EUROCAE

TECHNICAL WORK PROGRAMME

Edition 2024

EUROCAE Technical Work Programme

EDITION 2024

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EXECUTIVE SUMMARY

The Technical Work Programme (TWP) 2024 is a strategic document which presents a clear view of the EUROCAE scope of work. It provides insight into the context of current and potential future EUROCAE activities for aviation executives and stakeholders of standardisation in the broad field of aviation.

The TWP also briefly summarizes the achievements in the context of the current aviation environment. A list of the current EUROCAE Working Group activities can be found in the Appendix of this document together with a more detailed outline of those activities covered in the EUROCAE Annual Report.

The focus of this TWP is to provide guidance for future activities in a consistent and harmonised way. A clear view of planned activities for EUROCAE is given. This does not contradict the fact that EUROCAE is a flexible organisation – it amends its plans as necessary. As shown in the recent past, EUROCAE is well-able to react on short notice and develop high-quality standards on demand.

The increasing importance of more environmentally friendly aviation shapes the Technical Work Programme of EUROCAE, addressing sustainability, advanced air mobility and decarbonisation. Also, the need for an optimized use of spectrum, the efficient and interoperable use of artificial intelligence in aviation systems, new technological platforms and support to the European space strategy play a key role for EUROCAE now and become even more important in the near future. Those topics and the related potential for establishment of new Working Groups within the related domains are particularly addressed through this document.

Complementing the activities, the TWP describes the standardisation stakeholders and assists coordination between industry, research, operational users and the political framework. The standardisation programme is closely coordinated with the SESAR Digital European Sky Programme and its roadmap, and it will liaise with the Clean Aviation programme as well as with the European Plan for Aviation Safety maintained by EASA.

The document further provides a vision looking forward into future possible evolutions, encompassing topics such as autonomy, quantum computing and other evolving technologies and concepts likely to affect future aviation. Thus, the TWP reflects the key values of EUROCAE, being transparent, fostering collaboration and being up-to-date with regard to innovation, harmonisation and international presence.

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CHAPTER 1
INTRODUCTION

The Technical Work Programme (TWP) serves the Technical Advisory Committee (TAC) as guidance for proposing new and strategically relevant Working Groups (WG) to the EUROCAE Council, in order to appropriately organise the future of EUROCAE activities. It is intended to be used as an input to the EUROCAE Business Plan.

To achieve its purpose, this document provides an overview of the ongoing technical standardisation activities currently undertaken by EUROCAE and a vision of activities to be potentially undertaken in the coming years.

The current and future activities are driven by sustainability, scalability, resilience and support of research and deployment. In detail, new technologies, automation, digitalisation, efficiency, and flexibility, 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. Some of these were already raised at the EUROCAE Symposium 2023.

The TWP attempts to anticipate this shift in activities, in line with inputs received from the various stakeholders.

This document is organised in five chapters:

- After the executive summary and this brief introduction in Chapter 1, Chapter 2 provides insight into the development context of the TWP.
- Chapter 3 gives an overview on the major stakeholders shaping the environment of EUROCAE activities.
- Chapter 4 covers ongoing and foreseen activities of EUROCAE in detail, where:
    - new or revised tasks are allocated to existing Working Groups (WG) in the short term - a 2-year time frame,
    - the establishment of specific new activities or WGs is proposed
    - future activities are becoming tangible.
- Chapter 5 explores the future potential activities which are not expected to start in the short term but may become relevant in the future.

An overview of the EUROCAE domains and related Working Groups is provided in Appendix A. The EUROCAE Website[1] should be consulted for information on published and already planned deliverables.

Appendix B lists all acronyms used in the document.

[1] https://eurocae.net/about-us/working-groups/

CHAPTER 2
TWP DEVELOPMENT CONTEXT

2.1 TWP content

The TWP presents the organisations that are stakeholders of EUROCAE and explains their fields of activities. It derives their standardisation needs and puts them into the context of the activities of the EUROCAE Working Groups.

EUROCAE covers standardisation activities in all areas of aviation. Although EUROCAE has its roots in Europe, it is an internationally recognised Standards Developing Organisation (SDO), known for its high quality, safety critical standards for all areas of aviation. 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, processes, services and operational aspects.

EUROCAE also serves new aviation entrants like Unmanned Aircraft Systems (UAS), Vertical Take-off and Landing (VTOL) or other concepts in a broader way. The resulting standards complement the regulatory and certification framework with a full set of standards, aiming to be recognised as Acceptable Means of Compliance (AMC).

The main EUROCAE activities consist of developing standards:

- in support of future regulatory requirements (e.g., ICAO, EASA, EU, FAA….),
- which could be recognised as AMC within the Aviation Safety Regulations,
- which could be used as AMC in support of Single European Sky (SES) Regulations,
- in support of, and in strong coordination with, the Air Traffic Management (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.

The types of documents produced by EUROCAE are defined in the EUROCAE Handbook, the EUROCAE Document (ED) Development Process and supporting documentation, accessible via the EUROCAE Workspace and duly documented in the Quality Management System (QMS).

2.2 Support of R&D, industrialisation, and deployment

Standardisation and regulation are key tools to support research & development, industrialisation, and deployment. Standardisation serves to codify the results of R&D programmes by exposing them to a wider group of experts, ensuring broad participation, openness, and transparency through the SDO processes, and delivering them into the public domain by publishing a consensus standard.

When there is a regulatory requirement, this becomes even more important; industry, stakeholders and the SDO together define the ‘how to comply’ with a regulation and effectively write the AMC, based on the latest state of the art of R&D and on a consensus reached within the community. In quickly developing fields, standards can be developed in a more flexible way and faster than regulations, which is another important aspect for the regulator, who could create an AMC simply by reference to them.

Commonly agreed standards also serve as an input to create a basis for deployment and for further R&D work. This is achieved through creating a level playing field for all stakeholders, by providing commonly agreed – standardised – levels of performance, test methods or procedures.

Standards are a very effective means to avoid divergences between the major ATM innovation programmes (i.e., SESAR, NextGen and others) and they bridge regional and global initiatives for modernisation of aviation in support of the ICAO GANP/GASP. Well developed standards provide a baseline of performance requirements which can

also encourage innovation by industry players to build a competitive advantage, while not compromising interoperability.

2.3 International Cooperation

Recognising the importance of global harmonisation and interoperability, there is need to have harmonised standards wherever possible.

As part of its overall stakeholder engagement plan, EUROCAE is building and maintaining relationships with regulators, international and regional organisations, manufacturers (equipment and software, air and ground), air navigation service providers, airports, airlines, professional associations, other standardisation organisations, R&D and academia as well as other relevant stakeholders.

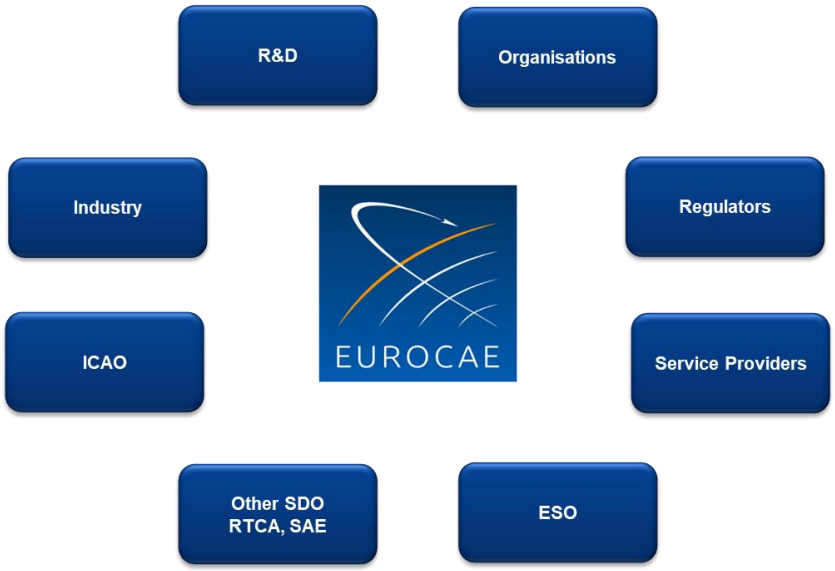
The international outreach activities and agreements concluded with organisations from regions other than Europe and the US (e.g., Asia (Japan, Korea, China, …)) help understand the structure of the aviation community in those regions, and their priorities and challenges. This facilitates communication with them and their involvement in EUROCAE, which contributes greatly to the international nature, applicability and recognition of EUROCAE standards in support of global interoperability.

The FAA is working with RTCA, ASTM and SAE to develop standards but on occasion also applies EUROCAE standards in their system, and indeed is working directly with EUROCAE in relevant areas. It is therefore important for European stakeholders to participate to such development and to secure long-term influence by performing joint developments of standards. In this respect, the close relationship between RTCA, ASTM or SAE and the FAA is different from the European model which is more open to non-European SDOs.

The development of new functionalities to support improvements in ATM performance are undertaken in the US within the NextGen programme. Other regions operate similar ATM modernisation programmes (e.g. CARATS in Japan).

CHAPTER 3
STAKEHOLDERS SHAPING THE ENVIRONMENT OF EUROCAE TECHNICAL ACTIVITIES

EUROCAE is working in an ecosystem of many aviation stakeholders. It is important for the organisation to understand the community's needs and trends, to initiate the timely development of appropriate standards and prioritise activities. Building and maintaining strong collaborative relationships with our members and other key partners is therefore an important element of our work.



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

- European Commission
- EASA
- ICAO
- EUROCONTROL
- SESAR 3 Joint Undertaking
- SESAR Deployment Manager
- Aeronautical industry
    - Aircraft manufacturers
    - Airborne equipment and system manufacturers
    - Ground equipment and system manufacturers
- Air Navigation Services Providers
- Airports
- Airspace users
- Clean Aviation
- National Research and Technology & projects
- Radio Frequency Spectrum Users
- Standardisation Organisations
    - RTCA
    - SAE
    - Other SDOs

All aviation stakeholders, and in particular EUROCAE Members, are free at any time to propose initiatives for EUROCAE standardisation work. In the recent past, we observed more non-members approaching us to initiate standardisation activities. These organisations normally join EUROCAE as members during the process.

EUROCAE activities also encompass coordination with stakeholders developing or using systems and procedures coexisting with the aviation environment (e.g., the efficient use of spectrum).

CHAPTER 4
ONGOING AND FORESEEN EUROCAE TECHNICAL ACTIVITIES

EUROCAE activities have been classified into the 11 domains, as per the following figure:

The six upper (blue) domains represent *operational* aviation industry and user-based clusters. The standardisation activities in those domains are very closely related to operational processes and procedures defined by use cases of the various stakeholders. The five lower (grey) domains specifically address *technical* or *technological* aspects and therefore are closely related to systems with standardisation activities describing certain performances. The technical and technological domains are transversal by nature.

