

SESAR INNOVATION PIPELINE

Air traffic management research and innovation

2023 Highlights





About SESAR JU

The SESAR Joint Undertaking is an institutionalised European partnership between private and public sector partners set up to accelerate through research and innovation the delivery of the Digital European Sky. It is harnessing, developing and accelerating the take-up of the most cutting-edge technological solutions to manage conventional aircraft, drones, air taxis and vehicles flying at higher altitudes.

The SESAR JU partnership brings together the EU, EUROCONTROL, and more than 50 organisations covering the entire aviation value chain, from airports, airspace users of all categories, air navigation service providers, drone operators and service providers, the manufacturing industry and scientific community.

The partnership also works closely with the regulatory and standardisation bodies, notably EASA and Eurocae, as well as key stakeholders, such as professional staff organisations, the military and global partners.

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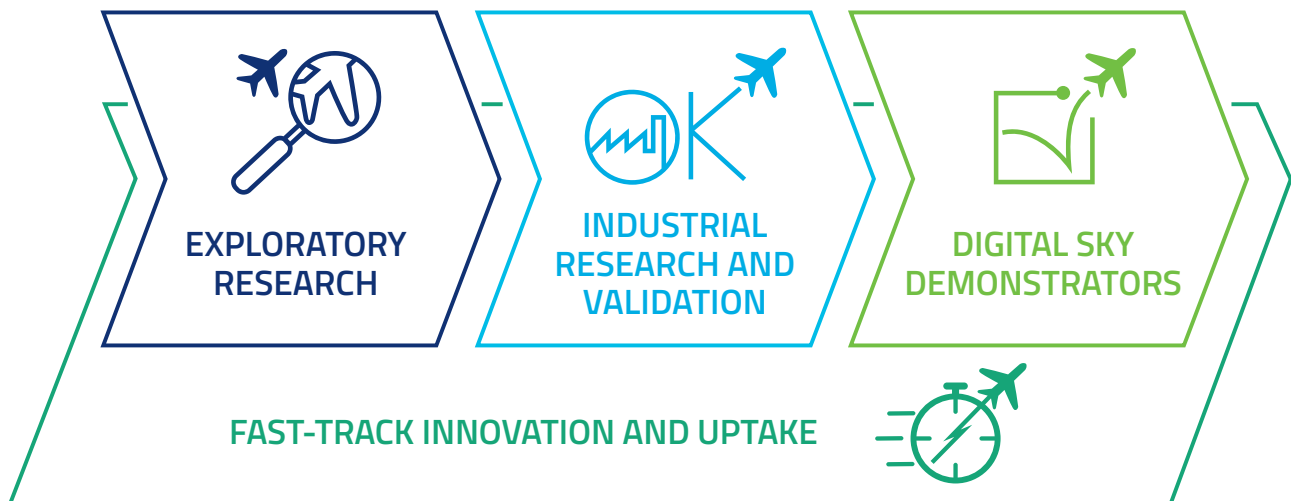
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The SESAR Innovation Pipeline

To deliver the Digital European Sky, the SESAR research and innovation programme is designed as an innovation pipeline, made up of exploratory research, industrial research and validation, fast-track and demonstrators, where ideas are transformed into tangible solutions.

The research takes place in test beds across Europe (simulation platforms, on-board commercial flights, dedicated airport testbeds and air traffic control centres), which validate concepts and candidate solutions. The testing is not limited to a specific location but can be used to test multiple environments irrespective of the location where the physical validation is held.



Snapshot of Digital European Sky project portfolio

In 2023, the Digital European Sky went full throttle, with the launch of projects in all strands of the innovation pipeline.

In February, 50 research projects spanning exploratory research, industrial research, and activities to fast-track innovative solutions, were selected representing a total investment of EUR 360 million by the aviation industry and the European Union through Horizon Europe (See 18 and 29 for project portfolio).

The 18 selected exploratory research projects aim to foster new and innovative ideas to transform air traffic management in Europe, as well as to encourage coordinated exchange of knowledge and stimulate the future ATM skilled workforce.

The 32 industrial research and fast-track projects address critical areas for change, including emissions reduction, automation enabled by artificial intelligence, resilient ATM service provision, as well as the swift uptake of solutions for the integration of drones (U-space), urban air mobility, multimodality and climate-neutral operations.

In June, 3 Digital Sky Demonstrators representing a total investment of EUR 138 million officially got underway in the areas of automation and virtualisation. The announcement was part of a larger package of transport infrastructure funding under the Connecting Europe Facility adopted by the Commission.

The projects were selected following a call issued in September 2022 by the European Climate, Infrastructure and Environment Executive Agency (CINEA) under the Connecting Europe Facility.














The selected demonstrators cover "gradual transition towards higher levels of automation" and "virtual centres and ATM data service providers (ADSPs)", two thematic areas from among nine flagships outlined in SESAR Joint undertaking's multiannual work programme (See 42 for project portfolio).

Overall, the programme now has 58 projects in operation across all nine flagships areas.

View SESAR Projects Portal

<https://www.sesarju.eu/projects/portal>

Digital European Sky at a glance

	 EXPLORATORY RESEARCH	 INDUSTRIAL RESEARCH AND VALIDATION	 FAST TRACK INNOVATION AND UPTAKE	 DIGITAL SKY DEMONSTRATORS		
FLAGSHIPS	Excellent science and outreach	Applications-oriented				
 Connected and automated ATM	ASTAIR HYPERSOLVER	CODA	FCDI ISNAP ATC-TBO	MIAR FCA	ESMA	
 Air-ground integration and autonomy			SOLO NETWORK TBO	ECHO 2 IRINA		
 Capacity-on-demand and dynamic airspace	HUCAN	SMARTS	ISLAND	IFAV3 FASTNet KAIROS		
 U-space and urban air mobility	ImAFUSA MUSE	AI4HyDrop		EUREKA ENSURE SAFIR-Ready	OperA SPATIO	U-ELCOME BURDI EALU-AER
 Virtualisation and cyber-secure data sharing	SEC-AIRSPACE			VITACY CNS DSP	DEVICE EXODUS	
 Multimodality and passenger experience	MAIA	MultiModX		SIGN-AIR		
 Aviation green deal	AEROPLANE E-CONTRAIL	Green-GEAR	CICONIA CONCERTO GEESE	DYN-MARS GALAAD	ECHOES HERON	
 Artificial Intelligence for aviation	SynthAIR TRUSTY	ASTRA	JARVIS	DARWIN		
 Civil/military interoperability and coordination			MITRANO HARMONIC			
Knowledge transfer	Engage 2	Transversal	AMPLE3	PEARL		
EU Funding	€22.287.314,59		€180.623.287,48		€116.321.251,55	

SESAR 2020 solutions lay foundations for the Digital European Sky

In 2023, the SESAR JU with its members and partners concluded intensive research under the SESAR 2020 research and innovation programme to deliver 136 solutions ready for market uptake. Once implemented, these new technologies and procedures are expected to reduce emissions, optimise capacity and improve the efficiency of air traffic management operations in the safest possible manner.



