram developed in SESAR PJ 19



Further the SESAR SWIM Concept of Operations has also become the main source of the ICAO manual on system wide information management (SWIM) Concept (Doc 10039, being finalised for publication) as developed through the ICAO ATM Requirements and Performance Panel (ATMRPP).

This ICAO document is the basis for the ICAO Information Management Panel (IMP). An essential element of the ICAO SWIM manual is the so-called Global Interoperability Framework that identifies the need for all SWIM standardisation actors to act together in a globally harmonised way.

SWIM services are defined to operate on a defined technical infrastructure as foundation; SWIM technical services are organised in so-called SWIM profiles. A SWIM profile is a particular set of standards tailored at meeting specific functional and non-functional requirements.

The latest SESAR definition is: “a SWIM profile is a coherent, appropriately-sized grouping of middleware functions/services for a given set of technical constraints/requirements that permit a set of stakeholders to realise Information sharing. It will also define the mandated open standards and technologies required to realise this coherent grouping of middleware functions/services.” Two profiles have been defined so far: one around web services (yellow profile, fully based on open and mature industry standards), one around the data distribution service -DDS (blue profile). A third profile (still draft) for air-ground SWIM exchanges (purple profile) is also being developed.

In order to accommodate military needs, a new profile (green profile) is also under development.

Current activities of this sub-domain

WG-104 SWIM Services has created a concept how to standardise SWIM compliant services by using the Extended horizon AMAN service as a first implementation.

Having reached a first specification of a SWIM compliant standard of a service, a guideline supporting the standardisation of future SWIM services needed and a lesson learned report about standardising a service are available.

For details on the deliverables please consult the table in annex.

Within the context of its work programme WG-104 has developed a list of services for future standardisation from 2018 onwards. This included the following steps:

- Development of criteria how to prioritise the available services,
- Definition of different areas where services are applicable,
- Prioritisation of services within these areas.

The prioritised list of services has been presented to TAC. As a result, the following services groupings have been identified as potential candidates for standardisation:

- MET Services
- A-CDM Services

- AIM Services
- AMAN Services

NOTE: Several of these services have been already developed and are now registered at https://eur-registry.swim.aero/services ; this is a clear indication of the interest of the ATM Community.

In addition to the standardisation of a SWIM service, the group was also tasked to provide a report capturing the lessons learned from their work and provide recommendation regarding the methodology for further SWIM service standardisation. This report also contains a proposal for potential future activities regarding the standardisation of ATM SWIM services, as mentioned above.

Initially set up as three individual reports, these documents have been grouped under ER-018 and published as one comprehensive EUROCAE report.

In 2019, it was decided to reactivate WG-104 in order to develop a new report "SWIM Information Service Specification Template and Methodology (Technical Standard)" with the view to facilitate the development of services and advanced profiles. This deliverable was submitted to Open Consultation in July/August 2021 and will be published in Q4/2021.

The governance aspect of SWIM is currently developed by the SWIM stakeholders in a project under the umbrella of the SESAR Deployment Manager. Close cooperation with this project is envisaged to support the standardisation and interoperability needs.

To this end, EUROCAE has already engaged with the SWIM Governance Project reiterating the availability of EUROCAE to undertake an active role with regard to SWIM standardisation.

Furthermore, EUROCONTROL has completed the task from EASCG to develop functional information exchange service implementation specifications – a SWIM Standards Package consisting of three EUROCONTROL Specifications: for SWIM Service Description, for SWIM Information Definition, and for SWIM Technical Infrastructure Yellow Profile have been published.

Taking advantage of the revision of the PCP in the CP1, the SESAR Deployment Manager (SDM) has augmented considerably the SWIM part of the deployment programme in order to support more practically the roll-out of the set of SWIM services mandated by the PCP/CP1 Implementing Regulation.

Vision of future EUROCAE activities in this sub-domain

Not all SWIM services require standardisation activities: EUROCAE activities regarding SWIM are most relevant for services that will be provided by more than one provider and where service provision is regulated.

SWIM services in need for standardisation will in the future be identified by the prospective SWIM Governance function, where a close coordination with EUROCAE is already foreseen.

The creation in 2019 of an ICAO EUR SWIM Project Team implementation group is showing the evolution towards broad implementation by States.

SWIM services in the airport domain and for information exchange in Air Traffic Control Centres ("Virtual Centre services") may be future candidates for standardisation.

EUROCAE has been contacted by the leader of SESAR Project PJ-38 about the potential standardisation of a Common ADS-C Service using SWIM and discussions about such a development are ongoing.

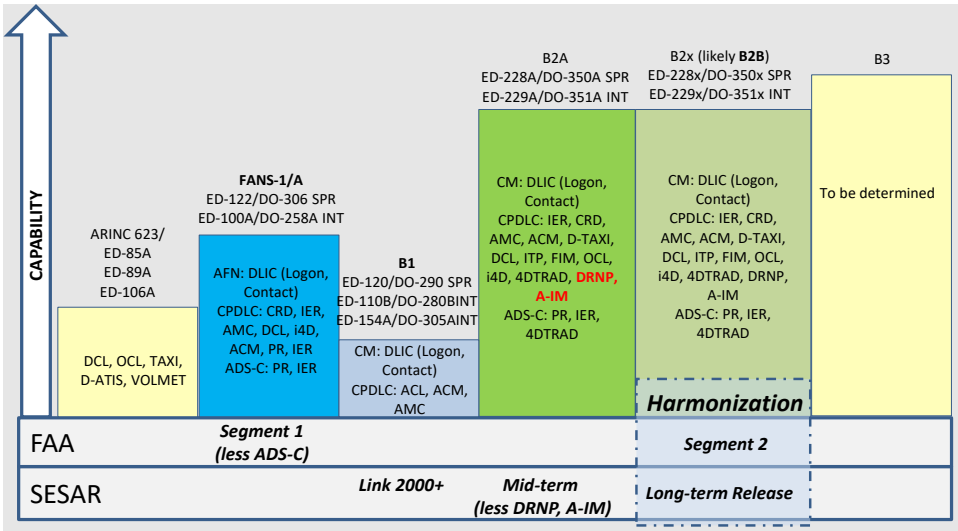
4.5.3. Datalink Applications

Current activities of this sub-domain

EUROCAE WG-78 Air Traffic Data Communications Services and WG-76 AIS/MET Datalink Applications are already active in this sub-domain. For details on the deliverables please consult the table in annex.

Vision of future EUROCAE activities in this sub-domain

As depicted in the Figure below, the revision B was identified by both NextGen and SESAR programmes as being the target for capability convergence (particularly through the inclusion of Advanced-IM and D-RNP).

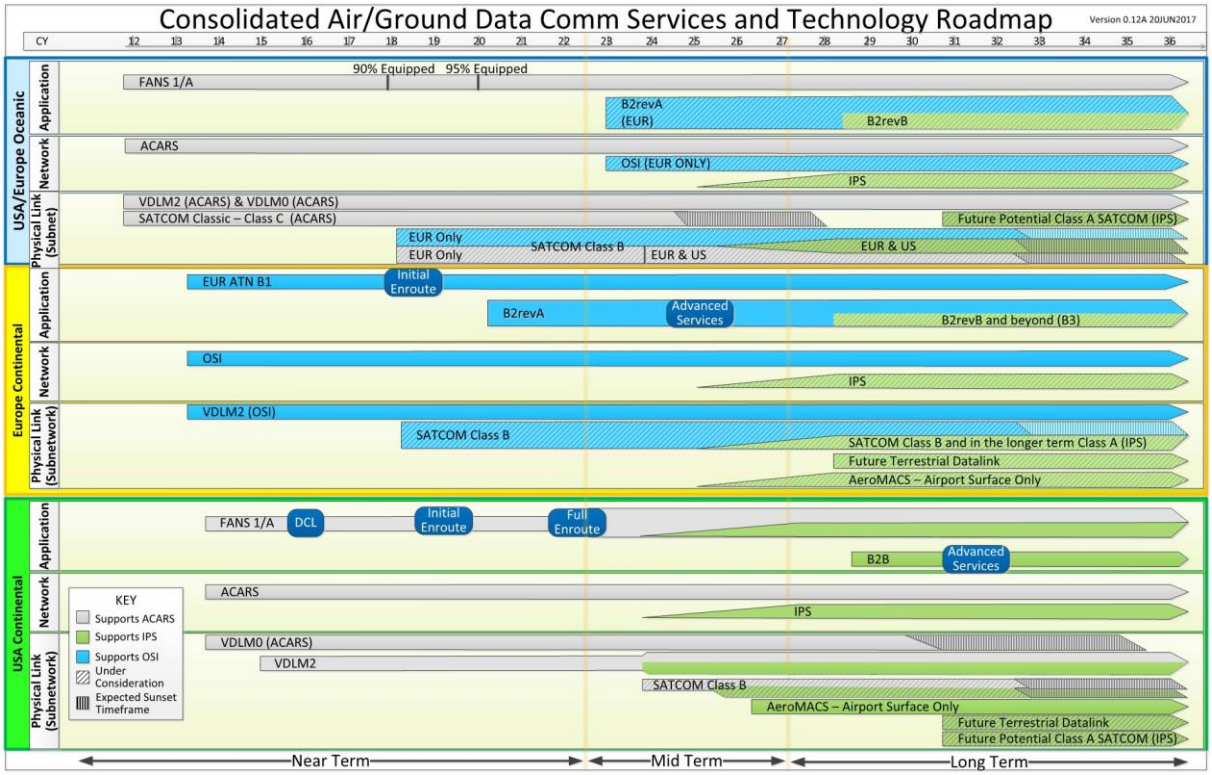


APPLICATION DEFINITIONS FOR VARIOUS ATS DATA COMMUNICATIONS VERSIONS

These capabilities will support the foreseen operations in Europe and in the United States. A joint SESAR NextGen communication strategy was developed under the joint EU-US coordination plan and reflects this vision. The main reason for this strategy was to identify potential interoperability and harmonisation challenges and opportunities and to address these further in the context of the MoC U.S./FAA/NextGen – EU/SESAR to be able to achieve interoperability and harmonisation to the level needed for airspace users flying in/out or overflying respective airspaces without having to be equipped with separate and specific capabilities for respective ATM and airspace environments

The figure below shows the combinations of Applications, Networks, and Physical links supported by both the EU and the U.S. A common combination of the three is required for respective continental and oceanic ATM and airspace environments allowing for interoperability.

It is important to mention as well that, the agreed joint target of transitioning towards the use of IPS for the network component, triggers interoperability and harmonisation opportunities to be clarified and elaborated upon across all three elements: applications, networks and physical links. Therefore, it is essential to support the IPS standards development in parallel.



CONSOLIDATED US AND EUROPE AIR/GROUND DATA COMMUNICATIONS SERVICES AND TECHNOLOGY ROADMAP

EUROCAE WG-108 and RTCA SC-223 are working together as a joint committee to develop a globally harmonised aviation standard for IPS.

WG-108 and SC-223 have aligned their deliverables to produce a MASPS. Deliverable schedule for SC-223 and WG-108 have been aligned for both the profiles document and the MASPS to enable joint publication of technically equivalent documents.

This activity also supports strategic development of the SESAR operational concept and cooperation with RTCA.

4.5.4. Aeronautical Information Services

Current activities of this sub-domain

At present, the active EUROCAE groups in this domain are WG-44 Aeronautical Databases. In addition, WG-76, together with RTCA SC-206, works on the specification of AIS/MET Datalink Services.

The work aims at providing a framework to enable the development of aviation-specific applications using geographic and appropriate aeronautical information/data as it relates to terrain, obstacles, and aerodrome mapping.

WG-44 is working jointly with RTCA SC-217 on revising ED-76A/DO-200B, and ED-77A/DO-201B, as well as on a new deliverable - Guidance document: “Considerations for Aeronautical Data Alteration”

Vision of future EUROCAE activities in this sub-domain

EUROCAE activities in the domain of AIS need to be in line with and support the evolution from AIS to AIM.

In the medium/long term, WG-44 is expected to undertake updates to the family of standards related to terrain, obstacle and aerodrome data supporting evolving user requirements and new envisaged applications. This would be based on feedback from stakeholders and could lead to new updates to ED-99D/DO-272D, ED-98C/DO-276C, ED-119C/DO-291C and ED-220/DO-342.

WG-44 may also need to assess the need to develop new standards, e.g. data for UAS/drones/“new entrants”, such as autonomous vehicles, vertical take-off and landing vehicles, as well as any other pressing demands for new industry standards on aeronautical data;

The increased emphasis on digital data exchange and distribution will result in an increased capability to present data and information in graphical form. In this context, digital NOTAM is being implemented in Europe as of 2018, thus improving the Pre-flight Information Briefing (PIB) by providing graphical presentation of dynamic data. This is not an isolated European development; the United States Federal Aviation Administration having already deployed an operational Digital NOTAM system at more than 300 US airports. To achieve a harmonised digital NOTAM implementation, an agreed standardised graphical symbol library (primarily targeted to ground operations, such as Digital NOTAM encoding and pre-flight briefing in the ARO environment) is needed. An activity should be foreseen in the Medium Term to address this standardisation need in order to avoid diverging implementations, which could lead to different interpretations and eventually safety issues. This could also include standardised graphical symbols for geofencing/geocaging areas relevant for drone operations. SAE International has published the standard “Human Factors Minimum Requirements and Recommendations for the Flight Deck Display of Data Linked Notices to Airmen (NOTAMs)” (Document ARP6467). This SAE standard is mostly a human factors standard. The EUROCAE work, which can be performed in partnership with SAE International, could build upon the SAE document, in order to develop a complete standard for representation of digital NOTAM in PIB.