Each EUROCAE activity, and its related Working Groups, will be associated to one main domain, even if also related to another one. For example, Space Traffic Management or U-space are respectively under the Space and Advanced Air Mobility domains, even if they obviously address the (Air) Traffic Management topic. Similarly, almost all software related activities will be covered in the “IT & Software” domain, even if the equipment or system involved might belong more specifically to one of the operational domains.

4.1 Avionics

This domain encompasses all standardisation activities which are related to equipment and systems on board aircraft. It also covers all on-board systems contributing to the Communication, Navigation and Surveillance (CNS) capability. In addition, this domain encompasses activities related to non-functional systems (infra-structure, networks). Activities contributing to the system performance (safety, environmental performance, architecture) will be outlined in the dedicated “System engineering” section.

4.1.1 Avionics architecture, infrastructure and networks

Regarding avionics networks and core avionics infrastructure, there are now two components widely used and certified on many platforms for over a decade. These components are still evolving along with the development of new technologies and support the increasing need for safety, reliability, communication and processing power.

- The highspeed network: Instead of conventional cabling, the network transmits digital data between aircraft systems, on a point-to-point basis, or thanks to several nodes referred to as switch modules.
- The modular avionics resources: legacy distributed avionics were historically designed with individual computers assigned to each specific function or system, whereas modular avionics provide generic hardware resources assigned and shared between several functions or systems:
  - High bandwidth buses and network

- Integrated Modular Avionics and associated architectures
- Enhanced integration of Avionics
- Integration of aircraft systems and avionics: a way forward to simplified operations.

4.1.2 Flight Controls and Auto Flight

Regarding flight controls, Fly-By-Wire technology has gained in popularity in smaller aircraft. Fly-By-Wire technology widely used in Commercial Air Transport is now on the verge of a breakthrough in general aviation and is clearly pushed by the new VTOL and UAS industry. Simplifying vehicle operation and unprecedented lift & thrust VTOL configuration requires automatic system protection and target control (as opposed to direct control) with a very high level of dependability.

Fail functional Fly-By-Wire flight control systems are paving the way for autonomous functions and simplified operations. Coupling the Auto flight system with flight controls may lead to architectures significantly improving the availability of the auto-flight function, leaving thereby the crew in the position of monitoring the mission around strategic goals.

Fly-By-Wire equipment manufacturers also endeavour to reduce cost, size, weight and power, acknowledged as the key values for AAM platforms.

4.1.3 Primary Reference Sensors

There is currently no activity specifically addressing primary reference systems, though future activity may be engaged when the industry and possibly the authorities confirm the need.

4.1.4 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 probe 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 particularly in domains where EUROCAE has competencies.

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

4.1.5 Computer Vision

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

Computer Vision relies by nature on multi-dimensional signals that require analysis, making it more sensitive to false interpretation or performance reduction, while allowing for a wider range of applications.

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 the ground progress of aircraft, 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.

4.1.6 True North Navigation

Air Navigation is currently organised and dependent on magnetic heading, though there are parts of the world where aviation safely operates in true track/heading thanks to the

introduction of GNSS and Inertial technologies. In addition, the local magnetic variations are varying by a few degrees over a period between 5 and 10 years, sometimes accelerating locally with a shorter time scale. Since the technology appears to be available and is now equipping modern aircraft, an initiative led by Nav Canada and endorsed by ICAO is looking at the possibility to remove any reference to magnetic heading and to use a true north navigation; thus removing the need to equip aircraft with magnetic variation databases, removing the need of Aeronautical Information update following magnetic variation surveys, and recalibration of Ground Radio-Navigation Aids. Smaller aircraft (General Aviation, Business & Regional, Helicopters) might be affected in a different manner.

Aerospace industries, ANSPs, Procedures Designers and Airspace users have been consulted and have started to evaluate the impacts from a technical, safety and operational point of view, along with the challenges, costs and benefits of this change, targeted for 2030 by Nav Canada.

The biggest challenges will be the transition phase, its duration, the acceptance by all ICAO states, the operational impacts for flight crews & ATC, the coexistence of equipped/non-equipped aircraft and the cost of evolutions. ICAO is about to launch a Study Group by end 2023/early 2024 to develop a Concept of Operations and a transition plan, which will potentially lead to additional standardisation activities (creation and evolution of existing standards).

4.1.7 Localisation, Navigation and Approach

4.1.7.1 GNSS based systems

The number of reported transient GNSS losses due to radio-frequency interference (RFI) is increasing. The loss of GNSS signal can cause a downgrade of the aircraft position computation capabilities. However, modern Civil Air Transport aircraft are designed to maintain position computation capability without a GNSS signal by using Inertial System or ground Radio-Navigation aids data, which is not always the case for smaller aircraft. Robust systems and procedures are in place for aircraft and operations, and are regularly reviewed with the industry, to ensure continued safety and security despite Global Navigation Satellite System Radio Frequency Interference (GNSS RFI) threats like Jamming or Spoofing proliferation.

As such, GNSS shall be protected from harmful interference in accordance with ITU Radio Regulations. Yet, several GNSS in-service events related to RFI have been observed. Industry is actively working with airworthiness authorities (EASA, FAA), international organisations (ITU, ICAO, EUROCONTROL, IATA, IFALPA) and standardisation bodies (RTCA, EUROCAE) to address the threat evolution in relevant regulations and standards, and implement if deemed necessary additional measures and mitigations on-board aircraft to avoid outputting hazardous misleading information.

The new DFMC SBAS standard, developed by EUROCAE WG-62 / RTCA SC-159, will bring additional robustness against RFI and add new features to detect and report RFI to aviation stakeholders. Application of these novelties to existing GNSS receivers may not be discarded in case the threat becomes unacceptable. Alternate means of navigation are envisaged upon the loss of GNSS as indicated below.

Research is ongoing on enhanced or new terrestrial technologies as a back-up to GNSS, e.g., Enhanced DME Network (DME-DME), wide area multi-lateration, and aircraft-based systems.

4.1.7.2 Alternative Position, Navigation and Timing (A-PNT)

This is a means to continue Performance Based Navigation (PBN) operations during periods when GNSS services are unavailable, due to interference or outage.

As a short-term solution to the need for GNSS back up, WG-107 is working on a revision to ED-57 MOPS for Distance Measuring Equipment (DME/N and DME/P) - Ground Equipment, in order to establish criteria suitable to qualify DME infrastructure able to support Required Navigation Performance (RNP) with containment, in line with the ICAO PBN Manual (foreseen achievable performance is RNP 0.5Nm). WG-107 works also on a new ED – MASPS (in alignment with the above MOPS) for DME Infrastructure supporting PBN Positioning.

4.1.7.3 4D Navigation

WG-85 jointly with RTCA SC-227 published ED-75E/DO-236E MASPS in June 2022 aiming to increase robustness against GNSS outages and prepare the system for future aircraft capabilities. WG-85 is now working with SC-227 on a revision of MOPS ED-xx/DO-283C “Required Navigation Performance for Area Navigation”, to ensure consistency with the above MASPS and include lessons learned from previous MOPS versions. The release of this MOPS update is expected for Q1-2024.

4.1.7.4 Radar Altimeter

To ensure compatibility of current and future Radar Altimeters (RA) with the Radio Frequency environment allocated for 5G Telecommunications, WG-119 has been launched jointly with RTCA SC-239 to develop a Radar Altimeter MOPS ED-30A/DO-155A. A new ED-310 Standard Guidance Document on Radar Altimeter RF Interference Rejection and Tolerance has been in open consultation since Q4-2022, to provide specifications to RA suppliers and avoid continual RA upgrades in an undefined environment. The revision of the ED-30A/DO-155A MOPS, intended to address new generation of Radio Altimeter receiver is scheduled for the end of 2024.

4.1.8 Communications

WG-82 New Air/Ground Technologies, WG-92 VDL Mode 2 and WG-108 ATN/IPS are already active on this topic. WG-78 Air Traffic Data Communications Services was reactivated in 2021 to update the published data communication standards to reflect the experience gained during the first implementations and revenue flights. WG-78 has also been tasked to develop Verification Test documents for the Air Traffic Services (ATS), which should be the main focus of the group in the coming years.

Three components of the radio communication system have emerged during recent 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), MASPS and MOPS are scheduled for Q4-2024.
- one satellite component to cover the TMA and en-route areas in addition to the oceanic areas. The new solution (SATCOM Class B) has been proposed by ESA and was validated in the SESAR programme in 2017; this system operates in the current AMS(R)S spectrum allocation. This introduction of service complements VDL2 in a multi-link environment.
    - ED-242C MASPS for AMS(R)S Data and Voice Communications Supporting RCP and RSP, released in 2021 is planned to be updated by Q4-2024 in a revision D to include additional services.
    - ED-223A MOPS for the Aeronautical Mobile Airport Communication was published in 2022
    - ED-243D MOPS for Avionics Supporting Next Generation Satellite Systems (NGSS) is scheduled for 2024.

It is nevertheless important to highlight that an EASA/FAA/Boeing/Airbus task force has delivered, in 2022, a harmonized and convergent vision for the future of connectivity for aviation. The overall roadmaps, including the ICAO GANP, may be revisited and the three potential technologies mentioned above may be amended in accordance with the recommendations of this task force.

In parallel, the WG-108 work on ATN/IPS progressed well, in particular for the development of MASPS and the finalisation of ED-262 IPS Profiles. Nevertheless, this document (ATN/IPS MASPS and IPS Profiles) is only a preliminary version dedicated to validation activities, and it is expected that an update will have to be developed. WG-92 released a Guidance on Air to Ground VDL Mode 2 interoperability ED-276A in 2023

and is developing an update of VDL Mode 2 MOPS and MASPS to specify the ATN/IPS over VDL Mode 2 protocol.

In the mid-term timeframe, the terrestrial component of Air-Ground communication in L-Band needs new standards. To be able to start work on standardisation, an operational concept and the use cases are needed.

For LDACS, the capacity study has demonstrated that the European ATM will require a new high bandwidth media around 2028 - 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 and MASPS 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 for RPAS and UAS.

4.1.9 On-board Surveillance Systems

4.1.9.1 Terrain protection and surveillance

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 HTAWS has been tasked to develop MOPS for HTAWS “Classic modes” focusing on the needs 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 (with a Change 1 version released in May 2022).

After completion of ED-285, WG-110 identified the need to launch a new activity concerning HTAWS for onshore operations. The work on the new deliverable started in September 2021 and it is expected for publication as ED-316 in Q4 2023.

4.1.9.2 Runway protection

Commission Implementing Regulation (EU) 2020/1159 mandated Runway Overrun Awareness and Alerting System from January 2025 for large commercial Aircraft (CS-25); the broad application of the recommendations of ED-250 MOPS (released in Dec 2017) may reveal the need adjust technical requirements and re-open the document.WG-101 (Runway Overrun Protection Systems) which developed ED-250 is currently dormant but may be considered for re-activation in the future.

