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DFG META-REP: A Meta-scientific Programme to Analyse and Optimise Replicability in the Behavioural, Social and Cognitive Sciences, deadline: 24. January 2024

In 2020, the Senate of the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) has established the Priority Programme entitled "META-REP: A Meta-scientific Programme to Analyse and Optimise Replicability in the Behavioural, Social and Cognitive Sciences" (SPP 2317). The present call invites proposals for the second three-year funding period (2024–2027).
Over the last 10 years, the "replication crisis" has had a substantial impact on the behavioural, social and cognitive sciences. Not only have researchers in these fields begun to reflect on low replication rates (and to investigate potential reasons for these), but also reform movements targeting empirical practices (e.g. "open science"), methodological standards, publication formats, assessment systems and incentive structures in science have gained momentum. At present, it is difficult to estimate to what extent these reforms will effectively and sustainably increase the replicability of empirical findings in the behavioural, social and cognitive sciences. However, it is already clear that they have initiated a much-needed discussion about what robustness, replicability and generalisability mean, how we can assess and secure them, and how we want science to work.
The Priority Programme META-REP aims to contribute to this discussion by adding a non-normative, empirically informed meta-scientific perspective. More specifically, META-REP has been initiated to tackle three overarching questions:
(1) The "what" question, which includes...
- the development, comparison and refinement of conceptual, methodological and statistical approaches to estimate reproducibility, robustness, "direct" replicability and generalisability in the behavioural, social and cognitive sciences, respectively;
- a clear conceptualisation and empirical operationalisation of replication failure vs. success in the behavioural, social and cognitive sciences.
(2) The "why" question, which includes...
- the systematic documentation and comparison of research practices, incentive systems, journal policies and (implicit and explicit) normative expectations (e.g. publication pressure) in the behavioural, social and cognitive sciences and their respective impact on replication rates;
- the systematic evaluation of the impact of questionable research practices, underspecified theories, design characteristics and/or invalid measurement models on replication rates in the behavioural, social and cognitive sciences.
(3) The "how" question, which includes...
- the development of measures, strategies and tools, and the evaluation of these regarding their plausibility, validity, acceptability, feasibility and their positive (and potentially negative/undesired) effects;
- the assessment and evaluation of instruments to monitor changes in norms, incentive structures and scientific practices in their respective scientific discipline and their effects (within and beyond the scientific ecosystem).
While most projects in the first funding phase have focused on the "what" and the "why" question (see the SPP's website under the link below for an overview of projects), we expect the second funding phase to focus more strongly on the "how" question as explained above. These projects can adopt a psychological, economical, sociological or scientometric perspective, and methodological approaches may include experimental studies, surveys, re- and meta-analyses, simulations or model building/testing approaches.
We expect that the research question targeted in each individual project (1) relates to one (or more) of the three overarching programme questions mentioned above, (2) can be addressed empirically (broadly defined) and (3) focuses explicitly on the behavioural, social and cognitive sciences. Proposals need to explain in detail (a) which of the three questions mentioned above (i.e., what, why, how) will be addressed by the planned project, (b) how the suggested approach is suited to tackle the respective question(s) and (c) what the expected contribution to the overall programme goals may eventually be.
Mutual cooperation and exchange between individual projects in this Priority Programme will be ensured by the coordination project. Collaborative endeavours such as distributed research initiatives ("ManyLabs" style), adversarial collaborations, cumulative theory-building and data sharing/data pooling across projects are welcome and will be supported by the coordination project. Applicants are encouraged to explicitly address opportunities for collaboration: project proposals should specify how such a collaboration could look like and how it contributes to the overall goals of the META-REP programme.
To particularly support young investigators (e.g. doctoral researchers / post-doctoral researchers), the coordination project of META-REP offers funding opportunities for small-scale collaborations between researchers in early career phases, start-up stipends for excellent young researchers and specific workshops on career development inside and outside academia. Gender equality and a family-friendly policy are explicitly endorsed.

Proposals and CVs must be written in English and must be submitted via the DFG's electronic proposal submission system elan by 24 January 2024.
Further Information:
https://www.dfg.de/foerderung/info_wissenschaft/ausschreibungen/info_wissenschaft_23_58/index.html

DFG AIMS-DFG Cooperation Visits Programme in the Mathematical Sciences, deadline: 31. October 2023

With this call, the African Institutes for Mathematical Sciences (AIMS) and the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) support the initiation of international research collaboration between researchers in early career phases from African countries and researchers at universities in Germany in the mathematical sciences.
The aim of the initiative is to familiarise and connect the wider research communities in the mathematical sciences in Africa and Germany with each other and support their internationalisation. The initiative enables participating researchers to identify joint research interests in the field of mathematical sciences and initiate specific joint project ideas.
This call is based on the DFG funding programme "Initiation of International Collaboration". Under this programme, applicants interested in establishing collaborative scientific relations with partners abroad may apply for funding for trips abroad or guest visits, for example.
For the purpose of this call:
- "Applicants" are researchers in the German research system who apply for funding under the AIMS-DFG Fellowship Programme,
- "Fellows" are researchers whose cooperation visits are funded under the AIMS-DFG Fellowship Programme.

Two different modules are available:
- Trips abroad to one of the five AIMS centres (in Cameroon, Ghana, Rwanda, Senegal or South Africa) undertaken by researchers in the German research system (max. three months)
- Guest visits to Germany undertaken by researchers in early career phases from African countries (max. three months)

The focus of this programme is to facilitate cooperation visits. However, the funding of scientific workshops can be granted in exceptional cases.
The funding remains available for a maximum of 12 months after the approval date: individual collaborative measures must be carried out within this time frame.
Applicants: researchers who have obtained their doctorates and who are working in the German research system may apply. Special rules apply to members of non-university research institutions.
Applicants from Germany visiting an AIMS centre:
- must be working in the German research system;
- must fulfil the DFG eligibility requirements;
- can apply to visit an AIMS centre themselves;
- must submit a letter of invitation from a host researcher at an AIMS centre.

Fellows from Africa visiting a host institution in Germany:
- can receive funding for their guest visit through an applicant in Germany;
- must have obtained their doctorate, be on track to defend their thesis or show proof of research activity. Candidates must have published at least one scientific article in a peer-reviewed journal listed on Math-SciNet or zbMath, for example;
- require a letter of support from an AIMS centre.

Applicants may apply either to undertake a cooperation visit to an AIMS centre themselves or for a fellow from Africa to visit the applicant's institution.
Proposals must be submitted in English by 31 October 2023.
Further Information:
https://www.dfg.de/foerderung/info_wissenschaft/ausschreibungen/info_wissenschaft_23_59/index.html

BMWK Schaufenster Elektromobilität 2025, Frist: 30. September 2023

Schaufensterprojekt bidirektionale Flottenkraftwerke 2025 in der Europäischen Union:
Unter diesem Förderschwerpunkt wird ein Schaufensterprojekt ausgeschrieben, das die Standardisierungserfordernisse und

sonstigen Voraussetzungen für den erfolgreichen Betrieb eines Flottenkraftwerks auf Basis gesteuerter bidirektionaler E Fahrzeuge realisiert. Ziel ist es, ein strommarktgeführtes und herstellerübergreifend genormtes Flottenkraftwerk ab 2025 als FuE-Demonstrationskraftwerk zu realisieren und die Marktvorbereitung und -einführung dieser Schlüsseltechnologie vorzubereiten. Im Rahmen dessen sollen unter anderem folgende Fragen untersucht werden:

- Wie soll eine möglichst einfache und effiziente Softwarearchitektur aussehen, welche die Einbindung millionenfacher dezentraler, mobiler Speicher aus E-Fahrzeugen einfach, effizient und sicher bidirektional und nach einem einheitlichen System steuert?
- Ist gegebenenfalls ein steuerungstechnischer Unterschied zwischen stationären und mobilen, dezentralen Speichern erforderlich und falls ja, wie kann dieser möglichst einfach umgesetzt werden?
- Welche Elemente einer strommarkt- bzw. -netzdienlichen Steuerung von dezentralen, mobilen Speichern müssen auf nationaler Ebene und welche auf europäischer bzw. internationaler Ebene definiert und genormt werden?
- Wie könnte ein europäisch/international vereinheitlichter Netzzugang an das öffentliche Stromnetz bidirektionaler Fahrzeuge aussehen und definiert sein?
- Welche sonstigen Voraussetzungen müssen geschaffen werden, z. B. in Bezug auf zügige digitale Anmelde-, Abrechnungs- und Prozesssteuerung oder sonstige Erfordernisse?

Im Zuge dessen sollen unter anderem auch möglichst schlanke und vereinheitlichte Anschluss-, Mess- und Abrechnungsprozesse für bidirektionale Flottenkraftwerke entwickelt werden, die auch im Europäischen Rahmen Anwendung finden können. Soweit eine Einbindung von assoziierten Partnern aus anderen EU-Ländern möglich erscheint, wäre dies ein willkommener Beitrag für die gemeinsame Entwicklung und den Betrieb von Flottenkraftwerken im europäischen und internationalen Kontext.
In der Projektskizze soll deutlich gemacht werden, wie nach einem strukturierten Verfahren alle hierfür erforderlichen Parameter, Akteure und Prozesse zusammengebracht werden. Die Herausforderungen müssen strukturiert so abgearbeitet werden, dass die unterschiedlichen Netz- und Systemdienstleistungen (wie z. B. Teilnahme an Redispatch- und Regelleistungsmärkten sowie insbesondere im Arbitragehandel) getestet, erprobt und entlang der Wirkkette herstellerübergreifend genormt bzw. standardisiert sind. Es soll am Ende ein voll funktionsfähiger, schlanker und wirtschaftlicher Betrieb solcher herstellerübergreifenden, komplexen Systeme demonstriert und die Marktvorbereitung und -einführung hiermit vorbereitet werden. Bestehende Lücken in der hersteller- und systemübergreifenden Standardisierung und Normung sind zu erfassen und systematisch abzuarbeiten. Dabei sind unter anderem relevant: Netzanschlussbedingungen in Deutschland sowie mindestens einem anderen EU-Mitgliedstaat, die Entwicklung und Demonstrationen entsprechend vereinfachter und harmonisierter Anmeldeprozesse von bidirektionalen Fahrzeugen sowie eichrechtlich fundierte Mess- und Abrechnungsprozesse nach einem einheitlichen Verfahren.
Soweit hier rechtliche und/oder untergesetzliche Rahmenbedingungen wie z. B. herstellerübergreifende gemeinsame Schnittstellen, IT-Architekturen, automatisierte Vorgangsbearbeitung beim zügigen Anschluss vieler dezentraler Einheiten zu einem gepoolten virtuellen Flottenkraftwerk erforderlich sind, ist dies in der Projektskizze darzulegen.
Sofern ein spezifisch europäisches Projekt mit assoziierten Partnern aus mindestens drei EU-Ländern vorgelegt wird, das darauf abzielt, vergleichbare Fragestellungen im europäischen Kontext zu untersuchen und entsprechende Lösungsoptionen zu entwickeln, kann gegebenenfalls ein zweites Schaufensterprojekt gefördert werden.
Schaufensterprojekt standardisierte Langstreckenverkehrssysteme für E-LKW und E-Reisebusse:
In diesem Schaufensterprojekt soll komplementär zu stationären LKW-Ladeinfrastrukturen ein vollautomatisiertes Batteriewechsel- und Bezahlsystem für E-LKW und E-Reisebusse nach einem herstellerübergreifenden Standard entwickelt und einem Testbetrieb unter realen Nutzungsbedingungen unterworfen werden. Hierbei sollten unter anderem folgende Fragen untersucht werden:

- Welchen Beitrag können herstellerübergreifend genormte Wechselbatterien für den elektrischen Fernverkehr mit hohen spezifischen Fahrleistungen leisten (transeuropäischer Verkehr, Reisebusse im 2-Schichtbetrieb; vollautomatisierte LKW etc.)?
- bei zu leistungsschwachen oder zu spät kommenden Netzanschlüssen für Ladeinfrastrukturen (insbesondere bei Anschluss an Hoch- und Mittelspannungsebene)?
- bei begrenzter Flächenverfügbarkeit für die Elektrifizierung von LKW-Stellplätzen?
- für die Begrenzung von Leistungsspitzen beim Laden vieler E-LKW zugleich?
- die Wirtschaftlichkeit und einen kostengünstigen Aufbau und Betrieb einer leistungsfähigen Ladeinfrastruktur auch für den transeuropäischen Verkehr?

Soweit in dem Projekt z. B. ein „Laden während der Fahrt“ über eine genormte Hochvolt-Schnittstelle angestrebt wird, ist die geplante Vorgehensweise in der Skizze entsprechend darzustellen. In dem Schaufensterprojekt soll untersucht werden, inwieweit eine standardisierte komplementäre Infrastruktur einen kosteneffektiven und europaweiten batterieelektrischen Fernverkehr erleichtern und zugleich einen Beitrag für zukünftige Anforderungen wie z. B. einen vollautomatisierten leisten könnte. Besonders relevant sind herstellerübergreifend nutzbare Austausch- und Lademöglichkeiten bei zugleich vollständigem Automationsgrad und universeller Nutzbarkeit z. B. in Bezug auf zukünftige automatisierte Mess- und Bezahlsysteme.

Im Rahmen des Schaufensterprojekts sollen sowohl das Geschäftsmodell und die Wirtschaftlichkeit als auch die Anforderungen und Bedürfnisse der jeweiligen Nutzergruppen (Spediteure, Reisebusse, Fahrer etc.) in Bezug auf die praktische Nutzererfahrung, Alltagstauglichkeit und Akzeptanz untersucht werden.
Ergänzend zu den oben genannten Schaufensterprojekten wird zur Einreichung von Projektskizzen aus den folgenden beiden Bereichen aufgerufen:
Innovationen für eine kostengünstige und umweltfreundliche Elektromobilität:
- Kostensenkung, Erhöhung der Resilienz in der Wertschöpfung, vereinfachte Produktionsverfahren: FuE-Projekte, die deutlich kostengünstigere und/oder qualitativ bessere Wertschöpfungsketten anstreben und/oder wesentlich dazu beitragen, resiliente Wertschöpfungsstrukturen zu entwickeln.
- Wirkungsgradsteigerungen: FuE-Projekte, die zu Wirkungsgradsteigerungen auf Baugruppen- oder Systemebene führen. Beispiele hierfür sind die gezielte Verbesserung der Aerodynamik von E-LKW und E-Bussen oder die deutliche Reduzierung von Umrichterverlusten.
- Modulare Elektrofahrzeug- und Ladesysteme und Kreislaufwirtschaft: Gefördert werden Projekte, die durch innovative Produktionsverfahren modulare Elektrofahrzeug- und Ladesysteme entwickeln, welche nahtlos in die Kreislaufwirtschaft der elektromobilen Wertschöpfungsketten integriert werden. Somit sollen nachhaltig Ressourcen und Rohstoffe eingespart werden. Im Fokus stehen möglichst vollständige Materialkreisläufe, welche die Elektromobilität deutlich umweltverträglicher machen. Gefördert werden auch Test und Demonstrationsprojekte, die Produktionsverfahren verwenden, die eine einfache Zerlegbarkeit von Fahrzeug und Ladesystemen und eine hohe Güte der Materialien nach Zerlegung sicherstellen.
- Standardisierte „plug and play"-AC- und -DC-Systeme für strommarktgesteuertes und/oder bidirektionales Laden in Privathaushalten, Gewerbe und öffentlichen Ladeparks:
Gefördert werden Projekte, in denen hersteller- und geräteübergreifend genormte „plug and play"-Lösungen für effiziente strommarktgeführte und/oder bidirektionale Ladesysteme entwickelt werden. Die FuE-Projekte können sowohl für Elektro-PKW, -LKW und/oder -Busse umgesetzt werden. Sie sollen aus Nutzersicht sehr einfache „plug and play"-Verbindungen von erneuerbarer Energieerzeugung, Energiemanagement, Ladeinfrastruktur und deren strommarktgeführter Fremdsteuerung nach einem gemeinsamen Standard ermöglichen. Die Wahl des im FuE-Projekt vorgesehenen Standards und der Funktionalitäten der angestrebten Funktionseinheit ist in der Projektskizze darzustellen. Die Entwicklungen sollen dafür sorgen, dass erneuerbare Energieerzeugung vor Ort, inklusive der Abgabe von Strom an die Mieter bzw. Nutzer und inklusive der hierfür notwendigen Komponenten, herstellerübergreifend mit gemeinsamen Standards einfach und kundenfreundlich miteinander verknüpft werden können. Dadurch sollen nutzerfreundliche „plug and play"-Produkte mit minimalem Installationsaufwand nachrüstbar sein.
Soweit hierfür die Entwicklung herstellerübergreifend genormter DC- und AC-Wallboxen mit entsprechender, steuerbarer, bidirektionaler Ladefähigkeit von Fahrzeugen inklusive der entsprechenden Mess- und Abrechnungs- systeme erforderlich sein sollte, ist dies im Rahmen dieses Schwerpunkts förderfähig.
Weitere Informationen:
https://www.bundesanzeiger.de/pub/publication/dbuHGV0omFA1Z215fEn/content/dbuHGV0omFA1Z215fEn/BAnz%20AT%2029.0

BMWK Bilateral Call between Argentina and Germany for Funding Business Technological Research and Development Projects, deadline: 15. December 2023, 1. Step

Germany and Argentina announce the launch of a call for proposals for joint research and development (R&D) projects focused on the development of innovative technology-based products, processes or services with strong market potential.
Submission Process:
Phase I: Submission of the proposal application form (PAF), prepared jointly in English, together with a Gantt chart stated in US dollars listing the activities to be performed jointly by the project partners and a consortium agreement by the partners involved in the project. In addition to the above documents, participants in Argentina must also submit an estimated budget for each of the participating Argentine companies (in Argentine pesos). In addition to the above documents, participants in Germany must file a complete ZIM application via the electronic upload portal to AiF Projekt GmbH, ZIM project management agency on behalf of BMWK, in German language.
These documents will be evaluated by experts from both countries, and projects considered eligible by both agencies will proceed to the next phase.
Phase II: The proposals that have a positive evaluation in Phase I may apply for funding to participate in the project to the respective national funding agency in Argentina, MINCyT through its National Agency for the Promotion of Research,

Technological Development and Innovation (Agencia I+D+i - FONTAR).
Types and characteristics of the projects to be submitted:
- Development of innovative technology at pilot and/or prototype scale.
- Production of knowledge applicable to a technological solution, the development of which may reach laboratory scale or equivalent.
- Technological development that, starting from an industrial research activity, results in an innovative product, process or service with market prospects (on a pilot or prototype scale).
- The maximum duration of projects will be 18 months and exceptionally 24 months.
- The project proposals should involve actual collaboration in Technological Research and/or
Development between companies from both countries.
The proposal must be balanced between the project partners, both in terms of participation in the project R&D activities and in budgetary terms; and the results must be beneficial to all participants. A proposal is considered to be balanced when the budget of a company or the sum of the budgets of the participating companies of either country does not exceed 70% of the total project budget.
Common Requirements:
- Participants must include, at least, one Argentine SME and one German SME, partnering under a collaboration agreement, the minimum content of which is described in section 5.1 of this call. Participation in the project by partners from business groups or linked companies in both countries shall not be considered as international cooperation.
- Optionally, companies may apply in collaboration with other research organizations, such as universities or technology centres, under a subcontracting scheme.
- The solution developed must be innovative, an improvement on the state of the art of the technology used and show significant potential for commercial application.
Submission Timeline:
For Phase I: From the date of publication to 15 December 2023 at 6:00 p.m. Buenos Aires time / 6:00 p.m. Berlin time.
Further Informatione:
https://www.zim.de/ZIM/Redaktion/DE/Artikel/International/argentinien.html

BLE Green ERA-Hub: Contributions to a sustainable and resilient agri-food system, deadline: 20. July 2023 12:00 CEST, 1. Step