This activity supports the transition from AIS to AIM.

The future activities considered are:

- Revised ED-98C User Requirements for Terrain and Obstacle Data (RTCA SC-217): Term TBD, Interested parties: Industry;
- Revised ED-99D User Requirements for Aerodrome Mapping Databases (RTCA SC-217): Medium/Long Term, Interested parties: Industry;
- Revised ED-119C Interchange standards for Terrain, Obstacle, Aerodrome Mapping Data (RTCA SC-217): Medium/Long Term, Interested parties: Industry;
- ED-xx Standard for graphical symbol library for representation of dynamic AIS and UAS geographical areas data and information (SAE, RTCA): Medium Term, Interested parties: ANSPs, EASA, Pre-flight Briefing Offices and Industry.

4.5.5.MET Services

Current activities of this sub-domain

Apart from the ongoing work of WG-76 AIS/MET Datalink Applications (addressed in the CND 6 communications sub-domain), there are no other current activities in this sub-domain.

The RTCA activity in SC-206 regarding weather information upload using TIS-B should be noted. WG-76 and SC-206 are working jointly on the development of the AIS/MET Datalink Services specification for the uplinking of MET information. At the same time the Combined Surveillance Committee (CSC), a joint activity of WG-49, WG-51, SC-209 and SC-186 are working on the integration of MET data into the ADS-B protocol for downlink and crosslink applications.

With the implementation of the Global Reporting Format (GRF) for the transmission of the Runway Condition Report a revision of ED-89A Data Link Application System Document (DLASD) for the “ATIS” Data-Link Service is required to increase the size of the messages transmitted via the ACARS Data Link. This work has been allocated to WG-76 and will be performed in two steps: a short time update (Change 1) to ED-89A to specify the larger message size and a medium term revision of the document (development of ED-89B) to make it data-link agnostic. RTCA SC-206 has indicated interest in a joint development.

Vision of future EUROCAE activities in this sub-domain

The work of WG-104 on SWIM Services has delivered a report on a potential work programme for future SWIM service standards. This report includes an analysis of the possible future standardisation needs in the MET Information Services domain.

With respect to any standardisation activities on MET sensors, the rationale for possible EUROCAE work needs to be further elaborated.

EASA is working to promote that weather information is delivered timely and in graphical format into the cockpit for strategic decision making. This is reflected in the European Plan for Aviation Safety (EPAS). Resulting standard work has more of a long-term character today.

4.5.6. A-CDM

A-CDM is a concept aiming at improving operational performance at airports which involves not only the airport operators but also other stakeholders such as: ANSPs, aircraft operators, ground handlers, de-icing companies and supporting services. Many airports have already implemented A-CDM and efficiently benefit from it.

It is not a new topic for EUROCAE as it has addressed previously this topic with the first A-CDM standards delivered back in 2008. Since then, the Airport CDM community continued to update A-CDM procedures and system features. They published further guidance material and released several updates of the main reference material, the EUROCONTROL Airport CDM Implementation Manual (currently Version 5.0, 2017).

This functional evolution of A-CDM as well as requirements derived from the CP1 or other domains with close connection to A-CDM (such as A-SMGCS with regard to dynamic taxi times) triggered the necessity to update the existing EUROCAE documents in this domain. EUROCAE WG-111 addresses the new content and is currently updating the existing standards accordingly. The EUROCAE activity addresses in particular the requirements, which demand an interface of A-CDM to A-SMGCS with regard to routing and dynamic taxi times. Another topic in that field is the description of the SWIM A-CDM Service definition, providing requirements for the interoperability between the ATM and Airport domain.

4.5.7. U-Space/UAM

The regulatory framework for European U-space operations (Urban and Sub-urban airspace including UAS), adopted in April 2021 by the European Commission, introduces the minimum necessary services and conditions for manned and unmanned aircrafts to operate safely in the same congested and low-level airspace.

This U-space definition and associated regulation aims at improving safety by enhancing situation awareness while supporting safe, efficient and secure access to UAS, and it will become applicable in January 2023.

Meanwhile, SESAR's research programme continues with research and demonstration projects, including, for the first time, an IR project, looking at the interface between U-space and ATM.

As part of the WG105, the SG3 dedicated to UTM (Unmanned Traffic Management) supports the definition of associated technical specifications, allowing industry to get prepared for its implementation. In addition to existing and recognized standards, MOPS are being developed in relation with operational data exchange between U-Space providers and ATS providers, identification and authentication, flight planning and authorization services, traffic information and geo-awareness services.

In addition, tracking for safety purposes is covered by ED-282 (E-Identification) currently under review and expected to be published by the end of 2021.

Urban Air Mobility (UAM) is a different and evolving concept that covers 'flying taxis', or even personal 'flying cars'. UAM can be defined as "safe and efficient air traffic operations in a metropolitan area". UAM operations are likely to include aerial operations *both with manned or unmanned (meaning "Pilot on board") aircraft* in the congested areas of the cities, towns or settlements.

UAM is also often linked to the concept of On-Demand Mobility (ODM): air traffic operations between any origin and any destination without the delays associated with scheduled service in traditional commercial aviation.

NOTE:

- *According to Regulation (EU) 965/2012, ''congested area' means in relation to a city, town or settlement, any area which is substantially used for residential, commercial or recreational purposes'.*
- *Aerial operations in congested areas for civil purposes, below certain heights, are not permitted, except when necessary for take-off or landing, or except by permission from the competent authority (Ref: SERA.3105 and SERA.5005(f)).*

Examples of UAM missions are already foreseen:

- On-demand air taxi operations moving people between fixed or ad hoc locations
- Air cargo operations moving goods between warehouses and stores
- Regularly scheduled "air metro" operations transporting passengers between a set of fixed locations
- Emergency medical evacuations, rescue operations, and humanitarian missions
- Law enforcement operations
- News gathering
- Weather monitoring
- Ground traffic assessment
- …

The following interacting components of the "Smart Cities" concept will need to be considered for their potential impact on UAM:

- Urban Ground & Underground Mobility
- Activity places (industry, administration, R&T, storage & distribution, entertainment & recreational sites…)
- Environment, Security & Privacy
- …

NOTE: *Operation of UAM is not restricted to cities as very often the missions include a connection flight toward/from airport (controlled or not) or sites outside congested areas.*

A stepwise approach for introduction of UAM Operations is generally envisaged:

- Emergent UAM operations: Characterized by low-tempo, low-density flights along a small set of fixed routes between a few take-off and landing areas
- Early expanded UAM operations: Characterized by higher-tempo, higher-density flights in a small network of vertiports feeding a common hub location and managed by UAM operator and third-party services
- Mature UAM operations: Characterized by high-tempo, high-density flights in a network with multiple hub locations, potentially with orders-of-magnitude more vehicles and operations.

A number of barriers must be overcome for UAM operations to be integrated safely and efficiently into the airspace system and for mature operations to be conducted:

- Barriers associated with UAM vehicles include ride quality, lifecycle emissions, ease of certification in terms of both time and cost, auditory and visual noise in terms of annoyance perceived by the community on the ground, affordability in terms of operating cost, safety in terms of casualties and property damage, and efficiency in terms of energy usage.
- Barriers associated with UAM airspace integration barriers include reviewing flight rules, establishing safety with technologies and procedures to ensure separation from terrain, urban obstacles, and other aircraft, and developing efficiency with tools and methods to sequence, schedule, and space UAM aircraft at vertiports.
- Overcoming the safety and efficiency barriers for airspace integration will require UAM vehicles and systems to be interoperable with each other as well as those of existing airspace users. At a minimum, standards must be developed for the

data exchange architecture and for communication, navigation, and surveillance (CNS).

Work on UAM will have an impact on the activities of other working groups.

Many UAM players are new in the aerospace industry, bringing new approaches to design, test and certification. Emerging technologies like autonomy, computer vision and artificial intelligence will be linked to UAM.

It is clear that UAM implementation will have an impact on both the emerging U-space environment and more traditional ATM, since many vehicles are likely to operate above or outside the vertical and/or horizontal boundaries of U-space airspace. This has significant implications for standardisation and airworthiness. The SESAR programme is currently running a number of research and demonstration projects to address this complex subject.

4.6. SECURITY

Purpose & Scope of activities of this domain

The Aeronautical Information Systems Security (AISS) Working Group (WG) shall address information security protection as a means to ensure safety of flight and to maintain the operation of the civil aviation infrastructure without significant disruption. Aeronautical Information Systems Security shall be seen from an end-to-end perspective from information production, processing, management, communication to operational usage and maintenance. AISS therefore encompasses the aircraft, supporting ground infrastructure including communication and the supply chain.

WG-72 is developing AISS guidelines addressing objectives and requirements including the operational concept in a holistic approach, rather than technological solutions in order to ensure their stability over time.

Within the scope described above WG-72 are therefore addressing both the airborne systems and ground systems, their end-to-end interdependence from the operational and AISS standpoints, recognising however, that AISS requirements may apply differently for airborne and ground systems.

WG-72 shall serve as a resource and coordinator for Aeronautical and ATM information security-related matters with all EUROCAE Working Groups. As part of its performance-based rulemaking, EASA will increasingly rely on industry standards, including the ones on AISS. Due to its long-term experience, WG-72 is playing a pivotal role in this realm of industry standards.

Current activities of this Domain

The purpose is to develop and maintain acceptable processes and methods of compliance addressing information security issues in support of existing safety processes and analytical methods (e.g. ED-79, ED-135 [under development], ED-268 / [under development, will be published as ER-023]), including associated methods/processes for ground-based systems.

- Develop and maintain guidelines and objectives for evaluating security architectures and security procedures, demonstrating their compliance with security and safety objectives.
- Determine and maintain design and operational compliance methods appropriate and adequate for the application of information security solutions to safety-related functions.
- Address the necessity and objectives for the management of information security events and guidelines for response to detected AIS attacks or suspected attacks.
- Provide guidance for post-response recovery, including identification of affected systems, restoration of system configurations, notification requirements, and other related activities.

EUROCAE working group WG-72 Aeronautical Information System Security is already active in this Domain. For details on the deliverables please consult the table in annex.

Vision of future EUROCAE activities in this domain

The need for the WG-72 to work on the ConOps for Security Logging (potentially only the top-level objectives) could arise.

The future activities considered are:

- Guidance on Supply Chain Security: Short term, Interested parties: CAAs, Operators, Industry and ANSPs;
- Aviation information security management system (ISMS): Short term, standard Interested parties: CAAs, Operators, Industry, ANSPs and Airports;
- Guidance on change impact analysis for cybersecurity: Short term, Interested parties: CAAs, Operators, Industry, ANSPs and Airports;
- « Patch » management Short term, Interested parties: CAAs, Operators, Industry, and ANSPs;
- Specification on Vulnerability Management by WG-72 (ARINC-TBC): Short term, Interested parties: CAAs, Operators, Industry, ANSPs and Airports;
- Specification on Forensic Analyses and Accident Investigation by WG-72: Short term, Interested parties: FAIs, CAAs, Operators and Industry;
- Guidance on Incidence Response and recovery Management by WG-72(ARINC-TBC): Medium term, Interested parties: CAAs, Operators, Industry, ANSPs and Airports;
- Guidance on Maintenance Security WG-72: Short term, Interested parties: CAAs, Operators and Industry;
- Guidance on Development & Production Security by WG-72: Medium Term, Interested parties: CAAs and Industry;
- Guidance on Cybersecurity Testing: Medium Term, Interested parties: Industry, CAAs, Operators, ANSPs, Airports;
- Specification on Risk assessment methodology: Medium Term;
- Projects related to Cyber resilience requirements (overarching & per domain): Medium Term.

This activity supports strategic development in ICAO, EASA, RTCA and supports SESAR Deployment and is driven by developments in Aeronautical Industry (Aircraft and avionics manufacturers) and ANSPs. Future activities should be coordinated with RTCA SC-216 and will take into account the FAA strategy. Decisions on potential future joint activities will be based on the result of this coordination.

Activities will also be coordinated in the framework of the ECSCG and reflected in the ECSCG RDP.

4.7. UAS, GENERAL AVIATION AND VTOL

4.7.1. Purpose & Scope of activities of this domain

It has been realised that the specific needs of General Aviation have been left aside for a long time. Now it has been recognised that a strong GA is as well of value and several activities are on their way to better adopt some systems and regulations to the needs of the GA community. This may lead to the development of specific derivate of existing standards or the inclusion of specific classes. The new approach for more high-level, non-prescriptive regulation may drive the creation of industry best practice standards as well.

Different to Unmanned Aircraft Systems (UAS) and Vertical Take Off and Landing (VTOL) where there are dedicated Working Groups (WG-105 and WG-112) and other links to existing activities (eg ACAS, HV…) already well established and actively developing standards.

The integration of those aircrafts into the existing Aviation structure (incl certification) as well as ATM system needs industry standards for interoperability and to achieve worldwide harmonisation and safety.

4.7.2. UAS

Current activities of this sub-domain

Unmanned Aircraft Systems (UAS) is a wide domain ranging from a small 300 g remotely controlled drone up to a big transport category aircraft, which may even carry passengers. In the adopted EU regulation, a classification into the open, specific and

certified category is made to allow a proportional approach. This classification is reflected in the activities.