Over the course of the programme SESAR 2020 pooled the knowledge and skills of 2 000 industry experts in 150 research projects. Despite delays during the COVID pandemic, cross-industry partnerships completed 1,000 validation exercises and [flight trials in dozens of locations](#) across Europe in real-life operations, sharing the experiences of controllers, pilots, engineers and researchers. The findings are documented in the [SESAR Solutions Catalogue](#) which details those solutions ready for industrialisation along with candidate solutions subject to further research.

Andreas Boschen, SESAR Joint Undertaking Executive Director: *“SESAR 2020 met on its promise to deliver benefits for safety, the environment, efficiency and capacity. Building on these strong foundations, the Digital European Sky successor programme is accelerating this transformation towards smart, sustainable and resilient air traffic management.”*

The combined number of solutions delivered to date represents three-quarters of the key solutions needed to bring about the transformation changes outlined in the [Airspace Architecture Study \(AAS\)](#).

Herman Mattanovich, Frequentis CTO: *“SESAR 2020 enabled stakeholders to work together towards a solution. We have completed 80% of the Digital European Sky, the next 20% will be the most challenging.”*

SESAR 2020 made significant progress in a range of areas, from virtualisation and interoperability, to trajectory-based operations and enabling technologies for airport total management. The programme leveraged modern technologies to support the future airspace architecture and developed capabilities to address today’s challenges of resilience, scalability, climate impact and the integration of new entrants.

Advanced air traffic control tools

Among high profile developments are [virtual centres](#), which give air navigation service providers added flexibility and resilience by decoupling services such as flight data, radar and weather information from the physical controller working position to increase service continuity. SESAR 2020 tested different architectures and delegated airspace between different ATM service providers to demonstrate the technical viability of the [concept](#).

Friedrich-Wilhelm Menge, DFS CTO: *“Changing the technological legacy is key to progress. We need to decouple the human-machine-interface and move to cloud technologies and service-oriented architecture.”*

Another key achievement has been in the area of trajectory-based operations to reduce controller workload and increase airspace capacity by establishing an integrated view of all flight trajectories, including military, based on four-dimensional (4D) aircraft trajectories (latitude, longitude, altitude and time). SESAR 2020 [industrial research](#) validated the downlinked aircraft trajectories from the flight management system to the ground to enable controllers to identify inconsistencies between the flight plan and the route flown. The [research](#) also developed technical specifications for the European datalink common service to distribute data downlinked from the aircraft to air traffic control, Network Manager, airlines and other parties.

Smart airports

Airport operations experienced a step-change as a direct result of technology developed by SESAR 2020 industrial research that enables data sharing between the airport operations plan (AOP) and network operations plan (NOP) using system wide information management (SWIM). The [total airport management \(TAM\)](#) solution increases predictability and supports collaborative decision-making based on timely information.

Philippe Laborie, Paris-Orly Airport Deputy Director: *“SESAR 2020 enabling technologies increase our control of operations. The more we integrate, the more we can improve performance.”*

Remote tower technology, with the programme delivering the [multiple remote tower module](#), pools air traffic control officers (ATCOs), who provide their services to airports on demand. When combining resources in a single centre, controllers can also assist each other if the traffic at a particular airport peaks. Even air traffic services at medium airports could benefit by connecting to a large remote tower centre as they could operate more efficiently, while helping the ATCOs to better balance their workload using sophisticated role management.

Significant advances were made in many other areas, including [runway optimisation](#) and airport surface management, and advancing solutions targeting all sizes of airports, including regional airports.

Accommodating future mobility and expanding to new horizons

A sector quick to embrace digital technology is the unmanned market where new entrants already offer emergency and medical services as well as inspection, survey and parcel deliveries. In 2016, SESAR 2020 delivered Europe's U-space Blueprint, setting out how drones will be integrated into the lower airspace; and the concept of operations ([CONOPS](#)) detailing what U-space means operationally in the context of EU U-space regulations. Between [2017](#) and [2022](#), extensive flight trials in urban and non-urban environments helped to shape U-space services and concept definition by delivering deployable solutions to help scale up this sector.

Hendrik-Jan Van Der Gucht, Skydrone Managing Director: *"U-space is speeding up the digitalisation process and paving the way for the digital transformation of ATM and aviation generally."*

Extending safe access to higher airspace, SESAR 2020 delivered a concept of operations to enable scalable operations above the flight levels where conventional air traffic operates. An array of new vehicles ranging from unmanned balloons, airships and solar planes to super- and hyper-sonic vehicles are seizing new business opportunities in this space, leading to the ECHO 2 Digital European Sky follow-on project.

Automation and artificial intelligence

Extensive research was carried on a wide range of AI-enabled tools addressing traffic hotspots, surveillance, runway optimisation and dynamic configuration, among other areas. These solutions are helping increase automation in many areas, for example introducing machine learning to reduce message



corrections in [automatic speech recognition](#). The [SESAR tool](#), which is ready for industrialisation, decreases speaking time by a factor of 30 and enables controllers to deliver more timely instructions. Workload is also lowered by the SESAR algorithm that removes potentially non-conflictual aircraft from the controller's screen by turning the label to a fade-out colour. [Attention guidance](#) offloads monitoring tasks based on accurate flight profiles and tactical events, potentially increasing airspace capacity.

Addressing climate impact

Tackling the environmental footprint of aviation was also the focus of these solutions, aimed at making taxi-out and runway operations more predictable and efficient, reducing holding patterns and vectoring in terminal airspace upon arrival, and optimising trajectories with i4D, among other technologies. All of which bring fuel savings. Some of these solutions also support local environmental performance objectives through noise mitigation and air quality improvements.

The follow-up programme, the [Digital European Sky](#), aims to accelerate this innovation lifecycle process by testing delivered solutions using Digital Sky Demonstrators in live operational environments, alongside further research supporting the transition towards higher levels of automation.

View SESAR Solutions Catalogue

<https://www.sesarju.eu/catalogue>

Campaign launched to update European ATM Master Plan

On 10 October, industry leaders gathered in Brussels for the SESAR Joint Undertaking Annual Conference to give their backing to the launch of a campaign to update the European ATM Master Plan, the official roadmap driving ATM modernisation efforts. [Industry associations issued a Joint Declaration](#), committing to rapid and united action to make European airspace the most efficient and environmentally friendly sky to fly in the world.

