

# Aviation Authorities' Research Agenda 2024

Proposed research topics for  
Horizon Europe Work Programme(s) 2025-2027

An Agency of the European Union



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## EXECUTIVE SUMMARY

The EASA Research Agenda 2024 provides a list of research topics proposed jointly by the Agency's experts and its Member States' Advisory Body Research Group (in consultation with its other Advisory Bodies as well as the European Commission) in the fields of aviation safety, security, environment, health, and innovation. It serves as a common input towards future European Research Programmes, such as Horizon Europe<sup>1</sup>.

The proposed research topics aim to support the aviation authorities' core activities (rulemaking, certification, approval, oversight) while preparing the Agency and Authorities' staff for future challenges. The Aviation Authorities' Research Agenda includes:

- Aviation authorities' needs – proposed as EASA managed topics: research projects to be launched and managed by EASA if EU Research Programmes funds are allocated to EASA in the form of a contribution agreement signed with the European Commission;
- Aviation topics – general: research priorities proposed to the European Commission for funds to be managed by executive agencies, such as the European Climate, Infrastructure and Environment Executive Agency (CINEA)<sup>2</sup>.

The EASA Research Agenda is updated on an annual basis, reflecting the evolution of the context in which the Agency and the National Aviation Authorities operate and latest data on safety and emerging risks.

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<sup>1</sup> [Horizon Europe](#) Work Programmes

<sup>2</sup> [CINEA – European Climate, Infrastructure and Environment Executive Agency](#)

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## 1 Background

With this document, EASA and the Member States Advisory Body Research Group propose important aviation research topics for the upcoming Horizon Europe Work Programme(s) 2025-2027.

In the past, the Agency has received funding from the European Research Programmes via Contribution Agreements signed in 2020, 2022 and 2024, totalling almost 40 Mio EUR budget for over 30 projects, some of which have now already successfully closed. Updated information, including deliverables, on those projects are available on the Agency website.

EASA, together with the contributions from the Member States Advisory Body Research Group and DG MOVE selected these topics following an assessment of their strategic relevance based on and complementing the European Plan for Aviation Safety (EPAS)<sup>3</sup>, which details the top-level priority research needs identified by the Agency. They also align with the objectives of the European Green Deal and the EU aviation strategy.

In the following two chapters, the proposed projects under these topics are briefly described. The fourth chapter summarises the strategic benefits and EASA's management approach.

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<sup>3</sup> [European Plan for Aviation Safety \(EPAS\) 2024](#)

## 2 Aviation Authorities needs – proposed as EASA managed topics

The table below provides an overview of the nine identified topics, organised into 13 project proposals which, if funded, will be launched and managed by EASA following a contribution agreement signed with the European Commission.

Topic	Scope
<b>Environment</b>	New SAF production pathways – To set up a pathway for new aviation fuels to reach qualification/ approval, to prove compatibility with existing aircraft technology, and to reach a higher production yield
<b>Security</b>	AI aspects, conflict zones – For enhanced aviation safety, integrated approach to safety and security risks, regulatory improvements, and technology advancements
<b>Artificial intelligence (AI)</b>	Human factors – To support certification and approval processes for AI applications Level 2 and 3A
<b>Data for Safety</b>	Researching future use cases in terms of aviation data sources and analytics and outputs
<b>Health / Medical</b>	Obstructive sleep apnea and High airspace operations – To assess impact and rulemaking for medical standards for: a) limiting the impact of fatigue caused by organic disorders and enhance safety; and b) HAO (for crew and passengers)
<b>Automation</b>	Impact on FC and ATCO – To enable changes to the regulatory framework to better allocate tasks and responsibilities between different actors considering the impact of technologies on the aviation profession (workload, fatigue) and mitigate identified safety hazards
<b>ATM/ANS</b>	Airspace classification - To harmonise airspace classification application addressing all airspace users (GA, U-Space, HAO) Performance of ground equipment – To harmonise and simplify approach for the certification and declaration of ATM/ANS equipment
<b>Air operations</b>	Extended minimum crew operations: pilot fatigue and performance - To create scientific evidence on which to base future rulemaking
<b>Drones</b>	Large scale BVLOS operations

**Table 1: Overview table of research topics for HE WP(s) 2025-27 – aviation authority needs**

## 2.1 Environment | New Sustainable Aviation Fuel (SAF) production pathways

### Scope and context

This research project aims to support and coordinate in the European Union the development of new SAF production pathways at a high TRL with dedicated research activities leading up to full fuel qualification, necessary to ensure airworthiness at aircraft/engine level and using the processes established by EASA under its EU Clearing House for SAF.

EASA has been tasked to develop and demonstrate the set-up of an EU Clearing house for SAF, which aims to develop the necessary processes and procedures to facilitate the qualification of novel SAF production pathways. The qualification of novel pathways is currently governed by the ASTM process and aims to test and qualify the new fuel types against technical and safety standards, which are accepted by EASA for applicants wanting to obtain type certification of aircraft and engines. The cost for the final research activities and related qualification of new SAF pathways has mostly been borne by the US Air Force and the FAA CLEEN programme, using the procedures of the US Clearing House for SAF. Therefore, there could be a general risk for EU stakeholders to become too dependent on non-EU funding and processes, which may lead to further risks as regards setting safety, environmental and competitiveness priorities.