Short range and regional operators, addressing remote destination on short runways with Short Take off and Landing capacities, may also benefit from additional protection against non-stabilized approach or detection of specific wind conditions.

4.1.9.3 Traffic Surveillance

The topic of traffic surveillance and collision avoidance systems is becoming more complex and needs to be kept interoperable while maintaining the independence as a

last resort safety net. The surveillance function of the Airborne Collision Avoidance System (ACAS) is enhanced by ADS-B and Extended Hybrid Surveillance. It will be extended to UAS, hence distinct collision avoidance systems (TCAS II, ACAS Xa/Xo, ACAS Xu: Collision Avoidance for UAS) are emerging and must be kept interoperable. ACAS Xu will be addressed in coordination with EUROCAE WG-105 on UAS. ACAS sXu (for small UAS) will be developed in a coordinated way by WG-75 and WG-105 and by monitoring the SC-147 activity. With ACAS X_R, a variant for rotorcraft will be developed as well.

Finally, collision avoidance resolution advisories have been and are intended to be more widely coupled to Flight Guidance systems.

Surveillance based on video tracking will be progressively integrated as one potential surveillance data source on airports, for final approach and surface movements. Such a function will support gap filling for surface movement displays and detection of airborne very small targets (such as micro and mini UAV). Activities regarding gap filler technologies and combined surveillance on airport surface could be envisaged.

4.1.10 Aircraft systems management and cockpit controls

Interactivity based on large touch screen display, on small control devices and virtual keyboards are now considered as the cornerstones of a smooth, evolutive and SWaP efficient operation, in recent avionics solutions.

Crew interactions within the cockpit are evolving significantly, consistent with the technology capacities of recent evolutions. Vocal commands and crew monitoring systems are examples that are entering cockpits and may require standardisation activities, in the short or medium term, to ensure interoperability between systems while providing an acceptable level of performance and safety.

With the arrival of electronic procedure management in many cockpit solutions, the crew alerting system now relates alerts with abnormal or emergency procedures, paving the way for both alert and procedure priorisation and correlation.

The next step may lead to adjusting dynamically the procedures by considering real time status of aircraft systems, based on “smart sensors” sensing aircraft systems. This would considerably reduce pilot workload, at least in some degraded situations, and may result in a simplification of the operation and associated training.

Thus, future crew alerting systems and increased coupling of aircraft systems with avionics may be key to simply the operation, leading to new standardisation activities.

4.1.11 External Vision

WG-79 EVS & SVS develops new approach capacities 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 being introduced on various types of civil aircraft (Business jets, helicopters, Air transport, …).

- An Enhanced Vision System (EVS) is an electronic system that 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 system that provides the flight crew with a computer-generated 3D 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.

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

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

Since the release of ED-249 MASPS for Aircraft State Awareness Synthetic Vision Systems and ED-255, main trends affecting this topic are driven by the desire to obtain some operational credit at reaching minima reduction with SVS and/or EVS, with Head-Down or Head-up/Head-mounted displays. The quantification of these credits for EFVS is supported by ED-291, released in 2021, which provides a method via flight test to measure and quantify the visual advantage performance of an installed EFVS. Consequently, updated operational concepts are needed.

Therefore, a new version of the Work Programme was approved for the development of the following standards jointly with RTCA 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

4.1.12 Recording and Distress Tracking Systems

WG-118 released ED-112B in September 2023, addressing the recording of the information displayed to the flight crew from electronic displays, as well as the operation of switches and selectors by the flight crew (a new ICAO Annex 6 requirement), cockpit voice recorder audio quality assessments, development in deployable recorders, modification introduced through ETSO-2C517 together with a deviation review.

The European Commission has published mandatory actions in the domain of flight tracking to improve the accuracy of the available impact point and to ease recovery of recorded data. One means to achieve the objective could be the use of deployable flight data recorders which are accomplished by an Emergency Locator Transmitter (ELT). WG-118 is currently updating ED-155 MOPS for Lightweight Flight Recording Systems to reflect deviations to ED-155 (published 2009) introduced through more recent ETSO/TSOs, additional recording capabilities, as well as alignment with ED-112B.

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

- MOPS on Deployable ELT linked to Flight Data Recorder (FDR) - joint with RTCA,
- Update of MOPS on Deployable FDR.

Other safety recommendations resulting from accident or incident investigation may trigger the development of future standards.

4.2 Air Traffic Management

This domain addresses various standardisation activities that concern Air Traffic Management (ATM) functions and components, which contribute to the safe and efficient movement of aircraft during all phases of operations and to global interoperability. It also covers ground systems providing CNS capability and specific topics related to specialised services (e.g., meteorological, aeronautical).

A significant driver for EUROCAE in this area will be the identification and development of standards that may be required to support the EASA regulatory material for ATM/ANS ground equipment, deriving from EU 2018/1139 (the Basic Regulation). In 2023, EUROCAE reviewed the catalogue of current and in draft EDs for their applicability to the ATM/ANS conformity assessment framework, however this review did not extend to the identification of additional standardisation needs that could be served by new EUROCAE standards. In coordination with EASA and the industry, EUROCAE will evaluate the need for additional activities to provide the missing standards allowing certification of ATM/ANS Ground Equipment.

4.2.1 ATM – Flight Data processing

WG-59 Flight Data Processing (FDP) Interoperability has been working on this topic for the recent years. Besides that, several validation exercises have been executed.

An update to the Flight Object Interoperability specifications (ED-133) is under finalisation.

4.2.2 ATM – Digital Voice communications

WG-67 Voice over Internet Protocol (VoIP) for ATM is active on this topic and started work on the revision of ED-136 and ED-138 in 2021.

ED-136A will address the introduction of a number of safety critical services and related environments for the application of VoIP for ATM such as remote Air Traffic Services Unit (ATSU) operations, contingency scenarios, flight-centric operations, RPAS voice services and will allocate safety and performance requirements for each of these services.

ED-138A will include the feedback received from current implementations on security and performance associated requirements. ANSPs are using this document as the specification of their Networks.

ICAO has referenced the relevant EUROCAE deliverables in Doc 9896 in support of worldwide implementation. It is expected that these references would be maintained. As a consequence, these activities are now supported by experts from outside Europe, namely the United States, Australia, Singapore and Brazil.

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

A future activity considered is related to the maintenance of the Technical Specification (TS) on Voice over IP Ground/Ground Communication (ICAO, SESAR). For this medium-term activity, interested parties include Industry, EUROCONTROL and ANSPs.

Research is ongoing in SESAR into the use of VoIP as a means of 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. Annex D.4.7. It will increase air-ground connectivity and avoid traffic growth being blocked due to the lack of availability of VHF frequencies. 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.

4.2.3 Standards for air-ground data communication

To advance Communication, Navigation, Surveillance/Air Traffic Management (CNS/ATM) concepts and support data communication developments for the Next Generation Air Transportation System and the Single European Sky ATM Research initiatives, WG-78 jointly with RTCA SC-214 has developed guidance material to define the safety, performance and interoperability requirements for Air Traffic Services (ATS) supported by data communications.

From 2024 onwards, WG-78 Air Traffic Data Communication Services will need to update the relevant documents of this domain.

WG-76 is working together with RTCA SC-206 on the specification of AIS/MET Datalink Services. A concern has been raised with regard to the high number of datalink standards that currently exist. EUROCAE will support activities to evaluate a possible consolidation of those standards.

4.2.4 Interoperability of ATM Validation Platforms

WG-81 ‘Interoperability of ATM Validation Platforms’ is active on this topic. 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.

Several low-level technical solutions have to be proposed in order to achieve a concrete interoperability of ATM validation platforms so that ED-147 and ED-148 do not remain at high-level interoperability concepts only. WG-81 is currently developing a

supplement to ED-147B Ch1 for the application of High Level Architecture (HLA) IEEE 1516.

4.2.5 VDL Mode 2

WG-92 is currently working on ED-92D (target date end of 2024) which is used as the baseline for the certification of avionics systems. It needs to be consistent with the European DLS-IR mandate.

WG-92 is also working on the “Signal-in Space MASPS for Advanced VHF Digital Data Communications” which is already available as RTCA document DO-224E. Target date for this deliverable is end of 2024.

An update to ED-276 (Guidance on Air to Ground VDL Mode 2 Interoperability) is scheduled for publication end of 2024.

In order to reach this objective, WG-92 is working jointly with the AEEC Data Link (DLK) Systems Subcommittee and the RTCA SC-214 VDL Sub-Group. Each group is in charge of a set of VDL-related documents, which are interlinked but cover different aspects.

4.2.6 Independent Non-Cooperative Surveillance Systems

WG-103 Independent Non-Cooperative Surveillance Systems (ICNS) will develop a system agnostic Technical Specification for non-cooperative surveillance sensors – supplemented as necessary with technique (multi/bi-static or mono-static, passive and/or active) or frequency specific aspects (operating spectrum will influence the clutter and target modelling) that may necessitate annexes specific to different high-level sensor types.

The Technical Specification will include guidelines to assist ANSPs procuring such Systems and is targeted for publication in early 2024.

4.2.7 DME Infrastructure supporting PBN Positioning

WG-107 is tasked to revise the existing EUROCAE Document ED-57 “Minimum Performance Specification for Distance Measuring Equipment (DME/N and DME/P) – Ground Equipment” and to develop a new document “Minimum Aviation Systems Performance Specification (MASPS) for DME Infrastructure Supporting PBN Positioning”. These documents are targeted for publication in 2024.

4.2.8 ATN/IPS

Based on the inputs from ICAO, and in coordination with the AEEC IPS and RTCA SC-223 activities, EUROCAE WG-108 will determine what exactly is needed to ensure the deployment of ATN/IPS. In particular, ICAO will standardise the needed features for ATN/IPS such as Security, Addressing, Mobility, etc. This will require providing guidance to ensure a consistent end-to-end deployment. The guidance document will ensure that the ATN/IPS deployment answers to the need in terms for safety, security and performance.

4.2.9 Virtual Centre

The latest developments in Europe in support to the modernisation of ATM led to the development of 2 important documents, the Airspace Architecture Study report and the European ATM Master Plan, 2020 edition whose subtitle is “Digitalising Europe’s Aviation Infrastructure”. The AAS Transition Plan provided more details on the timeline and the required elements to progress towards this digitalisation.

One of the key common elements of these strategic documents is to implement virtualisation, automation, service orientation and digitalisation of ATM, in particular via virtual centres.

Virtual centre technologies and concepts are expected to support the increase of resilience and adaptability of the European ATM Network in terms of capacity and cost efficiency. Internationally agreed standards are needed to support the successful implementation of virtual centres.

WG-122 is tasked to develop standards and related deliverables to support the implementation of the virtual centre concept. ER-026 ‘Virtual Centre - Strategy for

Standardisation - Phase 1' was published January 2022 and the WG continues development of a second report- 'Taxonomy of Services for Virtual Centres'. As the Virtual Centre concepts continue their validation through SESAR projects, so too the standardisation needs will continue to evolve. By early 2024, WG-122 can be expected to devise its proposed next steps for standards development in this area.