The declaration acknowledged the need to boost cooperation and investment on breakthrough innovations, which will deliver the Digital European Sky and contribute to reducing aviation's climate impacts. It highlighted that, given the pressing climate goals, the safety-critical nature of ATM, and timeframes for innovation, the Master Plan is the vehicle that will provide essential direction and focus to future ATM investments. The Master Plan will also align efforts with the growing number of other initiatives and frameworks targeting aviation sustainability.

[Analysis](#) by the SESAR JU, EASA and EUROCONTROL suggests that introducing new technologies and procedures into ATM can provide a significant and immediate contribution towards making aviation climate neutral, while work progresses on other high impact innovations, such as sustainable aviation fuels and new aircraft. For example, it is estimated that already delivered SESAR solutions could result in a 4% reduction in CO₂ emissions per flight and that the solutions already implemented through Common Project 1 have contributed 2% in emissions reductions per flight.

Making Europe the most efficient and environmentally friendly sky to fly in the world - Joint discussion paper

The paper aims to stimulate discussion among Europe's aviation stakeholders and policymakers on the contribution that air traffic management needs to make towards aviation's climate neutrality ambitions.

www.sesarju.eu/publications



The new European ATM Master Plan will set the vision and prioritise the digital solutions which will be the key enablers in delivering the Digital European Sky. The solutions will enable European airspace to flexibly accommodate new and different types of air vehicle, all flying climate-efficient trajectories that are dynamically adapted in real time using AI-enabled systems.

European Commissioner for Transport, Adina Ioana

Vălean said: "Air traffic management can clearly play a significant part in both reducing aviation emissions and supporting smart and integrated transport solutions. Up to 10% of CO₂ emissions could be avoided by increasing the efficiency of air traffic management in European airspace, as envisaged by the Single European Sky framework. I therefore welcome today's launch of the European ATM Master Plan campaign to further modernise flying in Europe."

Speaking on behalf of the Spanish Presidency of the Council of the EU, **Álvaro Fernández-Iruegas, Deputy Director General, Spanish Civil Aviation Authority** said: "The work of SESAR and its partners is central to the EU sustainable and smart mobility strategy, which relies upon digital innovation and interoperability. Spain has been proud to work for a more united, autonomous and fair Europe during its presidency of the European Council, and the European ATM roadmap is exactly the kind of future-looking collaboration that we support."

Andreas Boschen, Executive Director, SESAR JU added: "The new European ATM Master Plan will address the climate change imperative. Building on the success of SESAR, the plan will set the strategic framework for our future efforts in ATM and show how digital innovation will open the trajectory to a digital and green European sky. I am looking for vision and ambition to make the next edition of the Master Plan a powerful tool for ATM transformation that benefits Europe's citizens and industry."

The aim is to have the new edition of the Master Plan adopted by the SESAR JU Governing Board at the end of 2024.

Austria at the forefront of synergy building in SESAR innovation

In 2023, we put the spotlight on Austrian SESAR Networking Initiative an open platform to foster engagement in SESAR innovation among Austrian public and private organisations.

Austrian stakeholders participating in SESAR and Single European Sky (SES) are as a whole convinced that SESAR is the most important European research initiative for air traffic management, and essential for the successful implementation of SES. During the SESAR 1 and SESAR 2020 programme execution, stakeholders met regularly and exchanged relevant information in order to both understand, align and find synergies between European and Austrian ATM research activities. Following the establishment of the SESAR JU States Representatives Group (SRG), Austrian stakeholders agreed to set up a more formalised SESAR networking initiative coordinated through the Innovation and Transport Directorates General of the Federal Ministry for Climate Action.

The Austrian SESAR Networking Initiative includes those responsible for research and innovation at the ministry and from the Directorate for Aviation (also members of the Single Sky Committee), as well as all Austrian founding members of the SESAR JU, namely Austro Control, EasyJet Europe, Frequentis AG. The Austrian Research Promotion Agency alongside other research and private organisations interested in SESAR, complete the group of participants in this networking initiative.

The agenda of those participating is to openly and transparently share SESAR-related information, focusing on alignment between European and Austrian aviation research and innovation agendas. The hope is to prevent duplication of research activities and ensure research projects are cohesive. Ultimately, stakeholders create a better and joint understanding of administrative, governance, and process topics related to the SESAR JU's Digital European Sky research and innovation programme. Topics shared include information about in-kind contributions to additional activities (IKAA) and best practices in project execution. Furthermore, members' changing priorities in the SESAR JU's multi-annual work programme are addressed within the initiative.



The networking initiative is managed by the SRG appointed Austrian representative. This ensures a mutual understanding of information between the networking initiative and the SRG. *"On the part of the Ministry, the exchange within the framework of the networking initiative is considered very valuable. Not only does the exchange between national stakeholders bring great added value for all participants in relation to the ATM Master Plan's vision, it also provides us with important input for our work in the SRG,"* says **Elisabeth Landrichter, Director General for Civil Aviation at the Federal Ministry for Climate Action.**

"This initiative is a great platform allowing members to exchange relevant SESAR Research and Deployment topics in an informal way. We especially appreciate the engagement of the different, but very relevant, directorates of the Federal Ministry for Climate Action as well as of the FFG. We learn from each other every time we meet, which allows us to better prepare ourselves for the upcoming calls," says **Michael Holzbauer, Director European Affairs at Frequentis**, where he currently leads several strategic ATM programmes, including SESAR.

"The SESAR Networking Initiative brings interesting transversal insight to the Austrian aviation stakeholders and enables a closer corporation, coordination and knowledge exchange. Having a platform that actively supports organisations to engage and exchange their interests and to organize research projects, which are aiming to fulfil the ATM Master Plan's vision, is considered highly valuable by Austro Control!" outlined by **Günter Tree, Head of Strategic Business Development at Austro Control Engineering Services.**



SESAR JU at Airspace World 2023

The global ATM community gathered from 8 to 10 March at Airspace World in Geneva, where SESAR JU and its partners showcased results from the SESAR 2020 research and innovation programme.

The event also saw the JU join forces again with the “Europe for Aviation” partners, hosting a wide range of briefings, exhibits, and demos, illustrating collaboration in action between the European aviation organisations working to implement the Single European Sky. In addition, Airspace World was also the backdrop to the annual gathering of the JU’s members and partners, which took place on 7 March.