Similarly, the airspace in which UAS are planned to be operated ranges from dedicated airspace blocks, low level operation, to full integration into the ATM system. At EUROCAE, the UAS related activities are successfully integrated into one working group having six sub-groups to deal with the various stakeholder demands.

EUROCAE WG-105 is active in this Sub-Domain, developing the necessary standards to enable safe integration of all classes of UAS into all classes of airspace, with a focus on Specific and Certified categories.

The ToR contains the following activities/deliverables to be developed in parallel work in the six dedicated sub-groups.

- Detect and Avoid (DAA);
- Command, Control, Communication, Spectrum and Security (C3S);
- U-Space, currently referred in the ToR as UAS Traffic Management (UTM);
- Design & Airworthiness Standards (D&AW);
- Enhanced RPAS Automation (ERA);
- Specific Operations Risk Assessment (SORA).

This structure allows that the Sub-groups (SG) are working in parallel, but with a coordinated view and exhaustive harmonisation with external stakeholders (EASA, JARUS, EDA, SESAR JU, EUROCONTROL) and other standardisation organisations like RTCA SC-228, ASTM F38, ISO TC20 SC16 (their focussed UAS subcommittees).

<u>SG 1: Detect and Avoid (DAA)</u>

EUROCAE WG-105 Sub-Group 1 addresses DAA against conflicting traffic for RPAS operating under IFR in Class A-C airspaces, then DAA against conflicting traffic for RPAS operating under IFR in all airspace classes, and DAA for UAS operating in VLL.

On DAA IFR for RPAS, SG-1 is engaged in a comparison of both RTCA and EUROCAE concepts.

DAA VLL MOPS Subgroup activity as started within WG105 Subgroup 13. Participants from industry identified relevant two use cases that have been approved by WG105 leadership. Ongoing work is focused on OSED update in order to clarify operational conditions and functions to be performed by the DAA system according to the use cases selected. Once this done, functional and performances requirements will be defined. It has been decided to not have a joined activity with RTCA SC147 on ACAS sXU, but rather to provide a status on sXU applicability in Europe based on respective OSED analysis. This analysis will be performed in WG-105 SG-13.

<u>SG 2: Command, Control and Communication, Spectrum and Security (C3&S)</u>

EUROCAE WG-105 Sub-Group 2 is active in RPAS C2 Datalink, Spectrum and Security.

Momentum is no greater on LOS or SAT C2 for RPAS in IFR: there is little motivation and few industrial actors in Europe, while the USA has established their C2 LOS standards via D0362 and DO-377, even if not perfect. A difficult point lies in spectrum allocation. We focus on a MASPS for C Band spectrum management.

SG2 is going now to a proposal for standardization on LTE communication for C2 and U-Space / UTM of VLL UAS, jointly with RTCA, supported by GUTMA+GSMA.

Security specifics of UAS & RPAS still need to be analysed with WG-72, as waveform technics used to increase robustness to jamming are conflicting with the need to save spectrum.

<u>SG 3: UAS Traffic Management (UTM)</u>

EUROCAE WG-105 Sub-Group 3 developed initially Geofencing and E-Identification as part of U-Space Foundation services Step A.

The MOPS for e-reporting will be published by the end of 2021. SG3 will now work on exchange of operational data through an exchange model based on the data model developed in ED-269.

SG 4: Design & Airworthiness (D&AW)

EUROCAE WG-105 Sub-Group 4 gathered activities on Certified IFR RPAS System Safety Assessment guidance, and Remote Pilot Stations MASPS. The new activities aims at developing Acceptable Means of Compliance to EASA SC Light UAS. For details on the deliverables, please consult the table in annex.

SG 5: Enhanced RPAS Automation (ERA)

EUROCAE WG-105 Sub-Group 5 addressed Automatic Take-off and Landing, Automatic Taxiing and Automation & Emergency Recovery. This phase is now quite over. All 3 MASPS have been published. Further tasks might emerge in the future to support the integration then accommodation of RPAS in the ATM, not identified yet (For information, RTCA phase 3 includes work on Lost C2 link procedure and adapted Navigation performance requirements). For details on the deliverables, please consult the table in annex.

SG 6: Specific Operational Risk Assessment (SORA)

EUROCAE WG-105 Sub-Group 6 is dedicated to providing further Means of Compliance to EASA AMC “SORA” as necessary. Current activities are focussed on Low risk operations, Low and Medium robustness: Safety assessment, Envelop protection, GNSS usage, overall guidance for SAIL II to SAIL III and IV applications.

For details on WG-105 deliverables, please consult the table in annex.

In addition, as the small UAS industry is developing rapidly, there are currently competing organisations that are defining standards for UAS automation of “small” UAS. These competing standards are considered to be more attractive than existing ED like ED-12/DO-178 by the UAS manufacturers, as our standards are mistakenly thought to be only for airline equipment and too onerous and difficult to use. RTCA and EUROCAE formed an ad-hoc group with members of the Forum on Aeronautical Software (FAS) to address the question for software development, which delivered conclusions in 2019. WG-117 has been formed to address software considerations for UAS and VTOL. WG-63 together with SAE S18 has initiated a new activity on adaptation of System and Safety methodology (ED79/135) to UAS and VTOL. What seems not covered now is about hardware design assurance and the adaptation or not of the ED-80/DO254. At a later stage, an extension or equivalent of ED-14/DO-160 could be envisaged for small to medium UAS (as per CS-LUAS < 600kg ?) but will need to gather detailed knowledge of UAS various environment and UAV designs.

Vision of future EUROCAE activities in this sub-domain

The vision for future activities will be refined based mainly on the developments related to the EASA rulemaking activities, the developments in JARUS and of the SESAR Exploratory Research programme in SESAR 2020. Activities performed in the ICAO RPAS Panel may in future also have an impact on the EUROCAE Work Programme.

In addition, following the outcome of the FAS ad-hoc group on the applicability of ED-12 to UAS, this type of activity covered by the WG-117 on low risk aviation application should be extended to other currently available EDs with the aim to provide guidelines tailored to the UAS, but also VTOL and General Aviation, stakeholder’s needs.

From WG-105 point of view, the development of an enhanced conspicuity standard applicable to both GA, helicopters and VTOL, interoperable or identical to the remote/electronic identification required of UAS should be a priority to keep efficient mixing of VFR / UAS traffic while maintaining safe separation.

From a secondary viewpoint, other mutual interest between UAS and GA could be on Aeronautical data (UAS geographical zones, terrain elevation and obstacles, landing sites, weather...)

It is expected that U-Space / UTM will be used in the future by GA and not only by UAS. VTOL, even piloted, will also need a performing traffic management system to increase flight density. With regards to the UAS/VTOL market, urban environment should generate higher and more sophisticated demands while rural environment will certainly generate less interest from U-Space / UTM service suppliers.

A clearer identification of such U-Space / UTM variants and their respective timeframe will support building the EUROCAE mid-term Work Programme

Concerning the UAS/VTOL market, urban environment should generate higher and more sophisticated demands while rural environment will certainly generate less interest from U-Space / UTM service suppliers.

Concerning the datalink, spectrum shortage may limit UAS operations and could become a priority topic in the future, while some technics used to increase robustness to jamming are conflicting with the need to save spectrum for other users.

4.7.3. General Aviation

Current activities of this sub-domain

Realising that there has long been a need for the interests of General Aviation users to be represented in the EUROCAE standards process EUROCAE and the International Council of Aircraft Owner and Pilot Associations (IAOPA) formalised the inclusions of General Aviation in the development of standards with the signature of a Memorandum of Understanding on March 26, 2018. IAOPA Europe represents over 45,000 members belonging to 35 autonomous, nongovernmental, national general aviation organisations in almost every nation in Europe. IAOPA Europe has represented general aviation in Europe for over 50 years and is the voice for general aviation pilots in Europe. Representatives and subject matter experts for IAOPA advocate for general aviation and the freedom to fly, with local, national, and regional organisations such as the EASA, the European Commission, the European Parliament, EUROCONTROL, SESAR Joint Undertaking and national CAA's. IAOPA Europe is the largest regional affiliation of IAOPA which is an observer organisation at the International Civil Aviation Organization (ICAO) and represents General Aviation globally.

The cooperation between the EUROCAE and IAOPA Europe takes various forms, including but not limited to exchange of general and technical information; sharing of expertise and best practices; participation in each other's working groups; coordinated communication activities. The MoU paved the way for the next steps, welcoming IAOPA as a member and IAOPA experts joining EUROCAE working group activities and the development of standards.

A second MoU was signed 23 June 2020 with the General Aviation Manufacturers Association (GAMA). GAMA exists to foster and advance the general welfare, safety, interests, and activities of the global business and general aviation industry as well as VTOL industry. This includes promoting a better understanding of general aviation manufacturing, maintenance, repair, and overhaul and the important role these industry segments play in economic growth and opportunity, and in serving the critical transportation needs of communities, companies, and individuals worldwide. The scope of the MoU may comprise various types of activities, including but not limited to the exchange general and technical information, sharing expertise and best practices, cross-participation in working groups, where appropriate and in accordance with the respective rules of procedure of each Participant's organisation; developing joint positions or recommendations, coordinated messaging to their respective members or stakeholders; and coordinated messaging to third parties, including (but not limited to) regulatory and legislative authorities, vendors and the media.

The development of standards recording the industry best practices in the domain of aircraft certification and supporting the revised performance-based certification standard CS-23 was mainly performed by ASTM. Many GA members typically leverage the work done jointly by EUROCAE and RTCA. We need to mention also here that part of these Standards will be also adopted by the VTOL community.

Vision of future EUROCAE activities in this sub-domain

The following areas have been identified as possible work areas that will impact the general aviation domain. These may result in contributions to existing or proposals for new standardisation activities by the GA community.

General items:

- GA Interoperability with CAT and UAS

Areas for potential standardisation activities:

- Traffic and Weather uplink
    - Connection between TPX, ADS-B, ACAS (X), DAA, Flarm

- Eventually new technologies
    - E-registration for UAS

Areas with potential interfaces

- EFB
    - EFB a potential alternative to certified equipment
- EVS/SVS/CVS
    - operational benefits for GA
- RMT TWR
    - Example GA airfields in US
    - Option - remote AFIS
- Heli TAWS
    - Updates for helicopters offshore operation (WG-110)
- ADS-B and Mode-S
    - Light weight and light cert ADS-B
    - Mode-S update
- ELT
    - ED-62B now published
    - New activity on return link service (RLS) WG-98 SG-1
- UAS
    - GA needs to have a voice in WG-105
- VTOL
    - Very close relation to GA
    - Partly overlapping in certification, standards and operation
- Electric and Hybrid propulsion
    - GA applications are very likely or already available
- SW qualification
    - Low risk applications (WG-117)
- Cyber Security
    - Currently covered with ED-201 to 204().

4.7.4.VTOL

Current activities of this sub-domain

Vertical Take Off and Landing (VTOL) aircraft are currently under extensive development. Many projects are in design or experimental phases worldwide, and several applications have been made to authorities seeking type certification within a demanding schedule.

Following an objective-based approach to the best extent, while also offering a certain degree of proportionality, EASA published on 2nd July 2019 a VTOL Special Condition (SC) to address particularities of this new aircraft category using lift/thrust units to generate powered lift and control. Further work is ongoing to develop Acceptable Means of Compliance (AMC) and Guidance Material (GM) on this topic, while EASA is seeking having European industry standards established.

A stepwise approach addressing the most important topics with potentially strong impact on the design was initiated jointly by EUROCAE and EASA. A VTOL workshop to discuss current activities, identify and prioritise standardisation needs with key stakeholders from industry, airspace users, Member States, European institutions, academia led to the creation of WG-112 “VTOL” in June 2019.

An aggressive programme of work was defined with priority activities already initiated amongst initially 5, but now 8 sub-groups:

- Electrical system
- Lift/Thrust system

- Safety & security
- Flight performance, flight envelope and handling qualities
- Ground infrastructure and airport operations.
- Avionics
- Concept of Operations (ConOps)
- Seats (joint with SAE Seat Committee)

This activity is also a Pilot project to support the development of the “lean standards” process decided by the EUROCAE Council.

Vision of future EUROCAE activities in this sub-domain

The development of VTOL aircraft for Urban Air Mobility will rely on emerging technology like autonomy, artificial intelligence, computer vision or existing technology developed for other purposes like communication networks where the specification of minimum operational performances may be required.

Similarly, guidelines may be required for the application of existing standards to the particular environment and usage spectrum of VTOL vehicles.

4.8. SUSTAINABILITY

4.8.1. Purpose & Scope of this domain

The purpose of this domain is to give an overview of existing EUROCAE activities regarding sustainability. Additionally, potential future topics are stated.

In the recent years environmental consciousness has gained in importance in all sectors of life and it has also become a political, a business and a moral issue. The European Commission established an ambitious sustainability & climate strategy (‘the European Green Deal’) which the European industry fully supports with the goal to reduce absolute emissions to the furthest extent possible. The overall goal is the “Net Zero Carbon 2050” commitment which requires the aeronautical industry to reduce their emissions down to zero by 2050. An important point is to still ensure a sustainable air traffic growth by keeping the emission and decarbonisation goals.

The goal can only be achieved through a holistic approach and should aim towards the following three basic principles:

- Reduce emissions
- Increase efficiency
- Decrease Noise

Besides the ongoing standardisation activities, additional work will be needed to reach the ambitious goals of the European Commission. The Strategic Research and Innovation Agenda [4] by SESAR Joint Undertaking, summarised industry needs and challenges which can ensure a sustainable future for aviation by accomplishing the three main points above. Some examples are stated below.