4.2.10 VCS-ATS Systems Integration for ATM Information Exchange

ATC Systems and Voice Communication System (VCS) represent the base combination required for an effective and efficient control of the air traffic assigned to operators. Although these elements are intended to be working together, the one defining the three-dimensional position and identification of an aircraft in the airspace, the other allowing communication to pilots, there is today no standard integration between them.

Besides aircraft position, the ATC system collects a number of other information elements through the protocol between aircraft and ground radar station. If made available, such information could be useful for a better usage of the communication infrastructure, allowing rationalisation of radio stations and permitting a punctual selection of the right communication satellite link between ATC Controller (ATCO) and pilot. Vice versa, the indication/highlighting on the air situation display of the aircraft whose pilot is currently speaking would increase the ATCO situational awareness.

A standard in this area would therefore be very beneficial because it provides large benefits to ATCOs having greater situational awareness, reducing their workload and increasing the overall flight safety. Such a standard would therefore bridge the ATM and VCS worlds, by integrating and exchanging information that are today available to ATCOs, but on separate systems.

WG-126, formed in 2023, is tasked to develop standards and related deliverables in this area.

4.3 Airports

This domain addresses standardisation activities related to airport systems and equipment, as they are not only important stakeholders in the ATM system, but also significant contributors to local and reginal economies. Special attention is given to the Counter-UAS capacity, providing airports the ability to minimise the risk and effect of unauthorised operation of Unmanned Aircraft Systems.

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 economic players in their region where their efficient operation requires the modernisation of their infrastructure, the digitalisation of their systems and capacity enhancements at a maximum level of safety and security.

The evolution of the ATM system and the development of new technologies in all aviation related domains will require airports to provide innovative solutions. Areas of concern for the future are the provision of services related to advanced air mobility, such as UAS, autonomously operating vehicles on the aerodrome surface or the provision of airport infrastructure for innovative flight handling. Related to the European Green Deal, is the need for standardisation activities covering the sustainability of aerodromes includes electric supply, hydrogen supply to airplanes using alternative power etc.

4.3.1 Advanced Surface Movement Guidance and Control Systems

Advanced Surface Movement Guidance and Control Systems (A-SMGCS) are widely referred to in regulations (especially EU 2021/116 Common Project 1 "CP1") and in the ATM Master Plan. Several of the referred ATM functionalities of an A-SMGCS are already reflected in the existing EUROCAE documents, delivered by WG-41. The recent update of ED-87 (to ED-87E) has concluded the technical definition and the specification of requirements for all available A-SMGCS services.

In addition to the CP1 elements, the ATM Master Plan drives standardisation needs for A-SMGCS functionalities that are related to new essential operational changes for airports and new service consumers, such as airport vehicles and deployed aerodrome systems.

As A-SMGCS gets more complex with an increasing number of technical constituents and operational stakeholders, EUROCAE started to work on a comprehensive interoperability specification for A-SMGCS, due to be published in 2024.

The evolution in the field of surveillance technologies encompasses new Surface Movement Radars (SMR), independent non-cooperative surveillance, next generation ADS-B, Multilateration (MLAT) improvements, video tracking and more. As a result, updates of the surveillance sensor standards and a collaboration with other EUROCAE working groups are foreseen. The future integration of surface management data links will be coordinated with data link experts while further interoperability with other ATC domains such as A-CDM or SWIM is needed as well.

EUROCAE's role is to provide performance specifications to allow an unambiguous and state-of-the-art description of technical performance and interoperability requirements serving the operational need of air traffic management and aerodrome operations.

EUROCAE Documents under development by WG-41 include:

- Interoperability Document on Data Exchange for A-SMGCS.
- MOPS for supporting sensor systems for use in A-SMGCS.
- Guidelines for the implementation and operation of A-SMGCS.

4.3.2 Airport Equipment

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.

WG-83 Airport Foreign Object Debris (FOD) Detection Systems is active on topics related to aerodrome systems and is updating ED-235 to reflect emerging technologies supporting FOD Detection, with a view to publishing ED-235A in 2024.

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 has required the creation of several MASPS. This is discussed in more detail in section 4.3.7 below.

4.3.3 Remote and Virtual Tower

WG-100 Remote and Virtual Towers (RVT) is active on this topic.

ED-240 'MASPS for Remote Tower Optical Systems' has evolved through 4 publications to the current ED-240B; each update incorporating specifications for additional functionality. The current ED-240B incorporated specifications for non-optical sensors and recording/playback functionality and was published in July 2023.

The multiple remote tower concept was validated in Wave 1 of SESAR 2020, and Wave 2 projects focussed on Remote Tower Centres and on the exploitation of SESAR remote tower technology in manned towers. The Working Group will monitor ongoing developments regarding remote provision of ATS to multiple aerodromes, and the implementation of Remote Tower Centres. The current MASPS notes services to multiple aerodromes as an implementation option but does not address any requirements for this service type.

The application of the RVT concept in an increasing number of sites will bring up additional standardisation needs in the future, for instance for new HMI input and presentation systems based on HUD or using Augmented Reality (AR) technology. Full integration of all ATC tools for safe and intuitive operation of RVT will require

standardised planning assistance, adapted radio communication and a robust data fusion of visual and other sensors.

On the basis of proven cost-effective optical and radar target tracking technologies and remote provision of ATS to Multiple Aerodromes, WG-100 will update ED-240B to support the application of Artificial Intelligence, increased automation and high level of cyber security.

4.3.4 Airport Collaborative Decision Making

Airport Collaborative Decision Making (A-CDM) is a key enabler for airport and network optimisation, through the sharing of information across stakeholders, allowing the real time updating of operational information and milestones, improving gate and turnaround management, as well as improving aircraft operating efficiencies both on ground and airborne.

ACI World has defined standards for B2B Communication developed by the Airport Community Recommended Information Services (ACRIS) Working Group of the ACI World Airport IT Standing Committee (WAITSC). The ACRIS WG has developed an A-CDM Webservice based on the Aviation Information Data Exchange (AIDX) that should serve as basis for the A-CDM standards.

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) also require to be reflected in updates on the MASPS and Guidance Documents for A-CDM.

WG-111 (A-CDM) is reviewing a series of EDs developed in 2008, and during 2024-25 is expected to deliver the following documents:

- Minimum Technical Specification for A-CDM Systems (ED-141A).
- Airport CDM Data Model Specification (ED-145A).
- Guidelines for Test and Validation Related to Airport CDM Interoperability (ED-146A).
- Airport CDM SWIM Interface Specification (ED-xxx).

WG-111 collaborates with EUROCONTROL, with the EUROCAE documents focussing on the technical specifications for A-CDM, while EUROCONTROL focusses on the functional requirements.

4.3.5 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. To do so, airports will be setting up a so-called Ground Coordinator.

As noted above, WG-111 is reviewing the existing standards for A-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 become more precise by keeping exact track of all handling processing e.g. by the usage of automated computer vision timestamping algorithms and the use of Artificial Intelligence.

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 Target Off Block Time (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 flows or measure queues and process duration in bottlenecks and congested areas.

In addition to integration of extended information relevant for turn-around processes, TAM addresses the outline of how turn-around processes will evolve and specifically how the turn-around processes could be monitored by the Airport Operations Centre (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 of TAM. Coordination with existing operational systems and standards, such as the ED-145A Airport CDM Data Model Specification and modification of existing other data interface standards may be the result of the future work in this domain.

4.3.6 Counter UAS

WG-115 Counter-UAS (C-UAS), working with RTCA SC-238, is active on this topic.

Sighting of drones in the vicinity of major airports has significantly impacted airport and flight operations. To prevent such disruptions, the airspace around an airport needs to be protected and unauthorised UAS activities need to be detected and reported, at the earliest possible stage, to Air Traffic Control and responsible authorities. Finally, and in accordance with national regulations, neutralisation or disruption of the UAS (either the Unmanned Vehicle, the Command & Control Datalink or the Remote Pilot) could be considered.

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.

WG-115 has developed ED-286 “OSED for Counter-UAS in controlled airspace” (published in Q1 2021) introducing the overall capability of a Counter 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. In 2023, ED-322 “System Performance and Interoperability Requirements for non-cooperative UAS detection systems” was developed.

The next tasks for WG-115 include:

- A review of ED-286, taking into account the evolution of understanding of C-UAS operational requirements and emerging system capabilities.
- Then, building on the OSED update, developing Interoperability Requirements for Counter-UAS systems.

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

4.3.7 Weather surveillance

The ICAO Friction Task Force developed the ‘Global Reporting Format (GRF)’ with new demands for Runway Condition Reporting. WG-109 Runway Weather Information Services (RWIS) was established to develop technical requirements for Runway Weather Information Systems and published ED-292 in December 2021; the GRF implementation slightly preceded this publication. WG-76 AIS/MET Datalink Services

updated ED-89A to accommodate GRF requirements for extended length messages in D-ATIS; ED-89A Ch1 was published in July 2023.

WG-109 has not met since the publication of ED-292, however is expected to re-convene in 2024 to review RWIS/GRF implementation to determine if an update to ED-292, or additional guidance material, is required by, or would be beneficial to, the industry.

4.4 Space and Space-based solutions

Aviation development is increasingly intertwined with space technology innovation therefore this domain includes all standardisation activities related to space-based solutions, either for providing CNS capability in all phases of operations, or for proposing ATM capacities. In addition, EUROCAE experience in space-based solutions and ATM may open the door to involvement in new activities such as Space Traffic Management (STM) in the future.

4.4.1 Global Navigation Satellite System

The use of satellite navigation services for aeronautical navigation has been growing steadily over the past three decades. Based on the use of the Global Position System (GPS) operated by the United States, the introduction of satellite navigation has enhanced safety by reducing CFIT, revolutionised the way to navigate by enabling flying more direct routes and by reducing fuel consumption and emissions, as well as the organisation of airspace. More recent Global Navigation Satellite System (GNSS) constellations include the EU developed Galileo, and Chinese developed Beidou.

To enhance GNSS positional accuracy, Satellite Based Augmentation Systems (SBAS) have been developed, the first being the Wide Area Augmentation System (WAAS) developed by the US Department of Transport. Europe has developed its own SBAS, the European Geostationary Navigation Overlay Service (EGNOS), which has delivered a certified Safety-of-Life service since 2011. Current EGNOS services are provided on a single frequency and only augment GPS. The European Commission has launched an ambitious modernisation plan for EGNOS (EGNOS V3) to deliver dual-frequency multi-constellation services augmenting both Galileo and GPS. Other SBASs are either in service, or under development for other regions of the world.

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.

These developments in Europe fully embrace the new concept of multi-constellation services developed by ICAO and support the plans in Europe 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.