EUROCAE and SESAR strengthen cooperation to accelerate the delivery of the Digital European Sky

In March, the European Organisation for Civil Aviation Equipment (EUROCAE) signed two cooperation agreements with the SESAR Joint Undertaking (SESAR JU) and SESAR Deployment Manager (SESAR DM). These agreements are aimed at strengthening cooperation and accelerating the delivery of the Digital European Sky as one team.

The memoranda of cooperation between EUROCAE and the SESAR DM, and between EUROCAE and the SESAR JU, both aimed to enhance collaboration on standardisation activities in aviation and speed up the industrialisation and deployment of SESAR Solutions.

The cooperative arrangements ensured that standardisation requirements were embedded at every stage of the SESAR lifecycle (i.e., definition, research and development, and deployment) and that standards-making was done collaboratively as one team between all industry stakeholders.

Anna von Groote, EUROCAE Director General, said, “The SESAR Joint Undertaking and SESAR Deployment Manager are active EUROCAE members. Innovative and developing domains such as ATM require inputs from stakeholders across the innovation cycle, and we are glad to see this synchronised effort in Europe and for EUROCAE to be an integral part of the innovation pipeline. All together we can support the aviation community with robust, relevant and timely standards.”



Andreas Boschen, Executive Director, SESAR Joint Undertaking, said: “Standardisation is critical to ensuring that the outcomes of SESAR research and innovation become an operational reality in line with the performance needs of the aviation industry. This new collaborative arrangement with EUROCAE sets us firmly on the path to delivering an inclusive and sustainable Digital European Sky.”

Mariagrazia La Piscopia, SESAR Deployment Manager Executive, said, “I am delighted to sign this memorandum today. Through this reinforced cooperation between SESAR Deployment Manager and EUROCAE, we can be even more successful in ensuring stakeholders have the right tools, references, and standards to implement the SESAR Deployment Programme. This arrangement facilitates the continuation of the European journey of ATM modernisation and digitalisation through SESAR as one strong team.”



SESAR research and innovation showcase at Fly AI Forum 2023

In April, FLY AI partners organised a two-day conference to explore the latest developments and deployments of artificial intelligence (AI) and machine learning (ML) in aviation.

Hosted by FLY AI partner, EUROCONTROL, the conference included updates from the European Commission on AI regulatory matters, the discussion of practical-use cases of AI benefits to aviation, an exhibition of projects and success stories, the exploration of the FLY AI digitalised catalogue of applications, and an overview of ongoing research and training activities. Several SESAR projects participated in the exhibition, presenting a range of AI applications. Involved in the exhibition were SESAR 2020 projects [BUBBLES](#), [MAHALO](#), [ARTIMATION](#), [ISOBAR](#), [HAAWAI](#), [IMHOTEP](#), and [SIMBAD](#).

SESAR sustainable solutions showcased at Paris Air Show

The SESAR JU showcased its research and innovation on sustainable aviation at the International Paris Air Show at Le Bourget from 19-26 June.

At the Paris Air Lab, an exhibition area dedicated to exhibiting solutions on decarbonisation, the SESAR JU showcased a selection of solutions aimed at making Europe the most environmentally-friendly sky to fly in the world. Solutions that were showcased included greener taxiing, climate-optimised trajectories, and more energy-efficient approaches and landings at airports.

The SESAR JU welcomed many important representatives from the aviation and transport sector, including **MEP Karima Delli, Aviation Director at DG Move, Filip Cornelis**, as well as representatives from the **French Education and Research Ministry**, who were all very interested in how SESAR is contributing to a more sustainable European sky.



In addition, the SEAR JU hosted a panel in the Paris Air Lab, featuring **Alain De Zotti, Airbus, Andreas Boschen, SESAR JU, Gerald Regniaud, DSNA, and LeAnn Ridgeway, Collins Aerospace**. Moderated by **Rosalinde Van der Vlies, DG RTD**, the panel discussed the environmental challenges facing air transport in Europe today, particularly in terms of ATM, and explored what's needed to accelerate the digital transformation of ATM and support a swift transition to greener aviation.

U-space makes it “Big in Japan”

In June, the SESAR JU and project partners travelled to Japan to showcase their work on U-space and exchange on developments with the country’s aviation and drone community. The main purpose of the trip was a bilateral technical workshop with the New Energy and Industrial Technology Development Organisation (NEDO), but also included meetings with the Japan Civil Aviation Bureau (JCAB) and participation at Japan Drone 2023.

A workshop co-organised by NEDO provided a chance for the SESAR JU and drone partners, EUROCONTROL, Enair,

Frequentis, CRIDA, to present the work of projects such as [U-ELCOM](#) and EUREKA, as well as technical details of the various solutions developed in support of U-space, the EU’s framework for the safe and secure integration of drones. Discussions also addressed capacity management based on dynamic pricing, the societal acceptance of urban air mobility (UAM), and vertiport integration.

In addition, the SESAR JU met with JCAB for a discussion of our respective activities relating to drones and UAM. With a dedicated SESAR stand and a panel discussion at Japan Drone 2023, the SESAR JU projects had the opportunity to widen its outreach to the 19,000 participants attending the expo.



Prague Airport wins SESAR JU-ACI Europe digital transformation award



In 2023, Prague Airport won the SESAR JU-ACI Europe Digital Transformation Award. The airport was recognised at the

annual ACI EUROPE Best Airport Awards during the ACI EUROPE / World Annual General Assembly, Conference and Exhibition, which took place in Barcelona on 28 June.

Prague Airport was the fourth airport to be awarded the prize, celebrating airports that successfully embraced digitalisation, adopting innovative technologies and procedures to improve the safety, capacity, efficiency, and environmental footprint of their airside operations. The airport has been an early adopter of key SESAR solutions, such as the airport operations plan and airport operations centre, and leads the way in terms of future mobility with initiatives on urban air mobility and inter-modality. It has adapted these to its local needs and benefited from adopting the latest digital innovation and technologies, such as machine learning and data integration. This approach has been rewarded with significant increases in the airport’s operational safety and efficiency.

Prague Airport joined the SESAR family in 2021 as a founding member of the SESAR Joint Undertaking.

EUR 7 million investment for European multimodality under rail and aviation synergy call

In October, Europe’s Rail and SESAR Joint Undertakings published a joint call for the development of an “Integrated air and rail network backbone for a sustainable and energy-efficient multimodal transport system”. The call targets solutions that will improve door-to-door mobility for Europe’s citizens, and is expected to generate synergies between the air and rail innovation communities. With a total investment of EUR 7 million, the call is being co-funded within the framework of the EU’s Horizon Europe research and innovation programme.