- Green trajectories
  - Aircraft are flying along fuel-efficient 4D trajectory.
  - A compromise between fuel efficiency and noise impact must be made.
- Advanced RNP green approaches
  - Aircraft are approaching by following precise 4D trajectories.
- Environmentally optimised climb and descent operations (OCO and ODO)
  - Aircraft delay the deceleration phase closer to the airport.
- Non-CO2 impacts of aviation
  - Trajectories should avoid areas where aircraft-induced clouds form.
- Optimisation of flight operations

[4] SESAR Joint Undertaking, “*Strategic research and Innovation Agenda*”, Luxembourg, European Union, September 2020

- Emission-free taxiing and traffic management.

- Impact of new entrants
  - The use of new propulsion systems (e.g. Electric, Hybrid and Hydrogen)
  - New UAS/RPAS and VTOL operations.
  - The development and use of non-fossil biofuels

Current activities focus on hydrogen and fuel cell systems, hybrid electric propulsion and high voltage systems.

4.8.2. Hydrogen Fuel Cells

Current activities of this sub-domain

Hydrogen and electricity together represent one of the most promising ways to achieve and realise a sustainable energy source and decarbonise civil aviation in the long term.

The joint activity is run in parallel to an FAA Aviation Rulemaking Committee (ARC) created in 2015. The ARC looked into hydrogen fuel cell technology use cases and certification objectives. The recommendation report was published by FAA in April 2019.

For the storage of electrical energy currently several activities for standardisation are running at RTCA or SAE. This includes lithium battery requirements, development of specifications for electrical actuators, traditionally powered by hydraulic systems, electrical aircraft engines, or solar cells etc. The EUROCAE role in this sector depends on the willingness of European industry and EUROCAE stakeholders to engage in this domain.

WG-80 has released the joint MASPS / Aviation Standard (AS) ED-245/AS-6858 in 2017, addressing technical guidelines for the safe development, testing, integration, validation and certification of Gaseous Hydrogen (GH2) based PEM Fuel Cell Systems (FCS).

The Working Group has also completed the development of a joint EUROCAE Report / SAE AIR (ER-020 / AIR-7765, issue in late 2019) that describes general considerations on hydrogen, on-board hydrogen storage and fuel cell systems, along with the benefits of such hydrogen-based solutions for aerospace applications. This document will describe the existing applications and the experience gained with exploiting these technologies. It explains how the experience learnt with these existing uses will help alleviate safety concerns and will underline the relevance of these solutions for usage in aviation.

Since mid-2019, the Working Group is working on a MASPS for liquid hydrogen storage for aviation. Aim is to develop system performance requirements for the safe development, testing, integration, validation and certification of Liquid Hydrogen (LH2) including LH2 fuel storage and LH2 fuel distribution. The MAPS is expected for fall 2022.

Procurement for Hydrogen systems in general aviation is increasing as well and therefore WG-80 added a second deliverable, a MASPS for Gaseous Hydrogen Storage for General Aviation, to their Work Programme. The standard deals with the specifics of gaseous hydrogen storage systems and aircraft's ecosystem. The Task Sheet (TS) was approved at TAC meeting 88 and the activity will be joint with SAE AE-7F. This new deliverable supports the General Aviation industry as mentioned in 4.7.3.

Vision of future new EUROCAE activities in this sub-domain

In the future, the Working Group still intends to work on the following activities with the following targets:

- The development of a joint guidance document that processes the recommendations coming out of the final ARC report and provides technical guidelines and proposed means of compliance for the safe development, testing, integration, validation and certification of one particular application of airborne hydrogen fuel cell system from those described in the ARC report, considering the equipment that is on-board and those necessary for handling and ground operations.

- The work will also consist of ensuring that these recommendations are appropriately captured in the documents which have been published (AIR-6464/ED-219 and AS-6858/ED-245). This may mean that new issues of the existing documents be created.
- The development of a joint document MASPS ED-yyy / AS(ARP)-yyyy that defines the technical guidelines for the safe development, testing, integration, validation and certification of material-based storage of Hydrogen (solid and chemical).
- The development of a joint document MASPS ED-zzz / AS(ARP)-zzz that defines the technical guidelines for the safe development, testing, integration, validation and certification of onboard reforming o:
    - The aircraft kerosene
    - Propylene Glycol Water mixture (PGW)
    - Methanol / Ethanol and any other fuel.

4.8.3. Hybrid Electric propulsion

Current activities of this sub-domain

The aviation industry is witnessing a revolution that will see integration of more electricity to power vehicles. One factor leading this revolution stems from environmental constraints (in order to lower the emissions): studies into the electrification of aircraft propulsion revealed the potential of reducing carbon footprint by 50% between 2005 and 2050 – supporting ACARE goals. This step-change in technology / architectures will require new ways of collaborating among airframers, engine manufacturers and system suppliers – and addressing the regulatory framework and means of compliance for these new architectures. Hybrid/Electric Aircraft promise to be one of the enablers in realising ACARE Flightpath 2050 goals.

WG-113 on Hybrid Electric propulsion has finalised the Report on standardisation needs for Hybrid Electric propulsion and is following an assessment to identify priority topics to complement the Special Condition applicable to any Electric / Hybris Propulsion System (SC-EHPS) with AMC material. To DPs, endurance and durability substantiation, where already launched to support this task and additional priorities are stated in the list below. A second internal report - standards review and assessment against the SC-EHPS, should complement the identification of these topics and gather all needs.

Vision of future new EUROCAE activities in this sub-domain

WG-113 is currently reviewing EASA´s SC-EHPS and will approve a priority list to support standardisation needs in respect to the SC.

4.8.4. Power distribution – High voltage

Electrical voltages used in the aeronautical industry are standardized at values like 115VAC, 28VDC, 230VAC, 270VDC.
With the constant increase of electrical power demand in aircraft and introduction of electrical and hybrid products the tendency to use voltages that are higher than the conventional ones is increasing. When speaking about electrical propulsion this increase in voltages goes up to 3000V (or even higher).
Higher voltages are needed to be used in order to decrease the weight of the wiring and other electrical components.
Currently, there are no existing aviation standards for high voltage. No components have been yet developed and qualified for this use and a gap in the standardization activities is identified to cover these new electrical technologies.
Therefore, WG-116 on high voltage has been launched by EUROCAE by the beginning 2020.

4.8.5. Future activities

<u>Green Airport</u>

A big opportunity towards emission reductions is to optimise aircraft operations on the aerodrome surface. The emissions of ground movements need to be cut as much as

possible and therefore new concepts of CO_2 free taxi procedures are currently developed. That for example includes autonomous taxi scenarios using CO2 free operating tugs respectively CO_2 free taxiing aircraft. Possible ways to achieve the required goals include the reduction of energy and fuel consumption. Also an investment in zero emission vehicles and ground support equipment with alternative drive systems and a switch to zero-carbon energy and fuel sources is possible, both requiring detailed technical specifications and interoperability standards.

Apart from the reduction of emissions during taxi, all the turnaround process needs to be considered, especially provision of power and conditioned air to the aircraft and all vehicles, machines and infrastructure serving the ground handling of aircraft (vehicles including tugs, passenger busses, luggage tugs etc.). The design of new energy-efficient infrastructure and the retrofitting of existing infrastructure plays a key role in this respect as well as the supply of the entire airport infrastructure including terminal buildings and car parks with regenerative energy.

It doesn't matter if the energy needed for aerodrome operation is provided through electric power, hydrogen, biofuel or other means – in all cases common charging/refuelling technology, infrastructure of energy provision and storage, well defined interfaces (plugs, network interfaces etc.) and state-of-the art soft- and hardware to optimize the operations will be needed. In the future the airports need to provide a sustainable energy supplying infrastructure for aircraft and zero emission vehicles of passengers and cargo handlings companies as well as for other stakeholders. Furthermore, they should create the preconditions to encourage passengers to use energy-efficient means of transport in combination with smart digital applications when travelling to the airport (mobility as a service).

Airports should support the efforts to improve the supply of aircraft with sustainable alternative fuels generated from renewable energy.

Quality of air is another important pillar to achieve the aim of sustainable and responsible airport operations. Any ultrafine particles and other air pollutants emitted directly or indirectly though aircraft operation will need to be avoided. Methods of measurement and quantifications need to be established.

To achieve all the above-mentioned goals effectively and in an efficient manner, standards need to be developed. They will also be necessary in order to allow an objective comparison and a quantitative measurements of performance goals on the one hand and interoperability of various technical solutions on the other hand.

Possible fields for EUROCAE standardisation activities regarding the environment friendly development of airports and airport operations are

- Interoperability standards for electric infrastructure for aircraft, ground vehicles and power supply at airports,
- Performance requirements and technical guidelines for the measurement of economical friendliness,
- Standards, safety requirements and interoperability requirements for infrastructure and interfaces with regard to the use of hydrogen on aerodromes,
- Guidelines and performance requirements for environmentally friendly targets and efficient ground operations,
- Requirements for the measurement of particles emitted by airport operations into the air.

<u>Formation Flight</u>

It has been demonstrated that mimicking birds formation flights in civil aviation can lead to fuel consumption reduction and CO2/NOx emissions reduction and can already contribute to greener aviation before next generation of zero emissions aircraft enter into service.

Formation flight principle relies on the concept of a follower aircraft that gets free lift from a leader aircraft's wake updraft. It has been estimated that around 5% of the follower trip fuel reduction and CO2 reduction can be obtained for widebody twin pairs separated by 1.5 – 2 NM, during flights greater than 2000 NM. Flight testing has already started including with a North Atlantic demonstration in 2021. A Controlled Oceanic entry into service is envisaged around 2025.

But indeed, a wide cooperation is needed between stakeholders such as aircraft manufacturers to make available interoperable platforms, airlines with viable routes, a viable concept of operations for Air Traffic Control and last but not least, to establish industry rules & standards for certification.

A first concept of Operations has been identified and foresees potential impacts in avionics systems, Air Traffic Management and Communication links. Upon the detailed impacts are identified and the go-ahead is given for this type of operation, standardization and rulemaking will get started.

4.9. ARTIFICIAL INTELLIGENCE

4.9.1. Purpose & Scope of activities of this domain

Artificial Intelligence (AI) technologies combine the raw computing power of machines with the cognitive power to reason, learn and make decisions.

AI technologies are attempting to provide computers the ability to:

- Recognise and understand inputs like handwritten inputs, natural language, audio, pictures, video and more;
- Interact / respond;
- Reason and make decisions.

AI technologies are developing fast and appear to become accessible, providing attractive future capabilities, thanks to the processing power significant increase in the recent years, enabling machine learning and computing so that they can perform certain tasks as well as or better than a human.

4.9.2. Current activities of this domain

EUROCAE WG-114 Artificial Intelligence (AI) is already active in this sub-domain. For details on the deliverables please consult the table in annex.

The objectives of this EUROCAE WG are to establish industrial best practices for the development and the certification of AI embedded into aerial vehicle and ground equipment, providing standards for Qualification of Aeronautical Systems embedding AI in Airborne (manned and unmanned) and Ground (ATM / CNS / U-Space / UTM).

The first task pursued by the group was to develop an internal report “Qualification Process of Aeronautical Systems Implementing Artificial Intelligence - Statement of Concerns” in order to establish a comprehensive statement of concerns versus the demonstration of conformity of AI-based products to the regulation requirements and clarify the future scope of the standard applicability. It was an opportunity to align the groups (EUROCAE WG-114 and SAE G-34) on a common understanding of the AI techniques and the concerns that the use of such techniques would cause with respect to the development of an aeronautic system, as well as to recommend a path forward and to form an efficient organisation to develop the future standard.

The report mainly focused on Machine Learning (ML) and performed a gap analysis on the main design assurance standards for airborne and ground systems to determine if they are sufficient when implementing ML, leading to the need to develop specific guidance and methods. ML development specifics were studied to identify areas of concerns and led to a ML workflow within a system development workflow. The group also identified an approach for ML-based system certification/approval and detailed potential development assurance activities to be further studied within the joint WG in addition to use cases of interest such as aircraft systems and ATM / U-Space / UTM.

It is planned that a joint activity between SAE and EUROCAE committees will address the needs identified in the internal report. The direction taken by the documents under development is stemming from this initial report.

4.9.3. Vision of future new EUROCAE activities in this domain

The future activities will highly depend on the type of applications of AI technologies. However, several aspects must be addressed independently of the applications and will probably require adapting existing standards and methods or to create new ones in particular for the development of computer processes and algorithms, their qualification and certification, including of the machine learning processes, the resulting updated

processes and algorithms as well as the nature and amount of data to be used to perform the incremental training.

Future activities to be contemplated include:

- Cyber security of Machine Learning products is not addressed in WG-114. There is a need for a complementary activity/group with cyber specialists. External liaisons have been created with EUROCAE WG-72 and SAE G-32 to address cyber security aspects. WG-114/G-34 will raise the concerns/threats that will be addressed in the ad hoc cyber security standards,
- Extend the standard to other AI technics beyond Machine Learning;
- Work on a framework to make aeronautical data accessible for trusted stakeholders (e.g. European major manufacturers).