Furthermore, the quantity of SAF is constrained due to the limited variety and capacity of feedstocks available for its production. Given the pressing need to maximize SAF production capacity to ensure that the climate targets can be achieved, approving new SAF pathways becomes crucial. At the same time, it is important that the qualification of the new SAF types and its distribution does not lead to potential unsafe conditions at aircraft level.

### Expected mid-term benefits

With this research topic, the EU has an opportunity to strengthen its capacity in the domain of SAF by ensuring processes and funds are in place to allow for sustainable and safe new fuel types to enter the EU market. A successful completion of the project will yield to:

- Enhanced fuel diversity: with additional SAF production pathways qualified, the European SAF industry would benefit from a more diverse range of feedstocks and technologies, ensuring resilience against disruptions.
- Enhanced fuel production yields: additional research activities using the ‘EU Clearing House for SAF’ process would assist fuel producers to optimize their production yields for targeted use of SAF in aviation. This will lead to a long-term benefit of reduced fuel costs for operators.
- Boosted R&D Capabilities: fortified European fuel R&D infrastructure would lead to increased innovation, potentially positioning Europe as a global leader in SAF research and technology.
- Improved Safety Standards: establishing robust Means of Compliance would ensure that SAF-optimized aircraft designs and operations are both safe and efficient, setting a gold standard for the global aviation industry; activities are and will continue to be fully integrated into international standard setting,

### Budget and timelines

... EUR, starting in 2025 for a period of three years.

## 2.2 Security | Interaction between artificial intelligence and cybersecurity

### Scope and context

The research topic revolves around the integration of artificial intelligence (AI) into the cybersecurity framework of civil aviation.

The rapid evolution of technology has led to an increased reliance on Artificial Intelligence (AI) in various domains, including civil aviation. With the increasing complexity of cyber threats, the integration of AI is essential to pre-emptively identify vulnerabilities, improve incident response, and strengthen aviation systems.

This research project aims to investigate the interaction between AI and cybersecurity in the context of civil aviation, to develop proactive measures, strengthen security and increase the resilience of the aviation system. The project will focus on the use of AI for cyber protection, ensuring the safe and secure operation air transport. The research should also assess any potential new vulnerabilities and threats created using AI for cyber security protection.

### Expected mid-term benefits

In the mid-term, the successful completion of this project will yield significant benefits for civil aviation. The aviation industry will benefit from enhanced cybersecurity through AI integration, proactively identifying and supporting to eradicate vulnerabilities. One relevant area where AI could provide significant benefits is the protection of critical position, navigation, and time (PNT) data ensuring accurate and reliable navigation and communication systems.

Aviation will be able to respond more efficiently to incidents and recover with minimal downtime. In addition, the aviation system will become more resilient and continuously adapt to emerging threats.

Conversely, failure to achieve project objectives can lead to increased vulnerability, reduced safety, and operational disruption within the aviation sector due to conventional and emerging “AI boosted” threat actors.

### Budget and timelines

... EUR, starting in 2025 for a period of 18 months.



## 2.3 Security | Risk assessment methodology for air operators to address conflict zones risks based on open-source data

### Scope and context

The research should deliver a proposal for a risk assessment methodology for conflict zones overflights that could be implemented by air operators based on open-source data.

Currently, there are no common practices or operational recommendations regarding the methodology for conducting a risk assessment on conflict zones overflight by air operators based on open-source data. The reliance on intelligence providers and their recommendations may not be a viable solution for all operators owing to budgetary constraints, therefore a common solution that could be used at no additional cost would be most beneficial.

The project would also support EASA work and understanding of the subject which in turn would be beneficial for the EU CZ Alerting System.

The proposal should consider established methodologies and best practices on the topic of conflict zones, such as in ICAO Doc 10084, "Risk Assessment Manual for Civil Aircraft Operations Over or Near Conflict Zones" and the EU framework for conflict zones risk assessment implemented by the Integrated EU Aviation Security Risk Assessment Group.

The results of this research project should therefore take into consideration the existing best practices and tools but explore how to strengthen the operational capabilities of air operators to implement their risk assessment and decision-making process in a dynamic manner based on open-source data.

### Expected mid-term benefits

A defined risk assessment methodology for overflights of conflict zones would offer several mid-term benefits to civil aviation. These include enhanced aviation safety, reduced exposure to high-risk areas, operational efficiencies, improved insurance coverage, regulatory compliance, crisis management preparedness and global collaboration.

Additionally, the methodology would facilitate data collection on conflict zones developments, supports training and preparedness, and would enable the development of effective strategies to avoid or mitigate risks associated with conflict zones. These mid-term advantages collectively strengthen aviation safety and enhance the industry's resilience to risks emerging from conflict zones.

### Budget and timelines

... EUR, starting in 2025 for a period of 12 months.

## 2.4 Artificial intelligence (AI) | Human factors

### Scope and context

In May 2023, EASA has published its Artificial Intelligence (AI) Roadmap 2.0. The next deliverable of this Roadmap is the Issue 02 of the EASA AI Concept Paper, which develops a novel layer of AI trustworthiness guidance related to Human Factors for AI, which is necessary to manage the approval of Level 2 AI applications. Such applications bring indeed the level of assistance from the AI-based systems to the Human end-user one level beyond, enabling automatic decision-making or action implementation, which was not foreseen in the Level 1 AI applications (Human assistance and augmentation).