The benefits expected from the outcomes of the selected projects will be manifold. Not only will the funded research and innovation activities help to improve future traffic management solutions predictability and punctuality for journeys involving air and rail, they will also relieve congestion in and around airports and rail stations and improve passenger flows. All of which will also bring environmental benefits in terms of emissions, noise and air quality.

The scope of the call matches the ambitions outlined in EU’s Sustainable and Smart Mobility strategy, which aims to make connected and automated multimodal mobility a reality by 2030.



It also reflects the commitment of both joint undertakings to establishing synergies and complementarity between their respective research and innovation programmes. This collaborative approach is key to pooling dispersed resources and aligning effort on some of Europe’s top priorities.

“ Closer integration of Europe’s air and rail networks will be a key element in building a mobility system for future generations that is truly sustainable, smart, and resilient. Innovation is key to achieving this objective. I am delighted to see that Europe’s Rail and SESAR Joint Undertakings are working together, through this joint call, to ensure complementarity and synergies between their research programmes, and to invest in the technologies and collaborative tools that will help make seamless multi-modal travel a reality.

Adina Vălean
European Commissioner for Transport



SESAR EXPLORATORY RESEARCH

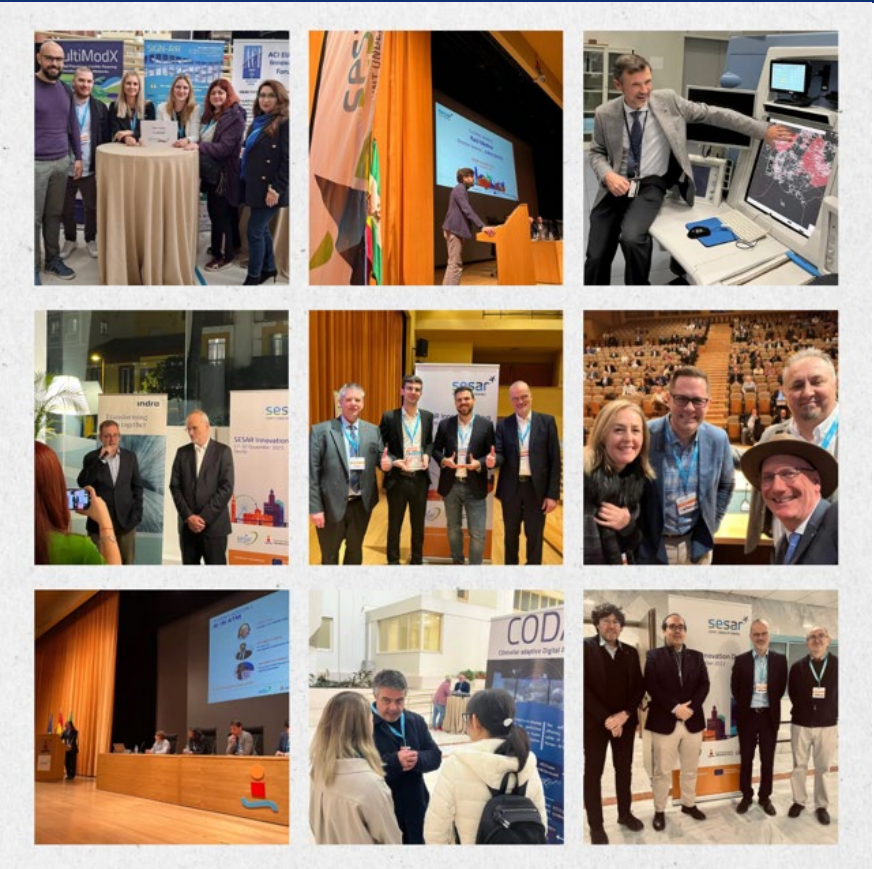
Exploring the boundaries of ATM research

Conference showcases innovation and scientific excellence, the twin engines for delivering the Digital European Sky

450 of Europe's leading researchers in air traffic management (ATM) and aviation gathered in Seville for the SESAR Innovation Days (SIDS) from 27 to 30 November. Hosted by the University of Seville at its Faculty of Engineering, with support from SESAR JU founding members, Enaire, Indra, Ryanair and AENA, the conference featured some 66 posters and 42 papers, covering data-driven methods for safety and resilience prediction, climate-optimised trajectories, drone traffic management, airport operations, among other research areas.

Speaking at the conference, **Andreas Boschen, Executive Director of the SESAR Joint Undertaking** welcomed the flow of innovative concepts coming into the Digital European Sky, noting how critical they are to addressing key challenges, such as airspace capacity, climate and catering for new entrants. *"We count on you, the brightest research minds, to dare to think outside the box and challenge conventional limits in order to transform European air traffic management, making it smarter, more resilient and above all sustainable."*

Following welcoming words from hosts **Andres Saez Perez, Dean of the Engineering School, University of Seville** and **Sergio Esteban Roncero, Delegate of the Rector of the university**, the conference heard from **María Luz de Mateo, Enaire**, who gave an industry view on the importance of collaboration



with academia for fostering knowledge exchange. She noted that the concepts discussed today will be the solutions of tomorrow to solve current and future challenges in the most efficient, environmental and safest manner. *"Common challenges need common solutions; we are fully dedicated to the development of innovative procedures and next-gen technologies to achieve the SESAR vision of a Digital European Sky,"* she added.

In his keynote, **Andrea Gentili, Clean Partnerships Manager and Deputy Head of Unit, Clean Planet, Directorate-General for Research and Innovation, European Commission**, said that the aviation industry has to become more digital, sustainable, and resilient in order

to meet Europe's climate ambitions and to maintain its global leadership. He made a strong appeal to the community to ensure that their research is aligned with policy needs, to deliver results that are impactful, and to find synergies with industry to ensure market take-up, keeping in mind citizens' changing mobility patterns.

Speaker **Milagros Sanchez, Strategy and Innovation ATM, Program Manager, Indra**, is a self-professed SESAR enthusiast: This spirit of partnership is the true catalyst for change. *"It is the only mechanism that breaks frontiers,"* she said, underlining the importance for industry to plug the brain drain and retain the young emerging talent who will shape the future of aviation.

Higher airspace operations

On day one, panellists from ICAO, EUROCONTROL, NATS, Politecnico di Torino and Airbus, discussed what is needed to cater for new types of air vehicles flying much higher than today’s aircraft. These vehicles offer a variety of services, including expansive mobile connectivity (equivalent to up to 250 telecoms towers) and earth observation applications. These higher space operations were the focus of a recently-completed SESAR 2020 exploratory research, [ECHO](#), which mapped out a concept of operations ([CONOPS](#)), and now [ECHO 2](#) a new SESAR project, will build on the CONOPS by introducing modules on space launch real-time monitoring and packages covering air-ground operational integration procedures (see page 15 for more details).