The objective of this Call is to support projects that contribute to the development of more sustainable and resilient food and farming systems. This includes consideration of what resources are used and how they are used; reduction of greenhouse gas (GHG) emissions; and impact on yields, product quality, human nutrition and profitability. The scope covers both organic and conventional farming and/or food approaches. A holistic systems approach to food and farming systems is encouraged both pre- and post-farm gate. Such an approach could be, for instance, to look at circularity, closing nutrient cycles, utilising side streams, and minimising waste, trying to enhance the efficiency at system level and to improve the use of natural resources. The approaches outlined hereunder may be used as inspiration for proposals, but not exhaustive and other approaches are also welcomed:
- Analysis of potential synergies and trade-offs of redesigned or new production systems or products along the value chain and their economic, ecological and social effects
- Identification of the most important drivers, facilitators and barriers to implement and accept new strategies, processes and products
- Design and analysis of socio-economic structures within a socio-ecological market economy that facilitate functional competition
- Building strategies to improve the consumers´ knowledge about the impact of their food choices and consumption behaviour on health, environment and economy (food literacy)
Proposals must address at least one of the following four topics which may also be combined in various ways; the items listed under each topic are not exhaustive for that topic. Not included in the scope are cultivated meat and precision fermentation of oils.
Topic 1: Enhance fertilizer efficiency and reduce fertilizer:
- Fertilizer production and recovery: innovative procedures to retrieve fertilizers from agricultural (by)-products, residues and

waste from agricultural/food production
- Fertilizer utilisation: improved/optimized use of fertilizer through innovative agricultural production strategies such as precision farming potentially supported by ICT solutions, modelling and decision support systems, as appropriate
- Organic fertilizer: biological nitrogen fixation by co-cultivation strategies, for example with legumes
Topic 2: Increase European protein self-sufficiency:
- Protein in feed: new concepts for optimal use of feed protein in livestock production, including livestock breeding for low protein feed rations
- Protein recovery: innovative biorefinery concepts to retrieve protein from residues of feed and food production
- Protein production: novel sources of protein from breeding of new protein crops and from alternatives (e.g. algae, seaweeds, insects) for food and non-food applications
- Protein in food: novel food protein sources, their consumer acceptance, and understanding of consumer choices
Topic 3: Mitigate GHG emissions in agricultural and food systems:
- Climate neutrality in agri-food systems: strategies and innovations for GHG mitigation and carbon removal
- Improved national GHG inventories: new and/or refined emission/removal factors enabling better monitoring, reporting and verification of emissions/removals
- Enabling conditions: evaluation of policy and/or economic measures to support GHG emissions reductions and enhance removals across the farm-to-fork chain
- Climate-friendly choices: better understanding of the drivers of consumer behaviour in order to support consumers in reducing food waste and making more climate-friendly food purchases
Topic 4: Sustainable energy use and production in agri-food systems:
This topic focusses on alternatives to fossil fuels and covers production and use of energy within agri-food systems.
- Energy saving strategies "from farm-to-fork", including approaches during food processing and packaging
- Renewable energy production in agri-food systems (e.g. biogas, wind, solar)
- Biogas production in circular systems, avoiding food-feed competition
- Benefits and trade-offs of energy saving and renewable energy use, including economic aspect
Universities and other higher education institutions, public research institutions, private non- profit organisations, and private companies can apply, subject to the national/regional regulations and eligibility criteria. Research consortia should consist of a minimum of three partners seeking funding from at least three different countries.
The Call is conducted as one-step-procedure but proposals are only eligible if pre-registered by 20th July 2023 via the online-submission platform. Proposals that have not been pre-registered within this time may not be considered for full proposal submission. Full proposals have to be submitted by 7th September 2023.
Further Information:
https://www.submission-greenerahub.eu/call1

HORIZON EUROPE ATM Excellent science and outreach for multimodality and passenger experience, deadline: 15. November 2023 17:00 Brussels time

Project results are expected to contribute to the following expected outcomes.
- Environment: the proposed solutions are expected to reduce the impact on the environment (i.e. in terms of emissions, noise and/or local air quality) or to improve the aviation environmental footprint thanks to an improved gate-to-gate planning. Additional environmental benefits will come from alleviating congestion at and around airports by improving passenger flows (through predictability and single-ticketing), etc.;
- Capacity: the proposed solutions are expected to contribute to capacity through real-time multimodal passenger constraint information that, when shared at network level, will help to reduce, for example, departure delay;
- Passenger experience: the proposed solutions shall improve the passenger experience by sharing data on air transport with travel service providers to help passengers plan intermodal journeys that include air segments. Results are expected to demonstrate the viability of the integration of airports as multimodal nodes into the ATM network to enable interoperability between aviation and other modes of transport;
- Cost-efficiency: the proposed solutions are expected to allow new 'as a service' businesses, based on new data-sharing standards and systems creating more value for aviation, within an integrated transport-system;
- Operational efficiency: improved, accurate, customer-focused planning, including user-driven prioritisation, allows operators to customise and optimise every flight, balancing their individual constraints against those of the network, with a

direct positive impact on additional gate-to-gate flight time, fuel burn per flight, and operational costs from congestion and disruption.
Flightpath 2050, Europe's long-term vision document on aviation research, has set the goal that 90% of travellers within Europe should be able to complete their journey, door-to-door (D2D), within 4 hours by 2050. The challenge is to develop potential innovative and breakthrough solutions to meet this goal. The role of ATM in the door-to-door chain of a passenger's journey may seem small, but the punctuality of flights, and passengers' perception of flying, is highly dependent on the smooth functioning of the entire journey. Considering ATM to be an integrated part of an intermodal transport system, the proposed solutions will make it possible to share data between transport modes and to collaborate better to optimise the performance of both the overall transport system and the D2D journey.
The SESAR 3 JU has identified the following innovative research elements that could be used to meet the challenge described above and achieve the expected outcomes. The list is not intended to be prescriptive; proposals for work on areas other than those listed below are welcome, provided they include adequate background and justification to ensure clear traceability with the R&I needs set out in the SRIA for the multimodality and passenger experience flagship:
- Understanding passenger expectations. Understanding passenger expectations (with regard to origin–destination, travel time, comfort, ecological impact and reliability, etc.) is a continuous activity linked to the flexibility/changes over time in demand for modes of transport. How can aviation monitor passenger expectations to improve its offer? How will changing passenger preferences shape the future multimodal transport system (e.g., airport products and services and the airport as a multimodal node)? (R&I need: passenger experience at the airport).
- Managing the passengers' access to airport. Research aims at better understand and dynamically manage the arrival times of departing passengers at the airport. Research may consider medium/short-term predictions on the performance of different airport processes (both airside and groundside) and different factors: the operational situation at the airport (e.g., potential delays of the arriving flight (previous flight leg)), passengers' preferences, situation along the journey to the airport in different ground transport modes, etc. The potential solutions will propose the most suitable personalized time schedule before departure per passenger, as well as a recommended transportation pattern to optimise the passenger experience e.g., avoid queuing at the airport. Research may address the use of smart contracts and the benefits that could be derived from the access to airline information using privacy-preserving solutions (R&I need: passenger experience at the airport).
- Multimodal airport. This research aims at evaluating the definition and impact assessment of new mobility solutions' (e.g., shared mobility) for a multimodal airport. Research may cover aspects such as airport access, the use of surface modes and connected and autonomous vehicles to access the airport (including studying the trade-offs in terms of the environment, door-to-door travel time, etc.). The integration of UAM to intermodal airport solutions is also under scope (e.g., how multimodal access can help to enlarge an airport's catchment area, etc.) (R&I need: access to / exit from the airport: airports are obvious multimodal nodes for aviation).
- ATM contribution to European Mobility as a Service (MaaS). Research aims at developing ATM innovative solutions enabling passengers to transfer seamlessly between air transport and other transportation modes to reach the final destination quickly, smoothly, predictably, on time and without interruption (R&I need: access to / exit from the airport: airports are obvious multimodal nodes for aviation). Research may address:
- The application of consistent door-to-door oriented passenger rights to guarantee the journey reconfiguration if contracted services cannot be met, irrespective of the mode of transport;
- The removal of the friction points for transferring between different modes of transport;
- The connection between ATM to advanced urban and regional air mobility concepts;
- Methods for predicting disruption in support of proactive mitigation and on suitable management and recovery mechanisms;
- The application of trusted autonomy (TA) to improve the knowledge on how to code smart contracts where different passenger rights are coded. Access to airline information could allow to code and pay directly, insurance, cancellations, overbookings, etc.;
- The integration and harmonization of data from disparate sources, their analysis and the generation of information and global learning.
- Seamless connection between airports of all sizes, vertiports and heliports. Research addresses potential solutions to enable simple, convenient, coordinated, safe and secure intermodal connections optimised for passenger experience. Research shall consider the EASA rulemaking task RMT.0230 about the introduction of a regulatory framework for the operation of unmanned aircraft systems and for urban air mobility in the European Union aviation system (R&I need: access to / exit from the airport: airports are obvious multimodal nodes for aviation).
- Digital twins for airports. This research aims at developing an AI-supported concept of digital twin (DT) for airports integrated within the network of transport service providers to optimise the travel time and the overall network capacity and reliability, while minimising the environmental impact and achieving a fully scalable network. Research shall address

the impact on airport operations and on safety in particular. Digital twins for airports consist of virtual models designed to reflect, accurate enough, a real airport. Several sensors located at the airport and related to vital areas of airport operations e.g., catchment area will generate relevant data to describe the real airport operations and performance e.g., passengers flows, aircraft turn around processes, etc. and the airport interaction with other modes of transport. Once informed with such data, the airport digital twin can be used to:
- Develop synthetic simulation models, both for probabilistic predictions and full simulations with virtualized assets;
- Create a what-if scenario generation capability for different operational use cases at the airport, influx of passengers, aircraft traffic, port and runway or access control systems, etc. and their impact on the airport catchment area;
- Generate different emergency / unusual scenarios both in the traffic at the airport itself (e.g., aircraft out of schedule, aircraft collision, any type of anomaly or malfunction, unauthorized traffic, different signals in the sensors and control and surveillance systems, terrorist attack at the airport, situations of maximum influx, adverse weather conditions, etc.) and in the airport catchment area to improve the different processes and services in those situations;
- Run what-if simulations and in particular, to assess multimodality use cases (e.g., how decisions taken at the APOC may influence the access/egress from the airport).
Research may study performance issues and generate possible improvements, all with the goal of generating valuable insights, which can then be applied back to the original physical object (R&I need: access to / exit from the airport: airports are obvious multimodal nodes for aviation).
- Information sharing and governance in an integrated transport network. Research aims at investigating efficient ways for information transfer between transport operators as well as between transport operators and travellers. On top of the technical problems related with information sharing, one of the main issues to be addressed for the implementation of intermodal solutions is the lack of incentives and governance models (i.e. stakeholders need to perceive incentives to actually engage in coordination mechanisms). Research on governance and economic aspects is needed to address this problem. A sound governance model shall answer questions such as, for example, who is responsible for the information transfer between the service providers and the travellers and who should compensate the traveller in an intermodal trip if a connection is missed due to an unexpected disruption, which interoperable communication standard is used, etc. Research shall consider the ATM dimension of the problem, engaging with relevant ATM stakeholders (R&I need: An integrated transport network performance cockpit).
- Mobility in the context of the European Integrated Transport Network. The European transportation ecosystem is transitioning from individual modes of transport, through the concept of Integrated Transport System, towards that of Mobility. Mobility is defined as "the potential for movement and the ability to get from one place to another using one or more modes of transport to meet daily needs". As such, it differs from accessibility, which refers to the ability to access or reach a desired service or activity. There is, however, no harmonised concept for mobility, at least not in the scientific sense we normally use in Aviation. Even the European Mobility as a Service (MaaS4EU) project, the most advanced related coordinated research activity in Europe, does not aim to develop a generic "mobility" concept, but rather to prove the MaaS concept, defined as "A user-centric, intelligent mobility distribution model, in which users' needs are met via a single platform and are offered by a service provider, the mobility operator". Research aims at developing a harmonised concept for multimodal Mobility in the context of the European Integrated Transport Network (R&I need: An integrated transport network performance cockpit).
Further Information:
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-sesar-2023-des-er2-wa1-6;callCode=null;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1,2,8;statusCodes=31094502;programmePeriod=2%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

HORIZON EUROPE ATM application-oriented research for connected and automated ATM, deadline: 15. November 2023 17:00 brussels time

Project results are expected to contribute to the following expected outcomes.
- Environment: the proposed solutions should have no negative impact on the environment (i.e. in terms of emissions, noise and/or local air quality) or on the potential improvement of the aviation environmental footprint;
- Capacity: the proposed solutions are expected to contribute to capacity by enhancing the management of separation minima, both for en-route airspace and the TMA, and the provision of additional meteorological services. At airport level, the solutions will enhance the calculation of arrival runway occupancy times and the resilience of runway throughput to meteorological disruptions, enhance departure queue management, improve visual separation procedures for the aerodrome

circuit and support fully automated airport operations through improved predictability;
- Cost-efficiency: the proposed solutions are expected to justify the investment costs related to the adoption of automated technologies and tools;
- Safety: The proposed solutions are expected to maintain at least the same level of safety as the current ATM system, with higher levels of automation, especially through the identification of negotiation-based resolutions at conflict resolution and collision avoidance levels, safety nets for new separation modes and improved approach procedures into secondary airports in low-visibility conditions;
- Security: The proposed solutions are expected to identify and mitigate the potential security risks deriving from having a more interconnected and automated ATM system.
The challenge is to design and develop concrete innovative applications (that are already TRL1, achieved within SESAR programme or outside) that aim at increasing the level of automation and connectivity of the future ATM ground system and make these applications ready to transition towards industrial activities in future DES calls. The future architecture of the European sky will rely in an increased level of automation: the proposed innovative solutions shall aim at achieving between level 4 [Automation supports the human operator in information acquisition and exchange, information analysis, action selection and action implementation for all tasks/functions. Automation can initiate actions for most tasks. Adaptable/adaptive automation concepts support optimal socio-technical system performance]and level 5 [Automation performs all tasks/functions in all conditions. There is no human operator.]in all operating environments, including the transition areas between Europe and neighbouring ICAO regions, which may have specific regulations and challenges. Higher levels of automation are considered an essential enabler for increasing the performance of the ATM system, enabling numerous actors to interact with each other seamlessly, with fewer errors making the system scalable and even safer than today. Proposals may take up the challenge to develop innovative solutions for an affordable and service-oriented way of sharing trajectories across ATM actors, enabling the capacity, cost efficiency, operational efficiency and environmental performance ambitions of the European ATM Master Plan for controlled airspace and airports. To realise the SESAR vision, innovative solutions to increase the level of connectivity between all components of the ATM infrastructure will be required i.e. hyper connectivity between all stakeholders (vehicle-to-vehicle, vehicle-to-infrastructure) via high bandwidth, low-latency ground-based and satellite networks.
The SESAR 3 JU has identified the following innovative research elements that could be used to meet the challenge described above and achieve the expected outcomes. The list is not intended to be prescriptive; proposals for work on areas other than those listed below are welcome, provided they include adequate background and justification to ensure clear traceability with the R&I needs set out in the SRIA for the connected and automated ATM flagship:
- Increased automation in core En-Route/TMA ATC functions. The objective of this research element is to develop core functions of en-route/TMA ATC centres aiming at automation levels 4 / 5 (as per the ATM Master Plan). Research may propose operational concepts and concrete applications that will support the evolution of en-route/TMA ATC from executive to supervisory control (e.g. delegation of control to the automation). Research shall address the challenges on the role of the human to ensure that the proposed applications are fully consistent with human capabilities and the specific challenges that hinder the application of machine learning / artificial intelligence methods for the further automation of ATM (e.g. transparency, generalisation, etc.). Research shall take into account the recommendations provided by the "expert group on the human dimension of the Single European Sky". Research may address the impact on the roles, the definition, responsibilities and tasks of the different actors e.g. ATCOs, FMPs, ATSEPs, supervisor, etc.), their training needs and other important aspects such as e.g., liability, certification aspects, etc. in an environment with higher levels of automation (R&I need: advanced separation management).
- Sector-less ATM. This research element aims at developing a sector-less concept, which considers all the entire upper airspace of the ECAC states as one single airspace and therefore, foresees the elimination of existing country boundaries and all sector boundaries within them. Research may evaluate the needs of advanced AI/ML-based tools (corresponding to automation levels 4 and/or 5) and the evolution of existing capabilities (e.g. evolution of the CWP HMI to consider larger airspaces, wide area communications, etc.) to support the concept in such wide area. Research may address how the concept will impact the current structure of the Air Navigation Service Providers (ANSPs), which will no longer be responsible for a specific national territory, but for aircraft flying across the entire ECAC airspace and explore potential alternatives to the conventional ANSPs (R&I need: advanced separation management).
- Evolution of flight-rule concepts, separation management service concepts and airspace classification. This element covers the potential evolution of responsibility for separation provision in an environment where advanced detect and avoid (DAA) and electronic conspicuity systems are fitted to majority – but not all - of participating traffic. Research should cover, individually and collectively, the role of the separator and the mode of separation provision; the need for and possible updates to or renewal of the airspace classification system; the definition and potential renewal of flight rules for manned and unmanned aircraft systems; and a potential review/qualification of the need for visual flight rules (VFR) flights to remain

in visual meteorological conditions, including the need to remain clear of cloud, given the existence of advanced electronic systems that replace and/or augment the performance of the human eye. The research must assess the impact on all current airspace users, including main airlines, business aviation, general aviation, sports aviation and military aviation, as well as considering the impact on new entrants (both drones flying low and manned or unmanned aircraft systems flying at high altitude) (R&I need: advanced separation management).
- Use of advanced meteorological information and capabilities (R&I need: advanced separation management). This research covers the needs to:
- incorporate ensemble weather information into decision support tools that can be adapted for different ATM stakeholders;
- produce very high-resolution, very short-range weather forecasts using numerical weather prediction models and observational data assimilation;
- share very short-range weather forecasts based on Aircraft Meteorological Data Relay and observational data assimilation (e.g., predicted wind, wind shear) during the approach and landing phases, Mode-S EHS, new possibilities emerging form ADS-C, etc. The research also covers the novel avionics and flight crew procedures required to use this information.
- Ionosphere gradients monitoring and Space Weather Forecast. This element covers monitoring and forecasting of ionospheric conditions to enhance GNSS positioning and improve the availability of augmentation systems (GBAS, SBAS) used in aviation. Most aircraft are equipped with GNSS receivers using GNSS position solution as an alternate surveillance tool in combination with other means (DME, VOR, NDB, INS, LDACS A-PNT, etc.). It is expected that, in the future, GNSS will be more frequently used for determining geometric altimetry as an alternative to barometric altimetry. Using data fusion technique, future ATM applications will combine data collected by the vehicle's own sensors as well as ground- and space-based augmentation techniques (e.g., exploiting multi-constellation GNSS). However, GNSS signals may be disturbed, attenuated or even lost due to severe space weather activities with impact on the ionosphere. Monitoring and forecasting ionospheric conditions and gradients is therefore needed to calculate exact GNSS position for navigation as well as in the determination of geometric altimetry. Furthermore ionospheric gradient information is crucial to assess the availability of augmentation systems (GBAS, SBAS) used in aviation (R&I need: advanced separation management).
- Traffic allocation to arbitrary flight levels. This research aims at enabling aircraft to fly at any arbitrary flight level, as optimised by aircraft performance, weight and atmospheric conditions. Even/odd cruise level assignment should be based on traffic supply, rather than on the semi-circular rule (also known as the hemispheric rule). The results should enable the use of all flight levels in the European one-way 'trunk routes' concept (R&I need: advanced separation management).
- Evolution of separation minima. The scope of the research includes investigating advanced modes of separation (e.g. dynamic separation) based on predictive modelling and ML techniques and enabled by further automation and improved connectivity. In addition, the dynamic calculation of the necessary separation parameters between aircraft (horizontal and vertical) to meet a minimum acceptable safety level (i.e. moving away from pre-determined separation standards) for en-route and TMA airspace should be addressed. The separation minima to be developed include both minimum radar separation (MRS), which aims to keep the risk of collision sufficiently low to meet the target level of safety (TLS), and minimum wake separation (MWS), which aims to keep the risk of wake encounter sufficiently low to meet the TLS and potentially provide safety benefits. The separation to be applied in operations will always be the maximum of the applicable MRS and MWS. The operational improvement will also require combined separation minima and consideration of flight-specific data (R&I need: advanced separation management).
- Adaptation of ground and airborne safety nets to new separation modes. This element covers advanced separation management that will require close conformance monitoring of the negotiated and authorised flight trajectories throughout the execution phase, so that operations are not disturbed by unnecessary resolution advisories, in particular if lower separation minima are introduced/considered. Consideration of the level of independence of safety nets from other aspects of control will be critical, as the levels of autonomy automation of detection, classification, resolution and monitoring of conflicting profiles in the planning and tactical phases of ATM will significantly increase (R&I needs: integration of safety nets (ground and airborne) with the separation management function).
- Space-based multilateration. This element covers space-based multilateration through ranging by satellites already used for space-based VHF or ADS-B systems, with preference given to those used for space-based ADS-B, as this could serve to cross-check the GNSS position acquired through ADS-B (in the same way that Mode S radar has a double check). Research may cover the specific challenges for active and passive spaced-based multilateration (e.g., synchronization, interoperability analysis with ground systems, etc.). The development of an integrity parameter for space-based ADS-B downlink to ground system should also be covered. Research shall address how to integrate the space-based multilateration in the context of performance based communication and surveillance (PBCS) concept (R&I need: enabling the deployment of a performance-based CNS service offer).
- Use of dedicated 5G network for complex low altitude operations. Research addresses the potential use of a dedicated 5G network customized for complex low altitude operations (e.g., airports and their terminal areas, vertiports, logistic hubs,

highly populated urban areas) supporting CNS requirements of safety critical applications. The potential solutions may be applicable to U-space, airports, vertiports, uncontrolled & controlled airspace with complex UAS and UAM operations. Research may address the possibility of sending local GNSS augmentation corrections through the 5G network. Since the solution may be potentially very expensive, research shall address business case aspects considering that there are other potential alternatives e.g., LDACS. A coordinated approach with regulators and European institutions to overcome the issue that potential air traffic applications currently do not represent sufficient business motivation for network operators to implement additional features of 5G specs. Research shall consider the work done by GUTMA (Global UTM Association) and GSMA (GSM Association) to standardize some 5G protocols applicable to U-space (R&I need: enabling the deployment of a performance-based CNS service offer).