Address human factors in relation to automation/autonomy/Artificial Intelligence and the evolving role of the human. An inter-working groups meeting involving WG-114, WG-63, WG-105, WG-112 and representatives from airspace users EASA, controllers and airports representatives was held to address this topic. It was agreed that WG-114 leadership supported by some TAC members will develop a problem statement in order to identify which questioned needs to be solved and addressed, which could lead several EUROCAE WGs to incorporate the resolution of these questions in their respective work program.

4.10. MISCELLANEOUS

4.10.1. Purpose & Scope of activities of this domain

The scope of this section is to work as a home for activities that do not fit 100% into other domains but are clearly within the scope of EUROCAE.

Currently this domain hosts: the Electronic Flight Bag (EFB) activity, which is shared by aircraft certification aspects and flight operation aspects, Space / space-based ATM systems, and counter-UAS.

4.10.2. Electronic Flight Bag

EUROCAE WG-106 Electronic Flight Bag is currently dormant. For details on the deliverables please consult the table in annex.

Electronic Flight Bags are a fast-evolving domain. Functionality is offered as applications, which can be hosted on portable platforms or on those, which are integrated into the aircraft. While the installed hardware falls under aircraft certification requirements, the applications are overseen under the operation regulations and therefore the operational certification process by NAAs. This drives the need for application developers having a clear set of objectives and acceptable means of compliance for the acceptance/approval of their applications by the various National Airworthiness Authorities responsible for operator oversight. To support such demand and to open a certification path through an EASA authorisation process, a MOPS is currently under development. While staying generic in principle, some need for requirements that are more detailed have been identified for those applications needing specific mitigation means to justify that the maximum failure effect, which may be caused by misleading information or loss of the function, remains minor.

During current activity, the need to have a certification path for the installed hardware elements has been identified. Beside the environmental qualification, the further integration of EFB applications and certified functions on the same hardware and on the same display drives the need for standardised requirements. A MOPS standardising requirements for shared use of hardware may be one potential next activity.

There may be an upcoming demand to further standardise applications under operator's control, outside of the scope EFB, in particular there is a justified assessment that their failure effect is acceptable. The integration of the airline operation centre with the aircraft by providing frequent data exchange is one domain of development, which may shift the focus of the crew from strategic decision support to more tactical support, which may come with a higher criticality. The developments may lead to a mid-term need to further expand the MOPS that is currently under development.

The basic concept of standardising non-required, normally non ETSO´d equipment or applications, could be used in other areas, where e.g. several different approval process could be replaced by one EASA or other CAA approval. Like for EFB´s normally part of the OPS approval process, common components can (not should) be approved only once.

4.10.3. Space / space-based ATM systems

The use of satellite navigation services for aeronautical navigation has been growing steadily over the past two decades. Based on the use of the Global Position System (GPS) operated by the United States, the introduction of satellite navigation has revolutionised the way to navigate as well as the organisation of airspace. It has brought numerous benefits, increasing efficiency of routing and rendering the sky a safer place.

Galileo, developed by the European Union, is already offering a free global state-of-the-art navigation capability with three signals offered to civil users and outstanding accuracy performance. The initial operational capability was declared in 2016 and the services delivered continue to improve every day. Full capability of the constellation is planned by the end of 2020. In addition, GPS is being modernised and new signals will soon be made available to civil users. Russia has rebuilt a full constellation of their GLONASS system and is gradually transitioning to modernised signals. China is also developing its own navigation constellation, Beidou (COMPAS).

In parallel to Galileo developments, EGNOS is the Satellite Based Augmentation Service (SBAS) operated by the European Union. It has offered flawless services to the aviation community since 2011, enabling several hundred EGNOS-based up to CAT1 approach procedures at airports throughout Europe, with no need for any ground infrastructure. Current EGNOS services are provided on a single frequency and only augment GPS. However, the European Commission has launched an ambitious modernisation plan for EGNOS that will deliver multi-constellation dual-frequency services augmenting both Galileo and GPS by 2027.

These developments in Europe fully embrace the new concept of multi-constellation services developed by ICAO. The Navigation System Panel of ICAO developing "standards and recommended practices" (SARPs) for new satellite navigation constellations and modernised augmentation systems. Strategic directions for the evolution of GNSS were provided by the ICAO 13th Air Navigation Conference in October 2018. Plans are already underway in several European countries to transition to a full “Performance Based Navigation” in the 2030 timeframe and to rationalise conventional navigation aids still in operation (NDBs, VORs), thereby contributing to the reduction of aviation Route Charges.

In this context, the leading European actors in the field (EC DG DEFIS and DG MOVE, EASA, EUSPA and EUROCAE) are joining forces and aligning the schedule of their respective activities to prepare the operational introduction of new satellite navigation services for aviation in the shortest timeframe. The organisations will be working together to ensure availability of a modernised infrastructure, user equipment, standards and a regulatory environment ready for the delivery of dual-frequency augmentation services of Galileo and GPS as of 2027. In particular, the recently stablished EU Space Program will ensure the continuity and the modernisation of both Galileo and EGNOS as well as Copernicus for earth observation. On the Galileo side, the launch of the Galileo second generation satellites will start in 2024. The second generation will significantly improve services capabilities notably in the field of secure navigation and resilience against emerging threats. On the side of EGNOS, the workplan is expected to include incentives for ensuring a collaborative approach with other SBAS providers in other world regions, as well as with other standardisation bodies such as ICAO and RTCA.

In addition to ensuring the continuity and evolution of the three Space Program components, the EU Space Program also proposes the development of a space-based secure connectivity infrastructure. This infrastructure will enhance the Galileo signal (making it able to withstand various potential interferences), provide to Copernicus data relay capacity for real-time missions, and host extra payload space-based sensors to perform Space Surveillance and Tracking directly from space among other capabilities.

Currently, a global air traffic surveillance system is being implemented by Aireon that uses a satellite-based, space-based Automatic Dependent Surveillance-Broadcast (ADS-B) network that, they claim, 'meets the strict real-time ATS surveillance requirements required for air traffic separation services anywhere in the world'. In addition, SESAR activities are investigating the use of space-based VHF in order to provide direct-controller pilot communications (DCPC) for both voice and CPDLC in oceanic and remote areas, initially by VHF voice and VDL2 CPDLC, and in the future via space-based LDACS.

In the wider space context, industry is seeking for harmonisation and a predictable environment to develop, produce and operate solutions. Within the EU Space Programme, this aspect is address by the GOVSATCOM component which proposes a satellite communications service under civil and governmental control enabling the provision of satellite communications capacities and services to Union and Member State authorities managing security critical missions and infrastructures.

Today launches of rockets are done through the traditional airspace structure, fully segregated by closing huge amount or airspace, proper integration in the ATM, handed over to STM (space traffic management) and re-enter into ATM back to land at the space- or airport, see section on New Entrants (3.11 above). The EU Space Programme considers the autonomy in launchers and Space Traffic Management a strategical objective too and considers exploring new and competitive solutions for access to space and for STM under the Space Surveillance and Tracking (SST) subcomponent presented in more detail later.

Finally, another topic increasingly becoming sensitive is the issue of Space Debris. New satellite constellations such as OneWeb and SpaceX are currently being launched. This further increase the density of space use, the risk of collision with existing debris and of production of new debris. The issue of Space debris management is briefly mentioned in ITU Radio regulation Resolution 659 . A solid regulatory framework would need to be in place to ensure safety of astronaut or potential space tourist. The protection of space infrastructure from space debris is also addressed in the 2021-2027 EU Space Programme where new initiatives on space situational awareness (SSA) are proposed, including:

- An SST sub-component aiming to improve, operate and provide data, information and services related to the surveillance and tracking of space objects that orbit the Earth;
- A Space Weather (SWE) subcomponent for the observation of parameters related to space weather events; and
- a Near Earth Object (NEO) sub-component to monitor the risk of near-Earth objects approaching the Earth.

4.10.4. Counter UAS

Sighting of drones in the vicinity of major airports has significantly impacted airport and flight operations. In addition, many close encounters during approach, landing and take-off of aircraft were reported, with an impact on flight safety. These occurrences regularly lead to the suspension of flight operations at the airport with significant impact on the airport, airlines and the flying public.

To prevent such disruptions, the airspace around an airport needs to be protected to prevent unauthorised UAS from entering it and unauthorised UAS activities need to be detected and reported, at the earliest possible stage, to Air Traffic Control and responsible authorities. Finally, and according to national regulations, neutralisation or disruption of the UAS (either the Unmanned Vehicle, the Command & Control Datalink or the Remote Pilot) could be considered.

Currently the air traffic system relies on the flight crews or airport personal to detect and report unauthorised UAS activities. This implies that the detection of these operations happens too late and at a moment when there is already a direct safety threat on the flights affected. Today there are only a few pre-mature technological means of primary surveillance for detection of unauthorised UAS activities and for those technologies no performance and interface requirements exist. In addition to the lack of systematic detection and reporting processes/tools, the existing systems and the reporting of UAS

activities by flight crews or airport personal do not provide enough information to allow follow-up activities, such as the identification and location of the operator of the UAS by law enforcement.

It should be noted that these actions target the detection of unauthorised UAS operations such as (intentional) malicious flight, contingency situations and careless operations of UAS etc. Professional UAS operations can be expected to follow rules and procedures in place to ensure the safe conduct, such as registering the operation, filing a flight plan, use proper identification and communication means with the airport and ATS providers. The implementation of U-Space will provide a valuable situational awareness capacity about small cooperative UAS operating in U-Space airspaces around airfields.

Regarding the capacity to defeat the UAS, it is essential that any countering measures (e.g. jamming, interception, destruction…) do not impact current operations. As such interoperability must be achieved with existing and near-future communication, navigation and surveillance systems.

In view of the situation described above, there are already a number of technical initiatives to improve the situation with respect to the unauthorised or malicious use of UAS in the vicinity of airports or, more general, any type of protected airspace.

Many nations have initiated projects to equip airports (civilian and military) with a Counter UAS (C-UAS) capability, including UAS detection and/or neutralisation. A non-exhaustive list of European and international actors with an interest or involved in different forms of C-UAS activities is provided here:

- Competent Member State authorities, working independently and/or on a bi/multilateral basis;
- EU-funded law enforcement networks involving Member State authorities;
- EU-funded projects, including ones funded through Horizon 2020, the Internal Security Fund – Police (ISF-Police), the European Defence Industrial Development Programme (EDIDP), and the Permanent Structured Cooperation (PESCO) arrangement;
- Sectoral and cross-sectoral initiatives launched by individual Directorates-General (DGs) within the European Commission, including critical infrastructure protection (CIP), the protection of public spaces, and protection against chemical, biological, radiological and nuclear (CBRN) threats;
- EU Agencies, including the EU Aviation Safety Agency (EASA), the European Defence Agency (EDA) , the European Border and Coast Guard Agency (EBCGA/Frontex), Europol and Cepol5;
- The EU Military Staff (EEAS) and relevant Common Security and Defence Policy (CSDP) missions, including civilian ones;
- International organisations, including NATO6 and NATO-affiliated centres of excellence7, INTERPOL8, the Hybrid Centre of Excellence in Helsinki; EUROCONTROL.

EASA established in 2019 a Counter Drone Task Force to develop a strategy to improve the situation in Europe. The Task Force proposed an action plan (Ref. 18) including five

---

5 The Police School in Piła, Poland is responsible for organising this year's Cepol course on "Unmanned Aerial Vehicles (drones) – threats and opportunities for Law Enforcement". The course was initially scheduled to be held in May 2020 but has since been postponed to the fall. Additional information is available here.

6 In early 2019, NATO adopted a C-UAS Practical Framework involving a number of different work strands and the creation of a C-UAS Working Group. One of the Practical Framework's priorities is interoperability standards development to be supported by the NATO Communications and Information Agency (NCIA).

7 The NATO Counter-IED Center of Excellence in Madrid (link) is engaged in various C-UAS-relevant projects.

8 Within INTERPOL, there are several different streams with C-UAS relevance, including one aimed at promoting incident reporting and another one focused on guidance-development. As an example, the organisation recently published a "Framework for Responding to a Drone Incident for First Responders and Digital Forensics Practitioners".

objectives to provide guidance for Member States to mitigate the threat. These objectives are currently being addressed by individual working groups:

- Objective #1 – Educate the public to prevent and reduce misuse of drones around aerodromes;
- Objective #2 - Prepare aerodromes to mitigate risk from unauthorised drones use;
- Objective #3 – Support the assessment of the safety risk of drones to manned aircraft:
- Objective #4 – Ensure that C-UAS measures are swiftly considered and implemented from a global safety perspective;
- Objective #5 – Support adequate occurrence reporting.

The FAA recognised in May 2019 (Ref. 20) the airports authorities' safety and security concerns relative to malicious or errant use of UAS and provided information regarding UAS detection systems and the use of countermeasure or mitigation technologies.

At its 40th Assembly in fall 2019 (Ref. 1), ICAO recognised the strong common message from ACI, CANSO, IFATCA, IFALPA and IATA on "The need for standards and guidance to mitigate the risks of, and to improve response to unauthorized UAS operations".

Considering the urgent need by aircraft and airport operators, a C-UAS Working Group was created by EUROCAE in December 2019 with the task to develop the necessary standards specifying minimum performance and interoperability requirements. In February 2020, RTCA decided to create SC-238 that will work jointly with EUROCAE on this topic.

WG-115 has developed ED-286 "OSED for Counter-UAS in controlled airspace" (published in Q1 2021) introducing the overall capability of a C-UAS System, including the detection capabilities of unauthorized UAS in a protected area of influence around an airport and address the resulting hazard or threat, in a risk-based balanced manner.