WG-28 Ground Based Augmentation Systems (GBAS), working with RTCA SC-159, contributes to the development of the multi-constellation multi-frequency concepts using Galileo in the frame of ICAO NSP DFMC GBAS Working Group, exploring options such as GAST D based on GPS and Galileo signals or GAST E (GPS/Galileo Dual Frequency GBAS).

The group is elaborating a report on preliminary material for GBAS multi-constellation multi-frequency MOPS developments, which is intended to outline the scope of the changes needed in order to incorporate DFMC GBAS in an update to ED-114B. It will identify the sections needing to be changed, and list/identify material needing to be developed for the section to be updated. The output shall differentiate between the impact of SFDC (“GAST D based on GPS and Galileo signals”) and DFMC GBAS. The report is aimed for December 2024.

WG-62 GNSS works on the development of standards for the use of GALILEO and other GNSS systems in civil aviation applications. The group has recently published ED-259A (“Minimum Operational Performance Standard for Dual-Frequency Multi-Constellation Satellite-Based Augmentation System Airborne Equipment”) in a joint

configuration with RTCA SC-159. This MOPS addresses the development of Galileo E1/E5a, GPS L1/L5, and multi-constellation multi-frequency SBAS airborne equipment. It is intended to support validation of airborne requirements as well as the development of DFMC SBAS services. ED-259A provides robustness requirements against jamming and spoofing threats, including radio-frequency interference detection.

ED-259 Revision B development, commenced in late 2023, will address all expected functions of SBAS equipment including navigation in degraded environments (i.e., single-frequency L5 mode), H-ARAIM (Horizontal Advanced Receiver Autonomous Integrity Monitoring), and the management of institutional scenarios developed at ICAO.

A WG-62 subgroup was launched in April 2022 to develop an Internal report as a pre-requisite to support the introduction of Beidou in the avionics standards for SBAS equipment which will be considered after the completion of the ED-259B version.

WG-82 New Air-Ground Data Link Technologies, working with RTCA SC-233, works on the development of standards relative to new air-ground data link technologies including three components: airport surface, satellite, and en route/TMA L band systems. For the space domain, WG-82 is currently updating ED-243C MOPS for Avionics Supporting Next Generation Satellite Systems.

4.4.2 Space-based secure connectivity

A global air traffic surveillance system has been implemented by Aireon that uses a satellite-based, space-based Automatic Dependent Surveillance-Broadcast (ADS-B) network. In addition, SESAR activities are investigating the use of space-based VHF to provide direct-controller pilot communications (DCPC) for both voice and Controller–pilot data link communication (CPDLC) in oceanic and remote areas, initially by VHF voice and VDL2 CPDLC, and in the future, possibly via space-based LDACS.

In the wider space context, industry is looking for harmonisation and a predictable environment to develop, produce and operate solutions. Within the EU Space Programme, this aspect is addressed 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.

The progress on these activities is supported by WG-82.

4.4.3 Space Traffic Management

Space Traffic Management (STM) is intended to develop a set of standards and rules to organise safe access to and operations in space, considering the proliferation of space vehicles, satellites, and space debris. EUROCAE currently has no WG developing related standards, but the topic is monitored closely.

Today, launches and recovery of rockets are done through the traditional airspace structure, fully segregated by closing airspace with substantial safety buffers, proper integration in the ATM, handed over to STM and re-entry into ATM to land at the spaceport or airport. The EU Space Programme considers the autonomy in launchers and STM a strategical objective, and intends exploring new and competitive solutions for access to space and for STM.

Developments in STM will need to work closely with, and ensure integration with, Higher Airspace Operations, and this will require extensive standardisation activity.

4.4.4 Higher Airspace operations

Higher Airspace Operations (HAO) refer to operations that take place in airspace above where conventional IFR operations occur. Although the upper and lower vertical limits are not formally defined, this airspace is typically from above FL 660 up to space, or around 100 km. EUROCAE currently has no WG developing related standards, but the topic is followed closely.

The variety of operations emerging for this airspace volume is such that some form of management will be needed, but it does not necessarily need to follow the model of ATM below it. Operators may be able to take more of a role in managing their fleets within new ICAO guidelines, making use of innovative services and technologies. It may be possible to adapt existing or emerging ATM concepts to support such operations, for

example trajectory-based operations or advanced flexible use of airspace, or it may need an entirely new model such as U-Space / UTM. This will need regional and global harmonisation since higher airspace operations will involve international and even inter-continental trajectories.

It is certain that all these emerging activities will, to varying degrees, have an impact on current aviation and on the air navigation system as a whole. Consequently, they must be integrated appropriately to encourage and enable innovative new businesses while maintaining the high levels of safety, regularity, efficiency, and security for all existing airspace users.

These considerations highlight several areas where EUROCAE currently has little standardisation activity. Enabling these operations will require the standardisation of new applications for existing technologies, as well as the introduction of new technologies that will need standardisation.

The European Commission (DG DEFIS) wants to strengthen Europe as global actor, with a tailored space strategy to foster innovation and entrepreneurship and to encourage applications as well as to reinforce autonomy and security. This includes supporting rocket launches from European sites in such a way that it can be managed safely and economically, in coordination with the ATM environment, as well as by creating a regulatory framework for orbital and sub-orbital activities that integrates with other users of the Higher Airspace.

All this is foreseen as performance-based regulation, supported by standards. Industry and operators are calling already today for more harmonisation and standardisation to develop quick and innovative operations in a predictable environment worldwide.

4.5 Advanced Air Mobility

The Advanced Air Mobility (AAM) domain, and its subset of Urban Air Mobility (UAM), encompasses emerging concepts such as piloted, unmanned or uncrewed aircraft systems, namely UAS, RPAS, and VTOL, for which a set of standards are needed to support their safe integration in the airspace. It also covers related topics, like UAS Traffic Management (UTM or U-space in Europe) and ground infrastructure, that are necessary for global integration in the operational environment. New concepts for general aviation will also fall in this domain.

***NOTE**: The EU has introduced the term Innovative Air Mobility (IAM), whilst the ICAO, FAA and other international stakeholders use the term AAM. This domain is evolving fast and terminology will continue to change.*

Working Group WG-105 is active in the very broad field of Unmanned Aircraft Systems. The six sub-groups are developing standards covering standardisation activities from technical design issues all the way to operational requirements of UTM.

WG-112 develops standards for VTOL systems in a holistic manner and therefore a manifold set of subgroups with very diverse range of topics is quite active. The goal is the safe and secure integration of those aircraft into the existing aviation structure (including certification), as well as in the ATM system.

4.6 Air Medical

The Air Medical domain was developed in 2020/21 and addresses measures to support management of the COVID-19 situation of the time and possible future pandemics. Common guidance and guidelines are needed for the safe detection, handling, and transportation of infectious passengers, aircraft cleaning, disinfection, and similar topics.

In 2023, WG-123 published ED-317 Guidance Document for Aeromedical Handling and Transport of Infectious Passengers. EUROCAE will continue to monitor developments in this area, however there are no standardisation activities currently underway.

4.7 Sustainability

4.7.1 Introduction

This domain aims at providing support in building a more environmentally, socially and economically sustainable aviation sector. Standards related to technological and operational measures, such as new energy sources, improved airframes, optimised operations, and other relevant improvements that contribute to reducing the environmental impact of aviation are in the scope of this domain. The human pillar of sustainability is also addressed via the Next Generation Aviation Professional (NGAP) Programme.

4.7.2 Context, status quo and future needs

ICAO estimates continued growth in air traffic and predicts that, in the absence of containment measures, the international aviation emissions (carbon dioxide (CO_2), Nitrogen Oxides (NOx), water vapour, soot particles…) could triple by 2050 compared with 2015.

Consequently, in 2022, ICAO set a Long-Term Aspirational Goal (LTAG) that seeks reaching net zero carbon dioxide emissions in international aviation by 2050. Prior to this date, several high-level measures and initiatives have already been taken by the aviation sector to meet this target, such as:

- CORSIA, the Carbon Offsetting and Reduction Scheme for International Aviation, agreed by all ICAO members states in 2016, and whose pilot phase started in 2021.
- The establishment by the European Union of a 'Fit for 55' legislative package which aims at reaching the EU Green Deal objectives, by allowing to meet an intermediate target of at least 55% net reduction in CO_2 emissions by 2030.

Practically, different steps are envisaged by the aviation sector to meet the CO_2 emissions reduction objective.

- In short term, scaling up the production of alternative, low carbon and sustainable aviation fuels (SAF), and seeking ways to optimize flight and ground operations. In the interim, also utilizing out-of-sector carbon reduction market-based measures, such as carbon offsets, to compensate the residual emissions.
- In mid to long term, innovating in technology and preparing improvements in infrastructure and operations. It is anticipated that the standards impacting the aircraft architectures, design and technologies will have to be ready by 2030, i.e. before the launch of major aircraft development programs.

EUROCAE's programme seeks to promote a reduced environmental impact of aviation, focusing its efforts on the standardisation needs generated in areas where R&D is advancing.

Some areas which can bring important environmental benefits in aviation operations include new feedstocks and production pathways for SAF and hydrogen, as well as battery-electric aviation. On the operational side, innovations that may contribute to reducing the aviation CO_2 impact, the Strategic Research and Innovation Agenda (SRIA)[2] has highlighted e.g., new ways of flying, optimum green trajectories, Formation flight, advanced RNP green approaches or environmentally optimised climb and descent operations (OCO and ODO). Standards related to measuring non- CO_2 effects can also bring important value in addressing the aviation decarbonation challenge. Also, harmonization of aircraft noise measurements and innovations around reducing noise as well as exploring the new opportunities arising from artificial intelligence, machine learning and Internet of Things.

Effectiveness of such standards will require a strong worldwide co-operation and joint activities with non-European Standardisation Organisations such as RTCA and SAE.

[2] Strategic Research and Innovation Agenda (SRIA) | Circular Bio-based Europe Joint Undertaking (CBE JU) (europa.eu)

The following section provides a description of Eurocae activities already running as well as an outlook of standardisation activities that could be launched in the mid-term.

4.7.3 New technologies for propulsion of aircraft

Conventional jet fuel, used to power aircraft engines, when combusted, contributes to 2% of anthropogenic CO_2 emissions, and like other fossil-based products its reserves are limited and localized around the world.

Consequently, activities during the recent years have been mainly focused on more efficient engines, increased use of electric energy, hybrid propulsion or other alternative and sustainable sources of energy with a view to have standards and other means of compliance ready by 2030.

For the storage of electrical energy, 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, and solar cells etc. The EUROCAE role in this sector depends on the willingness of European industry and EUROCAE stakeholders to engage.

4.7.3.1 Hydrogen Fuel Cells

WG-80 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 WG 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 describes the existing applications and the experience gained from exploiting these technologies. It explains how the experience learnt from these existing uses will help alleviate safety concerns and will underline the relevance of these solutions for usage in aviation.