US airspace modernisation

Day two opened with a look at US national airspace system modernisation, from long-term research and innovation to implementation. Flexibility is the driving requirement behind the US Automation Evolution Strategy, said Rebecca Guy, Vice-President, Programme Management Organisation, US Federal Aviation Administration (FAA). The operational needs and environment are changing all the time, she said, noting that now rockets take off daily stateside compared to 5 per year 20 years ago. A move away from hardware infrastructures to cloud-based services and standardised systems is helping to reduce the innovation lifecycle and to move technology implementation forward, she added. Connectivity with the aircraft will be at the centre of future operations, said Steve Bradford, Chief Scientist for NextGen, at the FAA, which will greatly improve efficiency.

AI use cases and future trends

The application of artificial intelligence in air traffic management was at the heart of discussions at a plenary on day two. Experts headlined some of the

operational use cases where artificial intelligence applications are being trialled through research and innovation, as well as some of the challenges facing acceptance and implementation of this promising technology.

The conference was also an opportunity to discuss with academic representatives from the University of Westminster and TU Braunschweig on the future research trends and needs in the context of the European ATM Master Plan, Europe’s shared roadmap for ATM modernisation. Key takeaways included having a free flow of operational data for the common good to help build the future faster; involving policymakers at early stages of concept design to ensure research outputs can better support future transport regulations; and to invest in future technologies like neuromorphic and quantum computing to optimise operations in real time and with greater accuracy.

The conference heard from **Micol Biscotto, coordinator of Engage 2, SESAR JU’s Knowledge Transfer Network (KTN)**, who presented some of the activities that are helping to nurture knowledge building on future trends and foster closer ties between academia and industry.

Closing remarks

Sergio Millanes Vaquero, Director of Seville Airport from SESAR JU founding member, AENA, presented the digital transformation taking place at the airport, including the use of passenger info bots, maintenance drones and

remote screening. He said that by harnessing innovation, the airport has been able to manage effectively the intensive growth it has experienced since COVID.

Innovation is also critical for meeting the climate impact of aviation. We have to take a 360-degree approach to climate, said **Giovanni Zucchetta, EU Public Affairs Lead from SESAR JU founding member, Ryanair**, who presented the company’s pathway to net zero, a strategy to become carbon neutral by 2050, covering sustainable aviation fuels, offsetting, but also improvements to ATM operational improvements.

In his closing address, **Raúl Medina, Director General, EUROCONTROL**, said: *“Predicting the future is always risky, but one thing we know for sure is that it is full of challenges. The SESAR JU and Digital European Sky have a major role to help us bring the ATM system up to the performance level needed to meet these challenges,”* he added. *“The time for change is now, we need to focus on the quick wins but also to have a long-term view”*, he concluded, underlining the importance of the update of the European ATM Master Plan, which is planned for 2024.

SESAR Innovation Days 2024

The conference closed with the announcement of the next SESAR Innovation Days which will take place in Rome, Italy, from 11 to 15 November 2024.





SESAR Young Scientist Award recognises rising stars in European air traffic management research

Europe's most promising young minds in air traffic management (ATM) research were celebrated at the SESAR Young Scientist Award ceremony, which took place during the closing plenary of the SESAR Innovation Days conference on 30 November at the University of Seville's Faculty of Engineering.

Awarded annually, the prize aims to distinguish young scientists, who have demonstrated excellence in ATM and aviation-related research fields. The award also provides researchers starting out in their career with an opportunity for further professional development. A further objective of the award is to showcase the potential of young talent to formulate fresh ideas and solutions to the challenges facing ATM and aviation.

The 2023 edition recognised scientific excellence in two categories: PhD and students (undergraduate/master). The awards were presented during a ceremony, presided over by Andreas Boschen, Executive Director, and Peter Hecker, Technical University of Braunschweig, Chair of the jury, and featured presentations from all short-listed scientists from both categories.

The top award in the PhD category went to Nils Mäurer, Universität der Bundeswehr München/Airbus, for his research, while working at the German Aerospace Center (DLR), into addressing cyber-secure communications in the next generation of aeronautical datalinks. The jury praised him for a very sound and rigorous approach to the research which included solution design, simulation, a security validation, lab work and flight trials.

Wang Zhengyi, Ecole Nationale de l'Aviation Civile/ Nanyang Technological University Singapore, was awarded second place for his thesis on strategic planning for unmanned traffic

management. In their evaluation, the jury commented positively on the relevance of the research and scientific excellence demonstrated in the thesis.

Taking third place in the PhD category was Marta Ribeiro, Delft University of Technology, for her thesis investigating whether reinforcement learning (RL) can improve self-separation efficacy, with emphasis on future unmanned operations. The jury commented positively on the novelty of the approach and scientific rigour of the work.

The top prize among the students category went to Christopher Conrad, Cranfield University, whose thesis targets developing a data model supporting vertiport operations. The jury praised Conrad for going beyond the current state-of-the-art innovations to tackle the question of resource management and schedule optimisation in urban air mobility.

Taking second prize in the category was George-Daniel Molivă, University POLITEHNICA of Bucharest, whose thesis focused on a mechanism to score the performance of automated ATC systems. The jury commended the scientific soundness of the approach taken in the research.

The third prize went to Olivier Schweiger, University of Vienna, on an AI-based decision-making tool for air traffic control. The jury found the thesis to be scientifically sound and the proposed approach to be innovative.

"I want to congratulate all the applicants, short-listed candidates, and our overall winners, Nils Mäurer and Christopher Conrad. Young talent is the lifeblood of innovation, injecting fresh perspectives, boundless creativity, and an unwavering passion to challenge the status quo. These are the key ingredients we need to deliver the Digital European Sky!" said **Andreas Boschen**, Executive Director of the SESAR Joint Undertaking.

Call for exploratory research projects launched

In June, a second open call addressing exploratory research was launched, covering a wide range of topics aimed at generating innovative concepts, methodologies, and technologies to support the delivery of a Digital European Sky. The selected projects will be funded within the framework of the EU's Horizon Europe research and innovation programme (Total budget: EUR 25 million).

The aim of the call (HORIZON-SESAR-2023-DES-ER-02) is to foster new and innovative ideas connected to EU policy to transform air traffic management in Europe, as well as encouraging coordinated exchange of knowledge and stimulating the future ATM skilled



workforce. Composed of two work areas, namely "ATM excellence science research and outreach" and "ATM application-oriented research".

The selected projects will be announced early 2024.