This research project aims at investigating concrete and feasible means of compliance for the new layer of Human Factors objectives and how compliance could be assessed including a definition of KPIs for performance in new roles for human, non-human, and hybrid teams. The research project could also lead to complement existing objectives for the Human Factors aspects of AI. For the scope of this project, Human Factors for AI objectives will apply to a wide range of aviation domains, including airworthiness, air operations, air traffic management / air navigation services, and aeromedical diagnosis.

The research project should demonstrate a clear relationship between the human factors objectives and implementation in the wider socio-technical system (e.g., training, procedures, competence certification etc.) and ethical practice as per the ethical requirements for trustworthy AI (Overview of the ethical guidelines from the EC HLEG (EC, 2019)). This would further support the EASA AI Roadmap 2.0 which was published in May 2023.

Along with the project, at least one real-scale aviation use case per domain (airworthiness, ATM/ANS) should be developed to demonstrate the effectivity and usability of the proposed methods and tools.

### Expected mid-term benefits

The expected short-term benefit is to support certification and approval processes by identifying concrete means of compliance to the Human Factors for AI objectives of EASA guidance for AI applications (AI Level 2 and 3A as defined in EASA AI Roadmap), with a specific focus on Level 2A and Level 2B. Transitions between levels should also be considered.

The expected medium-term benefit is to enable advanced type of operations in all domains covered by the EASA Basic Regulation (Regulation (EU) 2018/1139), with enhanced Human-AI teaming capabilities of AI-based systems.

### Budget and timelines

... EUR, starting in 2025 for a period of 24 months.

## 2.5 Health-Medical | Obstructive sleep apnea (OSA) in aircrew and air traffic controllers (ATCOs)

### Scope and context

The current medical requirements for aircrew and Air Traffic Control Officers (ATCOs) are based on assessments conducted over two decades ago. However, over the past decade, it has become evident that Obstructive Sleep Apnea (OSA) carries significant safety implications and affects individuals as early as 30 years old. OSA can lead to excessive daytime sleepiness, personality disturbances, cardiac dysrhythmias, myocardial infarction, stroke, sudden cardiac death, hypertension, and cognitive impairment, including decreased memory, attention, planning, problem-solving, and multitasking abilities. The effects of OSA are even more important in the current context of fatigue both for pilots and ATCOs and on the verge of the upcoming projects contemplating single pilot operations.

There are just a few studies of prevalence of OSA in the aviation environment due to several difficulties for the adequate identification of the disorder, follow up and control of disease, logistics and deployments that may difficult or preclude the used of appropriate treatment that may lead to infradiagnostic of the disease among aircrew and ATCOs and limited data in the aviation environment, as long as identification and evaluation of treatment adherence.

### Expected mid-term benefits

The goal of this research project should be to provide solid evidence that can inform decision-making regarding regulatory needs concerning the assessment of the respiratory system for pilots and ATCOs.

The anticipated outcome of this research is to provide solid evidence that can inform decision-making regarding regulatory needs concerning the assessment of the respiratory system for pilots and ATCOs. The research report will allow rulemaking activities to further enhance safety and limit impact of fatigue caused by organic disorders. The report is expected to provide implementation recommendations and impact assessment for the recommended regulatory changes.

### Budget and timelines

... EUR, starting in 2025 for a period of 24 months.

## 2.6 Health-Medical | Aero-medical fitness of aircrew members and passengers in higher airspace operations (HAO)

### Scope and context

The existing medical regulations for pilots, as outlined in Regulation (EU) 1178/2011, do not consider the assessment of operational requirements specific to Higher Airspace Operations (HAO). To address this gap, there is a need to review the current aero-medical requirements, including any limitations, with due consideration to the stresses associated with HAO.

The external factors and stresses of the specific operational conditions of HAO flights (suborbital or hypersonic flights) might include acceleration (G-forces), barometric pressure changes, microgravity effects, ionizing radiation, noise, vibration, cabin air quality and spatial disorientation and if necessary, these requirements should be adjusted to accommodate the medical certification of pilots of suborbital flights. Likewise, the external factors and stresses on the pilots of other types of slow higher airspace flights, notably airships, balloons and HTA systems need to be studied. In addition, the research shall collect critical data related to the impact of HAO on human health of persons on board the aircraft.

Research should also aim to evaluate potential medical requirements that may need to be applied to individuals other than crew members, on board HAO aircraft, including passengers and participants.

A coordination and cooperation between aviation and space authorities is recommended.

### Expected mid-term benefits

The anticipated outcome of this research is to provide new evidence that can be translated to decision-making regarding regulatory needs, concerning the aero-medical assessment of aircrew and minimum medical requirements for passengers and participants on HAO flights.

It may potentially lead to the definition of new minimum medical standards for this type of operations, for pilots and passengers on board.

The research report will allow rulemaking activities to further enhance safety and find solutions to the potential HAO stress factors hazards. The report is expected to provide valuable information and data that might impact assessment for the future update of regulation.

### Budget and timelines

... EUR, starting in 2025 for a period of 30 months.

## 2.7 Automation | Flight crew

### Scope and context

Operational safety and efficiency are continuously evolving and are strongly impacted by the development of new technologies. The innovative technologies aim that aircraft systems' resilience improves, pilot tasks are better supported, and overall system performance is increased. Specific developments in cockpit design, in combination with appropriate operational procedures and crew training, may support new operational concepts in commercial air transport, from Extended Minimum Crew Operations (eMCO), in which one pilot may be at the controls during non-critical segments of the cruise phase; to single-pilot operations, in which one pilot may be at the controls during the full flight; to remotely piloted aircraft, where one or more pilots on the ground operate, control or monitor the aircraft or a series of remote aircraft operations; to eventually fully automated flights.