Since mid-2019, the WG has been working on a MASPS for liquid hydrogen storage for aviation. The 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 use of Hydrogen systems in General Aviation is increasing as well; therefore in 2021 WG-80 added a second deliverable, a MASPS for Gaseous Hydrogen Storage for Small Aircraft, to their Work Programme. The standard deals with the specifics of gaseous hydrogen storage systems and aircraft's ecosystem.

In the future, the Working Group 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 Administrative Reforms Commission (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 of:
    - Aircraft kerosene (Jet A1),

- Propylene Glycol Water mixture (PGW),
- Methanol / Ethanol and any other fuel.

4.7.3.2 Hybrid Electric propulsion

Studies into the electrification of aircraft propulsion revealed the potential of reducing carbon footprint by 50% between 2005 and 2050 – supporting ACARE Flightpath 2050 goals. This step-change in technology / architecture 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.

WG-113 on Hybrid Electric propulsion published the report on standardisation needs for Hybrid Electric propulsion (ER-025). Activities on endurance and durability substantiation are currently underway, with additional focus areas to be considered during 2024.

4.7.3.3 Power distribution – High voltage

With the constant increase of electrical power demand in aircraft and introduction of electrical and hybrid products, there is an increasing tendency to use higher voltages compared to traditional aircraft systems. For electrical propulsion systems, voltages of up to 3000 V (or even higher) are envisaged.

WG-116 on High Voltage was launched by EUROCAE at the beginning 2020 to address this issue.

Higher voltages are favoured in order to decrease the weight of the wiring and other electrical components. But usage of voltages above 540 VDC will introduce new considerations like ageing of electrical harnesses, protection of maintenance personnel, flight crew and passengers, and airframe insulation, that will impact the overall aircraft electrical systems design

These considerations will lead to WG-116 developing interactions with:

- WG-14 to adapt Equipment Qualification Conditions prescribed in ED14/DO160,
- WG-31 for consideration of Electro-Magnetic Interference, and
- WG-63 providing guidance on new hazards to take into account when performing Aircraft Safety analyses.

4.7.4 Green Airport

4.7.4.1 Autonomous Taxi

A substantial 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 being developed. Possible ways to achieve the required goals include the reduction of energy and fuel consumption. That, for example, includes autonomous taxi scenarios using CO_2 free operating tugs, or CO_2 free taxiing aircraft. 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.

Beyond the environmental impact resulting from the reduction of the use of aircraft engines and hence of fuel consumption during taxiing phases, such concept are expected to favour:

- Cost savings for the airlines,
- Decrease of noise pollution where airports are located in high-density population areas,
- Ultimately compliance to local or global regulations that will be progressively implemented to reduce emissions and noise pollution from aviation.

Apart from the reduction of emissions during taxi, all the turnaround processes need 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 buses, 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.

The SESAR initiative STX (Sustainable TaXiing), due to finish in 2024, is aiming at devising Operational Concepts for operating safely various forms of Autonomous Taxiing systems building in the cooperation of the relevant European stakeholders (airlines, ground handling companies, airport operators, air navigation service providers, regulators, aircraft or aviation systems industry, the EU and its agencies, international organisations, etc.).

From 2025 and onwards, EUROCAE will build on the guidance material issued by the STX initiative to start harmonizing and ultimately standardizing (sustainable) ground operations.

To achieve all the goals for sustainable airport operations 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 environmentally friendly development of airports and airport operations are:

- Interoperability standards for electrical 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 about 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.

4.7.4.2 Airport Energy Infrastructure

Regardless of whether the energy needed for aerodrome operation is provided through electric power, hydrogen, biofuel or other means, common charging/refuelling technology, infrastructure for energy distribution and storage, well defined interfaces (plugs, network interfaces etc.) and state-of-the art software and hardware to optimize the operations will be needed. In the future the airports will need to provide a sustainable energy supplying infrastructure for aircraft and zero emission vehicles of passengers and cargo handling companies as well as for other stakeholders. Furthermore, airports 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.

4.7.4.3 Quality of Air

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 quantification need to be established.

4.7.5 Wake energy retrieval (automated formation flight)

It has been demonstrated after numerous flight trials, including transatlantic (north Atlantic) flights involving several international ANSPs, that mimicking birds' V-shape flights in civil aviation leads to fuel consumption reduction (typically 5% for the following aircraft's end-to-end flight) and CO_2/NOx emissions reduction (around 6 tons of CO_2 was saved during an Airbus Toulouse-Montreal transatlantic flight in Nov 2021) and can contribute to greener aviation before next generation of zero emissions aircraft enter into service.

The formation flight relies on the principle of an aeroplane harvesting a part of the energy from the wake vortex generated by a leading aeroplane, by actually surfing it.

The implementation of Wake Energy Retrieval operations could be envisaged from 2028 over North Atlantic in a phased approach so that they can be first implemented, with a limited number of changes to ICAO provision.

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.

An initial Concept of Operations has been identified and foresees potential impacts in avionics systems, Air Traffic Management and Communication links. In order to enable the concept to be used globally, standards will need to be established to define, inter alia, pair and split procedures, terminology to be used, the separation required between aircraft, the transfer of responsibility between ATC and the paired aeroplanes and frequency allocation for the coordination. The outcomes of a trial implementation phase will be used to propose additional updates to ICAO Standards and Recommended Practices (SARPs) and related guidance material so that Wake Energy Retrieval operations can be regulated, and further extended into domestic and/or interface area airspaces. The aviation industry is now working on the detailed impacts, and standardisation and rulemaking can begin, firstly at ICAO and then, from 2025 on detailed MOPS impacts, for instance on a 1090MHz aircraft to aircraft parameter exchange, as a result of the current SESAR 3 project GEESE.

4.7.6 Next Generation Aviation Professionals

The NGAP 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 its own NGAP Programme in 2020. WG-125 is developing guidance documents on mentoring as well as on education and industry connections. The work aims to attract professionals into aviation and encourage students to pursue a career in the aviation industry.

EUROCAE has identified suitable stakeholders and obtained 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 has a diverse set of stakeholders, ranging from industries across various domains in aviation, universities, research institutes, vocational educational institutions, SDOs, and regulators. It aims to perform activities that would positively influence stakeholders, students, and general public.

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.

4.8 RF Spectrum

This domain encompasses various aspects linked to the use and management of the Radio Frequency Spectrum, and the interoperability issues between aviation systems or functions and their environment, either on-board or in the open.

WG-96 Wireless On-Board Avionics Networks, aiming at supporting ICAO SARPs for Wireless Avionics Intra-Communication (WAIC), released in July 2022 the ED-260A document, providing system requirements and rules to ensure coexistence between wireless avionics intra-communication systems and between WAIC and radio altimeters on board other aircraft.

A MOPS for Wireless Avionics Intra-Communication System (ED-319) has also been developed by WG-96, providing a complete set of requirements at equipment level; at the time of writing this 2024 TWP, the document was in the open consultation phase.

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. This situation resulted in the creation of the joint WG-124/SC-242 “Spectrum Compatibility”. The intention behind the development of this 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. More particularly, the objective is to ensure that the RF characteristics of aeronautical systems supporting safety and flight critical functions, such as CNS systems, are specified in a consistent and complete manner and are defined in such a way as to be consistent with existing regulatory requirements and guidance material. The guidance material, planned to be published in 2025, should also provide information to a broader audience including non-aeronautical sectors on the RF performance necessary to meet existing aviation performance standards (e.g. availability, reliability, continuity, latency etc) for safety-of-life functions.

The Guidance material will rely on the development of two EUROCAE Reports (ER), the first one being “Survey of Radio Frequency (RF) Performance of Standards for Aeronautical RF Systems”. This ER is intended to be the reference for non-aerospace spectrum stakeholders, to support effective and successful discussions with the aerospace industry, and to inform Civil Aviation Authorities and ICAO while the second ER, Report for Aeronautical Radio Frequency Systems, their Regulatory Framework, and Operational Considerations, will be a reference for a broader audience including aviation systems developers, as well as for non-aerospace spectrum stakeholders. As such, it will support effective and successful discussions with the aerospace industry and regulators in future ITU Study Cycles.

The deliverables are envisaged to be referenced by EASA, other CAAs, ICAO, and national/international spectrum regulators, as appropriate, in guidance material for aviation systems.

4.9 IT & Software

This domain covers initiatives to guarantee the safe design, development, and qualification of aviation software, both for on-board and in ground systems. It also covers the specific topic of artificial intelligence applied in aviation.

4.9.1 Interoperability of virtual avionic components

WG-97 Interoperability of Virtual Avionics Components is developing an update to ED-247A Technical Standard for Virtual Interoperable Simulation for Tests of Aircraft Systems in virtual or hybrid bench. The first release of the standard covered main avionics interfaces and was followed by a revision 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.

4.9.2 Artificial Intelligence

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 with 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 quickly and appear to become more accessible, providing attractive future capabilities, thanks to the significant processing power increases in recent years, enabling machine learning and computing so that they can perform certain tasks as well as or better than a human.

The objectives of WG-114 Artificial Intelligence (AI) 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” to establish a comprehensive statement of concerns versus the demonstration of conformity of AI-based products to the regulation requirements, and to 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.

The direction taken by the documents under development is stemming from this initial report

4.9.3 Aviation Software Standards

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 Commercial Off the Shelf (COTS) software for UAS solutions.

Regarding Software (SW) Assurance for Low-Risk Applications (WG-117 SG-1), decision was taken in 2022 to focus more specifically on alleviation objectives to match “LR2” (below level C objectives) for a first time, sufficient to comply with up to HAZ Failure conditions on UAS lower Risk operations.

On the conditions enabling the re-use of COTS/OSS SW into DAL C SW, a draft is currently being internally reviewed on both the EUROCAE and RTCA sides to proceed to a first release in 2024.

4.9.4 Lower-risk Aviation Applications

The regulatory framework for UAS is being developed along a risk-based, operation-centric approach that considers certified, specific, and open categories. While the certified UAS category is aligned with the ED-12C/DO-178C document suite for development, the open category does not have a software development standard needed for use and deployment, and the specific category does not currently have a comprehensive compliant development standard identified to provide assurance as to the safe operations of the UAS.

The continued release of information on UAS development and UAS operations by EASA provides an opportunity for a new software development standard that will be tailored to lower-risk UAS applications, and the specific category defined by EASA. Moreover, certain lower-risk applications within the General Aviation (GA) community might also benefit from a simplified software development methodology.

WG-127 is tasked to define the Software Considerations in Low-Risk Applications Equipment Certifications and Approvals.

4.10 Security

The Aeronautical Information Systems Security (AISS) Working Group (WG) addresses information security protection as a means of ensuring safety of flight and maintaining the operation of the civil aviation infrastructure without significant disruption. AISS 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 in charge of Aeronautical Systems Security develops AISS guidelines addressing objectives and requirements including the operational concept in a holistic approach, rather than technological solutions to ensure their stability over time.

Within the scope described above, WG-72 therefore address both airborne and ground systems, their end-to-end interdependence and particularities from operational and AISS standpoints.