- Potential use cases and applications of LDACS for other airspace users (e.g., GA, U-space, Innovative Air Mobility). The objective is to research the potential application of LDACS datalink / voice infrastructure (delivered at TRL6 for schedule / business aircraft in industrial research) focused on other airspace users e.g., GA, U-space, etc. The research shall address the definition of operational use cases, which should also take into consideration U-space and Urban Air Mobility areas (R&I need: enabling the deployment of a performance-based CNS service offer).
- Alternate surveillance (A-SUR). Alternate surveillance builds on the idea that the position known by an aircraft through whatever means (e.g., GNSS, DME, VOR, NDB, INS, LDACS A-PNT, etc.) can be downlinked through whatever datalink is available (e.g., SATCOM, LDACS, VDLM2, Hyperconnected 4G/5G/LTE, Mode S, ADS-B, etc.) to be used as back up for surveillance. Therefore, on the ground it is made available in ASTERIX format in case the primary surveillance are not available. Alternative means of surveillance can be also explored (e.g., high-resolution video images, etc.). Research addresses:
- The definition of initial performances that the alternative downlinks should have to comply with (within the context of PBCS framework);
- The design of innovative data fusion and predictive algorithms (e.g. based on ML) to integrate very heterogeneous data sources;
- The analysis of the integrity of the data in case of operational use.

Technical enablers, expected performances and architectures to include this data in the surveillance chain should be analysed. In addition, cost analysis for different alternatives for A-SUR should be part of the research (R&I need: enabling the deployment of a performance-based CNS service offer).

- Trajectory advisories. Research aims at developing automated applications that could provide trajectory advice (including uncertainty considerations and improved weather forecasts) to ATCOs either for human confirmation or for automatic implementation. This trajectory advice could consist of a ranked list of trajectory options based on different optimization criteria (e.g., optimising cost, minimising environmental impact, etc.). For elaborating these trajectory advisories, the automated application shall assure separation and consider a variety of other operational constraints (e.g., ad-hoc downstream and pilot requests or non-conformance, continuous descent and arrival management demands, downstream airspace availability and workload, AUs business needs and equity, the evolution of certainty over the prediction horizon, ATCO preferences and ensuring workflow integration and redundancy and safe degradation, etc.). Research includes the analysis on the uncertainty spread of airport take-off times, as those uncertainties ripple forward into the downstream ATC sectors, influencing significantly on any ATC related resolution and automation support tool. Research may use operational data and/or "intermediate" operational data (from demonstrations, shadow mode trials, simulations, etc.) to build a wide catalogue of non-nominal situations to help dimensioning the level of uncertainty at various operational stages and prediction look-ahead times (R&I need: network-wide synchronisation of trajectory information).
- Innovative applications for improving traffic synchronization. Research aims at developing innovative applications for queue management in ATM, thus optimising airport and TMA throughput and reducing the environmental impact of ATM. The data-integration between arrival and departure managers, A-CDM parties and TBS tools, to allow the dynamic optimisation of runway use based on prevailing operational needs is also under scope (R&I need: intelligent queue management). This may include the enhancement of:
- Extended AMAN capabilities e.g. the transfer of the predicted arrival holding times from the TMA to the upstream airspace or airports to reduce holding, the use of ML and AI for the refinement of AMAN algorithms, the use of weather data, by taking into account more efficient spacing through incorporation of satellite-based navigation techniques (ABAS, SBAS, GBAS), etc. Regression algorithms could be used (e.g. state of the art techniques such as transformer-based networks) to reduce possible errors made in the AMAN algorithm, etc.;
- Departure queue management e.g. through further automation and exchange of highly accurate trajectory information between all actors (i.e. airports, ANSPs and aircraft operators). ML and AI could be used (but not only) to monitor differences between DMAN sequences and their implementation, in order to improve DMAN sequencing algorithms, improve pre-tactical planning, etc. Classification and regression models could be implemented using the monitoring of the DMAN

sequences to improve their accuracy;
- Coupled AMAN–DMAN functions e.g. by using improved algorithms e.g. based on ML and AI techniques to identify the most appropriate departing aircraft to make use of an arrival gap. The integration with other airport systems will ensure that the departing aircraft is loaded in a timely manner and taxies to the right place at the right time to be ready to take off. Ranking models could be implemented to determine the best aircraft based on arrival gap, aircraft waiting time, and other environmental conditions.
- Automated provision of optimised trajectories during airport ground operations for all aircraft, vehicle drivers and tugs. This research addresses different optimization criteria e.g., delays, environmental impact, etc. for all aircraft, vehicle drivers and tugs during airport ground operations. The proposed solution should aim at providing optimised trajectories before the execution of taxiing operations, monitoring the executing of these operations, and re-planning when deviations from the initial plans are detected. Research includes the suitability of the multi-agent systems for degraded conditions too i.e., situations with low-visibility conditions, changing weather and weather extremes, etc., and its robustness when human roles are in the loop. Research shall take into account the output of project AEON (R&I: airport automation including runway and surface movement assistance for more predictable ground operations).
- Improved aircraft protection on the airport surface. Research focuses on the development of advanced capabilities to support the flight crew to protect the airframe and decrease collision risk with nearby mobiles or fixed obstacles when moving on the airport surface (e.g., thanks to radar system generating alerts when the aircraft is getting close to mobiles/obstacles). The airport moving map and ATSA-SURF might not be sufficient to prevent collision with nearby mobiles (e.g., A380 incident at John Fitzgerald Kennedy airport) or fixed obstacles (e.g., A380 incident at Le Bourget air show). Safety is improved as this will help to avoid common accidents on the airport surface that often cause serious damage to the aircraft wings. This will also avoid disturbances cause by aircraft incidents on the airport operations (R&I: airport automation including runway and surface movement assistance for more predictable ground operations).
- AOP and performance monitoring for a group of airports. Research address the development of a single AOP to address the needs of a group of airports with similar operational needs that are too small to have their own AOP. This AOP combines information from each individual airports in order to meet collaboratively agreed joint targets for the group of airports, but taking into consideration individual airport needs and situation. The coordination among airports should always align and never compete with the overall airport-network view. Research also address the collaborative process for the definition of performance targets agreed for any set of airports that decide to gather under such a common AOP. The wider neighbouring community will participate in this process. The benefit of joint target setting will be the ability to set more challenging targets for a group of airports than would be possible for a single airport, thus providing improved service to the Airspace Users over a range of KPA. The overall performance of the group of airports will be monitored against the shared performance targets. The performance of one single airport or the group of airports will be provided, suitably filtered to all the stakeholders (wide access to airport performance). When a group of airports (too small to have their own AOP) with similar operational needs have decided to gather under a single AOP, there is a need to set and monitor the performance targets in order to further enable performance optimisation. Research may include TMA aspects e.g., planning (R&I: airport automation including runway and surface movement assistance for more predictable ground operations).
- ATCO stress and fatigue risk assessment and ATCO resilience. An increased level of ATCO productivity will make it possible to manage traffic growth with the current level of resources, thus improving cost efficiency. However, stress and fatigue are physiological responses that have negative effect on ATCO performance and hence on safety. ATCO resilience is the ability for controller individuals to detect, resist or recover from suffering negative experiences such as stress and fatigue. Research on solutions to predict and monitor these negative effects not only in actual environments, but also in future highly automated environments are crucial to identify corrective measures such as adaptive automation. Historical data may be exploited to find models to assess and predict stress or fatigue (system interactions, reaction times, ATCO tasks, voice frequency, communications, etc.). It is also known that individual particularities such as ATCO chronotype, hours of sleep, accumulative high workload in different shifts, may affect differently to stress or fatigue reporting. Research is needed on how individual features can affect stress and fatigue and how these can be incorporated in their assessment. In addition, ATCO resilience against stress and fatigue should be improved. Resilience has been proven to be associated with some inherent traits of individuals: is positively correlated with conscientiousness, agreeableness, openness to experience and extraversion, and negatively correlated with neuroticism. On the other hand, the formation and improvement of individual resilience are considered as the dynamic process, which could be learned at any period of life. Resilience could be acquired over a period by using a process rather than coming all at once. Psychological coherence training and biofeedback training have proven to be an efficient method for ensuring individual detection and recover from fatigue and stress; as well as for achieving resilience quickly during the short breaks in long-time continuing monitoring and working (R&I need: Role of the Human).

Further Information:

https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-sesar-2023-des-er2-wa2-1;callCode=null;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1,2,8;statusCodes=31094502;programmePeriod=2%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

HORIZON EUROPE ATM Excellent science and outreach for air–ground integration and autonomy, deadline: 15. November 2023 17:00 Brussels time

Project results are expected to contribute to the following expected outcomes:
- Operational efficiency: the proposed solutions shall improve operational efficiency thanks to advanced communication means and increased automation. In particular, further improvements on vertical flight efficiency and cruising/taxiing fuel consumption are expected;
- Environment: the proposed solutions shall aim at optimising fuel-burn and the CO2 emissions per flight;
- Capacity: the integration of new airspace users and air vehicles (unmanned aircraft, HLO operations, etc.) shall not negatively impact capacity;
- Cost-efficiency: is expected to be improved thanks to the new services supported by air-ground connectivity;
- Safety: increased air-ground autonomy will enable the human actors to be discharged from routine tasks and to focus on strategic tasks, including safety oversight of the operations;
- Security: The proposed solutions are expected to identify and mitigate the potential security risks deriving from the increased connectivity between stakeholders.

The Digital European Sky vision foresees the progressive evolution towards autonomous flying, increasing the global ATM performance in terms of capacity, operational efficiency and accommodation of new and/or more autonomous forms of mobility and air vehicles, i.e. supporting the evolving demand in terms of diversity, complexity from very low-level airspace to high level operations. The challenge is to propose and develop potential innovative or breakthrough solutions to allow the accommodation or full integration of these air vehicles, which will have a high degree of autonomy and will use digital means of communication and navigation. This requires closer integration and advanced means of communication between vehicle and infrastructure capabilities so that the infrastructure can act as a digital twin [A digital twin is a digital representation of an intended or actual real-world physical product, system, or process (a physical twin) that serves as the effectively indistinguishable digital counterpart of it for practical purposes, such as simulation, integration, testing, monitoring, and maintenance]of the aircraft. Future operations should therefore rely on direct interactions between air and ground automation, with the human role focused on strategic decision-making while monitoring automation. The objective is to ensure that both manned and unmanned aerial vehicles operate in a seamless and safe environment using common infrastructure and services supporting a common concept of trajectory-based operations.

The SESAR 3 JU has identified the following innovative research elements that could be used to meet the challenge described above and achieve the expected outcomes. The list is not intended to be prescriptive; proposals for work on areas other than those listed below are welcome, provided they include adequate background and justification to ensure clear traceability with the R&I needs set out in the SRIA for the air-ground automation and autonomy R & I flagship:
- New advanced means of communication between vehicle and ground infrastructure capabilities. In the future, the aim is to enable a much richer integration of ground infrastructure and air vehicles, so that ground information of vehicles, operations, etc. becomes similar to a digital twin of the traffic and vehicles situation. Future operations rely on direct interactions between air and ground automation, with the human role focused on strategic decision-making while monitoring automation support. Research shall address innovative and automated means of air ground communication. Research may address different operating environments e.g., airport, en-route, TMA. In the airport environment, research shall take into consideration EASA Triple 1 research (R&I need: Enabling greater ground and airborne integration and wider performance).
- Air-to-air (A/A) communication. The objective of this research element is to address A/A communication to enable new operations and to support advanced separation management and safety nets in the context of the safe cohabitation of different types of air vehicles (e.g., high altitude, drones, business aviation, scheduled aircraft, rotorcraft, etc.). This includes the definition of potential use cases describing the application of A/A communication, potential technical solutions, spectrum needs, risk assessment of loss of A/A communications, etc. A/A communication in the context of ATM/U-space, in particular for the safe co-habitation of these diverse aerial vehicles, is also in scope (R&I need: enabling greater ground and airborne integration and wider performance).
- Air-to-air (A/A) exchange services. Research addresses the definition of air-to-air services for the dissemination and exchange of relevant information (e.g., meteorological weather hazards, wake vortices, trajectory information between aircraft

for operational purposes, etc.). Significant weather events, such as wake turbulence, icing, etc., captured by on-board system, which may be of safety concern to individual or multiple aircraft, could be broadcast to other airspace users. The objective is to increase safety and operational efficiency (R&I need: enabling greater ground and airborne integration and wider performance).
- Improved air safety using on-board / ground wake turbulence detection and prediction. Research focuses on how safety could be improved thanks to the use of wake turbulence detection information, which could be provided via different means (either air or ground based). This information could improve the pilot situational awareness regarding the surrounding wake turbulence events, since he/she will have access to this wake turbulence information through on-board sensors. Regarding the on-board detection, the aim is to ensure tactical measurement of wake turbulence activation of flight control response countering wake turbulence impact in order to increase the stability of the aircraft, thereby improving safety and capacity. Research may also address ground-based en-route ATC wake turbulence alerting: the ground-based prediction would rely on aircraft trajectory prediction, accurate higher altitude wind information (using downlink / Mode-S) and wake turbulence encounter risk model. The technical ground-based en-route wake turbulence encounter risk prediction capabilities need to be assessed from a feasibility and performance perspective. Research aims at confirming the technical capability to predict the risk with sufficient accuracy while limiting the risk of false alarm to an acceptable level, thus delivering the expected safety benefits. The on-board based detection has been addressed to some extent in SESAR (PJ.06.08.01/PJ.12.02.02 and PJ.02 in Wave 1) but the concept presented some technical challenges, which should be addressed. For the ground-based part, work performed in the non-SESAR project SAFEMODE shall be considered (R&I need: enabling greater ground and airborne integration and wider performance).
Further Information:
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-sesar-2023-des-er2-wa1-2;callCode=null;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1,0;statusCodes=31094502;programmePeriod=202%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

HORIZON EUROPE ATM Excellent science and outreach for Artificial Intelligence (AI) for aviation, deadline: 15. November 2023 17:00 Brussels time

Project results are expected to contribute to the following expected outcomes.
- Environment: the proposed solutions shall have a positive impact on the environment (i.e. in terms of emissions, noise and/or local air quality) and on the aviation environmental footprint e.g., AI will enable the optimisation of aircraft trajectories;
- Capacity: AI will play a fundamental role in aviation/ATM to address airspace capacity shortages, enabling dynamic configuration of the airspace and allowing dynamic spacing separation between aircraft;
- Operational efficiency: the proposed solutions are expected to improve the synchronisation and predictability of the ATM system;
- Cost efficiency: AI will enrich aviation datasets with new types of datasets unlocking air/ground AI-based applications, fostering data-sharing and building up an inclusive AI aviation/ATM partnership;
- Safety: the proposed solutions are expected to maintain at least the same level of safety as the current ATM system;
- Security: the proposed solutions are expected to maintain at least the same level of security as the current ATM system.
Tomorrow's aviation infrastructure will be more data-intensive and thanks to the application of Machine Learning (ML), deep learning and big data analytics aviation practitioners will be able to design an ATM system that is smarter and safer, by constantly analysing and learning from the ATM ecosystem. Artificial intelligence (AI) is one of the main enablers to overcome the current limitations in the ATM system. AI is a breakthrough technology that could radically influence or transform the aviation/ATM industry value chain, potentially impacting all stakeholders, including original equipment manufacturers (OEMs) and their business models. The impact of transformative AI will be felt throughout the industry, and beyond. The challenge is to develop potential innovative and breakthrough AI solutions that will help addressing capacity issues in ATM by enabling better use of data, leading to more accurate predictions and more sophisticated tools, increased productivity and enhancing the use of airspace and airports. Considering the extent of these challenges, the proposals shall define and develop potential innovative AI-based solutions that may come up with innovative responses based on non-straightforward correlations of parameters, while improving the scalability, efficiency and resilience of the system.
The SESAR 3 JU has identified the following innovative research elements that could be used to meet the challenge described above and achieve the expected outcomes. The list is not intended to be prescriptive; proposals for work on areas other

than those listed below are welcome, provided they include adequate background and justification to ensure clear traceability with the R&I needs set out in the SRIA for the AI for aviation flagship.

- AI for higher automation. This element covers the development of an AI-powered infrastructure and services (supporting higher levels of automation). In addition, the aim is to develop automation of ATM processes in which analysis and prediction are particularly likely to benefit from AI, and to develop AI-powered ATM environment requirements, infrastructure, and common regulation and certification guidelines. This may include the research on multi-agent deep reinforcement learning (RL) that has a great potential to enable a highly automated ATM, where functions, roles and tasks are allocated to human and artificial intelligence-based agents at both ground and airborne side based on the strengths and weaknesses of each type of agent. Research shall take into account the impact on the role of the human, responsibility and liability aspects, etc. (R&I need: human–AI collaboration: digital assistants).
- Exploring underuse AI paradigm in ATM. AI Paradigms (X-axis) are the approaches used by AI researchers to solve specific AI-related problems. Without trying to be exhaustive, a broad classification accounts for: logic-based tools, knowledge-based tools, probabilistic methods, machine learning, embodied intelligence, search and optimization. Latest projects applications have concentrated most of the research efforts on application of ML in ATM, in detriment of exploring the possibilities of what the other paradigms could do for ATM. Research aims at investigating these alternative possibilities (R&I need: human–AI collaboration: digital assistants).
- Transfer-learning and few-shot learning methodologies in ML ad XAI. Research focuses on transfer-learning and few-shot learning methodologies. In ATM domain, the transfer-learning methodology could be another essential research and development direction for utilizing machine learning and XAI. The lifelong machine can incorporate transfer learning for parameterizing to learn domain-invariant features (e.g., how existing AI models can be used for solving different tasks that share common features or attributes). Transfer-learning can also be used where there are some relations between ATM tasks, such as balancing arrival and departure capacity and take-off delay prediction. Few-shot learning (FSL) is a machine learning framework that enables a pre-trained model to generalize over new categories of data (that the pre-trained model has not seen during training) using only a few labelled samples per class e.g. models for the detection of objects in an image, etc. Research on this element shall consider the output of project ARTIMATION (R&I need: human–AI collaboration: digital assistants).
- Innovative methodologies for ATM safety, security and resilience. Research aims at developing methodologies (or evolution of existing ones) for safety, security and resilience that will contribute to ensure that ATM is robust against ever-evolving risks, threats and disruptive events in the physical and cyber worlds in an environment with automation levels 4/5. New and disruptive technologies, operations and business models to ensure ATM is resilient against internal and external threats, including health, natural disasters, terrorism and criminal activity. Research shall ensure coordination with EASA (R&I need: trustworthy AI-powered ATM environment).
- Ensuring the integrity of non-ATM data for AI/ML applications in ATM. For artificial intelligence and machine learning applications in aviation the integrity and quality of input data is critical. The benefits of AI in ATM can only be leveraged if the models are fed with great quantities of good quality data. While existing ATM data present certain homogeneity and is, by design, oriented to ATM uses and analysis, other data sources also needed for the development of AI models in ATM are heterogeneous and not adapted to ATM granularities. One example is meteorological information, which is presented in a variety of sources and formats that are not always of direct use in ATM solutions. There is a need to develop potential solutions to identify erroneous data injected from non-ATM sources that could introduce a safety risk in ATM and how to mitigate it. The research shall address these non-ATM data availability and format, proposing a framework for data curation, sharing and feeding oriented to ATM use cases, as well as developing new indicators at least for data quality and integrity (R&I need: Trustworthy AI-powered ATM environment).
- Enhancing robustness and reliability of machine learning (ML) applications. Research aims at enhancing machine learning (ML) applications to ensure they are technically robust, accurate and reproducible, and able to deal with and inform about possible failures inaccuracies and errors. Research aims at developing potential solutions to address this challenge, which shall include/refer to the EASA methodologies for certification of AI in aviation. The scope may address:
- Verification methods of robustness for machine learning (ML) applications. Due to the statistical nature of machine learning applications, they are subject to variability on their output for small variations on their input (that may even be imperceptible by a human). Research aims at proposing new methods to verify the robustness of machine learning applications, as well as to evaluate the completeness of the verification;
- Standardised methods for evaluation of the operational performance of the machine learning (ML). Research addresses the definition of reference methods and metrics to assess the accuracy or error rate of ML applications;
- Application of transfer learning and data augmentation techniques for the development of the proposed applications, thus guaranteeing their robustness. In addition, these systems would be continuously validated using ML Ops methodology and explainability techniques, to ensure system performance and detect as early as possible if concept drift is occurring;

- Identification, detection and mitigation means of bias in ML applications. Machine learning applications are subject to bias, which can compromise the integrity of their outputs. One of the most challenging aspects when collecting, preparing or using data, is the capability to identify, detect and finally mitigate adequately any bias that could have been introduced at any time during the data management and/or of the training processes. Research aims at developing potential solutions to address this challenge (R&I need: trustworthy AI-powered ATM environment).
- Accelerating AI implementation for ATC automation. AI implementation pace in ATC is far slow compared to other industries. Safety is the principal barrier in the ATC context. Research aims at developing concrete applications that can support the acceleration of AI implementation in Europe. The research seeks for environments where full (or close to full) ATC automation may become a reality in the short term without human supervision. Those scenarios could be very low complex situations like night shifts, where few flights need ATC service are the most suitable, but the research should explore the suitability of more complex scenarios. Research also addresses exploratory activities on solutions non-dependant of human supervision to take back control to solve contingency is necessary. Research may propose ML-based potential solutions to address specific operational use cases, relying on explainability techniques to validate the robustness and performance of the system in all types of situations (R&I need: Trustworthy AI-powered ATM environment).
- Just culture and AI. Before the introduction of AI/ML into the ATM system, it was difficult but possible to draw the red line between "gross negligence", "wilful violations" and "destructive acts" on the one side and "honest mistakes" on the other side. State of the art algorithms for AI/ML systems such as neural networks are essentially "black boxes" in terms of explainability. Arguably, the best-known disadvantage of neural networks is their "black box" nature. Simply put, it is unknown how or why the neural network came up with a certain output given a certain input. In other words, they are tremendously successful in providing accurate predictions based on historical data, but no one can understand why. The introduction of AI/ML in essence clouds the drawing of a red line between "gross negligence", "wilful violations" and "destructive acts" on the one side and "honest mistakes" on the other side. Research aims at redefining just culture and rewrite its procedures in the era of digitalization (R&I need: Trustworthy AI-powered ATM environment).
- Development of ATM specific ontologies. This research element focuses on special-purpose representation systems (e.g., semantic networks and description logics) that can be devised to help organizing a hierarchy of ATM related categories. There are many variants of semantic networks, but all are capable of representing individual objects, categories of objects, and relations among objects. Knowledge representation through a semantic network will enable ATM-related knowledge to be expressed not only in natural language, but also in a format that can be read and used by software agents; hence, permitting them to find, share and integrate information more easily (R&I need: AI Improved datasets for better airborne operations).