The evolution in technology entails that the role of pilots will evolve progressively in parallel to the supporting technology, with a different overall distribution of their tasks. Progressive higher automation levels will imply that for many of the current tasks, the pilot's role will change from an executive role to a primarily supervisory role (with the machine executing the task in standard circumstances). Through this research we will attempt to identify and analyse how the technological evolution impacts the nature and frequency of pilot's interventions/tasks, and subsequently their overall performance, including fatigue. We will also aim to identify potential safety hazards related to the transition to the new role, and specific to the new role. Another of the questions posed by these developments is the impact that this increased reliance on technology will have on the allocation of responsibility for the conduct of safe operations. The current allocation of responsibilities put the ultimate responsibility for the safe conduct of the flight on the pilot-in-command / commander. However, in a context of extended automation, where the decision-making process may be at least influenced with the machine, and ultimately even transferred to it, to what point can they still be considered responsible?

### Expected mid-term benefits

The research activity will lead to changes to the regulatory framework to

- better allocate tasks and responsibility for aircraft operations between different actors, considering the impact of automation;
- provide clear definition of roles, responsibility, accountability for all levels of automation and transitions between those levels;
- mitigate any safety hazards identified because of the transition to higher automation level and of the implementation of new roles for pilots;
- provide clear guidance for failure modes (incl. AI systems failure, human incapacitation, human as main form of redundancy in socio-technical systems failure scenario);
- implement ethical practice throughout design lifecycle and ethical behaviour towards the human(s) in the system;
- introduce strategic Human Resource Management for new roles and transition towards new roles, training, recruitment, selection and assessment of competence in existing and future roles.

### Budget and timelines

... EUR, starting in 2025 for a period of 36 months.

## 2.8 Automation | Air traffic controller

### Scope and context

The target vision presented in the ATM Master Plan anticipates that technological evolution will transform the way air traffic services will be provided in the mid-term. In this vision, ATCOs will delegate a large portion of their tasks to machines, arriving to a 'joint cognitive system' that can handle traffic in a safer and more efficient manner.

This evolution entails that the role of the ATCO will evolve progressively in parallel to the supporting technology, with a different overall distribution of their tasks. Progressive higher automation levels will imply that for many of the current tasks, the ATCO role will change from an executive role to a primarily supervisory role (with the machine executing the task in standard circumstances).

This evolution of the ATCO role from executor to supervisor will have an impact on the types and frequency of their tasks.

The objective of the research is to identify and analyse:

- Identify and analysis how the technological evolution (degree of automation and supervisory vs. executive role) impacts on the nature and frequency of ATCO interventions/tasks, and subsequently in their overall performance, including fatigue.
- potential safety hazards related with the transition to an evolved ATCO role, which might impact ATCO cognitive skills and capabilities, and with the new role (e.g., specific to a supervisory role).

### Expected mid-term benefits

The results of the research would provide factual scientific data that could substantiate intervention strategies (e.g., further rulemaking, implementation support) in the field or ATCO competence management and licensing, as well as in relation with the introduction of new ATM/ANS functionalities.

As well, the information on potential hazards/risks linked with the evolution of the ATCO role would inform EASA safety assessment and assurance activities needed both for the oversight and enforcement in relation with the provision of ATM/ANS services, and as well, for the introduction of new ATM/ANS functionalities and concepts aiming to increase the efficiency of ATM/ANS service provision.

### Budget and timelines

... EUR, starting in 2025 for a period of 18 months.

## 2.9 ATM/ANS | The application of airspace classification in Single European Sky airspace

### Scope and context

The current airspace classifications as established by point SERA.6001- Classification of airspaces of the Annex to Regulation 923/2012 except for the airspace above FL195 is designated as appropriate to the needs of the Member States.

Through the application of SERA.6001 a common definition of the airspace classification has been applied, however, the designation by the Member States has result is an unharmonized application in the airspace below FL195.

Such unharmonized applications leads to flight inefficiencies, decreased the safety and difference in service expectation when conducting operations in similar airspace within different Member States.

This project should therefore provide the required data and information including that relevant to U-space implementation, to determine the:

1. The distribution of the application of airspace classification in Member States airspace and the context of such application. And
2. A recommendation for a set of parameters to support a harmonised application of the classifications.

### Expected mid-term benefits

The deliverables from this project will provide factual data with respect to the airspace classification and provide a reasoned framework (parameters) that could be applied to enable a harmonised airspace classification application. A harmonised, application will support safe and effective commercial and large aircraft operations as well and general aviation.

Upon completion the project the deliverables will provide the required evidence and initial inputs to commence an intervention strategy (e.g., further rulemaking, implementation support) to define the classification application conditions in support of a Single European Sky.

### Budget and timelines

... EUR, starting in 2025 for a period of 18 months.



## 2.10 ATM/ANS | Methods to evaluate performance of ATM/ANS ground equipment and determine appropriate assurance levels

### Scope and context

The existing methods applied by ANSP for ensuring the safety and interoperability of ATM/ANS system and constituents (ATM/ANS equipment) vary and although there are industry standards and methods available for determining the appropriate safety, these standards are not compatible with each other. Furthermore, modern ATM/ANS equipment and those envisaged to by the ATM Master Plan make significant use of data through the application of virtual systems (e.g., cloud computing). This ATM/ANS equipment, in particular the hardware, are purchased from non-aviation entities and are also used in other domains and are referred to as Commercial of the shelf (COTS). With the transition to the EASA framework for attestation of ATM/ANS equipment (COMMISSION DELEGATED REGULATION (EU) 2023/1768 of 14 July 2023), there is a need to ensure that harmonised methods are applied.