WG-72 shall serve as a resource and coordinator for Aeronautical and ATM information security-related matters with all EUROCAE Working Groups. For example, WG-72 has been coordinating with WG-112 on VTOL and WG-105 on UAS. More recently, WG-72 provided detailed feedback in support of the WG-96 WAIC security document prior to Open Consultation. In 2023, WG-72 also held a joint session with WG-63 on complex aircraft systems. As part of its performance-based rulemaking, EASA relies on industry standards to implement and comply with AISS requirements. Its long-term experience and intrinsic purpose leads WG-72 to play a key role in the development of industry standards for security, along with RTCA SC-216.

4.10.1 Current activities

The purpose is to develop and maintain acceptable processes and methods of compliance addressing information security issues in support of the development of the AMC/GM of the PART-IS in the frame of the Rule Making Task (RMT) 0720.

In 2023, the European Strategic Cooperation Platform (ESCP) under EASA leadership has delivered the AMC/GM for the PART-IS. It belongs to EUROCAE WG-72 with RTCA SC-216 to facilitate the implementation and minimize the impact of the new Information Security Management System (ISMS) organisation by writing a guidance document that supplements the current Safety Management System on security aspects, for the worldwide aeronautical community including airframers, airlines, ANSP/CNSP, airport and MRO stakeholders. This work is captured in the new standard ED / DO on ISMS.

Even if WG-72 was not initially tasked to elaborate objectives in terms of technological solutions, intended to be continuously updated in response to new threats, a new ED / DO Standard on Aviation Data Security has been initiated to set a minimum performance to protect generation, storage, and delivery of data, including Operational Flight Programs, sensitive maintenance data records and other security relevant data, meant to be shared between worldwide aeronautical community actors mentioned above.

WG-72 is currently structured around four sub-groups:

- WG-72 SG-3 is focusing on organisational aspects of information security in a revision of ED-206 Guidance on Information Security Event Management (ISEM). This standard is targeting organisations that need to manage information security events that can affect aviation safety.
- WG-72 SG-4 is working on the adaptation of ISMS to aviation. EASA published new regulation including requirements on the management of cybersecurity risks for approved organisations and competent authorities in aviation. Requirements in this regulation are asking organisations and competent authorities to implement and maintain an ISMS. The document is intended to be used by organisations and authorities subject to the new EASA regulation in a standardised way to implement, maintain and improve an ISMS in the aviation framework and as a baseline for auditing by certified organisations.
- WG-72 SG-5 addresses end to end security for data. The resulting standard is expected to ensure that the data having an impact on aviation safety is secured during production, transport, storage and usage, this may include, airborne software, databases, production and maintenance data, and possibly data used in end-to-end digital communication. The assurance of data and information security for aviation demands for a holistic approach across all the involved sub-sectors and in particular the ground segment, e.g. airports and air navigation services/air traffic control. Data security can be approached from an aircraft-

centric view however, must consider all the supporting functions – in the form of an aviation functional chain – that contribute to safe and secure flight operations.

- Finally, WG-72 SG-6 is working on an update of ED-202A with improvement on change impact analysis related to information security of embedded systems. EASA has provided some guidance in Part 21 A.91 for classification of minor / major change and the update of the standard could improve this guidance material. The revision is intended to identify minimum set of activities required to demonstrate compliance of the change, provide some guidance for the authority involvement on the compliance demonstration, and the implementation of security update on certified products.

  WG-72 SG-6 is aligning guidance for performing Change Impact Analysis with respect to security with the process found in another technical disciplines and to better integrate with the process for managing changes to a certified product. The new Change Impact Analysis guidance will also provide more support for securely managing Supplemental Type Certificates. SG-6 will also use this opportunity to align the complementary documents ED-202 and ED-203.

4.10.2 Anticipated evolutions

Assuming that the civil aviation regulatory framework(s) are about to evolve in many places around the world (e.g. USA), there is a need to ensure that coordination remains efficient to avoid duplication or inconsistencies between standardisation activities, as it would be detrimental to the industry and the overall effectiveness of the cybersecurity defence strategy. Such coordination and “situational awareness” activity shall encompass all those organisations likely to play a role in the development of the European regulatory framework.

Given also that AISS has a lot of commonalities with information security requirements or guidance applied in other domains, precautions shall be taken to focus and develop only the standards required for civil aviation and be able to rely upon useful already existing ones.

4.11 System Engineering

The scope of this domain is to accommodate activities on transverse topics that are clearly within the scope of EUROCAE, but do not solely fit within a single domain, such as Environmental Qualification, Aeronautical Database Management, System Wide Information Management, and Quality and Safety Design.

4.11.1 Environmental Qualification

WG-14 Environment, working with RTCA SC-135, and WG-31 Electromagnetic Hazards, working with SAE committees AE2 and AE4 are both active on this topic.

WG-14’s primary focus is on the update of ED-14G/DO-160G Environmental Conditions and Test Procedures for Airborne Equipment to reflect advances in aircraft technologies and testing methodologies. ED-14G/DO-160G is widely referenced in regulatory material and by aircraft manufacturers, and is supported by the associated user guide ED-234/DO-357. ED-14H/DO-160H is planned for publication in 2026, with the updated user guide to follow.

Additionally, a WG-14 subgroup is developing an environmental qualification standard that will specify requirements and procedures for surface-based (not airborne) equipment in the UAS Detect and Avoid, the Command and Control Link, and Control Station Equipment. Liaison with WG-105 (UAS) is ongoing in this topic.

WG-31’s scope includes the development of standards underpinning regulation and the certification of aircraft in relation to electromagnetic hazards such as lightning protection, electromagnetic compatibility (EMC), High Intensity Radiated Fields (HIRF) etc. WG-31 has a large programme of work updating the suite of standards in these areas, working cooperatively with SAE to deliver technically identical documents.

WG-31 is also liaising with WG-112 VTOL which is developing lightning protection standards for these new aircraft designs.

4.11.2 Aeronautical data management

WG-44 Aeronautical Databases, working with RTCA SC-217, is active on this topic.

The standards related to aeronautical databases aim 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.

Aeronautical Information Services (AIS) has been evolving from the paper product-centric service to the data-centric Aeronautical Information Management (AIM) with a different method of information provision and management.

This evolution is being referred to as the transition from AIS to AIM. The major changes in the transition to AIM will be the increased emphasis on information management requirements such as digital data exchange and distribution, which is expected to place the future AIM in a position to better serve airspace users and ATM.

EUROCAE activities need to be in line with and support this evolution.

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 members also liaise with WG-105 (UAS) to develop new standards for aeronautical data required for UAS/drones/“new entrants”, such as autonomous vehicles, vertical take-off and landing vehicles. Additionally, EASA RMT 722 (currently on hold) may need to be monitored by WG-44 for any additional standardisation needs. RMT 0722 addresses the provision of the aeronautical data by the aerodrome operator taking into account not only the provisions of ICAO Annex 14, Volume I, but also some cases related to the provisions of ICAO Annex 15 and PANS-AIM.

The increased emphasis on digital data exchange and distribution will result in an increased capability to present data and information in graphical form.

4.11.3 Complex aircraft systems

WG-63 is active on this topic.

Industry has requested EASA and FAA to extract the objectives from ED-79A/ ARP-4754A. ED-79A/ARP-4754A is accused of being too prescriptive and focussed on best practice instead of defining objectives. This led to the development of a first version of a new standard, which was instead published as ER-023/AIR-7209 Development Assurance Principles for Aerospace Vehicles and Systems. However, EASA’s position is to continue reliance on ED-79A/ARP-4754A as ER-023/AIR-7209 is not explicit enough to be easily operable.

At the same time, a revision B for the ED-79A/ARP-4754A 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.

Other standards are planned from 2023 regarding “Use of Models and Tools for Aircraft Systems Development” (ER-xxx / AIR-6276) and a “Guidance on System Theoretic Process Analysis (ED-xxx/AIR 6913)”. Finally, recent activity was launched on Guidance to address Common Cause Errors in Aircraft / System Designs. Draft version is in progress (ER-xxx/AIR-7126).

Model-based activities, as upcoming processes involving safety, are partially applied on some specific and innovative aircraft programmes; processes and tools maturity still need to be improved to be widely accepted and used for new developments. Model Based Safety Assessment (MBSA) is planned to be addressed in ED-135/ARP4761 revision A. There is probably a need to monitor MBSA processes to be ready for standardisation activities when mature enough.

As the Specific Operations Risk Assessment (SORA) methodology will start to be applied for UAS under the new EASA regulations, attention should be given to potential difficulties and possible needs for guidelines.

4.11.4 System Wide Information Management

Through the SESAR programme, Europe has made great progress on defining, developing and validating System Wide Information Management (SWIM).

A key document 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.

Further the SESAR SWIM Concept of Operations has also become the main source for the ICAO Manual on System Wide Information Management (SWIM) Concept (Doc 10039).

Initial implementation of SWIM is required since 2016 as detailed in the Pilot Common Project (since updated by Common Project) 1 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).

WG-104 SWIM Services created a concept how to standardise SWIM compliant services by using the extended horizon Arrival Manager (AMAN) service as a first implementation (ED-254), published in 2018. The concepts developed in ED-254 may be usable for other services in the future.

Having reached a first specification of a SWIM compliant standard of a service, a guideline supporting the standardisation of future SWIM services was needed. 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 SWIM Services Standardisation Package and published as one comprehensive EUROCAE report.

WG-104 developed a 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 published in 2021 (ED-294) following which WG-104 was put in dormant status.

Taking advantage of the revision of the Pilot Common Project (PCP) in the CP1, the SESAR Deployment Manager 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 CP1 Implementing Regulation.

Operational stakeholders will be connected to the ATM Network as defined by SESAR through the NOP/AOP integration using the “Yellow Profile”.

In addition, SESAR 2020 programme activities around SWIM are on-going.

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.

CHAPTER 5
LOOKING INTO THE FUTURE

EUROCAE is constantly evaluating the potential for standardisation of emerging technologies in the field of aviation or affecting the operation of air traffic. All identified tangible activities of the stakeholders mentioned above are considered for possible future standardisation activities and expressed in this technical work programme.

The following shortlist outlines only few possible fields of standardisation that are derived from concepts of air transport that are at the edge of development or in very early stages of research.