Further Information:
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-sesar-2023-des-er2-wa1-8;callCode=null;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1,0;statusCodes=31094502;programmePeriod=202%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

HORIZON EUROPE ATM Excellent science and outreach for connected and automated ATM, deadline: 15. November 2023 17:00 Brussels time

Project results are expected to contribute to the following expected outcomes:
- Environment: the proposed solutions should have no negative impact on the environment (i.e. in terms of emissions, noise and/or local air quality) or on the potential improvement of the aviation environmental footprint;
- Capacity: the proposed solutions are expected to contribute to capacity by improving runway throughput and ground operations, as well as the use of medium/high/very high density en-route/TMA airspace;
- Cost-efficiency: the proposed solutions are expected to justify the investment costs related to the adoption of automated technologies and tools;
- Safety: the proposed solutions are expected to maintain at least the same level of safety as the current ATM system, in a more connected and automated environment;
- Security: The proposed solutions are expected to identify and mitigate the potential security risks deriving from having a more interconnected and automated ATM system.

The future ATM environment foreseen by the Digital European Sky vision will be increasingly complex, integrating new airspace users' needs, new airspace vehicles with different performances than conventional aircraft e.g., different speeds and altitudes, etc. The challenge is to propose and develop innovative or unconventional ideas to increase the level of

automation (i.e., level 4 (high automation) and level 5 (full automation)) and digitalization in Europe's ATM and design a future ATM infrastructure that would help reducing rigidities in the ATM system and making it even safer than today's while improving its scalability and resilience. Secure data sharing between all the components of the ATM infrastructure and the relevant non-ATM stakeholders is another cornerstone of this vision. Research proposals shall aim at leveraging and exploiting emerging digital technologies that could help transforming the sector, in support of new airspace users and design a future ATM infrastructure commensurate with the performance required by each airspace user type and environment. This includes those environments in the transition areas between Europe and neighbouring ICAO regions, which may have specific regulations and challenges.
The SESAR 3 JU has identified the following innovative research elements that could be used to meet the challenge described above and achieve the expected outcomes. The list is not intended to be prescriptive; proposals for work on research elements other than those listed below are welcome, provided they include adequate background and justification to ensure clear traceability with the R&I needs set out in the SRIA for the connected and automated ATM R&I flagship:
- Moving from magnetic to geographical bearings. This research element aims at moving from magnetic to geographical bearings. The objective is to investigate the operational aspects and potential impact on different actors e.g., airspace users, pilots, ATCOs, procedure design, aerodrome operator, etc. An estimation of the potential benefits would also be required, as well as the definition of standardization needs. Research aims also at studying what would be needed from a CNS and avionics perspective (including changes on, for example, flight management system (FMS), surveillance infrastructure, etc.) for this evolution (R&I need: enabling the deployment of a performance-based CNS service offer).
- Autonomous runway inspections and surveys. Research aims at addressing technical and operational aspects related to autonomous runway inspections and surveys (e.g., laser scans, cameras, drones, etc.) for assessing runway conditions under the EU Global Reporting Format. Research shall be complementary to and avoid duplication with on-going activities under EASA (e.g., project "Runway Micro Texture" that involves laser scans). The scope covers foreign object or debris (FOD) detection, inspection of runway (RWY) aids, etc. Research shall address the impact on the aerodrome operations e.g., performance aspects (R&I need: runway use optimisation through integrated use of arrival and departure TBS tools).
- Review separation principles at and around airports (risks analysis vs. separation standards). Research aims at reviewing the principles of minimal runway separation for both independent and dependent operations and developing potential solutions to minimise separation through automation. The research element aims at building a minimum acceptable safety model based on the probability of collision and taking account of geometry, relative speed, ground and airborne systems capabilities, adherence to a planned trajectory, etc. Research shall build on time-based separation and PBN research taking advantage of airborne navigation capabilities, surveillance capabilities, etc. and may require advanced tools based on trajectory prediction and conflict detection / conflict monitoring. The objective is to increase capacity by safely placing aircraft closer together and to make a better use of available infrastructure. Results of this research aim at moving away from pre-determined separation standards (R&I need: runway use optimisation through integrated use of arrival and departure TBS tools).
- Automated ATC in airports operations. Research aims at developing and validating operational concepts for higher levels of automation in airport operations (levels 4 and 5 as per the ATM Master Plan). The proposed solutions shall be fully consistent with human capabilities. The potential use cases include e.g., automated guidance system for ground movements, automatic ground conflict resolution, enhanced functionalities for digital towers, the application of ML techniques to help in decision making building on similar situations that happened in the past, etc. Research shall address the specific challenges that hinder the application of machine learning (ML) and artificial intelligence (AI) methods to increase the level of automation in airport operations (e.g., transparency, generalisation, etc.). Research shall take into account the recommendations provided by the "expert group on the human dimension of the Single European Sky" in relation to evolving roles in environments with high levels of automation. Research aims at reviewing all the roles, responsibilities and tasks of the different actors (airborne and ground, ATM and U-space, operational and technical), as well as training needs and change management. Research shall plan a close coordination with EASA to ensure complementarity and consistency with EASA activities (e.g., on AI). Research shall take into account the output of previous exploratory research projects in this area e.g., AEON, TACO (R&I: airport automation including runway and surface movement assistance for more predictable ground operations).
- Safety, ethical and liability challenges of increased automation. Research aims at investigating the safety, ethical and liability challenges associated with increased autonomy and automation level in air traffic management (ATM). Research may address the challenges imposed by artificial intelligence (AI), AI training data and AI-human partnerships, distributed systems-of-systems and decision-making, the human-machine interface and the changing role of the human – pilots and air traffic controllers – in the system, etc. Research may investigate the concept of trusted autonomy (TA), which refers to two or more interacting and self-governed autonomous intelligent systems (including humans) where one side of the interaction is willing to delegate a task that will make it vulnerable to other parties in the interaction who are willing to accept and can autonomously perform the task. This includes the study of how the interface between these systems and their end users

should be designed. The integration of distributed cryptographic systems (e.g. blockchain, ZkP, smart contracts, etc.) with autonomous systems and how they could support in decision making is also under scope (R&I need: role of the human).
- Models and theories of behaviour change. An active role for the human factor in system design will be vital to support the transition from the tactical involvement of controllers to management of traffic "by exception". Research is needed to understand and manage the impact of system changes on human performance and workload in the long term. Readiness to change, barriers to change and likelihood of relapse should be addressed in system design, monitoring and improvement over the long term. Both models of behaviours and behavioural change theories should be investigated as diagnostic tools to explain and predict specific behaviours. Furthermore, resilience in handling abnormal situations should be addressed, in order to understand how this resilience can be maintained with reduced human involvement (R&I need: role of the human).
- ATCOs up-skilling, reskilling and de-skilling in the face of new technologies. The introduction of future new technologies and higher levels of automation may increase the space for potential and new type of errors that cannot be easily foreseen. Research aims at analysing the potential of these new technologies to disrupt established patterns in coordinated activity between ATCOs' and between ATCOs' and flight crews. In particular, research covers the needs for up-skilling, reskilling and/or de-skilling ATCOs in the future environment. This may imply the need of developing new mental models, how the AI system works, how it fails, why it fails, and how to adapt (R&I need: role of the human).
- Innovative ways to present traffic to ATCOs. The delivery of ATM services irrespective of physical infrastructure or geographical location implies that local operational and geographical information of a sector might not be known in advanced. Research aims at exploring innovative ways to present the traffic to the ATCOs, so that the flight representation on the screen does not necessarily imply their visualisation on the zenital view of a sector. Research may develop means to help future ATCOs bridging their lack of local knowledge and reducing training time. Technologies based on extended reality (XR) may be used in the proposed research (R&I need: role of the human).
Further Information:
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-sesar-2023-des-er2-wa1-1;callCode=null;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1,0;statusCodes=31094502;programmePeriod=202%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

HORIZON EUROPE ATM Excellent science and outreach for the aviation Green Deal, deadline: 15. November 2023 17:00 Brussels time

Project results are expected to contribute to the following expected outcomes.
- Environment: the proposed solutions are expected to contribute to the achievement of the objectives of a 55 % reduction in greenhouse gas emissions by 2030 and net-zero greenhouse gas emissions by 2050, from a gate-to-gate perspective, by introducing new concepts enabling proper modelling of non-CO2 emissions and their impact on optimum green trajectories, taking into account the expected interoperability with new entrants (i.e. U-space flights). The objective is not only limited to foster greenhouse gases reduction but also to reduce noise and air pollution;
- Capacity: the proposed solutions are expected to rely on high automation to reduce controller workload to improve capacity, which will then allow optimal and environmentally-friendly flight trajectories;
- Cost-efficiency: saving fuel for airspace users will reduce CO2 emissions and related costs for emission allowances.
The European Green Deal has set the objective of net-zero greenhouse gas emissions by 2050, in line with the EU's commitment to global climate action under the Paris Agreement. To achieve this objective it is required to accelerate the shift to smarter and more sustainable mobility. The challenge is to achieve zero inefficiencies due to ATM by 2040: this means not only eliminating inefficiencies in the current system but also in the design and execution of the future ATM and U-space architecture. Proposals shall define and develop innovative solutions that could cover a wide variety of aspects e.g., operational measures that could be put in place to improve the fuel efficiency of flights, speeding up the modernisation of the air infrastructure to offer more capability and capacity and therefore offering more efficient trajectories, adapting the charging scheme to incentivise environmentally friendly operations, etc. The scope covers as well innovative ideas to accelerate decarbonisation of ATM and reduce the CO2 and non-CO2 emissions, through the integration of energy, transport and digitalisation platforms that are at the base of the green transition.
The SESAR 3 JU has identified the following innovative research elements that could be used to meet the challenge described above and achieve the expected outcomes. The list is not intended to be prescriptive; proposals for work on areas other than those listed below are welcome, provided they include adequate background and justification to ensure clear traceability with the R&I needs set out in the SRIA for the aviation Green Deal flagship.

- Atmospheric physics for aviation (non-CO2) emissions, noise and air quality pollutants. Further understanding of non-CO2 effects (climate metrics) and associated uncertainties is needed. This element covers research to increase the body of knowledge on the physics of the atmosphere, to better understand the impact on global warming of non-CO2 emissions (NOx, SOx, H2O, particulate matter, etc.), including contrails and aviation-induced cloudiness. The non- CO2 climate impact of aviation exhibits large uncertainties. Among others, they include the uncertainty in the meteorological forecast, the uncertainty associated to the calculation of climate effects and impact, the selection of the emission model, or the model parameterisations required for development of efficient MET services. Research should aim in particular to reduce the uncertainty associated with the radiative forcing effects of aviation emissions identified in the 2020 European Commission report on the non-CO2 impacts of aviation Investigate the relationship between atmospheric conditions at time of emission and subsequent non- CO2 climate effects. Close coordination with EASA is expected, to ensure complementarity and consistency with EASA activities. Research may include:
- The definition of an adequate physical climate metric which is able to assess (quantify) climate effects of future emissions;
- The comparison in terms of quality of current meteorological forecasts, as well as of individual approaches presented so far by previous research initiatives e.g., FlyATM4E in order to provide a quantitative measure of the climate effects of aviation emissions, comprising contrail (cirrus) effects, NOx-induced effects, direct effects of water vapour emissions and aerosol induced effects;
- The evaluation of radiative transfer modelling, which determines climate effects of aviation emissions;
- The assessment of models of contrail life cycle and comprehensive chemistry-climate modelling involving representation of reactive species and aerosols, which influence radiative transfer in the atmosphere;
- Improve and systematically evaluate the quality of the weather forecast to represent those key meteorological fields, which are relevant for climate effects of aircraft emissions (e.g., upper tropospheric humidity, ice water content or representation of ISSR) as well as background concentration of reactive species;
- The quantification of impacts on non-CO2 effects from different blending ratios of different types of sustainable aviation fuel (SAF) (e.g., HEFA, FT-SPK, etc.);
- Explore possible options to evaluate and validate contrail formation and atmospheric conditions, by e.g., satellite products. This will allow gaining confidence in radiative effects induced, but also identify success of alternative routing strategies, which aim e.g., to avoid warming contrails as could be explored during live trials.
Research shall take into consideration the output of SESAR projects FlyATM4E, SINOPTICA and ALARM, and other non-SESAR projects, which outcomes are fully relevant on this research element e.g., ACACIA (research on transport patterns of nitrogen oxides NOx) and ClimOP. In addition, research shall ensure coordination with project CICONIA funded under call HORIZON-SESAR-2022-DES-ER1.
Research also aims at increasing the body of knowledge on the impact of ATM on areas such as noise and air quality pollutants (nitrogen oxides (NOX), particulate matter (PM), volatile organic compounds (VOCs), sulphur dioxide (SO2), carbon monoxide (CO) and unburnt hydrocarbons (HC)). Research aims at better understanding the ATM environmental impacts beyond greenhouse emissions (CO2 and non-CO2 aviation emissions). In particular considering that in the near future there will be new types of aircraft propulsions, new aircraft configurations and new propulsion fuels (e.g., hydrogen), whose impact on noise and air quality need to be researched (R&I need: non-CO2 impacts of aviation).
- Noise and air quality pollutants. Research aims at increasing the body of knowledge on the impact of ATM on areas such as noise and air quality pollutants (nitrogen oxides (NOX), particulate matter (PM), volatile organic compounds (VOCs), sulphur dioxide (SO2), carbon monoxide (CO) and unburnt hydrocarbons (HC)). Research aims at better understanding the ATM environmental impacts beyond greenhouse emissions (CO2 and non-CO2 aviation emissions). In particular considering that in the near future there will be new types of aircraft propulsions, new aircraft configurations and new propulsion fuels (e.g., hydrogen), whose impact on noise and air quality need to be researched (R&I need: non-CO2 impacts of aviation).
- Comparative study on potential metrics to be adopted in the ATM domain to aggregate non-CO2 and CO2 impacts on climate change. The study should cover, for example, global warming potentials (GWP) 100, average temperature response (ATR) 20, ATR 50, ATR 100, radiative forcing index (RFI) and alternative metrics, taking as a starting point the options outlined in the 2020 European Commission report on the non-CO2 impacts of aviation. Proposals should include an initial task to review the state of the art of environmental metrics and engage with all relevant stakeholders in order to provide insights into the pros and cons of each potential metric, with the aim of formulating informed recommendations for the way forward, including the identification of additional research needs if applicable. This research should consider how metrics can be used in different contexts, for example for operational decision-making in the pre-tactical and tactical phases of ATFM, operational decision-making in real time by ATC, post-operations analysis and environmental performance monitoring at network level. Close coordination with EASA is expected, to ensure complementarity and consistency with EASA activities. In addition, the proposed climate metrics should be able to assess (quantify) climate effects of future emissions (and not only of historic emissions e.g., as done in the radiative forcing concept) by e.g., evaluating atmospheric response (temperature

change) after a dedicated time horizon (e.g., 20, 50, and 100 years). Research shall take into account the output of project FlyATM4E (R&I need: non-CO2 impacts of aviation).

- Atmospheric physics for aviation (extreme weather events). This element focuses on climate resilience and adaptation, as it aims at increasing the body of knowledge on the physics of the atmosphere, to make it possible to better predict extreme weather events that may impact aircraft operations, and in particular cause airport closures or significant reductions in airport capacity (with knock-on effects on the network). The research should in particular consider the challenges for accurate prediction that may result from changes to weather patterns arising from global warming in the short to medium-term. Research may also address the knowledge gaps in the understanding of the links between long-term climate change and risks to the aviation sector required to achieve a coherent strategy and short-term decision-making. These gaps have been reported in the "ICAO CAEP aviation and climate change factsheet" and the "European aviation environmental report 2022". It is important to address these long-term links to allow ATM become more resilient, and assure that ATM short term induced decision will not jeopardise long-term ATM resilience and sustainability (R&I need: accelerating decarbonisation through operational and business incentivisation).
- Environmental impact assessment methodology and new metrics. It is necessary to develop further the methodology used in SESAR 2020 not only to cover the research phase, but also the deployment and implementation phases. As part of this methodology, the use of big data analysis and machine learning should be extended to the development of new environmental metrics that will be used to monitor environmental impacts and incentivise actors to promote compliance with environmental targets and regulations. These metrics will also be integrated into the environmental dashboard, and into the environment impact assessments toolset. Research shall consider as well the European Aviation Environmental Report. Research shall take into consideration the SESAR environmental performance assessment methodology (R&I need: accelerating decarbonisation through operational and business incentivisation).
- Development of the environmental performance-monitoring toolkit to include new entrants. There is a need to develop further the set of European environmental impact assessment tools, in order to analyse, inter alia, the integration of new entrants into the future ATM system and the overall environmental benefits and impacts they will have. This element covers the expansion of the ATM aircraft performance models (on emissions and noise) to include new entrants and new aircraft types/fuels. It involves research into the impact on the environment of new fuels and/or new aircraft types (hydrogen, electric, sustainable aviation fuels, new hyper-/supersonic aircraft (with consideration of sonic booms)), including the development of new models to assess the impact that ATM operational changes may have when these aircraft are introduced into the traffic mix. It should also include the development of methodologies to assess the environmental and societal impact of U-space-enabled drone operations, including in particular the identification of all potential impacts (e.g., visual pollution, noise over populated areas, intrusion into privacy, risks to wildlife (migrating birds, nesting areas, etc.)). Due to the complexity and diversity of environmental impacts, particular attention needs to be paid to the analysis of trade-offs, between environmental impacts, but also possibly with other performance areas (R&I need: impact of new entrants).
- Impact of zero-emission aircraft on ATM. The advances in the development of electric and hydrogen-powered propulsive systems support the future vision of air transport without any direct carbon emissions, thereby contributing to the Green Deal goal. It is anticipated that hydrogen and electric-powered flights will carry lower payload and may have requirements for longer turn-around times. Their performance will also be different from that of conventionally powered aircraft. Their introduction will fundamentally change the traffic demand that will have to be managed by the ATM system. There is a need to define scenarios of future fleet composition, model the resulting air traffic demand, evaluate the reduction of the environmental footprint enabled in each of the scenarios (considering direct and indirect emissions), analyse the implications of these changes on the airspace structure and the ATM system, and outline potential solutions for their adaptation. It is also relevant to explore the implications for airline operations that may impact ATM processes e.g., longer turnaround/airline scheduling, new flight planning/flight plan acceptance processes. New network management processes and changes to airport capacity also need to be considered. The research shall be tightly focused on the ATM dimension; impact of ATM on other relevant domains, or impact of ATM constraints on other domains may be addressed, but this should not be the core objective of the project. Integration of the new aircraft models into ATM models is in scope, but development of aircraft/propulsive systems and/or aircraft/propulsive system models is out of scope (the research should use aircraft/propulsive system models developed prior to the start of the project). The goal of this research is to inform policymakers, industry leaders, and researchers about the potential R&D needs to allow the safe integration of zero emission aircraft in the ATM system (R&I need: impact of new entrants).
- New forms of air traffic management. Research aims at exploring new forms of air traffic management to support the integration of highly automated vehicles and autonomous aircraft e.g., high altitude platform systems (HAPS), aircraft with new propulsion systems (electric/hydrogen), unmanned aircraft systems, recreational flying vehicles and other new entrant operators while minimising their environmental impact, in terms of greenhouse gases emissions, noise and air pollutants. Research shall take into consideration the variety of vehicle performances and their impact on traffic management (R&I

need: impact of new entrants).
Further Information:
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-sesar-2023-des-er2-wa1-7;callCode=null;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1,0;statusCodes=31094502;programmePeriod=202%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