This research project should therefore provide the required data and information to determine the following:

- Certification characteristics and performance of ‘cloud’ systems and COTS solutions/products.
- How best to ensure the suitability for use of COTS equipment.
- Principles, methods, and safety considerations to be applied in overseeing virtual system (e.g., cloud computing).
- A methodology applicable to ATM ground equipment to determine “failure conditions”.
- Principles, methods, and safety considerations to determine SWAL & HWAL

### Expected mid-term benefits

The lack of harmonised and recognised methods for the identification of failure conditions, the definition of HW & SW requirements and assurance of the safety COTS equipment has resulted in a significant number of different approaches applied by the equipment manufacturers and ANSPs. With the advent of Regulation (EU) 2023/1768 there is a need for a common approach and understanding of the safety requirements.

The deliverables from this project will provide the initial data to support the continued rulemaking activity (RMT.0774) to further develop and complete the initial set of Detailed specifications (DS-GE and DS-SoC) (see NPA 2023-05).

The resulting changes to the Detailed Specifications will enable the application of the appropriate safety requirements, harmonise, and simplify the certification and declaration of ATM/ANS equipment, thus ensuring the safety, interoperability and functioning of the Single European Sky and provide a common approach and understanding of the safety requirements.

### Budget and timelines

... EUR, starting in 2025 for a period of 24 months.

## 2.11 Air operations | Extended minimum-crew operations (EMCO) – pilot fatigue and performance

### Scope and context

Transitioning from a two-pilot crew to one pilot at the controls during specific periods of the cruise phase will require changes in operational procedures, crew coordination, use of automation, and in how the roles and responsibilities of the pilots and ATC are blended to maintain the expected high levels of safety. These modifications need a review of the roles and tasks that are required from the various actors in the operational environment.

In implementing eMCO, one of the questions is the effect of the cruise phase segments with one pilot at the controls on fatigue. While one could, in fact, simply argue that the possibility of resting for periods of time during the cruise phase will significantly reduce fatigue, there could be other arguments that would, however, produce a detrimental effect, reducing the benefit from the rest (boredom, levels of stress not foreseen today, psychological elements). In addition, it must be considered that one of the foreseen benefits of eMCO would be, at a certain stage after initial implementation, an extension of the “two-pilot” FTL scheme taking credit from in-flight rest, like the “augmented crew” logic.

Therefore, while the Agency prepares for deployment of eMCO operations, and once those operations start, specific research into the impact of such operations on crew fatigue needs to be undertaken to assess to what extent “credit” for eMCO could be given in terms of flight time limitations (FTL).

### Expected mid-term benefits

The research activity is considered necessary to validate, based on analysis, experimental testing and operational experience, the assumed benefits of eMCO operations in terms of pilot fatigue and the impact on psychological wellbeing. Without proper validation of the assumptions in these areas, an extension of the “two-pilot” FTL scheme taking credit from in-flight rest, like the “augmented crew” logic, will not be possible, not allowing airlines to access the full potential economic benefits of this new operational concept.

The research will therefore result in a regulatory intervention to better tailor fatigue risk management requirements to the specific needs of eMCO.

### Budget and timelines

... EUR, starting in 2025 for a period of 36 months.

## 2.12 Drones | BVLOS operations

### Scope and context

Today, beyond visual line of sight (BVLOS) operations mainly take place within segregated or temporary reserved areas. In some cases, Member States enable them with the support of visual observers, but here the business case for scaling up operations is not viable. The objectives of the EU Drone strategy 2.0 are to realise the growth potential of drones and provide the expected benefits to the society. To this end, the European drone industry calls for support to enable large scale BVLOS operations. The study should address the main technical challenges of BVLOS operation, notably how to mitigate the air risk outside U-space airspace.

Concretely the proposal aims to study how e-conspicuity solutions, based on mobile technology or others, could be used by UAS operating in BVLOS outside U-space airspace to enable a safe and efficient detect and avoid capability. This will also include effective avoidance procedures; minimum UAS performance, depending on the characteristics of the airspace it is operating in; and the minimum distance to be kept between a drone and a manned aircraft or between two drones (depending on the classes of UA and manned aircraft). In addition, there should be an assessment of the network performance and minimum availability requirements for supporting this technical enabler.

### Expected mid-term benefits

The deliverables from this project will provide a definition of mobile communication performance requirements for e-conspicuity and defined necessary avoidance procedures as well as separation minima between either a drone and manned aircraft or between 2 drones.

Furthermore, this project will conduct an assessment of network performance and determine minimum availability requirements for mobile telephony. This project's outcomes will have a vital role in avoiding mid-air collisions and increasing General Aviation pilots' awareness of the surrounding airspace.

### Budget and timelines

... EUR, starting in 2025 for a period of 18 months.

## 2.13 Data4Safety | Research best aviation intelligence solutions for new aviation domains

### Scope and context

In September 2022, EASA launched with the partnering EASA Member States and Industry Data4Safety Members the development phase of Data4Safety (D4S DEV phase).