Modelling climate-optimised trajectories to cut non-CO₂ climate effects

Climate impact reduction has for a long time focused on carbon dioxide (CO₂) released into the atmosphere, but recent assessments show non-CO₂ climate effects to be equally, if not more, harmful. **Dr Sigrun Matthes** coordinates aviation climate change research at Germany's DLR research centre: "The climate effect of aviation is composed of CO₂ and non-CO₂ effects - which include contrail-cirrus, NO_x induced changes on ozone and methane, water vapour effects and aerosol indirect effects." The radiative effects caused by these non-CO₂ emissions can be positive or negative, equivalent to warming and cooling climate effects, depending upon the weather, flight path, and climatic conditions representing the physical state of the atmosphere. The net radiative effect of non-CO₂ emissions is

positive and thus has a warming effect on climate. According to a report published by the European Aviation Safety Agency in 2020, non-CO₂ emissions account for more than half of aviation's total climate effect.

Under Dr Matthes' leadership, the now completed SESAR FlyATM4E project investigated climate optimised aircraft trajectories that mitigate the impact of non-CO₂ emissions based on analysis of flight data during different meteorological conditions, vertical, and horizontal flight paths. There are still many uncertainties surrounding the radiative effects of non-CO₂ emissions, however, project partners identified a potential 20-50% reduction in climate effect as a result of minor flight detours, estimated to less than 4% of the direct operating costs.

FlyATM4E explored a concept on how to describe the spatially and temporally varying climate effect of non-CO₂ emissions, e.g. where warming contrail can form, based on atmospheric weather prediction together with numerical

modelling to provide quantitative estimates of aviation climate effects. Project partners developed a prototype algorithm combining climate change functions with meteorological forecast information to enable identification of an optimised route for a particular flight which can be used by flight dispatch during the planning phase. The prototype provides functions for different non-CO₂ emissions night and day which can be merged into one climate change function to show how much an emission released would modify the global surface temperature over e.g. the next 20 years. Universidad Carlos III de Madrid, Director PhD Program Aerospace Engineering, **Manuel Soler** explains: "We are optimising trajectories to take climate change into account as part of the business objective. We can find win-win solutions by weighting climate effect against cost to pick solutions that are more eco-efficient." He acknowledges 20-50% uncertainty is high, and expects further research to help refine the algorithms.

The prototype algorithmic climate change functions can be plugged into existing flight planning systems today, with the potential to also support planning decisions at network management level and by navigation service providers. Accessed via an application programming interface (API), the solution could be used to provide polygons, graphs, and maps at different flight levels showing areas most likely to produce a large climate effect in terms of the global surface temperature over the next 20 years. "This is a SESAR success story because for the first time we've been able to encapsulate climate change information into an open-source library, available for anyone to access," says Sigrun Matthes concerning the DLR lead research paper (Dietmüller et al., 2022). *"It offers a preliminary meteorological service related to climate change to support industrialisation and the development of future standards."*

More about the project

<https://www.sesarju.eu/projects/flyatm4e>



Concept of operations for higher airspace published

A concept for operations (ConOps) for higher airspace is now available! Delivered by the SESAR JU ECHO project, led by EUROCONTROL, the ConOps defines future operational roles, responsibilities, procedures, and infrastructure required to support higher airspace demand over the short, medium, and long term.

The higher airspace (airspace approximately 60,000 ft) is no longer exclusive to space rockets and military planes but hosted an expanding range of vehicles, including long-endurance balloons, high altitude platform stations (HAPS), supersonic, and hypersonic aircraft. With missions varying from connectivity and surveillance to passenger transport and satellite services, these

vehicles with vastly different operating characteristics present a new airspace management challenge.

"This anticipated demand was very diverse, ranging from slow-moving high-altitude platform systems to suborbital hypersonic vehicles," explained **ECHO project coordinator, Henk Hof** from EUROCONTROL. *"Space operations and launch/re-entry phases also had to be included in the demand analysis,"* Hof pointed out.

Led by SESAR Founding Member, EUROCONTROL, the ECHO consortium brings together the leading European industry, organisations, institutes, and research centres dealing with higher airspace operations: Airbus UTM (Airbus Operations SL), CIRA, DASSAULT AVIATION, DLR, DSNA, ENAC (Italian CAA), ENAC (French University), ENAV, ONERA, and THALES Alenia Space.

Ground work

The project began by researching existing procedures and concepts for air traffic management at higher airspace. From this, a broad framework of principles and assumptions was established. This built upon high-level principles agreed to at the European Higher Airspace Operations Symposium, held in April 2019. The project team also sought to involve as many stakeholders as possible in the initiative, as well as cooperating with military organisations' regulatory task forces.

"It was clear that many so-called new entrants came from outside the traditional aviation industry," said Hof. *"In order to reach as many stakeholders as possible, we held a number of consultations and workshops. All our findings were presented and discussed at these workshops, in order to achieve a good level of buy-in."*

Harmonised approach

Out of this work, a clearer shared understanding of future higher airspace demand was achieved. This provided the basis for developing robust traffic management solutions. "A solid Concept of Operations (ConOps) was developed," added Hof. "This defined future operational roles, responsibilities, procedures, and infrastructure required to support higher airspace demand over the short, medium, and long term." The ConOps covered everything from low- to high-speed activities to space missions. Preflight strategic deconfliction was conceptualised to ensure the separation of operations on agreed trajectories and avoid collisions. "The results of this project were not an end point but a starting point," said Hof. "This pointed the direction for the way ahead."

A follow-on project, ECHO 2, is underway as part of the Digital European Sky programme and built on the firm foundation laid by ECHO. "The principle of

building traffic management according to demand is a key element that needed to be tested," noted Hof. "We envisaged limited services and infrastructure in areas of low demand, whereas in regions of medium- to high-density operations, users may require new traffic management services." Regulatory coordination at the international level will also be needed for certain types of operations. Industrial associations were expected to play a key role in these discussions. "This project helped Europe to develop a clear position on this issue," remarked Hof. With the release of the final ConOps, Europe has a clear and robust concept that can be used both to promote European developments and to support global evolution through ICAO.

More about the project:

<https://www.sesarju.eu/projects/ECHO>



A new horizon for synthetic data generation in aviation

A new era in synthetic data generation in aviation might be on the horizon with the launch of the SynthAIr project - Synthetic Data Generation for ATM Systems. The initiative is a response to

the scarcity of relevant data for aviation and the inherent limitations of AI models in handling diverse datasets. The project, which kicked off in September in Trondheim, Norway, comprises four partners from four different countries: Sintef, Deep Blue, EUROCONTROL, and Delft University of Technology, under the coordination of Massimiliano Ruocco from Sintef, who is leading the research

in this innovative field during its 30-month duration.