The following standards are still planned to be produced jointly with RTCA SC-238 in the coming year

- An SPR for non-cooperative UAS detection systems, and
- An INTEROP for Counter-UAS systems

Depending on decisions from regulatory and security authorities, further standards (MASPS or MOPS) could be added to the WG TOR.

4.10.5. Thermal detection of potential COVID-19 carrying passengers

Early 2020, the world airline market was suddenly brought to a halt by the Covid-19 pandemic. Starting in China, this virus was rapidly transmitted worldwide by the prevalence of air travel and resulted in outbreaks and fatalities worldwide.

The virus is spread by the transmission of droplets and is particularly transmitted in enclosed areas like aircraft cabins.

One of the main characteristics of patients of the virus is a fever of higher than 38°C, and this temperature can be easily sensed by a thermal camera – this technology is in wide use within airports particularly in the Asia Pacific region.

WG-120 was created in September 2020 to define the specification and parameters for sensors which could be used onboard commercial aircraft to monitor the temperature of passengers to a sufficiently high degree of accuracy, in order to highlight to the cabin crew when a passenger presents with a fever, ideally at the aircraft door so that such passenger can be isolated and refused permission to board if possible. A camera system would also allow the cabin crew to automatically check whether masks are being worn.

The objective of this piece of equipment would be to provide passenger reassurance, and to serve the recovery of the aviation industry which relies on passenger confidence. An international standard would allow Regulatory Bodies a framework in which to allow passengers to board, and therefore the airlines to carry more passengers, following the worldwide lockdown based on the Covid-19 pandemic. The work is linked also to the ICAO "Collaborative Agreement for the Prevention and Management of Public Health

Events in Civil Aviation" (CAPSCA) as well as the EASA Aviation Industry Charter for COVID-19.

ED-297, a new MOPS for Airborne Thermal Camera Systems, was therefore developed according to an aggressive timeframe, and has now entered its open Consultation phase; this MOPS is expected to be published by the end of 2021.

4.10.6. Cleaning and Disinfection

As the subject of preventive cleaning and disinfection during and post event (Aircraft, Cockpit, Galley, Cabin and Cargo holds) is extremely important for the confidence of the passengers, staff and crews, several standardization bodies are starting work in this field aiming at standardizing the activities and techniques used for the aircraft cabins and cockpits.

EUROCAE created a new Working Group (WG-121), working jointly with RTCA SC-241, ensuring a global Outcome and checklists (not reinventing the wheel).

The participation of Airspace Users and Industry partners in the EUROCAE group is targeted at gaining additional recognition and use of the IATA developed guidance "Aircraft cleaning and disinfection during and post pandemic" together with other existing industry guidance, as a reference.

The IATA guidance can become the worldwide recognized Standard of Aircraft, Cockpit, Cabin and Galley Cleaning and Disinfection. This may ensure a consistent approach in the future and prevent prescriptive measure like the one applied by EASA for the long-haul & Short haul scheduled and charter or cargo flights.

The initial EASA (issued in March 2020) Safety Directives on cleaning and disinfection of the aircraft were revised at the end of June 2020. EASA has adopted some of the IATA recommended practices into their guidance.

After the WG has published ED-287 in December 2020, WG-121/SC-241 received comments from the US Center for Disease Control and Prevention (CDC). It is now planned to revise ED-287 and update the sections affected by the comments by the end of 2021. After this activity, it is expected that the WG will be dormant.

4.10.7. Infectious passenger handling in air ambulance operations

Aeromedical matters are at the crossroads of aviation and healthcare/ medicine. Whilst aviation has been standardised internationally for many years, this is not the case for healthcare/medicine which still adheres largely to national standards. Several private and voluntary aeromedical accreditations (EURAMI, NAAMTA, CAMTS) have been aiming at closing this gap, but none of them are compulsory and they are not supported on a supranational level. Within an aeromedical framework, guidelines for the safe handling and transport of infectious passengers including actions before, during and after a flight. An international standard developed by a EUROCAE WG would be applied initially within the European Union and could serve as a blueprint for other regions and organisations. The COVID-19 pandemic highlighted the need for this standard, however guidelines should not be limited to COVID. The aim is to have guidance for future pandemics and diseases.

The TAC reviewed the proposal and recommended the Council to approve the creation of this new WG at the next meeting in November 2021.

4.10.8. Portable Electronic Devices (PED)

WG-99, jointly with SC-234, have developed standards ensuring PED tolerance demonstration of aircraft independently from non-aviation PED radio communication standards:

- ED-130A Guidance for the Development of Portable Electronic Devices (PED) Tolerance for Civil Aircraft, December 2016 (incl change 1, March 2019)
- ED-239 Aircraft Design and Certification for Portable Electronic Device (PED) Tolerance, December 2016

Following the publication of these standards, WG-99 was disbanded.

Since the publications, the scope of frequency allocation has evolved. The expansion in additional spectrum ranges of WiFi 6E, adds support for 6 GHz wireless spectrum up

to 7 GHz and more, and the 5th generation cellular mobile network also known as 5G expands spectrum close to the radio altimeter spectrum.

Although the technical impact will likely be low, applicants using the guidance material for PED tolerance may find today's documentation ambiguous regarding the spectrum expansions, because both spectrum allocations are not yet explicitly named.

The ED-130A aircraft PED tolerance demonstration will need to include spectrum above 7GHz for Wi-Fi 6E PED tolerance clearance on non-HIRF legacy aircraft. The 5G spectrum expansion causes a need to clarify interference path loss demonstration on aircraft as per DO-307A, table 4.7.

5. LOOKING INTO THE FUTURE

This new section is presenting a collection of new topics that will influence the standardisation activities of EUROCAE indirectly or in the longer-term. The broad range of topics reflects the fact that EUROCAE is developing standards in a dynamic, emerging and sometimes disruptive technology environment.

- Autonomy & Single pilot operations
- Air-to-air connectivity
- Air-ground integration supported by system-to-system connectivity
- Quantum computing
- Higher airspace operations
- Ground handling services (GHS)
- Performance-based approach to separation management
- Automatic speech recognition

ANNEX 1

CURRENT EUROCAE WG ACTIVITIES

Domain	WG | Document Project	ED reference	ED title	Current target date for submission to OC	Current target date for publication
Avionics (non-CNS)					
Avionics Architecture and Network	WG-96 | DP002	ED-XXX	MOPS for a Wireless Avionics Intra-Communication System	30/06/2021	31/10/2021
	WG-96 | DP004	ED-260A	MASPS for Coexistence of Wireless Avionics Intra-Communication Systems within 4 200-4 400 MHz	19/02/2020	30/09/2020
	WG-95 | DP003	ED-103B	Minimum Operational Performance Standard for In-Flight Icing Detection Systems	01/04/2021	01/07/2021
Safety systems	WG-110 | DP002	ED-xxx	Minimum Operating Performance Standard for Helicopter Terrain Awareness and Warning Systems (HTAWS)	30/09/2023	01/03/2023
	WG-118 | DP001	ED-112B	Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems	30/09/2021	31/03/2022
	WG-118 | DP002	ED-xxx	Minimum Aviation system performance standards (MASPS) for Crash Protected Recording Systems for UAS	01/04/2024	02/09/2024
	WG-88, WG-98, WG-101 are currently dormant.				
System Engineering	WG-97 | DP003	ED-247B	TS of Virtual Interoperable Simulation for Tests of Aircraft Systems in virtual or hybrid bench	31/01/2023	01/05/2023
	WG-117 SG-1 | DP001	ED-XXX	Process Standard for Software Considerations in Low Risk Applications Equipment Certifications and Approvals	31/12/2020	30/06/2021
	WG-117 SG-2 | DP001	ED-XXX	Process Standard for the Integration of COTS Open Source and Service History into Software	31/03/2021	30/09/2021
System Safety Assessment	WG-63 | DP002	ED-135	Guidelines and methods for conducting the safety assessment process on civil airborne systems and equipment	31/03/2021	30/06/2022
	WG-63 | DP003	ED-79B	Guidelines for Development of Civil Aircraft and Systems	30/09/2021	30/06/2022
	WG-63 | DP004	ER-xxx	Use of STPA During Development and Safety Assessment of Civil Aircraft	31/12/2021	31/12/2022
	WG-63 | DP009	ER-023	Development Assurance Principles for Aerospace Vehicles and Systems	31/03/2021	31/12/2021
	WG-63 SG-1 | DP001	ER-xxx	Applicability of Existing Development Assurance and System Safety Practices to UAS and VTOL	31/07/2021	31/12/2022
Environment	WG-14 | DP001	ED-14H	Environmental conditions and test procedures for airborne equipment	31/12/2021	30/06/2022
	WG-14 | DP002	ED-234A	User Guides to ED-14H	31/12/2021	30/06/2022

Domain	WG | Document Project	ED reference	ED title	Current target date for submission to OC	Current target date for publication
	WG-31 | DP002	ED-XXX	User guide for lightning protection of fuel tank structure and systems	30/06/2022	31/12/2022
	WG-31 | DP006	ED-105B	Aircraft Lightning test methods	30/06/2022	31/12/2022
	WG-31 | DP007	ED-xxx	Qualification test for indirect and direct effects	31/12/2022	30/06/2023
	WG-31 | DP021	ED-107B	Guide to certification of aircraft in a High Intensity Radiated Field (HIRF) environment	30/09/2022	31/03/2023
	WG-31 | DP022	ED-xxx	Assurance guide for use of simulation and modelling in support of certification processes for HIRF	31/12/2022	30/06/2023
	WG-31 | DP023	ED-158A	User Manual for certification of aiircraft Electrical Electronic systems for the indirect effects	30/06/2023	31/12/2023
	WG-31 | DP024	ED-xxx	Guidance for fuel tank certification regarding electrostatic risk	31/12/2024	30/06/2025
CNS					
Navigation services and sensors enablers	WG-28 | DP005	Internal Report	Report on status of GBAS Multi-Constellation Multi-Frequency developments in SESAR	30/11/2022	31/12/2022
	WG-28 | DP015	ED-114B change1	MOPS Global Navigation Satellite GBAS Ground Equipment to support Precision Approach and Landing	30/06/2022	31/12/2022
	WG-62 | DP001	ED-xxx	Status of Single Constellation GALILEO OS receiver MOPS	31/03/2022	30/09/2022
	WG-62 | DP004	ED-259A	Minimum Operational Performance Standard for Galileo - Global Positioning System - Satellite-Based Augmentation System Airborne Equipment	31/03/2022	30/09/2022
	WG-62 SG-1 | DP001	IR-XXX	Internal Report on Beidou System and BDSBAS	30/09/2023	30/09/2023
	WG-107 | DP001	ED-57A	Minimum Performance Specification for Distance Measuring Equipment (DME/N and DME/P) – Ground Equipment	30/06/2022	31/12/2022
	WG-107 | DP002	ED-XXX	Minimum Aviation Systems Performance Specification (MASPS) for DME Infrastructure Supporting PBN Positioning	30/06/2022	31/12/2022
	WG-85 | DP003	ED-75E	Minimum Aviation System Performance Standards - Required Navigation Performance for Area Navigation	30/06/2022	30/12/2022
	WG-85 | DP004	ED-XXX	Minimum Operational Performance Standards Required Navigation Performance for Area Navigation	31/12/2023	31/03/2024
	WG-79 | DP004	ED-xxx	MASPS for a Combined Vision System for Helicopter Operations for Low Visibility Operational Credit	31/12/2021	30/06/2022
	WG-79 | DP005	ED-xxx	MASPS for SVS SVGS CVS	30/06/2021	31/12/2021
	WG-79 | DP006	ED-xxx	MASPS for EVS CVS EFVS	30/06/2021	31/12/2021
	WG-119 | DP001	ED-30A	MOPS for Low Range Radar Altimeters	30/06/2022	31/12/2022
Surveillance	WG-41 see below.				