Data4Safety (also known as D4S) is the flagship data collection and analysis programme of the European Union Aviation Sector that will support the goal to ensure the highest common level of safety and environmental protection for the European aviation system. The programme aims to provide a Big Data Platform and Analysis capability at European scale and level, including a structural link with ECCAIRS2 that enables analytics and insights from the European Central Repository safety data (ECR as per Regulation (EU) 376/2014). This means collecting and gathering all data that may support the management of safety risks at European level. This includes safety reports (or occurrences), flight data (i.e. data generated by the aircraft via the Flight Data Recorders), surveillance data (air traffic data), weather data - but those are only a few from a much longer list. As for the analysis, the programme's ultimate goal is to help to "know where to look" and to "see it coming" as well as to support data-driven changes at system level. In other words, it will support the Performance-based Environment and set up a more predictive system. More specifically, the programme will allow to better know where the risks are (safety issue identification), determine the nature of these risks (Risk Assessment) and verify if the safety actions are delivering the needed level of safety (performance measurement). It aims to develop the capability to discover vulnerabilities in the system across terabytes of data.

During the D4S DEV phase, the programme efforts are particularly focused on expanding the D4S membership to all interested Aviation Safety Partner Organisations of the European Union and further research and develop the technical capacities of the Programme to deliver the maximum benefits for the European Union Aviation Sector – in particular with the collection of additional aviation safety data sources and the further development of the Programme's outputs (also call "Use Cases") on aviation domains to be newly on-boarded on the Programme during the D4S DEV phase.

In the context of the D4S DEV phase, this research project aims at early researching the future Use Cases to be delivered by the Programme for the benefit of the new domains to be on-boarded during the last stages of the D4S DEV phase - both in terms of aviation data sources and analytics and outputs – with a focus on the utilization of Training data (both for Pilots and Air Traffic Controllers) in correlation with aviation data derived from in-service operations, Rotorcraft, General Aviation and Drones operations and in the field of Environment.

### Expected mid-term benefits

The expected mid-term benefits are:

- Firstly: Explore, research and validate what are the best Use Cases in view of the on-boarding the new aviation domains and their data on the Data4Safety Programme with a clear understanding of which Use Cases are going to deliver which benefits. Ultimately this will improve the overall capacities of the European Union aviation system to manage risks and support data-driven changes with adapted aviation intelligence.
- Secondly: Analyse/assess some of the Use Cases in detail and report the results.

### Budget and timelines

... EUR, starting in 2025 for a period of 36 months.

### 3 Aviation topics – general

The two topics described in the following sections have been identified from an aviation authority's point of view as important aviation needs to be included in EU Horizon Programme.

#### 3.1 Enhancing Resilience and Accuracy in Positioning, Navigation, and Timing (PNT) Systems

##### Description of the research topic and reasons for the proposal from an Agency perspective

Resilient PNT systems are today of major strategic significance in supporting and enhancing a wide range of activities, from individual convenience, economic products and services to national security. With the increasing integration of technology in everyday life, the importance of accurate and reliable PNT services continues to grow. Areas, where PNT plays already a crucial role include, but are not limited to:

- Transportation and Logistics in air, maritime, and land transportation
- Telecommunications (network synchronization),
- Banking and finance (time-stamping transactions and ensuring synchronization),
- Agriculture (field mapping, crop monitoring, and guiding agricultural machinery),
- Emergency services (ensuring accurate location tracking and coordination),
- Military and defence (navigation, targeting, and coordination of forces),
- Science and environment (data collection and analysis),
- Urban planning and infrastructure,
- Space exploration (navigation, spacecraft tracking, and coordinating activities in space),
- Personal use (smartphones, apps, fitness trackers, and smartwatches for location services, activity tracking, and time synchronization)

Today, Positioning, Navigation, and Timing (PNT) services are primarily provided through Global Navigation Satellite Systems (GNSS). There are several other systems like the European Galileo, the US GPS, the Russian GLONASS and the Chinese BeiDou, and supplementary technologies that contribute to PNT services globally. All these systems have in common that their signals are weak and vulnerable to jamming and spoofing. The central topic of cybersecurity is very important in this context. For this reason, a dedicated research task on Aviation Resilience – cybersecurity threat landscape has already been launched. It is therefore not subject to this proposed new research task.

As it has become clear that over-dependence on GNSS poses great risks additional research into alternative PNT methods is essential to provide fallback options in case of GNSS signal loss or degradation. Great benefit is expected through integration of PNT technology with rapidly emerging technologies, such as 5G, IoT, and autonomous vehicles, which require more robust and precise PNT systems.

This research project aims to address the critical need for improved resilience and accuracy in Positioning, Navigation, and Timing (PNT) from a systems point of view. The project shall investigate the potential of innovative solutions and technologies, including signal processing, satellite

technology, atmospheric science, quantum navigation, robust PNT system architectures, integration with emerging technologies as well as policy and regulatory frameworks.

The research outcome will prepare for future challenges and unknowns in PNT technology and help regulators in their endeavour to ensure adaptability and long-term sustainability of these critical systems.

PNT systems are typically global in nature. Hence, this research must include aspects of international cooperation and harmonization, particularly as far as regulatory frameworks and the sharing of technologies are concerned.