HORIZON EUROPE ATM Excellent science and outreach for capacity on demand and dynamic airspace, deadline: 15. November 2023 17:00 Brussels time

Project results are expected to contribute to the following expected outcomes:
- Capacity: the proposed solutions are expected to provide a more stable and predictable level of capacity in all-weather operations. In addition, by providing capacity dynamically where and when it is needed and re-configuring the airspace to match the traffic flows, overall system resilience will be significantly increased;
- Operational efficiency: the proposed solutions are expected to improve operational efficiency in terms of human performance and the resilience of the staff involved (e.g., ATCOs) to new working methods generated because of new/different task allocation strategies. Trajectory management and dynamic airspace configurations will provide further improvements in vertical flight efficiency;
- Cost-efficiency: dynamic airspace configurations, capacity-on-demand, ATCO training programmes will provide scalability. ATCO productivity is expected to increase significantly;
- Safety: the proposed solutions are expected to maintain at least the same level of safety as the current ATM system.
The future ATM system will require increased agility and flexibility in providing capacity where and when it will be needed across the network, particularly for maximising the use and performance of limited resources, i.e. airspace and ATCOs. The challenge is to propose innovative potential solutions that will supply the required capacity on demand in a dynamic, agile and resilient manner, improving cost and flight efficiency while maintaining (or improving) safety. These solutions shall enable the dynamic reconfiguration of resources and the provision of new capacity-on-demand services to maintain safe, resilient, smooth and efficient air transport operations while allowing for the optimisation of trajectories even at busy periods. The proposed innovative solutions shall aim at responding to emerging business needs that can only be addressed through standardised data sharing between air traffic service providers using a highly interconnected, digital and resilient network.
The SESAR 3 JU has identified the following innovative research elements that could be used to meet the challenge described above and achieve the expected outcomes. The list is not intended to be prescriptive; proposals for work on areas other than those listed below are welcome, provided they include adequate background and justification to ensure clear traceability with the R&I needs set out in the SRIA for the capacity on demand and dynamic airspace flagship:
- Increasing the use of middle airspace. This element addresses the potential business case for increasing the use of middle airspace (approximately between 15 000 ft. and 25 000 ft.) by different type of aircraft (jet engine aircraft, aircraft with new propulsion systems, etc.). Research shall address the environmental impact of providing ATFM slots for flights in middle airspace e.g., fuel consumption, emissions, etc. and the trade-offs with other KPAs such as increased capacity (and reduced delays) (R&I need: on-demand ATSs).
- Network performance cockpit for "network minded" decision making. This research element aims at establishing a network performance cockpit for "network minded" decision making including support to enhanced connectivity both for identifying unattended business opportunities and for managing disruptive crises. How to optimize the current computer assisted slot allocation (CASA) algorithm to consider flow interactions and to implement regulations based on traffic flows with the consequent reduction of delay, and therefore, overall network performance improvement is under scope. In addition, these evolutions may include the consideration of actual aircraft performance, flight profile preferences by airlines and direct routings given by controllers in the en-route phase of flight. This new approach to set ATFCM regulations will improve the ATFCM network decision-making and will avoid unnecessary and ineffective regulations by considering optimal solutions at regional level. In support of the network performance management, research shall propose flow-monitoring dashboards (R&I need: on-demand ATS).
- Global weather and environment monitoring ATM network. The key objective is to design and start developing a single monitoring and reporting system for a green ATM, covering all aviation impacts: greenhouse emissions, noise and air pollutants and relevant safety and security threats. This research element addresses the secure integration of multiple data to monitor, collect, integrate and present weather and environment information to the different stakeholders on the ATM

system including: pollution, contrails, noise, weather, vehicle status, congestion and other safety and security threats, such as volcanic eruptions, earthquakes, tsunamis, extreme weather events, conflicts, etc. The primary source of the data may include a variety of sensors: ground, air, stratosphere, space-based, etc.: research covers the challenge to integrate / fuse all this information that may have different granularity, rate, characteristics, etc. Research includes the definition of potential solutions to predict safety and security threats in negatively affecting ATM safety, manage risks as they emerge and recover from disruption caused by, for example, factors such as disease, climate change, volcanic eruptions and solar storms that affect electronic equipment. While focused on the ATM dimension, proposals shall consider potential constraints imposed by other domains as well as collateral impacts of ATM research on other domains (R&I: ATM continuity of service despite disruption).
Further Information:
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-sesar-2023-des-er2-wa1-3;callCode=null;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1,0;statusCodes=31094502;programmePeriod=202%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

HORIZON EUROPE ATM Excellent science and outreach for for U-space and urban air mobility, deadline: 15. November 2023 17:00 Brussels time

Project results are expected to contribute to the following expected outcomes.
- Environment: the proposed solutions should have no negative impact on the environment (i.e. in terms of emissions, noise and/or local air quality) or on the potential improvement of the aviation environmental footprint;
- Capacity: U-space shall not negatively affect the capacity of the ATM system and will enable additional system capacity by enabling large volumes of unmanned aircraft to access the airspace;
- Passenger experience: U-space will open the way to new services (delivery, inspection, security, etc.) that will increase the wellbeing of European citizens. Particular attention must, however, be paid to safeguarding privacy and ensuring social acceptance;
- Safety: the proposed solutions are expected to maintain at least the same level of safety as the current ATM system;
- Security: the proposed solutions are expected to maintain at least the same level of security as the current ATM system;
- Cost-efficiency: the proposed solutions are expected to reduce the operation costs of unmanned aircraft.
The Digital European Sky vision includes the seamless integration of U-space with the ATM system to ensure safe and fair access to airspace for all airspace users, including innovative air mobility (IAM[1]) flights departing from airports. The challenge is to define and develop breakthrough solutions that will enable U-space to provide the means to manage safely and efficiently high-density traffic at low altitudes involving heterogeneous vehicles (small unmanned aerial vehicles, electric vertical take-off and landing – eVTOLs - and conventional manned aircraft), including operations over populated areas and within controlled airspace. Research aims at developing solutions that will support the seamless integration of U-space with the ATM system to ensure safe and fair access to airspace for all airspace users, including UAM flights departing from airports.
The SESAR 3 JU has identified the following innovative research elements that could be used to meet the challenge described above and achieve the expected outcomes. The list is not intended to be prescriptive; proposals for work on areas other than those listed below are welcome, provided they include adequate background and justification to ensure clear traceability with the R&I needs set out in the SRIA for the U-space and UAM flagship:
- U-Space as accelerator of evolution of ATM. This element explores whether U-space can be an accelerator of the ATM innovation life cycle, facilitating faster, lower-risk adoption of new technologies or approaches (automation, artificial intelligence (AI), internet of things (IoT), cloud, ML Ops, etc.). This could include, for example, the use of U-space communication solutions for air–ground communications on the airport surface (to free up the very high frequency (VHF) spectrum for use in the air), adaptation of U-space automation concepts to manned aviation (e.g., advanced automation). In terms of the evolution of ATM, the aim will be to exploit the potential use of U-space technologies and concepts for manned aviation, with a focus on exploring the potential applicability of advanced U-space services to uncontrolled airspace, in particular Class G airspace. Applications to higher airspace operations (HAOs) are also within the scope of this element (R&I need: transfer of U-space automation technology to ATM).
- Integrated CONOPS U-space / ATM (R&I need: enable UAM). The research shall focus on:
- The development of an integrated U-space / ATM CONOPS;
- The evolution of CORUS CONOPS on U-space towards version 5.0 (research shall take into consideration the output of

project CORUS-XUAM);
- Provide a full U-space / IAM roadmap from ER to deployment and elaboration of key pending R&D needs to be addressed in the different pillars of the R&I pipeline.
- Urban airspace evolution. The largest concentration of drones is expected over populated areas, but these will not be drone-only areas: manned flights will still need to operate like they do today (e.g., security forces, emergency services, etc.); many of the manned missions over urban areas require flexibility, loitering, etc. and are often of high priority. The future scenarios will combine manned aircraft and small drones in the same mission (e.g., events, emergency management, etc.). In addition, people-carrying eVTOLs, initially with an on-board or remote pilot and in the future autonomous, will also be introduced in the urban airspace. In the current environment, manned flights over urban areas are typically operated under VFR or special VFR rules; this set-up provides the flexibility required by their typical mission profiles, but if unchanged would be very limiting towards drone-manned aviation airspace sharing. The objective of the research is to investigate potential solutions to introduce drones in the urban environment while still allowing flexibility for manned aircraft and drones as required by the typical urban mission profiles. Solutions may include digital flight rules (to be developed) and/or the dynamic creation of corridors/reserved areas when required by the mission, with the definition of containment requirements. It is expected the research to address in particular the concept of 2D containment for VFR aircraft, considering the applicability of RNP-like navigation specifications for VFR aircraft or the development of specific navigation requirements for VFR aircraft, that potentially combine visual references with on-board instrument support. The research should aim at developing a scalable concept and deepen into its applicability at a small scale (a few drones and manned aircraft flying typical missions in the same area, representative of the initial demand). The research may cover related urban-specific technical issues such as, inter-alia, C2 performance, GNSS performance and the potential areas with a microclimate that are often found in heavily built-up areas. Proposals should provide evidence that the applicants are familiar with the existing literature (e.g., previous SESAR research in this area, in particular PJ.34 project AURA research on ATM/U-space integration, previous SESAR U-space demonstrations, etc.) and existing standards (e.g., PBN/RNP) and describe how their proposed work would address the outstanding research challenges (R&I need: enable UAM).
- Cooperative operations between drones. This research element explores operations where several drones need to operate cooperatively, such as drone swarming, formation flying, etc. that could involve the coordination of several flight plans as well as their dynamic evolution. One example is the in-flight battery replacement (including fast charging) for electrical drones. Electrical aircraft may be the alternative for the aviation in a future where a key objective is to reduce emissions and noise. Batteries for aeronautical propulsion must evolve to accomplish with low weight, spatial restrictions, safety, reliability and environmental protection requirements. However, the low specific energy of batteries compared to the energy density of kerosene means reduced time and distance flown before the electric batteries run out and need to be replaced. In-flight battery replacement has been proposed as a way to address this limitation. Research can model the flight missions with in-flight battery replacement and investigate the U-space concepts that might be needed to support these operations. The research covers the integration of these missions in the U-space ecosystem. Drone design and battery design are outside of scope; projects shall use drones/drone models developed prior to the start of the project; however, the development of U-space systems and the integration of new drone models/drone mission models into the U-space systems or simulators are in scope (R&I need: develop advanced U-space services).
- Improving risk modelling in U-space. Research activities shall develop more accurate air-risk and ground-risk models (e.g., more accurate estimation of the severity of an aircraft crashing on the ground due either to a direct impact or to a mid-air collision) to better understand the link between the TLS and the subsequent impact e.g., frequency of fatalities, economic impact, reputational impact, etc. The scope may include the link to potential models for insurance policies. Research should consider different scenarios and variables (e.g., variable demand, etc.) and take into account also vertiports and, particularly, vertiports with more than one FATO and frequent operations. Research shall apply SORA methodology (R&I need: U-space safety assurance).
- Integration of air vehicles and personal air vehicles. In the future, new unmanned aircraft systems and personal air vehicles will fly long range and at higher altitudes to feed airports. This research will investigate the necessary seamless integration of those personal air vehicles into a more automated ATM (R&I need: ATM/U-space integration).
- ATM/U-Space/UAM performance interdependency and trade-offs. U-Space services may have an impact in ATM performance results, presenting the need to explore potential trade-offs between different key performance areas / indicators. Research shall explore the interdependencies between the ATM and U-space/UAM performance framework, analyse interdependencies between these environments and potential trade-offs to facilitate the deployment of U-space/UAM new services (R&I need: ATM/U-space integration).
- Multi-domain scenario generation service for U-space. Research aims at developing a multi-domain what-if scenario generation service (air, land, surface, cybersecurity) capable of consuming and testing the services exposed from the flight plan management and drone fleet control platforms and being able to generate different load situations, emergencies or

simulation of different scenarios in real time, such as:
- The registration of fleets, drones, users and consumption of all services enabled for this purpose;
- The whole process of requesting flight plans with different cases in order to validate the platform in all the allowed use cases;
- Simulation and generation of different scenarios of thousands of drones in operation that consume in real time the position and the intersection services between drones and geofences for the drones control platform;
- Generation of what-if scenarios where drones perform anomalous behaviours e.g. navigate outside the authorized corridor in the flight plan, enter in forbidden geofence, generate UAS with risk of collision with other drones etc.;
- Creation of different emergency situations affecting drones with authorized flight plans, both before starting the flight and during the flight, so that the systems and communication services, and the warning and flight plans modification services are exposed to stress tests for the involved flees and scenarios, in order to stress the control systems and services in real time.
Further Information:
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-sesar-2023-des-er2-wa1-4;callCode=null;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1,0;statusCodes=31094502;programmePeriod=202%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

HORIZON EUROPE ATM application-oriented research for air–ground integration and autonomy, deadline: 15. November 2023 17:00 Brussels time

Project results are expected to contribute to the following expected outcomes.
- Capacity: the integration of new airspace users and air vehicles (unmanned aircraft systems, HLO operations, etc.) shall not negatively impact capacity;
- Cost-efficiency: thanks to the new services supported by air–ground and air-air connectivity, cost-efficiency is expected to be improved;
- Operational efficiency: the proposed solutions are expected to contribute to the improvement of the operational efficiency thanks to advanced communication means and increased automation (e.g., machine-to-machine communication). In addition, further automation will improve trajectory management, in particular vertical flight efficiency;
- Environment: the proposed solutions shall aim at optimising fuel-burn and the CO2 emissions per flight;
- Safety: increased air-ground autonomy will enable the human actors to be discharged from routine tasks and to focus on strategic tasks, including safety oversight of the operations;
- Security: The proposed solutions are expected to identify and mitigate the potential security risks deriving from the increased connectivity between stakeholders.
The challenge is to design and develop concrete innovative applications (that are already TRL1, achieved within SESAR programme or outside) that aim at increasing the level of air-ground integration, supported by high automation levels and that will enable the transition to trajectory based operations (TBO). The proposed solutions will aim at realising the Digital European Sky vision that foresees the full integration of an increasing number of new forms of mobility and air vehicles, which have a high degree of autonomy and use digital means of communication and navigation. The proposed solutions shall support the evolution towards the future ATM system, exploiting existing technologies as much as possible, and developing new ones in order to increase global ATM performance in terms of capacity, operational efficiency and accommodation of new and/or more autonomous air vehicles, i.e. supporting the evolving demand in terms of diversity, complexity from very low-level airspace to high-level operations. The challenge is to ensure the full integration of certified drones into all classes of airspace, full U-space services and single pilot operations thanks to increased automation and delegation of separation responsibility to systems.
The SESAR 3 JU has identified the following innovative research elements that could be used to achieve the expected outcomes. The list is not intended to be prescriptive; proposals for work on areas other than those listed below are welcome, provided they have already successfully achieved TRL1 (within SESAR programme or outside) and include adequate background and justification to ensure clear traceability with the R&I needs set out in the SRIA for the air–ground integration and autonomy flagship.
- Frequency switching management. This research will investigate, from a gate-to-gate perspective, the automation of air–ground coordination to ensure the use of automatic voice and datalink frequency selection for communications by the pilot and ATC. The scope of automatic frequency selection covers an assessment of multilink schemes, such as policy-based

routing (including criteria for selection of terrestrial or satellite bearer and best frequency based on prevailing airspace and service requirements). This is expected also to support enhanced crew resource management, single-pilot and cross-border operations (R&I need: enabling greater ground and airborne integration and wider performance).

- Advanced air–ground integration for general aviation. This activity will ensure that access to all airspace classes remains open to general aviation in an equitable manner and at an affordable cost as well as the leverage on-board technologies (potentially not certified) in order to guarantee better and safer flights for all general aviation users, including sports aviation. It may also include the development of a concept enabling VFR aircraft to share their intended plans in real time with ATC and/or U-space service providers through a low-cost non-certified EPP-like concept based on whatever application the general aviation pilot is using to plan his/her flight in real time. This solution would complement surveillance information and would result in a continually updated flight plan, which could be used to automatically change the destination airport, to ensure that general aviation pilots receive updated information if their plan changes and to support search and rescue operations when no surveillance information is available. VFR pilots would retain at all times the same degree of flexibility in changing the plan as they have today. Research shall develop applications beyond the state of the art (e.g., existing apps for GA like Safesky) (R&I need: enabling greater ground and airborne integration and wider performance).
- Clear air turbulence data presentation to ATC. According to IATA, turbulence is the leading cause of injuries to airline passengers and crews globally. Flight crews routinely report clear air turbulence to controllers, who, workload permitting, relay turbulence reports with aircraft that will be overflying the same area. However, controllers often are not able to properly relay this information. Turbulence information is also relevant for controllers, e.g., because it can support proactive management of level change requests. Research can propose potential solutions for sharing turbulence reports to controllers addressing how the information will be presented to ATCOs and how they would use it. Proposals should focus on improvement of the clear air turbulence prediction processes (R&I need: enabling greater ground and airborne integration and wider performance).
- Evolution of controller/pilot communication. In today's environment, each en-route or TMA sector requires a dedicated VHF frequency for controllers and pilots to communicate over, which means the lack of availability of VHF spectrum in areas with a high density of air traffic, can make it impossible to increase ATC capacity by adding additional sectors. However, the share of controller-pilot communications over datalink vs. those conducted over voice is expected to increase rapidly over the coming years. As voice communications become less and less frequent, it will be impractical to require a single VHF frequency to be reserved for the exclusive use of the controller-pilot communications within a sector. Instead, the SESAR long-term concept is that voice will be transmitted via the same channel as datalink, i.e. move to digital voice. The new concept also allows for an evolution of the voice communications concept. For example, in digital voice, the transmissions for change of frequency and checking into a sector would not be necessary anymore. Instead, the handover from one controller to the next will be linked to the handover of the CPDLC communications and be completely transparent to the flight crew, i.e. whenever the pilot makes a voice transmission, the communication would be routed to the controller in charge of the flight. Digital voice will also make it possible to configure voice communications as broadcast or point to point depending on the environment. Where broadcast is not in use, an access indicator might be implemented to indicate to the flight crew the voice channel is busy (without transmitting the content of the ongoing communication), to avoid simultaneous transmissions over the same channel. There is a need to further investigate how the dynamic allocation of IP connections may reduce the need for VHF channels on the ground side and the need for the airborne side to switch frequencies several times during the flight. In SESAR, the technical feasibility and performance of the digital voice concept has been researched by solution PJ.33-W3-02 in SESAR considering LDACS as the underlying technology. The objective of this element is to further develop the operational concept and make a holistic analysis of the potential for the concept to be supported by alternative datalink technologies, e.g., Satcom, commercial links, satellite-based VHF, etc. (R&I need: enabling greater ground and airborne integration and wider performance).
- Air and ground synchronisation applications. AI-powered systems are expected to be integrated into ground and cockpit systems, enhancing communication for trajectory management and much more. The scope of this research includes the identification of innovative applications / AI-based solutions that could improve such synchronisation. Research aims at performing a risk assessment on loss of air-ground communications and determining continuity, integrity and performance requirements on air-ground communications for the proposed applications (R&I need: enabling greater ground and airborne integration and wider performance).
- Controller support systems for improved radio communication and inclusion of automation. Several radio communications require the controller to bear a significant workload, be it for a negotiation process with pilots or repetition of routine messages, the coordination with datalink communication and the induced task of simultaneous input into a dedicated information system. The multiple remote tower use case is for example in need of a solution to address the specific problem of multiple frequencies management in a safe and easy way. Assistance, either automated or reducing time and workload for input or radio frequency management at large would therefore be beneficial. Research aims at developing a proof of concept