- Single pilot operations
- Autonomous taxi
- Zero emission taxi
- Higher Altitude Operations
- Air-to-air connectivity
- Air-to-ground integration by system-to-system connectivity
- Performance based approach to separation management
- Advanced Ground Handling Services:
- Quantum computing:

APPENDIX A
CURRENT WORKING GROUPS

Reference	Title	Domain	Joint with
WG-14	Environment	System Engineering	RTCA SC-135
WG-28	Ground Based Augmentation Systems (GBAS)	Space	RTCA SC-159
WG-31	Electromagnetic hazards	System Engineering	SAE AE2, AE4
WG-41	A-SMGCS	Airports	ETSI TC Aero
WG-44	Aeronautical Databases	System Engineering	RTCA SC-217
WG-49	Mode S Transponders	Avionics	RTCA SC-209
WG-51	Automatic Dependent Surveillance - Broadcast (ADS-B)	Avionics	RTCA SC-186
WG-59	Flight Data Processing (FDP) Interoperability	ATM	
WG-62	GNSS	Space	RTCA SC-159
WG-63	Complex Aircraft Systems	System Engineering	SAE S-18
WG-67	Voice on Internet Protocol (VoIP) for ATM	ATM	
WG-72	Aeronautical Systems Security	Security	RTCA SC-216
WG-75	Traffic Alert and Collision Avoidance Systems (TCAS)	Avionics	RTCA SC-147
WG-76	AIS/MET Datalink Services	ATM	RTCA SC-206
WG-78	Standards for Air Traffic Data Communications Services	ATM	RTCA SC-214
WG-79	Enhanced Vision Systems (EVS), Synthetic Vision System (SVS)	Avionics	RTCA SC-213
WG-80	Hydrogen and Fuel Cell Systems	Sustainability	SAE AE-7A
WG-81	Interoperability of ATM Validation Platforms	ATM	
WG-82	New Air-Ground Data Link Technologies	Space	RTCA SC-223, RTCA SC-222
WG-83	Airport Foreign Object Debris (FOD) Detection Systems	Airports	
WG-85	4D Navigation	ATM	RTCA SC-227
WG-92	VDL Mode 2	ATM	
WG-96	Wireless On-Board Avionics Networks	RF Spectrum	RTCA SC-236
WG-97	Interoperability of virtual avionic components	IT & Software	
WG-100	Remote & Virtual Tower (RVT)	Airports	
WG-103	Independent Non-Cooperative Surveillance System (INCS)	ATM	
WG-105	Unmanned Aircraft Systems (UAS)	AAM	
WG-107	DME Infrastructure supporting PBN Positioning	ATM	
WG-108	ATN/IPS	ATM	RTCA SC-223
WG-109	Runway Weather Information Systems	Airports	

Reference	Title	Domain	Joint with
WG-110	Helicopter Terrain Awareness and Warning Systems (HTAWS)	Avionics	RTCA SC-237
WG-111	Airport Collaborative Decision Making (A-CDM)	Airports	
WG-112	Vertical Take Off and Landing (VTOL)	AAM	SAE Seats
WG-113	Hybrid Electric Propulsion	Sustainability	SAE E-40
WG-114	Artificial Intelligence	IT & Software	SAE G-34
WG-115	Counter UAS (C-UAS)	Airports	RTCA SC-238
WG-116	High Voltage Systems and Components in Aviation	Sustainability	SAE AE-11
WG-117	Topics on Software Advancement	IT & Software	RTCA SC-240
WG-118	Crash-Protected and Lightweight Flight Recorders	Avionics	
WG-119	Radar Altimeters	RF Spectrum	RTCA SC-239
WG-122	Virtual Centre	ATM	
WG-123	Infectious passenger handling in air ambulance operations	AirMed	
WG-124	Spectrum	RF Spectrum	RTCA SC-242
WG-125	Next Generation Aviation Professionals (NGAP)	Sustainability	
WG-126	VCS-ATC Systems Integration for ATM Information Exchange	ATM	
WG-127	Lower-risk Aviation Applications	IT & Software	

Dormant Working Groups

Reference	Title	Domain	Joint with
WG-95	In-flight Ice Detection Systems	Avionics	SAE AC-9C
WG-98	Aircraft Emergency Locator Transmitters	Avionics	RTCA SC-229
WG-99	Portable Electronic Devices	Avionics	RTCA SC-234
WG-101	Runway Overrun Awareness and Alerting System	Avionics	
WG-102	GEN SUR SPR	ATM	
WG-104	SWIM Services	System Engineering	
WG-106	Electronic Flight Bag (EFB) Software Applications	Avionics	
WG-120	Technical Means for identifying potential Covid-19 carriers among passengers	Air Medical	
WG-121	Aircraft Cleaning	Air Medical	RTCA SC-241

APPENDIX B
ACRONYMS

AAM	Advanced Air Mobility
AAS	Airspace Architecture Study
ACARE	Advisory Council for Aviation Research and innovation in Europe
ACAS	Airborne collision avoidance system
A-CDM	Airport Collaborative Decision Making
ACI	Airports Council International
ACRIS	Airport Community Recommended Information Services
ADS-B	Automatic Dependent Surveillance-Broadcast
ADSP	ATM Data Service Provider
AEEC	Airlines Electronic Engineering Committee
AI	Artificial Intelligence
AIDX	Aviation Information Data Exchange
AIM	Aeronautical Information Management
AIS	Aeronautical Information Services
AISS	Aeronautical Information Systems Security
AMAN	Arrival Manager
AMC	[EASA]: Acceptable Means of Compliance
AMS(R)S	Aeronautical Mobile-Satellite (R) Service
ANS	Air Navigation Service
ANSP	Air Navigation Service Provider
AOG	Aircraft On Ground
AOP	Airport Operations Plan
A-PNT	Alternative Positioning, Navigation, and Timing
APOC	Airport Operations Center
AR	Augmented Reality
ARAIM	Advanced Receiver. Autonomous Integrity Monitoring
ARC	Administrative Reforms Commission
ARINC	Aeronautical Radio Inc
ARP	[SAE] Aviation Recommended Practice
ASD	AeroSpace and Defence Industries Association of Europe
ASD-STAN	ASD-Standards
A-SMGCS	Advanced Surface Movement Guidance and Control System
ASTM	American Society for Testing and Materials
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATI	[UK] Aerospace Technology Institute
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Sir Traffic Services
ATSP	Air Traffic Services Providers
ATSU	Air Traffic Services Unit
CAA	Civil Aviation Authority
CAN	Controller Area Network
CAP	Civil Aviation Publication
CARATS	Collaborative Action for Renovation of Air Transport Systems
CCO	Continuous Climb Operation
CDO	Continuous Descent Operation
CDTI	[SP] Centre for Development of Industrial Technology
CFIT	Controlled Flight Into Terrain
CNS	Communications, Navigation & Surveillance
COTS	Commercial off-the-shelf
CORAC	[FR] Conseil pour la recherche aéronautique civile
CP1	Common Project One
CPDLC	Controller–pilot data link communication
CS	[SES] Community Specifications
CS	[EASA] Certification Specifictions
CUAS	Counter UAS
CVS	Combined Vision System
DCPC	Direct Controller Pilot Communications
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
DP	[SES] Deployment Programme
EASA	European Union Aviation Safety Agency
EASCG	European ATM Standards Coordination Group
EC	European Commission
ECSCG	European Cyber security in aviation Standards Coordination Group
ED	EUROCAE Document
EFVS	Enhanced Flight Vision System
EGNOS	European Geostationary Navigation Overlay System
EGNSS	European Global Navigation Satellite System
EHPS	Electric / Hybrid Propulsion System
ELT	Emergency Locator Transmitters
EMC	Electromagnetic Compatibility
EN	European Norme
EPAS	European Plan for Aviation Safety
ER	EUROCAE Report
ESA	European Space Agency
ESCP	European Strategic Cooperation Platform
ESO	European Standardisation Organisation
ETSO	European Technical Standard Orders
EU	European Union
EUROCONTROL	the European Organisation for the Safety of Air Navigation
EUSCG	European UAV Standards Coordination Group
IMA	Integrated Modular Avionics
INCS	Independent Non-Cooperative Surveillance
INTEROP	Interoperability Requirements
IP	Internet Protocol
IPS	Internet Protocol Suite
IR	[EASA] Interoperability Regulation
ISEM	Information Security Event Management
ISMS	Information Security Management System
ISO	International Organization for Standardization
IT	Information Technology
ITU	International Telecommunication Union
KPA	Key Performance Area
LDACS	L-band Digital Aeronautical Communication System
LH2	Liquid Hydrogen
LIDAR	Light Detection and Ranging
LTAG	Long Term Aspirational Goal
LuFo	[GE] Luftfahrt Forschungs Programm
MASPS	Minimum Aviation System Performance Standard
MBSA	Model Based System Assessment
MBSE	Model Based System Engineering
MET	Meteorological
ML	Machine Learning
MLAT	Multilateration
MoC	Memorandum of Cooperation
MOPS	Minimum Operational Performance Standard
MoU	Memorandum of Understanding
NGAP	Next Generation Aviation Professional
NextGen	Next Generation Air Transportation System
NOP	Network Operations Plan
NSA	National Security Agency
OCO	Optimized Climb Operation
ODO	Optimized Descent Operation
OS	Operating System
PANS	[ICAO] Procedures for Air Navigation Services
PBN	Performance Based Navigation
PCP	[SES] Pilot Common Project
PGW	Propylene Glycol Water Mixture
QMS	Quality Management System
R&D	Research and Development
RA	Radio Altimeter
RAIM	Receiver autonomous integrity monitoring
RDP	Rolling Development Plan
RF	Radio Frequency
RFI	Radio Frequency Interference
RMT	Rule Making Task
RNP	Required Navigation Performance
RPAS	Remotely Piloted Aircraft System
RTCA	Radio Technical Commission for Aeronautics
RVT	Remote Virtual Tower
RWIS	Runway Weather Information Services
SAE	Society of Automotive Engineers
SAF	Sustainable Aviation Fuel

SARPs	Standards and Recommended Practices
SATCOM	Satellite Communication
SBAS	Satellite-Based Augmentation System
SCG	Standards Coordination Group
SDM	SESAR Deployment Manager
SDO	Standard Developing Organisation
SES	Single European Sky
SESAR	Single European Sky ATM Research
SFDC	Single Frequency Dual Constellation
SJU	SESAR Joint Undertaking
SMR	Surface Movement Radar
SOA	Service Oriented Architecture
SORA	Specific Operations Risk Assessment
SPO	Single Pilot Operation
SPR	Safety and Performance Requirements
SRIA	Strategic Research and Innovation Agenda
STM	Space Traffic Management
STX	[SESAR] Sustainable TaXiing
SUR	Surveillance
SVS	Synthetic vision system
SW	Software
SWAP	Size, Weight and Power
SWIM	System Wide Information Management
TAC	[EUROCAE] Technical Advisory Committee
TAM	Total Airport Management
TC	Technical Committee
TCAS	Traffic Alert and Collision Avoidance System
TMA	Terminal Manoeuvring Area
TOBT	Target Off Block Time
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
USSP	U-space Service Provider
UTM	UAS Traffic Management
VCS	Voice Communication System
VDL	VHF Digital Link
VHF	Very High Frequency
VoIP	Voice over IP
VTOL	Vertical Take Off and Landing
WAAS	Wide Area Augmentation System
WAIC	Wireless Avionics Intra-Communications
WG	Working Group
WIMAX	Worldwide Interoperability for Microwave Access