Domain	WG | Document Project	ED reference	ED title	Current target date for submission to OC	Current target date for publication
	WG-49 | DP002	ED-115A	Minimum Operational Performance Standard for Light Aviation Secondary Surveillance Radar Transponders	31/08/2023	30/11/2023
	WG-49 | DP011	ED-73F Ch. 1	Change 1 to ED-73F MOPS for Secondary Surveillance Radar Mode S Transponders	28/02/2022	30/06/2022
	WG-51 SG-1 | DP003	ED-102B Ch. 1	MOPS for 1090 MHz Extended Squitter ADS-B and TIS-B Change 1	28/02/2022	30/06/2022
	WG-51 SG-3 | DP008	IR-XXX	Internal Report: Summary of Activities and Proposed Changes to ED-194B and ED-236A	31/10/2022	31/10/2022
	WG-51 SG-4 | DP001	ED-142A	Technical Specification for Wide Area Multilateration Ground System with Composite Surveillance Functionality	31/12/2021	30/06/2022
	WG-51 SG-4 | DP002	ED-129C	Technical Specification for an ADS-B Ground System	31/03/2022	30/09/2022
	WG-75 | DP015	ED-256 Ch. 2	MOPS for ACAS Xa with ACAS Xo Functionality Change 2	31/03/2022	30/06/2022
	WG-75 SG-2 | DP001	ED-XXX	MOPS for ACAS Xr	30/09/2025	31/12/2025
	WG-102 | DP001	ED-261-1	Safety and Performance Requirements Standard for a Generic Surveillance System (GEN-SUR SPR) - Volume 1	31/12/2019	30/06/2020
	WG-102 | DP002	ED-261-2	Safety and Performance Requirements Standard for a Generic Surveillance System (GEN-SUR SPR) - Volume 2	31/12/2019	30/06/2020
	WG-102 | DP003	ED-261-3	Safety and Performance Requirements Standard for a Generic Surveillance System (GEN-SUR SPR) - Volume 3	31/12/2019	30/06/2020
	WG-103 | DP001	ED-288	Technical Specification (TS) for an Independent Non-Cooperative Surveillance (INCS) System	31/03/2019	30/09/2019
Communication means	WG-82 | DP012	ED-223A	Minimum Operational Performance Standards (MOPS) for the Aeronautical Mobile Airport Communication	30/09/2022	31/03/2023
	WG-92 | DP003	ED-92D	Minimum Operational Performance Standard (MOPS) for an Airborne VDL Mode 2 System Operating in the Frequency Range 118-136.975 MHz	30/06/2022	31/12/2022
	WG-108 – see below				
ATM					
ATM – Flight Data processing	WG-59 | DP001	ED-133A	Flight Object Interoperability	31/12/2021	30/06/2022
ATM – Digital Voice communications	WG-67 | DP028	ED-138A	Network Requirements and Performances for VoIP ATM Systems	31/12/2022	30/06/2023
	WG-67 SG-5 | DP001	ED-136/1A	VoIP ATM System Operational and Technical Requirements Volume 1 - OSED	31/12/2022	30/06/2023
	WG-67 SG-5 | DP002	ED-136/2A	VoIP ATM System Operational and Technical Requirements Volume 2 - SPR	31/12/2022	30/06/2023
ATM Simulators	WG-81 | DP001	ED-147B	ATM Validation Platforms Interoperability Specification	01/03/2021	01/09/2021

Domain	WG | Document Project	ED reference	ED title	Current target date for submission to OC	Current target date for publication
	WG-81 | DP003	ED-148A	Guidance to Achieve ATM Validation Platforms Interoperability	01/03/2021	01/09/2021
	WG-81 | DP006	ED-147B ch 1 Supplement to ED-147B	ED-147B ch 1 Supplement to ED-147B "Technology Mapping for HLA"	30/11/2021	31/03/2022
Virtual Centre	WG-122 | DP001	Internal Report	Virtual Centre Standardisation	n/a	31/12/2021
Airport					
A-SMGCS	WG-41 | DP003	ED-87E	MASPS for A-SMGCS including Airport Safety Support Service Routing Service and Guidance Service	31/12/2021	30/06/2022
	WG-41 | DP004	ED-xxx	Interop Document on Surveillance, Routing, Safety Support	31/03/2022	30/09/2022
	WG-41 | DP018	ED-zzz	MOPS for supporting sensor systems for use in A-SMGCS	31/03/2023	30/09/2023
Airport Equipment	WG-83	ED-235A	MASPS for Foreign Object Debris Detection Systems	Tbd	tbd
	WG-109 | DP001	ED-292	Minimum Aviation System Performance Standards (MASPS) for Runway Weather Information Systems	05/11/2020	30/11/2021
Remote and Virtual Tower (RVT)	WG-100 | DP003	ED-240B	MASPS for Remote Tower Optical Systems	31/12/2022	30/06/2023
Services					
System Wide Information Management) (SWIM) Services	WG-104 | DP005	ED-294	SWIM Service Specification Template and Methodology	30/09/2020	31/12/2020
	WG-104 | DP007	ER-xxx	Final Report on the Activities undertaken by WG-104	31/12/2020	31/12/2020
Datalink Applications	WG-78 | DP014	ED-228B	Safety and Performance Standard for Baseline 2 ATS Data Communication	28/02/2023	30/06/2023
	WG-78 | DP015	ED-229B	Interoperability Requirements Standard for Baseline 2 ATS Data Communications	28/02/2023	30/06/2023
	WG-78 | DP016	ED-230B	Interoperability Requirements Standard for Baseline 2 ATS Data Communication - FANS 1A Accomodation	28/02/2023	30/06/2023
	WG-78 | DP017	ED-231B	Interoperability Requirements Standard for Baseline 2 ATS Data Communication ATN Baseline 1 Accommodation	28/02/2023	30/06/2023
	WG-108 | DP001	ED-xxx	MASPS on ATN-IPS end-to-end interoperability and certification	30/09/2022	31/03/2023
	WG-108 | DP003	ED-262A	Technical Standard of Aviation Profiles for ATN IPS	30/09/2022	31/03/2023
Aeronautical Information Services	WG-44 | DP019	ED-xxx	Considerations for Aeronautical Data Alteration	30/09/2021	31/03/2022
	WG-44 | DP020	ED-76B	Standards for Processing Aeronautical Data	30/09/2023	31/03/2024
	WG-44 | DP021	ED-77B	User Requirements for Navigation Data	31/12/2023	30/06/2024

Domain	WG | Document Project	ED reference	ED title	Current target date for submission to OC	Current target date for publication
	WG-76 SG-1 | DP001	ED-89A Ch. 1	Change 1 to ED-89A Data-Link Application System Document (DLASD) for the “ATIS” Data-Link Service	31/01/2022	31/03/2022
	WG-76 SG-1 | DP002	ED-89B	Data-Link Application System Document (DLASD) for the “ATIS” Data-Link Service	31/12/2022	31/03/2023
MET Services	WG-76 | DP001	ED-xxx	Minimum Aviation Systems Performance Standard (MASPS) for AIS/MET Datalink Services	28/02/2023	30/06/2023
A-CDM	WG-111 | DP001	ED-141A	MASPS for Airport CDM Systems	30/06/2022	31/12/2022
	WG-111 | DP002	ED-145A	Airport CDM Data Model Specification	30/06/2022	31/12/2022
	WG-111 | DP003	ED-146A	Guidelines for Test and Validation Related to Airport CDM Interoperability	30/06/2022	31/12/2022
	WG-111 | DP004	ED-xyz	Airport CDM SWIM Interface Specification	31/12/2022	30/06/2023
Security					
	WG-72 SG-2 | DP002	ED-205A	Process Standard for Security Certification and Declaration of ATM ANS Ground Systems	30/06/2021	31/12/2021
	WG-72 SG-3 | DP001	ED-206	Guidance on Security Event Management	30/06/2021	31/12/2021
	WG-72 SG-4 | DP001	ED-201A	Aeronautical Information System Security (AISS) Framework Guidance	09/04/2021	31/12/2021
UAS, General Aviation and VTOL					
UAS	WG-105 SG-1 | DP002	ER-xxx	Comparison of OSEDs related to DAA for UAS.	30/09/2021	31/03/2022
	WG-105 SG-11 | DP001	ED-271	Minimum Aviation System Performance Standard for Detect and Avoid (Traffic) in Class A-C airspaces under IFR	31/12/2019	30/06/2021
	WG-105 SG-12 | DP002	ED-XXX	Minimum Aviation System Performance Standard for Detect & Avoid [Traffic] under VFR/IFR	31/12/2022	30/06/2023
	WG-105 SG-12 | DP003	ED-XXX	Minimum Operational Performance Standard for Detect & Avoid [Traffic] under VFR/IFR	31/12/2023	30/06/2024
	WG-105 SG-13 | DP002	ED-XXX	Minimum Operational Performance Standard for Detect & Avoid in Very Low Level Operations	31/12/2023	30/06/2024
	WG-105 SG-13 | DP003	ER-xxx	European Industry Position Report on RTCA SC-147 ACAS sXu		20/12/2022
	WG-105 SG-2 | DP002	ED-xxx	MOPS for UAS Communications by Cellular Networks	30/06/2022	31/12/2022
	WG-105 SG-21 | DP002	ED-265	Minimum Operational Performance Standard for RPAS Command and Control Data Link (C-Band Satellite)	31/12/2018	31/12/2020
	WG-105 SG-22 | DP002	ED-XXX	Minimum Aviation System Performance Standard for management of the C-Band Spectrum in support of RPAS C2 Link services	31/12/2020	30/06/2021
	WG-105 SG-3 | DP002	ED-yyy	Minimum Operational Performance Standard (MOPS) for Aeronautical Data Provision and Exchange	30/06/2022	31/12/2022

Domain	WG | Document Project	ED reference	ED title	Current target date for submission to OC	Current target date for publication
	WG-105 SG-3 | DP003	ED-yyy	Minimum Operational Performance Standards for Network Identification Service of UAV in UTM U Space	30/06/2022	31/12/2022
	WG-105 SG-3 | DP004	ED-yyy	MOPS for Flight Planning and Autorisation Service for Global awareness in UTM U Space	30/06/2022	31/12/2022
	WG-105 SG-3 | DP006	ED-yyy	Minimum Operational Performance Standard for Traffic Information Situation Dissemination Exchange	30/06/2022	31/12/2022
	WG-105 SG-3 | DP007	ED-yyy	Minimum Operational Performance Standard for U Space Geo Awareness Service	30/06/2022	31/12/2022
	WG-105 SG-32 | DP002	ED-282	Minimum Operational Performance Standard for UAS E-Reporting	30/06/2020	31/12/2020
	WG-105 SG-4 | DP002	ED-xxx	GD to support development of AMC when EASA SC Light-UAS Medium Risk is used as TC Basis	01/07/2022	31/01/2023
	WG-105 SG-53 | DP001	ED-253	OSED for Automation and Emergency Recovery	31/12/2018	30/06/2019
	WG-105 SG-6 | DP004	ED-280A	Guidelines for UAS safety analysis for the Specific category (low and medium levels of robustness)	30/06/2021	31/12/2021
	WG-105 SG-6 | DP005	ED-xxx	Guidelines for SAIL II application of SORA	30/06/2021	31/12/2021
	WG-105 SG-6 | DP006	ED-xxx	GD to support compliance with SORA design-related OSOs applicable to SAIL III and IV	01/07/2022	31/01/2023
	WG-105 SG-61 | DP003	IR-xxx	SORA Support Work Plan	31/12/2020	31/12/2020
	WG-105 SG-62 | DP001	ED-xxx	Guidelines on the use of multi-GNSS for UAS (low robustness)	30/09/2020	31/01/2021
	WG-105 SG-63 | DP001	ED-xxx	Guidelines on the automatic protection of the flight envelope from human errors for UAS	31/12/2020	30/06/2021
General Aviation	No current activities				
VTOL	WG-112 SG-1 | DP001	ED-xxx	Process Standard for crashworthiness test of battery systems for eVTOL applications	01/07/2021	15/09/2021
	WG-112 SG-1 | DP003	ED-XXX	Technical Standard on Rechargeable Lithium Batteries in eVTOL applications	01/12/2021	30/01/2022
	WG-112 SG-1 | DP004	ED-290	Guidance on High Voltage Definition and Consideration for Personal Safety	01/10/2020	01/12/2020
	WG-112 SG-1 | DP005	ED-XXX	Guidance on specifying random hardware failures rates of Lithium-Ion Cells for eVTOL applications	01/02/2022	01/05/2022
	WG-112 SG-1 | DP006	ED-296	Guidance on Design Assurance for High Voltage Standards and Power Quality for VTOL Applications	01/07/2021	01/09/2021
	WG-112 SG-2 | DP001	ED-xxx	Guidance on designated fire zone for VTOL	01/02/2023	01/05/2023
	WG-112 SG-2 | DP002	ED-xxx	Guidance for Common mode analysis for lift - thrust system for VTOL enhanced category	01/01/2022	01/04/2022
	WG-112 SG-2 | DP003	ED-xxx	Guidance for rotorburst analysis for VTOL enhanced category	01/05/2022	01/08/2022

Domain	WG | Document Project	ED reference	ED title	Current target date for submission to OC	Current target date for publication
	WG-112 SG-3 | DP001	ED-xxx	Information security guidance for VTOL and collaborative systems	01/03/2022	01/05/2022
	WG-112 SG-3 | DP002	ED-xxx	Partial Generic Preliminary Aircraft Safety Assessment (PASA) for VTOL	31/03/2022	31/05/2022
	WG-112 SG-3 | DP003	ED-xx	Specific Risks Assessment: Magnetic Heading	01/08/2022	01/11/2022
	WG-112 SG-3 | DP004	ED-xx	Guidance on the demonstration of acceptable occupant safety - injury prevention measures	01/03/2022	01/05/2022
	WG-112 SG-3 | DP008	ED-XXX	Specific Risks Assessment: Positioning System	01/06/2021	01/08/2021
	WG-112 SG-4 | DP002	ED-295	Guidance on VTOL Flight Control Handling Qualities Verification	01/06/2021	01/08/2021
	WG-112 SG-4 | DP004	ED-xxx	Compliance methodologies for VTOL certification in “inadvertent icing” operation	01/02/2022	01/03/2022
	WG-112 SG-4 | DP006	ED-xxx	VTOL Performance	01/10/2022	01/01/2023
	WG-112 SG-4 | DP007	ED-xxx	VTOL Cockpit configuration and Control Strategy	01/07/2022	01/10/2022
	WG-112 SG-5 | DP001	ED-xxx	VTOL charging infrastructure	01/06/2022	01/09/2022
	WG-112 SG-5 | DP002	ED-xxx	VTOL vertiports	01/01/2022	01/10/2021
	WG-112 SG-5 | DP003	IR	eVTOL charging	01/10/2022	01/10/2022
	WG-112 SG-6 | DP001	ED-XXX	Compliance methodologies for VTOL energy level information to the crew	31/03/2022	01/06/2022
	WG-112 SG-6 | DP002	ED-298	Guidance on minimum Primary Flight Instruments for VTOL Aircraft	01/05/2021	01/08/2021
	WG-112 SG-6 | DP004	ED-xxx	VTOL Minimum Flight Instruments – Display of parameter trends and limitations	01/10/2022	01/01/2023
	WG-112 SG-7 | DP002	ED-278A	Concept of Operations for VTOL Aircraft Volume 1 - General Considerations	01/11/2021	31/12/2021
	WG-112 SG-8 | DP001	ED-xxx	MOPS on crashworthy seat systems for Advanced Air Mobility (AAM) aircraft	01/04/2022	01/08/2022
	WG-112 SG-8 | DP002	ED-xxx	Guidance on crashworthy seat systems for Advanced Air Mobility (AAM) aircraft	01/12/2022	01/02/2023
Sustainability					
Hydrogen Fuel Cells	WG-80 | DP003	ED-xxx	MASPS for Liquid Hydrogen fuel cells on-board aircraft	01/06/2022	01/09/2022
	WG-80 | DP005	ED-XXX	MASPS for Gaseous Hydrogen Storage for General Aviation		
Hybrid Electric Propulsion	WG-113 | DP002	Internal Report	Standards review and assessment against the SC-EHPS	01/03/2021	01/03/2021
	WG-113 | DP003	ED-xxx	Guidance material for endurance substantiation of Electric - Hybrid Propulsion Systems EHPS	01/06/2021	01/09/2021