for an enhanced system to assist radio management. This would relieve the controller from the active execution of input, ease message, identify potential errors and eventually enable automatic treatment of requests or communication (R&I need: enabling greater ground and airborne integration and wider performance).
- Integration of super-high-altitude operating aerial vehicle. These vehicles, which can be viewed as drones, will also need to be integrated, with entry and exit procedures through segregated or non- segregated airspace. As a result, new airspace users include highly autonomous vehicles. Safe separation management of this traffic and efficient integration into the traditional ATM operation is both a technical and operational challenge. By 2035, daily high-level operations (HLO) are expected and their transition from a segregated and/or non-segregated airspace have to be well established with appropriate regulations (with EASA involvement), clear technological capabilities and suitable performances for such air platforms. The research could also benefit from research on the physics of the atmosphere for such HLO, based on the existing state of the art. Research should consider the relevant human factor issues (R&I need: super-high-altitude operating aerial vehicles).
- Single pilot operations (SPO). Research aims at addressing the following aspects:
- Safety systems and crew health and HP monitoring systems for supporting SPO. In order to operate safely with a reduced crew, safety systems and crew health monitoring systems will be a key enabler to trigger the back-up modes in case of incapacitation, stress or exhaustion of crew members. This is of paramount importance in order to be able to recognise possible dangerous situations, forgotten steps of procedures or checklists, inappropriate or non-executed actions by the pilot.
- Incapacitation detection in SPO. Development of a highly reliable automated incapacitation detection system. Research addresses the challenges derived of a possible failure of the incapacitation detection system, false positives and how to address partial incapacitation or drift towards incapacitation. The transfer of authority can fall into a grey area between the air and ground pilots for a relevant period: crew resource management (CRM) procedures and guidelines for this new distributed crew should be developed and evaluated. The analysis of the transition period from nominal SPO case (on-board pilot in control) and incapacitation confirmation is as well under the scope.
- This research addresses also the expected role of FOC/WOC in the case of SPO abnormal situations: it requires their connection to ATC centres to support safe return to land even in a congested traffic environment. Research should consider the relevant human factor issues. Research shall consider the output of project SAFELAND (R&I need: Single-pilot operations (SPO)).
- Machine-to-machine communication. In addition to human-to-human communication, such as controller–pilot datalink communications (CPDLC), datalink will also support machine-to-machine communication. This covers for example a machine-to-machine negotiation-based conflict resolution. The development of mechanisms and tools for creating negotiation-based resolutions at conflict resolution and collision avoidance levels (e.g., what-if extended projected profile (EPP)-based tools, or ATC offering a choice to the FMS of two potential cruising levels) will be addressed. This is a flight deck to ATC solution (i.e. with airline operations centre involvement). Technical and operational requirements, as well as use cases and initial validation, will be addressed in this research (R&I need: integrated 4D trajectory automation in support of TBOs).
- FMS-twin for enhanced A/G connectivity. The SESAR-developed availability of the flight management system (FMS) trajectory on the ATM ground systems via the EPP downlink has represented a breakthrough in ATM. This capability provides visibility to ATM systems of what is loaded in the FMS, thereby enabling a multitude of advanced applications on the ground. It is envisaged that additional applications can be developed if the ground ATM system also have availability of what-if FMS trajectories, which make it possible for ATM to anticipate how the trajectory would change under certain hypotheses. The hypothetical trajectory revision to be considered could be proposed by the ATM system, be proposed by the flight crew (potentially associated to a request for a clearance) or be automatically generated (to inform the ATM system of the way the FMS would implement different potential clearances that are relevant to the current context). However, development of additional applications for the FMS is slow and complex due to the safety criticality associated to the FMS flight-path control capabilities; for the same reason, once an FMS feature is developed, there is little flexibility for its evolution. A potential way through might be the development of an FMS-twin software, to be installed in an on-board embedded computer without flight-path control capabilities, in an Electronic Flight Bag without flight-path control capabilities, or in the FOC (on the ground). If located on board the aircraft, the FMS-twin should be able to exchange information with both ATM and the FOC through non-certified A/G links. The FMS-twin is expected to be a decision support tool enabling the A/G exchanges during the execution phase for both A/G FF-ICE/R2 negotiations for the update of the trajectory during the execution phase beyond the horizon of interest of ATC and A/G exchanges in support of the ATC TBO concepts. The research would explore the challenges of the FMS-twin concept, define a first set of candidate applications and perform an initial evaluation of potential benefits. Research shall take into consideration the potential applications to meet the needs of solution PJ.01-W2-08A2 and/or solution PJ.07-W2-38 (R&I need: Integrated 4D trajectory automation in support of trajectory-based operations (TBO)).
- Advanced aircraft on-board systems. Research aims at developing potential ATM applications such as: tools for monitoring flight crew workload, support to 4D navigation (applied to all types of flight from low altitude to suborbital), increased

situational awareness, self-separation of traffic, traffic prediction, collision alerting and avoidance, all weather approach and landing, and automatic flight control. Research also addresses pilot support systems for automatic route negotiation with ATCOs. A route change request requires the pilot to sustain a negotiation process with ATCOs over a shared radio channel while performing its duty. Industry is developing tools for supporting the pilot during this process that, however, are very limited in terms of automation and, as a result, require still active execution of the task by the pilot. Research aims at developing a proof of concept of an automatic system for reliving the pilot from the active negotiation by delegating that to an automated system (R&I need: integrated 4D trajectory automation in support of TBOs).
Further Information:
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-sesar-2023-des-er2-wa2-2;callCode=null;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1,0;statusCodes=31094502;programmePeriod=202%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

HORIZON EUROPE ATM application-oriented research for the aviation Green Deal, deadline: 15. November 2023 17:00 Brussels time

Project results are expected to contribute to the following expected outcomes.
- Environment: the proposed solutions are expected to contribute to the achievement of the objectives of a 55 % reduction in greenhouse gas emissions by 2030 and net-zero greenhouse gas emissions by 2050, by maturing concepts enabling optimal and optimum green trajectories, thus reducing CO2 and non CO2 emissions, as well as contributing to new and up-to-date models to tackle emissions and noise and improve local air quality.
- Capacity: the proposed solutions are expected to improve airspace capacity through the identification of optimal and environmentally friendly flight trajectories, taking also into consideration the new entrants (e.g., U-space flights).
- Cost-efficiency: saving fuel for airspace users will reduce CO2 emissions and related costs for emission allowances.
The challenge is to design and develop concrete innovative applications (that are already TRL1, achieved within SESAR programme or outside) that aim at achieving the objective of net-zero greenhouse gas emissions by 2050 set by the European Green Deal, in line with the EU's commitment to global climate action under the Paris Agreement. The proposed solutions shall demonstrate their potential to accelerate the shift to smarter and more sustainable mobility, to improve the fuel efficiency and reduce the emissions (both CO2 and non-CO2) generated by ATM operations and increase the understanding of the climate impacts of aviation to better anticipate them and take adaptation measures. The challenge includes the adaptation of the route charging scheme to take into consideration the green deal objectives and how to enable the definition of globally harmonised policies and regulations to support climate-friendly flight operations. The challenge includes as well the development of innovative ideas to accelerate decarbonisation of ATM through the integration of energy, transport and digitalisation platforms that are at the base of the green transition.
The SESAR 3 JU has identified the following innovative research elements that could be used to achieve the expected outcomes. The list is not intended to be prescriptive; proposals for work on areas other than those listed below are welcome, provided they have already successfully achieved TRL1 (within SESAR programme or outside) and include adequate background and justification to ensure clear traceability with the R&I needs set out in the SRIA for the aviation green deal flagship.
- Multi-scale multi-pollutant air quality systems. Development of solutions for the evaluation of the impact that the air traffic regulation policy options can have on the environment and climate. The proposed solutions should be able to follow the fate of aircraft emissions in the atmosphere on both the global/regional scale (e.g., transport of pollutants from the troposphere to the stratosphere, impact onto the radiative properties of the atmosphere, ozone production, etc.), and on the local scale (e.g., impact close to an airport area during landing and take-off phases). The main area of applicability of such a solution is to support the aviation community in estimating the extent of the environmental impacts that current and future air traffic movements might have. Research shall address integration and optimization aspects to reduce the overall computational time and human errors (R&I need: optimum green trajectories). Research shall take into account the output of project CREATE.
- Greener long-haul flights. Long-haul flights contribute the most to aviation CO2 emissions and other environmental impacts. Europe has a big contribution to this market sector and therefore it is essential to explore innovative coordination and interoperability actions with ATM systems of destination/origin regions of European long-haul flights in order to reduce the overall environmental impact of these operations. Research aims at developing applications that will contribute to the green improvement of long haul flight operations e.g., increasing the level of ATM automation, air-ground collaboration

(R&I need: optimum green trajectories).
- Validation of novel metrics in support of environmental impact assessment in ATM. The collaborative management of environmental impacts and the implementation of strategies to reduce them require the development of indicators/metrics that will enable, on one hand, all ATM decision-makers to make informed decisions at different levels and, on the other hand, to communicate on ATM community efforts towards environmental sustainability. Research aims at developing and validating new environmental metrics for use in R&I and/or operations. The areas for development include use of EPP data for environmental performance assessment, development of meaningful operational proxies that can support ATM decision making in ATFM or ATC operations, development of methodologies for providing an accurate estimation of CO2 and non-CO2 emissions and noise with minimal input data (e.g., based only on surveillance data combined with flight plan data), etc. The research can also investigate the adaptation to ATM of software and methodologies currently in use by airlines to optimise their environmental performance (R&I need: accelerating decarbonisation through operational and business incentivisation).
- Explore the concept of "green flag" flights. Making operations greener needs a real boost based on realisable operational frameworks and incentives for the ATM actors. These incentives encompass all phases of flight and start from strategic and pre-tactical phases, where ATM decision-makers have to make informed decisions towards higher environmental sustainability. In ATM process terms, this means an environmentally responsible ATFCM, an E-ATFCM. An enabler of this E-ATFCM framework is to explore new environmental indicators oriented to facilitate decisions to ATM actors. The concept of "green flag" seeks the establishment of a methodology for environmental scoring of flight plans, analysing all aspects derived from the plans that may have an impact on environment. This includes all type of emissions, contrails and noise. The concept may also include the consideration of whether there is availability of alternative means of transport for the same route, e.g., train, so that requirements for a flight to be "green flagged" are higher where there are viable alternatives. The low impact "green flagged" flight plans may benefit from having priority in slot allocation, lower route charges and other advantages linked to pre-tactical and tactical operational decisions. The concept of "green flight" needs to be grounded in a careful review of environmental impact aspects and the validation of the proposed scoring against reference measurements of impact. The research must also address the impact of the concept in the SES performance scheme, including the consideration of trade-offs with other key performance areas (R&I: Accelerating decarbonisation through operational and business incentivisation).
- Automated stepless aircraft high-lift device management. The research activities shall aim at supporting the development of a concept for the stepless management of aircraft high-lift devices with automated support. The objective is to support pilots in managing the energy of the aircraft during the last (e.g., 10,000 ft.) part of the descent phase, in order to reduce fuel consumption and noise perception on the ground. The improved high-lift device management shall improve the adaptability of the flight to the prevailing approach conditions in terms of current aircraft mass and weather conditions. The ability of the aircraft to apply speed changes as required by ATC or potentially by an on-board airborne separation assistance system (ASAS) such as interval management will also be improved, and the environmental impact of such speed changes will be reduced. The research shall take into account both classic 3-degree approach paths and increased glide-slope paths. Research shall take into consideration the results of project DYNCAT (R&I need: environmentally optimised climb and descent operations (OCO and ODO)).
- Green applications to reduce ATM impact on non-CO2 emissions, noise and air quality. Research aims at developing innovative applications that could contribute to reduce the impact of ATM on non-CO2 emissions, noise and air quality pollutants. The air quality pollutants (nitrogen oxides (NOX), particulate matter (PM), volatile organic compounds (VOCs), sulphur dioxide (SO2), carbon monoxide (CO) and unburnt hydrocarbons (HC)) not only concern the airport local area: their potential impact may affect a substantial area around the airport and other ATM stakeholders could collaboratively work with the airport to design, implement and operate solutions to minimise these aviation impacts. For non-CO2 emissions, these green applications could consist of different ATC support tools (automated advice to adapt pre-tactical and tactical flight planning to reduce non-CO2 emissions, monitoring tools on environmental impact, improved capabilities to ensure that traffic minimize non-CO2 emissions in different phases of flight, etc.). The proposed solutions may use AI for optimising trajectories, creating 'green' routes and increasing prediction accuracy. Research could also consider applications for greener network operations e.g., DCB with a lower monitor value per sector to ensure not only safety but also to enable optimal environmental efficiency to be facilitated for each flight (R&I need: non-CO2 impacts of aviation).
Further Information:
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-sesar-2023-des-er2-wa2-3;callCode=null;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1,0;statusCodes=31094502;programmePeriod=202%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

HORIZON EUROPE ATM application-oriented research for Artificial Intelligence (AI) for aviation, deadline: 15. November 2023 17:00 Brussels time

Project results are expected to contribute to the following expected outcomes.
- Environment: the proposed solutions are expected to demonstrate the positive impact of AI-based solutions on operational mitigation of aviation's environmental impact.
- Capacity: the proposed solutions are expected to contribute to capacity by addressing AI-based human operator support tools to, for example, ensure the integration of new entrant aircraft types.
- Operational efficiency: the proposed solutions are expected to improve the operational efficiency by enabling better traffic predictions and forecasts, thus contributing to punctuality.
- Safety: the proposed solutions are expected to maintain at least the same level of safety as the current ATM system.
- Security: the proposed solutions are expected to maintain at least the same level of security as the current ATM system.

The challenge is to design and develop concrete innovative AI applications (that are already TRL1, achieved within SESAR programme or outside) that aim at:
- Enabling better use of data, leading to more accurate predictions and more sophisticated tools (e.g. new conflict detection, traffic advisory and resolution tools), increased productivity and enhancing the use of airspace and airport;
- Enriching aviation datasets with new types of datasets unlocking air/ground AI-based applications, fostering data-sharing and building up an inclusive AI aviation/ATM partnership to better support decision-makers, pilots, air traffic controllers and other stakeholders;
- Supporting (i.e. AI assistants) all ATM actors from planning to operations and across all airspace users;
- Enabling the virtualisation of infrastructure and air traffic service provision in all types of airspace, ranging from very low to high altitude operations. In doing so, AI will enable the system to become more modular and agile, while building resilience to disruption, traffic growth and greater airspace user diversity;
- Developing new ATM/U-space services.

The SESAR 3 JU has identified the following innovative research elements that could be used to achieve the expected outcomes. The list is not intended to be prescriptive; proposals for work on areas other than those listed below are welcome, provided they have already successfully achieved TRL1 (within SESAR programme or outside) and include adequate background and justification to ensure clear traceability with the R&I needs set out in the SRIA for the AI for aviation flagship.
- Innovative methodologies for quantifying the impact on safety and resilient performance of higher automation in ATM. This research aims at developing new methodologies for quantifying the impact on safety and resilient performance of higher automation in the ATM system applying data-driven techniques. These methodologies shall provide additional tools for the ATM stakeholders for evaluating and quantifying the impact of higher automation (e.g. AI/ML-based SESAR solutions) and could be potentially used for in-depth verification of safety criteria associated to a given SESAR solution in early R&I stages, but also to evaluate the state of the current system. Research shall built on the work performed by project FARO on en-route environment and automation levels 2/3, but it shall extend to other operating environments and to higher automation levels (4/5) (R&I need: trustworthy AI powered ATM environment).
- Safety filter for AI solution. Study safety filter concept for data prediction responsible for deciding on the usability of the ML model predicted data. Safety filter works as a safeguard, without human intervention, and qualifies the predicted sensor-data, as valid or invalid, by applying captured expertise rules. Research may address the application of dynamic risk assessment (DRA) and business impact assessment (BIA) techniques to distribute and enrich the exchange of information with federated learning architectures (R&I need: cyber-resilience). Research shall take into account the output of project SINAPSE.
- Artificial situational awareness: This research aims at developing artificial situational awareness solutions based on high-integrity information that are able to describe the traffic situation on a sector (en-route / TMA) or airport and, integrated with machine-learning (ML), enable the assessment of probabilistic events (e.g., trajectory prediction or conflict detection). By combining reasoning engine with machine learning, the proposed solutions shall be able to assess complex interactions between objects, draw conclusions, explain the reasoning behind those conclusions, and predict future system states. The objective is to develop AI-based systems that can assist ATCOs with monitoring tasks and contribute to the team situation awareness (SA): a situationally aware system would share the ATCOs' SA since it would have access to the same data as an ATCO. Research may:
- Assess how ML module predictions could use the optimization of their anticipation spans as they differ from ATCOs;
- Analyse how automation and adaptation to novel system changes ATCOs' learning success;

- Investigate whether certain information could pertain to shift supervisors, Network Managers, ATSEP and FMPs;
- Explore the possibility of flexible machine/machine coordination between sectors or units;
- Develop an HMI that will allow the ATCOs to review information, inform ATCOs with the right timing, be able to recognise when certain information is necessary in order to avoid ATCOs attention dissipating on less important information and additional memory load, recognise when an ATCO SA is degraded and provide the necessary alerts at an appropriate time, etc.;
- Develop scenario simulators so that, through probabilistic models, future scenarios can be predicted;
- Validate benefits in terms of safety (e.g., by introducing an additional safety net performing tedious monitoring tasks with high reliability), interoperability between different systems (e.g., by enhancing data handling) and capacity (e.g., by automating some of the monitoring tasks and enabling the introduction of other automation systems).

Research shall take into account the output of project AISA (R&I need: human–AI collaboration: digital assistants).

- Explainable Artificial Intelligence (XAI): since the decisions provided by AI/ML algorithms are often opaque, non-intuitive and not understandable by human operators, this represents a limitation to their applicability in ATM. The objective of this research is to improve transparency of automated systems in the ATM domain investigating methods based on Explainable Artificial Intelligence (XAI) in operational use cases e.g., predicting air traffic conflict resolution and delay propagation, validating the robustness and transparency of the system, etc. Research shall take into account the output of project ARTIMATION (R&I need: human–AI collaboration: digital assistants).
- AI-powered co-piloting. Research aims at investigating how AI can support pilots in complex and critical situations, when workload may be high and/or the time to react very limited. For these situations, research should focus, for example, on how to exploit high levels of automation to perform non-critical tasks for pilots and how the HMI should work during such operations, so the pilot can focus on essential tasks e.g., during taxi-out, descend, approach and landing. These applications may play a significant role in the transition to single pilot operations. In addition, AI-powered applications could support the pilot in situations where workload is low e.g., engaging pilot's attention and alert the pilot in case something unexpected happens. Research may address the development of algorithms based on reinforcement learning to help the pilot make decisions. The research results should demonstrate how the technology could support pilots in carrying out their tasks (e.g., demonstrate an increase in human capabilities during the execution of complex scenarios or a reduction in human workload in the execution of standard tasks), and assess the impact on the role of the human (R&I need: human–AI collaboration: digital assistants).
- AI for complex operations. This research is about developing AI-based human operator support tools to ensure the safe integration of new entrant aircraft types into an increasingly busy, heterogeneous and complex traffic mix (i.e. unmanned aircraft systems, supersonic aircraft, hybrid and fully electric aircraft). Algorithms for decision-making based on neural networks and classical optimization techniques could be addressed. Research may also consider the use of more advanced techniques such as reinforcement learning. Research should also cover the wider implications for other organisations and the impact on the network (R&I need: human–AI collaboration: digital assistants).
- User interface providing conflict resolution advisory transparency. This research focuses on visual elements that allow better understanding why a particular conflict resolution solution is recommended. The visual elements increase the transparency of advisories by providing the operator an insight into the deeper structure of the work domain as well as the inner workings of the AI agent. Research may address:
- The potential benefits of advisory transparency on advisory acceptance and system trust in relation to ecological approaches, AI interpretability models, and the connection between the two. Previous research on this field suggests that transparency alone may not be suitable as a measure for increasing operators' acceptance of advisories and trust in a system when that system performs different from the individual;
- Transparency mechanisms for supporting the ATCOs in understand how the system works (e.g., the data processing, filtering, constraints etc. in the model), how it derived a specific advisory (relationships between input data and output), and why the proposed advisory is considered best (e.g., best match to the individual, group, or optimized according to reinforcement learning (RL) model).

Research shall take into account the output of project MAHALO (R&I need: human–AI collaboration: digital assistants).