The following specific subtopics shall be looked at:

- **Signal Processing:** Research into advanced signal processing techniques to improve the accuracy of PNT systems. This includes filtering noise and interference from signals to enhance the precision of location data.
- **Atmospheric Science:** Studying atmospheric conditions that can affect signal transmission, such as ionospheric and tropospheric delays. Also, disruptions by solar storms are relevant in this context. Understanding these effects is crucial for improving the accuracy of PNT systems.
- **Quantum Sensing and Navigation:** Research into quantum technologies for navigation, such as quantum accelerometers and gyroscopes, which could provide accurate PNT data without relying on satellite signals. Provide a technological outlook.
- **Robust PNT System Architectures:** Developing robust PNT system architectures considering backup or alternatives to GNSS, such as terrestrial-based systems, inertial navigation systems, and celestial navigation techniques. This research is vital for ensuring continuous PNT capabilities in GNSS-denied environments.
- **Integration with Other Technologies:** Exploring how PNT can be integrated with other technologies like 5G, Internet of Things (IoT), and autonomous vehicles to enhance capabilities and applications.
- **Policy and Regulatory Research:** Understanding the legal, policy, and regulatory issues surrounding the deployment and use of PNT systems, including concerns related to privacy, spectrum management, and international cooperation. This should also include the assessment of the easy procurement of jammers within the EU as well as the monitoring and detection of jammers.

[Link to EASA strategic priorities](#)

The proposed task ties in with several EASA strategic priorities as defined by the [Agency Single Programming Document 2023-2025](#) or [EPAS 2023-2025](#) Vol. I and Vol. III. particularly as regards the following topics:

**EPAS Vol. I chapter 3.1: Systemic safety and resilience (level 2 priority)**

This includes the management of risk interdependencies such as information security risks, as well as other security risks with an impact on aviation safety.

**EPAS Vol. I chapter 3.3: Operational Safety (level 2 priority)**

An important aspect of this is EASA's task to ensure the safety of ATM/ANS equipment which will very much depend on future PNT architectures.

It also relates to the issue of SESII + implementation. EASA as Regulator has an important role to play in the determination and certification of pan-European services. The Single European Sky regulatory framework and the EASA Basic Regulation may need to be updated accordingly.

To achieve the proposed goals for a 'Digital European Sky', the focus should be on a scalable system and on the development of digital technology and AI that would allow for meeting the capacity on demand. The proposal calls for greater resilience and scalability in air traffic management, by making it easier to adapt traffic capacities to different demand patterns.

### **Artificial Intelligence in Aviation Programme**

The proposed research may support the future developments of the AI roadmap specifically in the area of PNT systems.

EPAS Vol. III identifies the following related research topics:

As concerns EPAS Volume III (final draft – 2024 edition) I identified four safety issues that relate to the research topic.

- GNSS signal manipulation leading to navigation or surveillance degradation (SI-5501)
- Space weather effects on aviation (SI-5102) (New with the 2024 edition)
- Over-reliance on satellite navigation (SI-0034)
- Cybersecurity (SI-2013)

### [Link to other relevant activities](#)

A dedicated research topic has already been launched on aviation resilience – cybersecurity threat landscape: [CYBER - Aviation resilience – cybersecurity threat landscape | EASA \(europa.eu\)](#)

### [Expected mid-term benefits \(outcome/impact\)](#)

The study is expected to contribute significantly to the enhancement of PNT systems globally, with wide-ranging benefits far beyond the aviation sector. It will help anticipate and prepare for future technological challenges, ensuring that PNT systems remain adaptable and robust against emerging threats and technologies.

Hence, the results will empower EASA, as a regulator, to make informed decisions about technological solutions and performance criteria for future PNT architectures, supporting a more integrated, automated infrastructure that can handle a significantly larger number of aircraft.



## 3.2 Icing in the context of sustainable aviation

### Description of the research topic and reasons for the proposal from an Agency perspective

The field of aircraft icing is of particular importance because it relates to the safety of flight facing adverse weather conditions, which became increasingly extreme during the last decade.

The aviation industry is working to develop the future clean and sustainable aviation. There is the need to innovate at the same time that safety shall be maintained.

On EASA perspective, to enable design, validation and future certification of new technologies emerging from clean aviation, future research should be initiated on 3 main areas:

1. Research to prepare for the development of means of compliance for certification of future sustainable aviation concepts including:

- Development of reliable numerical tools to be used to validate the designs against the icing environment of Appendix C, O, P and snow.
- Development of Supercooled Large Drop Testing Capabilities such as icing wind tunnel test or ice tankers.
- Development of European Ice Crystal test Capability (For engine /air data probe).
- Development of Falling / Blowing Snow Testing Capability.

2. Research on Icing environment to assess the impact of the climate change effects on the certification icing environments and characterise the Icing environment applicable to new air mobility products flying at low altitude.<sup>4</sup>

3. Research of new/technologies for Ice detection and protection, including:

- Ice crystal and SLDs Ice Detection systems to optimise Ice crystals protection or support the detect and exit the SLD appendix O or a portion of the appendix O conditions.
- High Efficiency/Low Energy protection: cleaner aviation with more electric airplanes will drive the need for new ice protection technology: more effective and with less energy .
- Dissimilar means for Air data (AOA/Speed) measurement and insensitive to icing threat. Air speed and aircraft attitude measurements are crucial for aircraft control. Air data/navigation probes are externally mounted and exposed to adverse conditions. Dissimilar means to determine the Aircraft speed and attitude would provide benefit and make the air data system even more robust / fault tolerant to environmental conditions (icing/hail).