Domain	WG | Document Project	ED reference	ED title	Current target date for submission to OC	Current target date for publication
	WG-113 | DP004	ED-xxx	Guidance material for durability substantiation of Electric - Hybrid Propulsion Systems EHPS	01/07/2021	01/10/2021
Power distribution – high voltage	WG-116 | DP003	ED-zzz	Interface Charasteristics and Power Quality of Aircraft High Voltage Propulsive Electrical Systems	30/06/2022	31/12/2022
	WG-116 | DP004	ED-zzz	Guidance for High Voltage Risk Mitigation at EWIS and Human Safety Level	30/06/2022	31/12/2022
Artificial Intelligence					
	WG-114 | DP002	ED-xxx	Process Standard for Development and Certification Approval of Aeronautical Products Implementing AI	30/06/2022	31/12/2022
	WG-114 | DP003	ER-xxx	Artificial Intelligence in Aeronautical Safety-Related Systems Taxonomy	31/12/2020	31/12/2020
	WG-114 | DP005	ER-xxx	Artificial Intelligence in Aeronautical Safety-Related Systems Use Cases Considerations	31/03/2021	31/03/2021
Miscellaneous					
EFB	No current activities				
Space / Space-based ATM systems	No current activities				
Counter UAS	WG-115 | DP002	ED-xxx	System Performance Requirements for non-cooperative UAS detection systems	30/06/2021	31/12/2021
	WG-115 | DP003	ED-xxx	Interoperability Requirements for Counter-UAS systems	30/06/2021	31/12/2021
Thermal detection of potential COVID-19 carrying passengers	WG-120 | DP001	ED-297	Minimum Operational Performance Standard for Thermal Camera Systems	31/07/2021	30/04/2021
Cleaning and disinfection	WG-121 | DP002	ED-287A	Guidance Document on Aircraft Cleaning and Disinfection	01/10/2021	01/12/2021
Infectious passenger handling in air ambulance operations	Proposed future activity				
Portable Electronic Devices	WG-99 | DP004	ED-130A Change 2	Analysis/evaluation of WIFI 6E spectrum expansion for testing non-HIRF legacy aircraft and primarily through update of section 6.3.2, table 6-4 “frequency range for full PED tolerant aircraft”	30/06/2022	31/12/2022
	WG-99 | DP005	ED-239 Change 1	Clarification of radio altimeter IPL requirements of DO-307A, primarily through update of table 4-7 “target IPL by receiver”	30/06/2022	31/12/2022

ANNEX 2

ACRONYMS

AAS: Airspace Architecture Study

AAS TP: AAS Transition Plan

AC: [FAA]: Advisory Circular

ACARE: Advisory Council for Aviation research and innovation in Europe

ACAS: airborne collision avoidance system

A-CDM: Airport Collaborative Decision Making

AD: Airworthiness directive

ADS-B: Automatic Dependent Surveillance-Broadcast

ADSP: ATM data service provider

Adv-IM: Advanced Interval Management

AEEC: Airlines Electronic Engineering Committee

AEH: Airborne Electronic Hardware

Aromas: Aeronautical Mobile Aircraft Communication System

AF: ATM Functionalities

AIA: Aerospace Industries Association

AIM: Aeronautical Information Management

A-SMGCS: Advanced Surface Movement Guidance and Control System

PANS AIM: Aeronautical Information Management - Procedures for Air Navigation Services

AIMSG: Aeronautical Information Management Sub Group

AIS: Aeronautical Information Services

AMAN: Arrival Manager

AMC: [EASA]: Acceptable Means of Compliance

AMS(R)S: Aeronautical Mobile-Satellite (R) Service

ANC: [ICAO] Air Navigation Conference

ANSP: Air Navigation Service Provider

A-PNT: Alternative Positioning, Navigation, and Timing

AR: Augmented Reality

ARAC: [FAA] Aviation Rulemaking Advisory Committee

ARAIM: Advanced Receiver. Autonomous Integrity Monitoring

ARINC: aeronautical Radio Inc

ARO: Aviation Recreational Organization

ARP: [SAE] aviation Recommended Practice

ASBU: [GANP] Aviation System Block Upgrades

ASD: AeroSpace and Defence Industries Association of Europe

ASD-STAN: ASD-Standards

ASISP: [FAA ARAC] Aircraft Systems Information Security/ Protection

ASR: Automatic Speech Recognition

ASTM: American Society for Testing and Materials

ATC: Air Traffic Control

ATFCM: Air Traffic Flow and Capacity Management

ATFM: Air Traffic Flow Management

ATM: Air Traffic Management

ATM MP: ATM Master Plan

AVSECP: [ICAO] Aviation Security Panel

BEA: Bureau d'Enquêtes et d'Analyses

CA: Collision Avoidance

CAA: Civil Aviation Authority

CAMTS: Commission on Accreditation of Medical Transport Systems

CAP: Civil Aviation Publication

CCO: Continuous Climb Operation

CDC: Centre for Disease Control [US]

CDO: Continuous Descent Operation

CDTI: Centre for Development of Industrial Technology (Spain)

CEN: European Committee for Standardization

CENELEC: Comité Européen de Normalisation Électrotechnique

CFIT: controlled flight into terrain

CNS: Communications Navigation Surveillance

CONOPS: concept of operations

COTS: Commercial off-the-shelf

CORAC: Conseil pour la recherce aéronautique civile (France)

CP: [ICAO] Communication Panel

CPDLC: Controller–pilot data link communication

[SES] CS: Community Specifications

CS-ACNS: [EASA] Certification Specification Airborne Communications, Navigation and Surveillance

CS-AWO: [EASA] Certification Specification All Weather Operations

CWP: Controller Working Position

CWP: Council Work Paper

DCL: Departure Clearance

DCT: Direct route Trajectory

DFMC: Dual-Frequency Multi-Constellation

DG: [EC] Directorate General

DG DEFIS: [EC] Directorate General Defence Industry and Space

DME: Distance Measuring Equipment

DO: [RTCA] Document

DOA: Design Organisation Approval

DP: [EUROCAE TAC] Discussions Paper

DP: [SES] Deployment Programme

D-RNP: Dynamic - Required navigation Performance

D-TAXI: Data link taxi

E-AMAN: extended Arrival Management

EASA: European Union Aviation Safety Agency

EASCG: European ATM Standards Coordination Group

EASp: [EASA] European Aviation Safety Plan

EATMN: European Air Traffic Management Network

EC: European Commission

ED: EUROCAE Document

EDA: European Defence Agency

EFVS: Enhanced Flight Vision System

EGNOS: European Geostationary Navigation Overlay System

EGNSS: European Global Navigation Satellite System

ELSA: VDL Mode 2 measurement, analysis, testing and simulation campaign Study

ELT: Emergency Locator Transmitters

EMC: Electromagnetic Compatibility

EPP: Extended Projected Profile

ER: Essential Requirements

ERA: Enhanced RPAS Automation

ESA: European Space Agency

ESO: European Standardisation Organisations: i.e. CEN, CENELEC, ETSI

ETSI: European Telecommunications Standards Institute

ETSO: European Technical Standard Orders

EURAMI: European Aero-Medical Institute

EUROCONTROL: the European Organisation for the Safety of Air Navigation

EUSCG: European UAV Standards Coordination Group

EVS: Enhanced Vision System

FAA: Federal Aviation Administration

FAS: [EUROCAE/RTCA] Forum for Aeronautical Software

FDP: flight data processing

FMS: Flight management System

GA: General Aviation

GADSS: [ICAO] Global Aeronautical Distress & Safety System

GALILEO: Europe's own global navigation satellite system

GAMA: General Aviation Manufacturers Association

GANP: [ICAO] Global Air Navigation Plan

GASP: [ICAO] Global Aviation Safety Plan

GBAS: Ground-Based Augmentation System

GEN: Generic

GHSP: Ground Handling Service Provider

GNSS: Global Navigation Satellite System

GPS: Global Positioning System

GSE: Ground Support Equipment

HAO: Higher Altitude Operations

HTAWS: Helicopter Terrain Awareness System

HUD: Head-up display

HW: hardware

ICAO: International Civil Aviation Organization

ICB: Industry Consultation Body

ICNSS: Integrated CNS and Spectrum

IEEE: Institute of Electrical and Electronics Engineers

IM: Interval Management

INCS: Independent Non-Cooperative Surveillance

INTEROP: Interoperability Requirements

IOP: Interoperability

IPS: Internet Protocol Suite

IR: Interoperability Regulation

ISO: International Organization for Standardization

ITU: International Telecommunication Union

I4D: Initial 4D

JARUS: Joint Authorities for Rulemaking on Unmanned Systems

KPA: Key Performance Area

LOA: Letter of Acceptance

LPV: Localizer performance with vertical guidance

LuFo: Luftfahrt Forschungs Programm (Germany)

LVP: Low visibility procedures

MASPS: Minimum Aviation System Performance Standard

MBSA / MBSE: Model Based System Assessment / Engineering

MET: Meteorological

MOC: Means of Compliance

MOPS: Minimum Operational Performance Standard

MoU: Memorandum of Understanding

MSAW: Minimum Safe Altitude Warning

MTCD: Medium Term Conflict Detection

NAA: National Aviation Authority

NAAMTA: National Accreditation Alliance of Medical Transport Applications

NEO: Near-Earth Object

NextGen: Next Generation Air Transportation System

NPA: Notice of Proposed Amendment

NOP: Network Operations Plan

NOTAM: Notice To Airmen

NSA: National Security Agency

NSO: NATO Standards Organisation

NTSB: National Transportation Safety Board

ODM: On-Demand Mobility

OEM: Original Equipment Manufacturer

OJEU: Official Journal of the European Union

PANS: [ICAO] Procedures for Air Navigation Services

PBN: Performance Based Navigation

PCP: [SES] Pilot Common Project

PED: Portable Electronic Devices

PGW: Propylene Glycol Water Mixture

PIB: Pre-flight Information Briefing

PUR: Passive Underwater Resonator

QMS: Quality Management System

RAIM: Receiver autonomous integrity monitoring

RBDM: Risk Based Decision Making

RDP: ATM Standardisation Rolling Development Plan

RMP: Rule Making Programme

RNP: Required navigation performance

ROAAS: Runway Overrun Awareness and Alerting System

RPAS: Remotely Piloted Aircraft Systems

RTA: Required Time of Arrival

R&D: Research and Development

SAE: Society of Automotive Engineers

SARPs: Standards and Recommended Practices

SBAS: Satellite-based augmentation systems

SC-EHPS: [EASA] Scpecial condition Electric and Hybrid Propulsion Systems

SC-VTOL: [EASA] Special Condition VTOL

SCB: [JARUS] Stakeholder Consultation Board

SDM: SESAR Deployment Manager

SDO: Standard Developing Organization

SDR: System Design Review

SES: Single European Sky

SESAR: Single European Sky ATM Research

SJU: SESAR Joint Undertaking

SMS: Safety Management System

SeMS: Security Management System

SPR: Safety and Performance Requirements

SUR: Surveillance

SURF-IA: Surface - Indications and Alerts

SVO: Simplified Vehicles Operation

SVS: Synthetic vision system

SW: Software

SWE: Space Weather

SWIM: System Wide Information Management

TAC: [EUROCAE] Technical Advisory Committee

TAM: Total Airport Management

TAWS: Terrain Awareness System

TBS: Timed-Based Separation

TCAS: Traffic alert and Collision Avoidance System

TIAM: Technology Independent Assurance Method

TMA: Terminal Manoeuvring Area

TOPMS: Take Off Performance Monitoring System

ToR: Terms of Reference

TS: Technical specification

TSO: Technical Standard Order

TWP: Technical Work Programme

UAM: Urban Air Mobility

UAS: Unmanned Aircraft System

UAV: Unmanned Aerial Vehicle

US: United States

VDL: VHF Digital Link

VHF: Very High Frequency

VoIP: Voice over IP

WAIC: Wireless Avionics Intra-Communications

WG: Working Group

WIMAX: Worldwide Interoperability for Microwave Access

WRC: World Radio Conference