- Guidelines for the design of future AI systems. This research relates to the application of EASA guidelines to the development of AI enabled systems in ATM. Research shall also contribute to the update of EASA guidelines, including feedback on the effects of conformance, transparency and complexity and other challenges associated to the design of future AI systems (e.g., trade-offs between privacy and transparency). Research may consider human-in-the-loop simulations considering controller trust, acceptance, workload and human/machine performance but also new approaches for validation, verification, and testing of AI applications, specifically for safety critical applications e.g., developing an agile validation methodology data centric security capabilities for AI systems to promote reliability, increase trust, and maintain a competitive edge in today's rapidly evolving technological landscape. Close coordination with EASA is expected, to ensure complementarity and

consistency with EASA activities on the following areas:
- Trustworthiness: capability to keep input and output privacy with relatively high cyber-security protection. Support the definition of the requirements and needs for input/output verification (related to trustworthiness in the framework of Structured Transparency) in the ATM context in support of the EASA certification process descriptions. Validate and further develop requirements and potential solutions with a co-joint analysis together with EASA and other operational experts. Clarify some of the challenges faced by EASA, e.g., to define the system requirements, processes, and tools that are needed to perform the validation and certification process.
- Learning Assurance: including the consideration of realistic operational cases in realistic operational conditions and new ML techniques. Need to develop specific assurance methodologies to deal with learning processes;
- AI explainability, which goes beyond the ML techniques to extract information from the models, and includes the interactions with other systems and with the human operators (human factors). Research may help to clarify which requirements and processes the target AI/ML system should comply with in order to be certifiable for operations;
- AI Safety case: discussing with EASA and other safety experts about the needs and requirements of a concrete safety-case can help to clarify and support the development the EASA guidelines for certification.
The concept of safety critical levels need to be further developed for AI applications in ATM. Research covers the definition and analysis of safety-related use cases for different safety level assurances. These safety levels may imply either the adaptation of current SW verification methods or the development of new ones to guarantee the safe of operation of AI in ATM. Research shall take into account the output of projects MAHALO, AICHAIN (R&I need: human–AI collaboration: digital assistants).
- Support to the certification of novel ATM-related AI/ML-based airborne and ground systems that enable higher levels of automation. The objective of this research element is to address issues related to the certification of novel ATM-related airborne and ground systems that enable higher levels of automation. Research will address solutions, methods, etc. that could support and simplify the certification process of innovative systems based on machine learning or artificial intelligence techniques. It is expected that proposals define a holistic approach to address this challenge considering not only technical aspects of the certification but also legal and regulatory aspects including privacy. Research may explore and assess potential approaches that could be applied for the certification of automation and that allow to demonstrate the safety of automation during nominal and non-nominal conditions. Of particular interest is to show how safety can be ensured even if not all situations and variations of parameters can be anticipated during the design phase. Proposals may apply uncertainty quantification to address this issue. Research may also address the specific challenges of certification of automation that can adapt its behaviour to changes of the environment over time. Research activities shall take into account other initiatives developing safety of life systems that may have different approaches to certification and review their applicability to ATM (e.g., EGNOS) (R&I need: human–AI collaboration: digital assistants).
- Development of framework to achieve effective Human-AI Teaming. As AI is developed to provide more intelligent behaviours, it is argued that there will be an increased need for AI systems to function effectively as team members with humans. Just as human-only teams have many advantages over solo workers (e.g., to manage workload fluctuations, provision of a diverse set of skills and capabilities toward the completion of common goals), human-AI teams can have similar benefits over human-only teams. When considering an AI system as a part of a team, rather than simply a tool capable of limited actions, the need for a framework for improving the design of AI systems to enhance the overall success of human-AI teams becomes apparent. A failure to consider the needs of the many air traffic controllers, pilots, flight dispatchers, flow managers, etc. who are responsible for successful ATM operations will result in AI technologies that eventually fail to provide the necessary high levels of performance and may instead cause inefficiencies and safety problems. The design of AI systems for human-AI teams needs to incorporate several highly interrelated considerations. These include designing the AI system to support not only task work, but also teamwork. These interrelated considerations include considerations about human-AI team performance and processes, team trust, team biases, team situational awareness, team training needs, human-AI interaction methods, interface, transparency and explainability and Human-System Integration processes, measures, and testing (R&I need: human–AI collaboration: digital assistants).
- Extended reality (XR) in support of ATM operations. The term eXtended Reality (XR) is includes technologies that enhance or replace our view of the world: encompasses augmented reality (AR), virtual reality (VR), and mixed reality (MR). Virtual reality guides the observer out of his/her actual environment and into an artificial one. Research aims at using virtual reality to improve the efficiency of ATM operations. Augmented reality enhances certain objects through transparent lenses in the observers' field of vision. MR sits somewhere between AR and VR, as it merges the real and virtual worlds. An evident area of interest is training be it training of maintenance personnel or ATCO/pilot training. ATCO virtual training goes beyond the execution of remote simulations or validations as the ATCO would be physically located anywhere since the simulator HMI is created with extended reality equipment such as glasses and/or haptic devices. The research would investigate the operational and technical feasibility of training individually or collectively with other ATCOs as if they were executing remote

simulations or validations through connection with remote real simulators. Research includes how ATCO performance data could be collected in real time to monitor training progress. Artificial intelligence could support the monitoring and detect when the ATCO has acquired the corresponding competence, or the ATCO needs to emphasize training in particular aspects. Pseudo piloting as well as the representation of adjacent sectors could be also based on speech recognition making the pilots and adjacent controllers also virtual. However, the scope under research is not only limited to training, but could also address specific operational challenges in different environments e.g., airport, TMA, en-route supported by XR techniques:
- Collaborative environment with multiple users that have the ability to interact with the rest;
- Applications to access to all relevant information in real time for efficiently and safely managing operations;
- Digital assistants to support decision-making, etc.);
- Location of tactical elements of operation in the field of vision obtained through advanced communication protocols: pilots, ATCO, maintenance, etc.;
- Display of indications, messages, status of own elements, alerts or information of interest;
- Intelligent adaptation of the displayed content according to the operating environment;
- Gestural or voice interaction (synthesizer and voice command);
- Situational awareness of the state of operations through AI.
The proposal shall show a thorough knowledge of past SESAR activities on this field i.e. ER RETINA and solution PJ.05-W2-97.1 (R&I need: human–AI collaboration: digital assistants).
- AI based human-machine collaboration to anticipate and respond to human needs by understanding ATCO's intent and goals. Research aims at developing potential AI based solutions able to understand the traffic situation and, in combination with ATCO attention tracking technologies, to infer ATCO's intent. The proposed solutions will support the ATCO not only by performing tasks he/she already intends to perform, but also by autonomously performing a task that is outside of the current scope of ATCO's attention. ATCOs could then set the desired level of supporting actions performed by the AI team member (adaptive automation) and still maintain situational awareness by performing their usual tasks. Research may evaluate the potential use of graph-based models and joint neural networks to help the ATCO better understanding the traffic situation. Research shall address the impact on the role of the human (R&I need: human–AI collaboration: digital assistants).
- Integrated platforms for the nowcasting and forecasting of multiple meteorological hazards. This research aims at developing of integrated platforms to incorporate predictions of atmospheric hazards (e.g., SO2 contaminants, severe weather situations such as deep convection and extreme weather and climate hotspots potentially contributing to global warming, etc.). The focus is to enhance the situational awareness of all stakeholders in case of multiple hazard crisis by facilitating the transfer of required relevant information to end-users, presenting such information in a user-friendly manner to ATM stakeholders, ultimately anticipating severe hazards and fostering better decision-making. Research may address:
- Extension of nowcasting models of SO2 in 1D (values for a given location) to 2D (lat-long) and 3D and nowcasting products for dust, ash, volcanic aerosol and precursors and smoke;
- The consideration of additional observations (e.g., radar, satellite, sensors on board the aircraft) to better characterize the weather extremes and enhance the quality of the extreme weather nowcasting;
- The integration of space weather and climate change in the new MET services;
- The application of artificial intelligence or deep learning models based on recurrent networks could be used to better predict weather phenomena;
- Address potential air traffic controller decision support systems able to import and process the meteorological forecasts and to adapt tactical arrival and departure scheduling to changing extreme weather conditions;
- Target airport, TMA and en-route operating environments and the potential use by different stakeholders (e.g., Network Manager, ANSPs (flow management positions and air traffic controllers), airports, airlines (dispatchers and pilots), etc.);
- Address the assessment of potential benefits in terms of capacity, efficiency, safety, predictability and resilience.
Research shall take into account the output of project ALARM (R&I need: AI Improved datasets for better airborne operations).
- Standardised testbed platform for developing, testing, and benchmarking AI-applications in ATM. Research in artificial intelligence in ATM has been traditionally fragmented in the area due to the lack of standardised testbeds. The development of a testbed to be adopted as a common framework for future research in applied AI in ATM will enable reproducibility and considering open science practices. Research covers the definition and publication of a library of use cases, including input and output data associated to persistent identifiers (such as digital object identifier (DOI)). This will ensure findability and a wider adoption within the ATM research community (R&I need: AI Improved datasets for better airborne operations).
Further Information:
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-sesar-2023-des-er2-wa2-4;callCode=null;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1,0;statusCodes=31094502;programmePeriod=202

%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

HORIZON EUROPE ATM Excellent science and outreach for virtualisation and cybersecure data-sharing, deadline: 15. November 2023 17:00 Brussels time

Project results are expected to contribute to the following expected outcomes.
- Cost-efficiency: the proposed solutions are expected to report on the potential reduction in infrastructure costs. There are potential advantages deriving from the sharing of space-based services for aviation applications. Potential reduction in infrastructure and the possible creation of competition between future data suppliers will reduce costs;
- Capacity: the proposed solutions shall aim at improving capacity and resilience thanks to an increased flexibility of ATS provision to better adapt to traffic demand and make best use of capacity at network level;
- Safety: the proposed solutions are expected to maintain at least the same level of safety as the current ATM system;
- Security: The proposed solutions are expected to identify and mitigate the potential security risks deriving from the future data sharing service delivery model.

The Digital European Sky vision aims at removing the close coupling of ATM service provision to the ATS systems and operational procedures. The challenge is to propose innovative (or unconventional) ideas that will enable data-sharing, foster a more dynamic and resilient airspace management and ATM service provision, allowing air traffic service units (ATSU) to improve capacity in portions of airspace where traffic demand exceeds the available capacity. A more flexible use of external data services, considering data properties and access rights, would allow the infrastructure to be rationalised, reducing the related costs. The proposed solutions shall aim at rationalising and harmonising the ATM infrastructure while reducing the defragmentation. Virtualization solutions shall aim at completely decoupling ATM service provision from the physical location of the personnel and equipment, while scaling up and down of system performance in quasi-real time, as and when required.

The SESAR 3 JU has identified the following innovative research elements that could be used to meet the challenge described above and achieve the expected outcomes. The list is not intended to be prescriptive; proposals for work on areas other than those listed below are welcome, provided they include adequate background and justification to ensure clear traceability with the R&I needs set out in the SRIA for the virtualisation and cyber secure data-sharing flagship:
- Quantum computing in ATM. Research aims at exploring how quantum computing could be applied in ATM and how it could impact ATM. The definition of potential measures to mitigate such impact (e.g., the impact of quantum computing on future security needs in ATM, etc.) is also under scope. Research may address other areas of interest such as NP-Hard problems coming from ATM (large-scale trajectory planning, airspace configuration optimization, etc.) (R&I need: future data-sharing service delivery model).
- Distributed/federated simulation in ATM. This research element focuses on the use of distributed/federated simulations in ATM as a means of boosting participant numbers by being location and time-zone independent and allowing for a more flexible and iterative design process, especially for design evaluation in the lower maturity phases of system development. The concept of simulation as a service (SaaS) as a method to deploy simulation resources (e.g., simulators, models, input data) in the cloud using web services (WSs) for users to access these resources is also under scope. As this area is in the very early stages of development, research should determine how its potential could be explored, so that, for example, the problem of a shortage of participants can be circumvented, while contributing to the availability of a wider range of experts globally. With possible reductions in demand for mobility and in flexibility in both time and space due to post-pandemic effects, this solution could provide both methodological and organisational benefits to the ATM and research communities. Research may take into consideration the experience on the use of this type of simulation in the defence domain. Aspects such as cultural/local ATM operational differences should also be studied, and more complex network effects analysed by enabling cloud-based remote human-in-the-loop multisite simulations, in a direction which may have additional synergies with that of ATM virtualisation. Technical and operational challenges related to cloud-based distributed simulations, especially in the case of human-in-the-loop experimentation, should be addressed in relation to the need to temporally synchronise the entire experiment and associated events and interventions, align all actors' views, etc. Research may address different architectures e.g., distributed interactive simulation (DIS), high-level architecture simulation (HLA), etc. This challenge becomes even more difficult when trying to integrate legacy systems, which is another aspect that the research is expected to investigate from operational and technical points of view (R&I need: scalability and resilience).
- ATM data management. The decentralization of the ATM system will bring with it the distribution of data management responsibilities among multiple actors. There is a need to establish requirements that ensure that data are correctly stored

and that the transmission of data is carried out in a secure and traceable way, also protecting privacy requirements. Proposals should describe a specific ATM data management challenge, selecting one or more ways to store (e.g., data spaces), buy (e.g., data markets) and transmit ATM data so that the security and traceability is improved and propose a plan to validate the relevant hypothesis. Research may consider generic data encryption solutions that are in use in other industries that may be useful for ATM (R&I need: cyber-resilience).
- Cyber threat intelligence services in aviation. The use of techniques based on machine learning (ML) to support cyber threat detection and mitigation is quite widespread in the state of the art of various industries (e.g., internet services, e-commerce, content delivery networks, etc.). The observation of anomalous traffic patterns or transactions enables the detection of cyberattacks. The transfer of these methods to aviation domain is not straightforward and, given the current tendency in aviation to enhance information-sharing to implement machine-to-machine automated functions (e.g., through SWIM implementation, increased bandwidth air–ground communications, etc.) while maintaining legacy systems built without any proper security policy, research in this area is needed. Research may address dynamic risk assessment (DRA) and business impact assessment (BIA) techniques and improve information sharing and federated learning architectures aimed at anomaly detection. EASA regulation on information security needs to be taken as a baseline. The proposal shall demonstrate a thorough knowledge of past SESAR (or non-SESAR) activities on this field (R&I need: cyber-resilience).
- ATM digital transformation. Research aims at advancing towards the digital transformation in ATM facilitating data exchange and decision-making thanks to innovative, unconventional and breakthrough solutions at all stages of the lifecycle, from research using open science frameworks, through to tactical and operational optimisation. Shared-information platforms and new IT tools and services will support optimised and interconnected services, providing real-time information to professionals and the travelling public and enhancing system resilience in the event of disruption and crisis. Improving resilience capabilities is key for increased safely level, the traffic control capacity should be preserved even in case of major failures especially in a contingency situation in order to maintain a business continuity of the infrastructures, being the system capable of seamless service provision through virtualization and delegation to other infrastructure elements providing reliable support to emergency management. Research also addresses the impact that the co-existence between diverse technologies within the ATM network may have. AI-based tools will enable optimised mobility offerings and travel options, especially in cases of disruption, allowing the system to remain operational at acceptably high-performance levels. The goal is to ensure that aviation reaps the benefits delivered by, for example, artificial intelligence (AI) and big data. While focused on the ATM dimension, proposals shall consider potential constraints imposed by other domains as well as collateral impacts of ATM research on other domains. Research scope includes the development of an exportable AI transversal platform that could be used in different ATC systems, supported by e.g., data platform capabilities, security and data ontology/governance aspects, graph neural networks (GNN), etc. (R&I need: free flow of data among trusted users across borders).
- Enhanced techniques to empower NM operations. This element covers improving data structure and data storage to empower big data exploitation and analytics in network manager (NM) operations. Research aims also at investigating how business intelligence strategies and technologies can be applied to improve the efficiency, stability and resilience of the network through data analysis of business information (R&I need: free flow of data among trusted users across borders).
- Innovation in route-charging schemes. This research element addresses how the route charging and cost-recovery mechanisms should evolve in order to move towards a service oriented provision scheme and how to better connect technological innovation with the SES performance scheme. Previous exploratory research projects in SESAR (e.g. COCTA) have shown the potential of new trajectory pricing schemes to support a more flexible distribution of the demand. Proposals addressing this area may build on this previous research or propose other innovative charging schemes (e.g., modulation of charges). Potential ideas include lower charges in periods of low demand, discounts for early flight planning with route commitment (in order to promote the SESAR shared business trajectory (SBT) concept and enable better ANSP resource planning), overcharge for changes after filing flight plan, etc. Research shall address the definition of potential innovative incentive mechanisms. Research may also look into charging schemes that consider environmental penalties or rebates, e.g. higher charges for flights filing flight-plans with longer routes than necessary, rebates for flights accepting an NM-proposed re-route or flying at a flight-level different from what they requested. The research element addresses the integration of SES performance and charging schemes and SESAR performance framework (R&I need: Regulations and standards).
Further Information:
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-sesar-2023-des-er2-wa1-5;callCode=null;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1,0;statusCodes=31094502;programmePeriod=202%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

HORIZON EUROPE ERC STARTING GRANTS, deadline: 24. October 2023 17:00 Brussels time

The ERC Starting Grants are designed to support excellent Principal Investigators at the career stage at which they are starting their own independent research team or programme. Principal Investigators must demonstrate the ground-breaking nature, ambition, and feasibility of their research proposal.
Starting Grants may be awarded up to a maximum of EUR 1 500 000 for a period of 5 years. The maximum size of the grants is reduced pro rata temporis for projects of a shorter duration. (This does not apply to ongoing projects).
Additional funding up to EUR 1 000 000 can be requested in the proposal to cover the following eligible costs when these are necessary to carry out the proposed work: (a) "start-up" costs for Principal Investigators moving to the EU or an Associated Country from elsewhere as a consequence of receiving the ERC grant, and/or (b) the purchase of major equipment, and/or (c) access to large facilities, and/or (d) other major experimental and field work costs, excluding personnel costs.
Additional funding is not subject to pro rata temporis reduction for projects of shorter duration.
All funding requested is assessed during evaluation.
The Principal Investigators shall have successfully defended their first PhD at least 2 and up to 7 years prior to 1 January 2024. Cut-off dates: Successful defence of PhD between 1 January 2017 and 31 December 2021 (inclusive).
The eligibility period can be extended beyond 7 years in certain properly documented circumstances. See section Admissibility and eligibility criteria of the ERC Work Programme 2024.
A competitive Starting Grant Principal Investigator should have already shown evidence of the potential for research independence, for example by having produced at least one important publication as main author or without the participation of their PhD supervisor. When submitting their proposal, the CV and a Track Record should include personal details, education, key qualifications, current position(s) and relevant previous positions, a list of up to ten research outputs that demonstrate how the applicant has advanced knowledge in their field, with an emphasis on more recent achievements, and a list of selected examples of significant peer recognition. A short explanation of the significance of the selected outputs, the role of the applicant in producing each of them, and how they demonstrate the applicant's capacity to successfully carry out their proposed project may be included, as well as a short explanation of the importance of the listed examples of significant peer recognition. The applicant may also include relevant additional information on career breaks, diverse career paths, and life events, as well as any particularly noteworthy contributions to the research community. These will provide context to the evaluation panels when assessing the Principal Investigator's research achievements and peer recognition in relation to their career stage.
Further Information:
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/erc-2024-stg;callCode=null;freeTe
%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

HORIZON EUROPE ERC SYNERGY GRANTS, deadline: 08. November 2023 17:00 Brussels time

The aim is to provide support for a small group of two to four Principal Investigators to jointly address ambitious research problems that could not be addressed by the individual Principal Investigators and their teams working alone. Synergy projects should enable substantial advances at the frontiers of knowledge, stemming, for example, from the cross-fertilization of scientific fields, from new productive lines of enquiry, or new methods and techniques, including unconventional approaches and investigations at the interface between established disciplines. The transformative research funded by Synergy Grants should have the potential of becoming a benchmark on a global scale.
Principal Investigators of any career stage are welcome and must demonstrate the ground-breaking nature, ambition and feasibility of their scientific proposal. Principal Investigators must also demonstrate that their group can successfully bring together the scientific elements necessary to address the scope and complexity of the proposed research question.
One of the Principal Investigators must be designated as the Corresponding Principal Investigator. At any one time, one Principal Investigator per Synergy Grant Group except the Corresponding one can be hosted or engaged by an institution outside of the EU or Associated Countries.
Synergy Grants may be awarded up to a maximum of EUR 10 000 000 for a period of 6 years. The maximum amount of grants is reduced pro rata temporis for projects of a shorter duration.
However, up to an additional EUR 4 000 000 in total can be requested in the proposal to cover (a) 'start-up' costs for

Principal Investigators moving to the EU or an Associated Country from elsewhere as a consequence of receiving the ERC grant and/or (b) the purchase of major equipment and/or (c) access to large facilities and/or (d) other major experimental and field work costs, excluding personnel costs. Additional funding is not subject to pro rata temporis reduction for projects of shorter duration. All funding requested is assessed during evaluation.
The 'Synergy Grant Group' applying for the ERC Synergy Grant must be made up of a minimum of two and a maximum of four Principal Investigators with competitive track records as appropriate to their career stage and, as necessary, their teams.
Each Principal Investigator must present as part of the proposal a Curriulum Vitae and a Track Record.
Further Information:
https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/erc-2024-syg;callCode=null;freeTe
%202027;programCcm2Id=43108390;programDivisionCode=null;focusAreaCode=null;destinationGroup=null;missionGroup=null;geog

DBU MOE Fellowship, Frist: 05. September 2023

Ziele:
- Weiterqualifikation von Hochschulabsolventinnen und -absolventen aus allen Fachrichtungen zu umweltrelevanten Themen
- Wissenstransfer in Wissenschaft, Verwaltung und Praxis
- internationale Netzwerkbildung zwischen Umweltexpertinnen und -experten aus allen Fachdisziplinen
Finanzielle Leistungen:
- jährlich bis zu 56 Fellowships
- Förderdauer: 6-12 Monate
- monatliches Fellowship: 1.350 €
- Kranken-, Unfall- und Haftpflichtversicherung
- mehrwöchiger Deutsch-Intensivkurs in Osnabrück vor dem Aufenthalt bei der gastgebenden Institution
Ideelle Förderung:
- Hilfestellung bei der Suche nach einer Gastgeber-Institution in Deutschland: in Frage kommen z. B. Universitäten, Forschungsinstitute, Unternehmen, Fachbehörden, NGOs
- Seminare zum gegenseitigen Austausch
- Einladung zu wichtigen Veranstaltungen der DBU
- Netzwerkbildung zwischen Fellows sowie Alumni über die Online-Kommunikationsplattform Stipnet
- jährliche Treffen der Alumni in ihren Heimatländern
Anforderungen:
- Master-/ Magister-/ Diplomstudium vor maximal fünf Jahren überdurchschnittlich abgeschlossen
- alle Fachrichtungen sind zugelassen
- Staatsangehörigkeit und Wohnsitz in einem der genannten MOE-Länder
- Vorschlag für ein umweltrelevantes und praxisnahes Thema
- ausreichende Deutschkenntnisse; müssen zu Beginn des Aufenthaltes bei der gastgebenden Institution nachgewiesen werden
- Promovierende können sich bewerben, soweit das Promotionsvorhaben erst nach der Fellowship-Förderung abgeschlossen wird
Bewerbungsverfahren:
- Online Bewerbungsverfahren in deutscher und englischer Sprache möglich
- Bewerbungsdeadline am 05.09.23
- Registrierung/Anmeldung auf der jeweiligen Länderseite
Weitere Informationen:
https://www.dbu.de/foerderung/moe-fellowship/