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<sup>4</sup> Note: the project will assess the use of specific models for the prediction of icing conditions (e.g., addressing cloud micro-physics for the formation ice crystals, super cooled water droplets), which can be coupled to climate models (e.g., General Circulation Models).

- Enhanced aircraft performance / Ice protection health monitoring to improve the ice protection system monitoring coverage based on smart systems capable to monitor a large number of Aircraft parameters.

[Link to other relevant activities](#)

Best Intervention Strategy on Flight in Icing

EPAS RES.0010 Ice Crystal Detection

EPAS RES.0017 Icing hazard linked to super cooled large droplets (SLD)

EPAS RES.0014 Air-data enhanced fault detection and diagnosis

EPAS RMT.0196 Update of the flight simulation training device requirements

EPAS RMT.0118 Analysis of on-ground wing contamination effect on take-off performance degradation

The Austrian aviation R&T funding programme Take Off has a specific focus on aircraft icing projects

[Expected mid-term benefits \(outcome/impact\)](#)

The climate evolution with increasing weather hazards, the new generation of low CO<sub>2</sub> aircraft with associated disruptive configurations, the new market of UAV/UAM, the stringency of new policies and certification rules justify the need to initiate research in the field of icing, to ensure safety and efficiency of proposed new solutions (TRL 3-5).

In the mid-term the following benefits could be expected, to have:

- the scientific expertise to develop means of compliance for the certification of icing systems;
- the scientific evidence for drafting the certification provisions for new air mobility products;
- the scientific knowledge to be able to develop new prototypes of ice detection and protection.

## 4 Strategic benefits and management approach

### 4.1 Strategic benefits

Research projects are an essential instrument to perform the core activities of aviation authorities as enhancing safety, security, sustainability, and efficiency.

EASA managed research projects excel through the combination of a profound project management and a technical management function, using the expertise of the Agency. These projects are geared to generate mid-term benefits, meaning that after a successful completion of a research project, EASA issues a plan how the results will be transformed in measurable benefits. This is a guiding component in all stages of the process starting from the project initiation request, the drafting of the Contribution Agreement between the European Commission and EASA, the drafting of the detailed technical specifications in the tender document up to the “business implementation plan”.

The latter contains an action plan of the post-project follow-up activities including the assignment of responsibilities and timelines. Such an action plan may as example include rulemaking, safety promotion, oversight or additional research activities or may have an impact on the certification method or provide an input to the integrated European risk management system. Furthermore, the results of these projects are important for aviation authorities to maintain and further extend their competences and expertise.

At the latest during the final dissemination event, the key elements of the business implementation plan are also shared with the public and the key stakeholders. EASA is also sharing the results with ICAO, as well as non-European authorities and States, which are involved in the Agency’s international cooperation activities.

EASA is regularly monitoring the progress of the benefit generation and is reporting it to the European Commission.

### 4.2 Management approach

The organisations, which are implementing the research projects are selected following a public procurement procedure. EASA is responsible for the drafting of the detailed technical specifications of the tender. EASA is also evaluating tender proposals based on evaluation criteria defined for such research projects.

After a project has been selected, EASA is overseeing the implementation of the project and provides project management as well as technical guidance to steer results and deliverables.

EASA uses the European Commission PM<sup>2</sup> methodology<sup>5</sup> to manage the research portfolio and EASA managed research projects. This methodology has proven to be a very good foundation to ensure an effective and efficient management process.

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<sup>5</sup> [PM<sup>2</sup> Project Management Methodology \(europa.eu\)](https://europa.eu)

In addition, EASA extended the methodology through a technical project management function. This extension proofed to ensure the technical excellence of the EASA managed projects. The overall approach is described in a management handbook.

**Project management plan, risk management register and deliverable acceptance procedure:** All EASA management research projects require an up-to-date integrated project management plan (PMP) as well as a coherent risk management register (RMR). The elements of the PMP and RMR are defined in the management handbook and are requirements for the contractor. Any amendments of the PMP and RMR are governed through regular management meeting with the contractor.

**Deliverable acceptance procedure:** EASA applies a well-defined deliverable acceptance procedure. For each deliverable, the deliverable acceptance requirements are specified through the detailed tender specifications and further detailed in technical meetings with EASA experts. A deliverable can only be accepted if all the deliverable acceptance requirements have been satisfactorily met.

**Communication, dissemination, and stakeholder management plan:** All EASA-managed projects, require an up-to-date communication, a dissemination and stakeholder management plan. These documents shall ensure a high visibility of the projects, a targeted dissemination of project results and a focus on the needs and expectations of the relevant stakeholders.

Considering that the research topics address authority needs, the aviation authorities of Member States as well as the European Commission are by default defined as key stakeholders. All other key stakeholders, such as from the industry, trade associations, committees, research organisations, the academia or related research projects are identified individually for each project. EASA is also regularly informing its advisory bodies, such as the Member States Body (MAB) as well as the Stakeholder Advisory Body (SAB) and its relevant technical bodies.

For each project, there is a project page at the EASA website<sup>6</sup>, providing an overview of the scope and objectives of the project, the tasks and deliverables, the expected benefits after project end and contractual information. On this project page all public deliverables will be published.

In all communication and dissemination activities, it is highlighted that the activities are funded by the Research Programme of the European Union.

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<sup>6</sup> [Research Projects | EASA \(europa.eu\)](https://easa.europa.eu/research-projects)