Bill and Melina Gates Foundation Entertainment Media Content Analysis and Monitoring, deadline: 04. August 2023

The Bill & Melinda Gates Foundation launched the Gender Equality Division in 2020 to accelerate progress toward a more

gender-equal world by addressing structural barriers that prevent women and girls from being fully active in their homes, economies, and societies. Restrictive gender norms1 are barriers to gender equality and prevent women and girls from achieving critical health and well-being outcomes.2 The Adolescents and Social Norms (ASN) team was established as a Learning Agenda to expand the body of data and evidence on gender norms and their impact on progress toward gender equality. By generating more data, supporting multimedia platforms, local leaders, and champions of women, the ASN team's goal is to accelerate sustained progress to achieving gender equality by changing gender norms, which will enable adolescent girls and young women to have the agency to make decisions about their health, education, and economic opportunities. The ASN team's portfolio for 2023 – 2027 will be focused on three countries: India, Kenya, and Nigeria.
Entertainment media (EM) plays a key role in creating narratives that affect health and livelihood outcomes of adolescents and can shape perceptions of norms.3 Integrating educational messages in EM narratives has shown to be an effective strategy for raising awareness, shifting attitudes, and inspiring individuals to change their behaviors and improve their health and well-being.4 In addition, studies have shown that the most popular programs watched by young adults do not always accurately portray the risks, consequences, and responsibilities of sexual behavior.5 As such, it is critical to understand the content that is being consumed by adolescent girls and young women (AGYW) and their influencers so that we can design the most effective EM interventions. Shifting cross-cutting gender norms among AGYW and their influencers can have a sustaining impact on a range of behaviors and outcomes.
The ASN team is interested in understanding the causal links between EM use/exposure and effects on outcomes related to sexual and reproductive health (SRH), age at marriage, gender-based violence (GBV), physical safety, women's economic empowerment (WEE), and human immunodeficiency virus (HIV). Hence, EM content analysis can lay the foundation for measuring potential causal links between EM use and impacts on these desired outcomes. It can also identify critical entry points or opportunities for the EM industry and content creators to produce and distribute gender-positive content.
This RFP seeks innovative approaches to addressing two objectives: (1) conduct EM content analysis and (2) monitor EM content in India, Kenya, and Nigeria.
A. Objective 1 - Conduct EM Content Analysis: collect baseline data and synthesize the EM content consumed by AGYW and their influencers in three countries: India, Kenya, and Nigeria. These include television shows, popular films, radio, digital platforms, etc. This will allow the ASN to understand how EM content impacts audiences, specifically AGYW and their influencers, the type of content that is most popular in each context. Identifying and analyzing the EM content will help to classify harmful content and inform the design of EM interventions that are needed to shift the EM industry toward creating gender-positive content in the three countries and other similar contexts. In a separate investment, a Tool Kit and Scale/Index will be developed to assist content creators in creating more gender-positive content. At the end of Year 1, a convening will be held for leaders of the Content Analysis and of the Tool Kit and Scale/Index to share indicators, data, and findings to align indicators across investments in the three priority geographies.
Although we expect the team that responds to this RFP to propose what they consider to be the best methodology, we anticipate a mixed method approach of conducting content analysis using established methodologies in the literature, including coding themes on the outcomes of interest, visual cues, brief mentions, dialogue, minor & major storylines, etc., and/or using emerging technologies, such as Artificial Intelligence (AI) supported language processing, which can provide key insights including but not limited to the following:
- Identify the top shows consumed by AGYW and their influencers and the types of content watched on TV and other media platforms for each of the countries, and specific sub-geographies within each country as relevant.
- Identify how outcomes and norms of interest important for the ASN team (gender-based violence, physical safety, women's economic empowerment, sexual and reproductive health, etc.) are portrayed in the shows included for analysis.
- Identify what themes regarding the outcomes of interest are most prominent among AGYW and their influencers.
- Identify if the shows analyzed integrate educational information into their storytelling and/or social media sites regarding the risks and consequences of the outcomes of interest.
- Identify if the shows include portrayals of harmful/positive beliefs, attitudes, and behaviors and identify harmful norms that might be normalized.
- Identify actual frequency of gender-related content (both positive and negative).
B. Objective 2 – Monitor EM Content: set up and maintain a platform for continuous monitoring of EM content for the top shows consumed by AGYW and their influencers in India, Kenya, and Nigeria until at least Oct 2027. These include television shows, popular films, radio, digital platforms, etc. This public good is expected to provide key insights including but not limited to the following:
- Track overtime the frequency of gender-related content (both positive and negative) that AGYW and their influencers are exposed to in the three countries.
- Track the increase or decrease in quality of gender-positive and gender-equitable EM content.
- Track the number of hours AGYW and their influencers spend on different media outlets.

- Track the frequency of use of different media sources.
Expected deliverables include but are not limited to the following below:
- A detailed workplan and implementation roadmap for the project.
- A detailed outline of the methodology employed in the work, why it is the best choice to address the two objectives outlined, analysis plan, how the expected results will be presented etc.
- Raw data (per a Data Sharing Agreement signed with the foundation, for internal use and further analysis to inform foundation and ASN team priorities).
- Initial results for feedback and team discussion.
- Semi-annual learning sessions to help the ASN team digest the results and main takeaways from the findings and facilitate learning discussions.
- Semi-annual reports.
- Publication(s) in peer-reviewed journals (optional).
- Proposal on the best approach to monitor and analyze EM content on an ongoing basis until 2027.
- A platform that can serve as a public good and where ongoing data and results from monitoring EM content in the three countries can be displayed and accessed by the public.
Teams that respond to this RFP are expected to provide two budget proposals: please submit your proposed plan and budget according to what is required to complete the scope of work.
- Budget focused on the cost for conducting the EM content analysis for the three countries, deliverable expected no later than July 2024
- Budget focused on setting up and maintaining a platform for continuous monitoring of EM content in the three countries until at least Oct 2027.
Further Information:
https://submit.gatesfoundation.org/prog/entertainment_media_content_analysis_and_monitoring/

Bill and Melina Gates Foundation Measles risk assessment and outbreak forecasting at global scale, request for concepts, deadline: 31. Juli 2023

Measles is a leading cause of child mortality [1], accounting for roughly 100 thousand deaths annually since 2015 [2]. As an exceptionally infectious virus, measles epidemiology is characterized by large and rapid outbreaks causing significant societal disruption. All of this burden is preventable: A safe and highly effective measles vaccine has been available since the 1960s. Increasing vaccine access is a human rights issue, and the Bill & Melinda Gates Foundation is part of a global partnership focused on reducing measles burden and interrupting transmission through vaccination.
Vaccine delivery in the highest burden areas requires significant advanced planning, taking on the order of 3 to 12 months. As a result, effective distribution of limited vaccine supply requires an understanding of forecasted risk, allowing global partners to prioritize efforts and prevent outbreaks. While risk in some endemic countries is relatively easily anticipated through empirical assessment of annual measles seasonality, a nontrivial portion of annual burden appears in countries that have not sustained transmission in years.
Project objectives:
- Development of a rigorous, tested, open access forecasting methodology and associated code repository.
- Documentation of the method and software, through some combination of peer-reviewed papers and white papers.
- A landscaping exercise of existing risk assessment tools with performance comparisons over multiple time horizons (3 to 12 months) to the newly developed method.
- Presentations and other scientific communications of the risk assessment framework and its use to global stakeholder groups.
- Leveraging lessons from measles to inform risk assessment for other vaccine-preventable diseases.
Data and technical considerations:
The final method is required to be fully open access, in keeping with Foundation policy and to allow public health officials in focus countries to engage freely. Key data sources will likely include demographic data from the World Bank, immunization data from WHO, including the timing and scale of historical supplementary immunization activities, and monthly case reporting data from WHO. That said, we encourage concepts to include data not highlighted above and to explore the possibility of other drivers of measles outbreak risk. Methods can leverage classical disease modeling and statistical inference concepts as much as is seen fit.

Application timeline and award details:
Concept proposals will be reviewed by the Foundation and WHO partners starting August 1st, 2023, with groups selected to advance by August 14th, 2023. Awards of at most $500k allocated over 2 years will be distributed starting in Q4 2023.
Further Information:
https://submit.gatesfoundation.org/prog/measles_risk_assessment/

EMBO Workshops, deadline: 01. August 2023 09:00 CET

Scientists can apply for funding to organise an EMBO Workshop. EMBO can contribute up to a maximum of 45,000 euros (35,000 euros of core funding plus 9,000 euros exclusively for travel grants and registration fee waivers, and 1,000 euros for childcare grants) per workshop.
EMBO supports the organisers by:
- Creating a dedicated workshop webpage, including registration and abstract submission forms
- Providing a poster and helping to advertise the meeting
- Offering funds for an EMBO Young Investigator Lecture, EMBO Policy Lecture or an EMBO Women in Science Lecture.

EMBO offers travel grants for each event. Participants of EMBO Workshops should apply directly to the organisers for travel grants.
Organisers are encouraged to experiment with hybrid or virtual conference formats. An extra 10,000 euros will be provided if organizers choose a hybrid format to cover the additional cost incurred for providing the online options.
EMBO Workshops must take place in an EMBC Member State, an EMBC Associate Member State, in countries and territories covered by a cooperation agreement or in countries eligible for support by EMBO and The Company of Biologists. Organisers can be of any nationality and be based in any country of the world.
EMBO Workshops must cover a topic from the life sciences, and organisers must provide a convincing justification that the workshop serves an active and evolving community. Furthermore, the application should include a list of (mostly) confirmed speakers.
Applications for EMBO Workshops are accepted twice a year and must be submitted through the online system. Organisers are advised to apply as early as possible in the calendar year preceding the proposed date of the workshop.
Further Information:
https://www.embo.org/funding/funding-for-conferences-and-training/workshops/application/

EMBO Practical Courses, deadline: 01. August 2023 09:00 CET

EMBO Practical Courses provide training in new techniques for researchers and core facility staff, enabling them to implement the techniques in their laboratories. The courses should last between five and ten days and are limited to 25 participants. EMBO provides funding and assists organizers in promoting the courses and creating webpages with a registration and abstract submission system.
Scientists can apply for funding to organise an EMBO Practical Course. EMBO contributes up to 45,000 euros (35,000 euros of core funding plus 9,000 euros exclusively for travel grants and registration fee waivers, and 1,000 euros for childcare grants) per workshop.
EMBO supports the organisers by:
- Creating a dedicated practical course webpage, including registration and abstract submission forms
- Providing a poster and helping to advertise the meeting.

EMBO offers travel grants for each event. Participants of EMBO Practical Courses should apply directly to the organisers for travel grants.
EMBO Practical Courses must take place in an EMBC Member State, an EMBC Associate Member State, in countries and territories covered by a cooperation agreement or in countries eligible for support by EMBO and The Company of Biologists. Organisers of a practical course can be of any nationality and be based in any country in the world.
EMBO Practical Courses must cover a topic from the life sciences, and the application should include a list of (mostly) confirmed instructors.
Further Information:

https://www.embo.org/funding/funding-for-conferences-and-training/practical-courses/

ESF Fight Kids Cancer 2023-2024 Call for proposals, date: 01. September 2023

FIGHT KIDS CANCER is thrilled to announce that its next call opening on September 1st, 2023 will be exclusively dedicated to research on paediatric brain tumours.
In order to substantially support this disease area, which is in dire need for new treatments, FIGHT KIDS CANCER decided to give more flexibility to the applying teams by increasing the possible amount available and duration per grant application:
For clinical trials:
- Up to 5 years
- Up to 5 million euros
For translation research projects:
- Up to 4 years
- Up to 2 million euros
As flexibility is the key motivation for the modification of the grants' duration and amount, the FKC Funders wants to stress the fact that applicants should apply for what they need and not refrain from applying for smaller amounts or shorter projects such as primer/ preliminary studies, projects or programmes grants.
Each project will be evaluated on its merit alone. Shorter, high-risk high gain projects are as welcome as are biology companion projects. Translational projects applying for longer duration or higher amounts will be expected to facilitate collaboration across institutions and borders within Europe to meet the FKC selection criteria.
The FIGHT KIDS CANCER secretariat at European Science Foundation is at the applicant's disposal for their questions.
FIGHT KIDS CANCER aims to catalyse and support pan-European leading-edge research initiatives in paediatric cancer to develop innovative approaches to improve the outcome for all children and adolescents with cancer. This call will cover the following non-exclusive objectives:
- Realise real impact on young patients,
- Improve survival rates and reduce toxicity to restore young patients to full health after treatment,
- Advance fundamental knowledge of paediatric malignancies,
- Support improved interdisciplinary research, methods and collaborations for tackling the issues of today,
- Strengthen collaboration and the development of scientific capacity across Europe.
FIGHT KIDS CANCER aims towards overcoming the structural lack of research dedicated to paediatric cancers by ensuring a recurring endowment that will be granted to the best European research projects every year. An additional ambition is to foster closer working ties between clinical and laboratory researchers.
Further Information:
https://www.esf.org/funding-programmes/fight-kids-cancer-2023-2024-call-for-proposals/

Fulbright Germany Diversity and Inclusion in the Classroom

The seminar, conducted in collaboration with the esteemed College of Education and Human Ecology at The Ohio State University in Columbus, Ohio, offers a unique and enriching opportunity for professional development in a hybrid format. It is designed to provide up to 30 scholarship recipients with valuable insights into American educational policies and the social and cultural considerations that shape pedagogical concepts of "equity, diversity, special education, and inclusion."
The program encompasses two parts:
The first part consists of an online preparatory course conducted virtually from March to May 2024. This online course aims to equip participants with foundational knowledge prior to their arrival at Ohio State University. Components of this online course will be both synchronous and asynchronous and include 6 online evening sessions stretched over the period March to May 2024.
The second part of the program consists of the in-person on-site experience in the United States at the Ohio State University in Columbus in October 2024. During the program at OSU, participants will have the opportunity to engage in professional conversations with local teachers, take part in practical workshops that expand and build upon topics covered in the online seminar, visit schools to gain insights into inclusive teaching put into practice, and immerse themselves in cultural experi-

ences and excursions that showcase the rich heritage of the region of Columbus, Ohio.
By combining online instruction with hands-on experiences in the U.S., the program aims to provide a comprehensive and well-rounded learning journey that enhances participants' knowledge, skills, and cross-cultural understanding in the field of education.
The program offers:
- An overview of American educational policies and the structure of the school system in the USA.
- An introduction to the political, historical, cultural, and social influences on pedagogical concepts of equity, diversity, special education, and inclusion in the American education system.
- Engaging discussions and workshops on diversity, equity, and inclusion; special education; MTSS; linguistic diversity in classrooms; and culturally responsive instructional planning.
- An overview of teacher education and professional development at American universities.
- Opportunities for professional exchange with American scholars, teachers, and students, including visits to a variety of diverse schools in the US.
- Cultural exploration through excursions and events, providing a chance to immerse in the culture and history of the Ohio region.
By actively participating in this seminar, educators contribute significantly to their professional development and the internationalization of teaching practices. The comparative exploration of both the German and US-American educational systems enables participants to broaden their pedagogical perspectives and to access practical examples to integrate into their own teaching design, particularly in the realm of "culturally sustaining pedagogies." Furthermore, participants get the opportunity to enhance their skills in project management, collaborative teamwork, impactful presentations, and English language proficiency.
This program empowers participants to actively engage in diverse opportunities aimed at cultivating a deep interest in Germany and its education system, thereby serving as a catalyst for fostering an ongoing dialogue between German and American educators.
Further Information:
https://www.fulbright.de/programs-for-germans/lehrer-innen/diversity-and-inclusion-in-the-classroom

Canon Foundation Research Fellowships, deadline: 15. September 2023

Annually, the Canon Foundation in Europe grants up to 15 Fellowships to highly qualified European and Japanese researchers. European Fellows are expected to pursue a period of research in Japan whereas Japanese Fellows are expected to do their research in Europe.
Canon Foundation Fellowships are for a minimum period of three months up to maximum of one year.
We support all fields of research. There are no limitations or restrictions. Applicants do not have to be currently enrolled or employed at the time of applying.
Canon Fellows from Europe are free to choose their host institutes and hosts in Japan. The same freedom is given to Japanese Canon Fellows coming to Europe. Canon Foundation Research Fellowships may be applied for when an agreement on co-operation and on a research plan has been reached between the guest researcher and the proposed host institution.
Applications can also be submitted by members of commercial, industrial, governmental or professional organisations.
All Europeans are eligible to apply (including UK, Israel, Turkey, Balkan and Baltic countries).
Applicants should have obtained at least a Master's or PhD degree within the last ten years of applying to the Canon Foundation. We will also consider candidates who obtained their qualification more than ten years ago as long as they provide further supporting information in their application.
Financial support for Research Fellows can reach up to 30,000 Euros per year and pro-rata for different periods. The Research Fellow can decide what costs the grant can be used for. Examples are living costs, travel, insurance, research costs, books, etc. There are no restrictions.
The next application deadline will be 15 September 2023 for applications starting between January and December 2024.
The Selection Committee's final decision will be emailed to applicants by mid-December 2023.
Further Information:
https://www.canonfoundation.org/programmes/research-fellowships/

Canon Foundation Japan-Africa Exchange Program Kyoto University, deadline: 15. November 2023

The Canon Foundation in Europe (CFE) and Kyoto University (KU) started the Canon Foundation-Kyoto University Japan-Africa Exchange Program in 2018. The program offers fellowships to highly qualified researchers in fields of research related to African Studies.
The program is intended to support 1) fellows from KU who carry out research at host institutions in Africa, and 2) those coming to KU from its partner institutions in Africa to conduct their research at Kyoto University. The fellowships are for a minimum period of three months up to maximum of one year between April 1, 2024 and March 31, 2025.
Applicants need to be holding at least an MA degree and employed either at KU or KU's partner institutions as post-doctoral fellows or faculty members at the time of applying. In addition, as long as African applicants can submit one of the two reference letters received from their prospective host from Kyoto University and prove their existing partnerships, they are eligible to apply for the program.
The financial support for successful applicants ranges from 22,500 Euro to 27,500 Euro per year and is pro-rated for different periods. CFE will directly administer the payments and notify the detailed payment procedure to each successful applicant.
The deadline for applications is November 15th, 2023.
Further Information:
https://www.canonfoundation.org/programmes/japan-africa-exchange-program-kyoto-university/

Sonstige Das ABC der EU-Forschungsförderung - Teil A - Ausschreibungen der EU-Forschungsförderung in HORIZON Europe, Termin: 22. August 2023 um 10 Uhr

Am 22.08.2023 führt von 10:00 bis 13:00 Uhr die Stabsstelle Forschungsförderberatung die Veranstaltung „Das ABC der EU-Forschungsförderung - Teil A - Ausschreibungen der EU-Forschungsförderung in HORIZON Europe" durch.
Mit der Veranstaltungsreihe werden Wissen und Kompetenzen zum EU-Förderprogramm HORIZON Europe vermittelt. Die EU-Referenten und Projektmanager der Stabsstelle Forschungsförderberatung geben ihre Erfahrungen aus mehr als 300 Anträgen und mehr als 60 EU-Projekten weiter. Ziel ist es, die Chancen zu verbessern, EU-Drittmittel für Ihre Forschung zu erhalten sowie Bausteine für die Antragstellung in HORIZON Europe aufzuzeigen und Tipps zur Antragstellung zu geben.
Inhalt:
- Fördermöglichkeiten in HORIZON Europe– Überblick zum Programm, Teilnahmebedingungen, Förderformen und –regeln
- Zeitplanung, Teilnehmerportal, Dokumente, Lesen einer Ausschreibung Antragstellung – Planung und Struktur eines Antrags
- Konsortium - Partnersuche, Begutachtung, Schreiben einer Zusammenfassung

Die Veranstaltung findet im Gebäude 80 R107, im Wissenschaftshafen, Niels-Bohr-Str. 1 in Magdeburg im Seminarraum in der ersten Etage statt.
Kontakt: Veronika Kauert, Tel. +49 (0) 391 67 52114, veronika.kauert@ovgu.de
Anmeldung unter:
https://eveeno.com/abc2023

Sonstige Contact Research Funding Advice of the Otto von Guericke University Magdeburg

For questions about funding opportunities, specific calls for proposals, help with submitting applications and project support, please contact the department for Research Funding Advice/EU-University Network of Otto von Guericke University Magdeburg.
Information on current events, funding structures and contact online at:
https://www.ovgu.de/en/ContactResearchFundingAdvice
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