With the rapid advancement of AI technologies, the aviation industry is at a critical juncture where data availability and ubiquity posed significant challenges to the development of AI-based tools, particularly those related to safety-critical data. SynthAIr is poised to address this pressing issue with an innovative approach.

"As SynthAIr launched, we stood at the cusp of a transformative era in aviation and ATM," said the Project Coordinator Massimiliano Ruocco (Sintef). "Synthetic data promised to overcome data scarcity, enhancing our predictive modeling capabilities. This project was our pathway to fully unlock AI's potential in ATM systems, driving groundbreaking innovations and efficiencies. Together, we charted a bold new course for the SESAR community."



The primary objective of SynthAIR is to pioneer AI-based methods for synthetic data generation in the ATM system domain. This initiative was a response to the scarcity of relevant data and the inherent limitations of AI models in handling diverse datasets. By exploring AI-based methods for synthetic data generation, SynthAIR aims to overcome these obstacles while simplifying the process for users with varying levels of expertise.

At the heart of the project lays the groundbreaking concept of the universal time series generator (UTG). Inspired by recent advancements in computer vision and language technology, the main idea is to learn a model from multiple datasets and generate synthetic data that accurately represented new, unseen datasets. This process is achieved by conditioning the UTG on a compressed representation of the target data. In the aviation domain, for example, UTG can be trained on data from a few specific airports and subsequently utilised to generate synthetic data for entirely new airport environments. This approach is extended to creating a universal time series forecaster (UTF) capable of making accurate predictions for new environments without the need for additional training.

“Synthetic data stood as a beacon of hope, promising to elevate the predictive modeling capabilities to unprecedented heights,” continued Massimiliano Ruocco. “It isn’t just about having more data; it is about having the right kind of data that could train our systems more effectively. With SynthAIR, the aim is not only to enhance the quality of predictions but also to fast-track the integration of AI in ATM systems. The potential of AI in aviation was vast, and with the right data, SynthAIR can unlock efficiencies, safety measures, and innovations that were previously beyond anyone’s reach.”

More about the project:

<https://www.sesarju.eu/projects/SynthAIR>

Engage 2: fostering knowledge transfer in air traffic management research and innovation

In June, Engage 2, the SESAR JU’s Knowledge Transfer Network (KTN) officially kicked off. Over the next four years, the network will organise an array of activities aimed at fostering closer ties between academia and industry in the field of ATM research and innovation.

The focus of the KTN will be feeding the findings from the Digital European Sky research and innovation programme into future fundamental and application-oriented research. Supporting this objective will be the Engage WIKI, which will provide a one-stop repository on ATM research, hosting data on from completed SESAR projects.

The KTN will carry out an array of activities to prepare the future aviation workforce, including open days, summer schools, calls for PhD students as well as mentorships for master’s students.

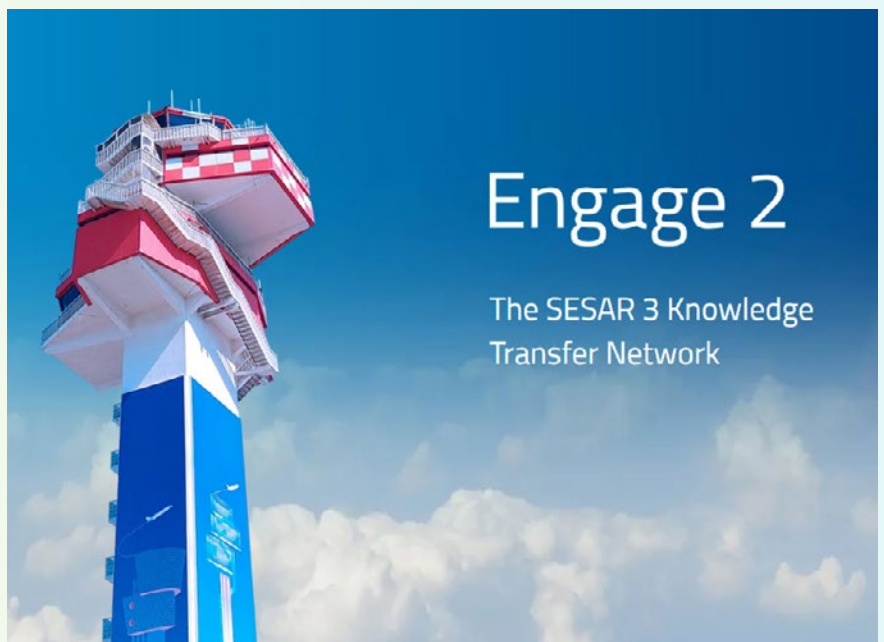
Fostering collaboration between industry and academia will also be the focus of the KTN, which will organise thematic workshops, matchmaking opportunities, and will make available “catalyst” funding to advance concepts towards higher levels of technical readiness levels.

Building upon the achievements of its predecessor, the Engage 2 KTN aims to support the SESAR JU in many initiatives, such as SESAR Innovation Days (SIDs) and contribute to the development of the SESAR Digital Academy.

Led by Deep Blue, Engage 2 can count on the extensive experience in applied research and exploratory research of all its nine partners: Technische Universitaet Braunschweig (DE), the University of Belgrade – Faculty of Transport and Traffic Engineering (RS), Fundacion Instituto de Investigacion Innaxis (ES), Frequentis (AT), EASN Technology Innovation Services (BE), EUROCONTROL, (BE), the University of Trieste (IT) and the University of Westminster (UK).

More about the project:

www.sesarju.eu/projects/engage2



Ongoing exploratory research projects

ASTAIR - Auto-Steer Taxi at Airport

The project is designing a support tool to fully automate the supervision of airport ground operations. The partners will prototype a human-machine interface that will make use of algorithms to autonomously manage vehicle movements on the airport surface. The project aims to provide the controller with enough flexibility to locally tweak the algorithm rules to cope with operational events.

Web: www.sesarju.eu/projects/astair

AEROPLANE - Advancing Measures to Reduce Aviation Impact on climate and enhance resilience to climate-change

Aviation and climate are inextricably linked. Air traffic emits greenhouse gas emissions that alter the composition of the atmosphere globally. In turn, these changes to the atmosphere increasingly result in extreme weather phenomena, which can adversely affect aircraft performance, leading to air traffic rerouting, delays and cancellations. The project aims to develop a toolkit to mitigate the climate impact of aviation and improve the sector's resilience to climate change.

Web: www.sesarju.eu/projects/aeroplane

AI4HyDrop - An AI-based Holistic Dynamic Framework for a safe Drone's Operations in restricted and urban areas

Drones are already used in an array of sectors, from agriculture, construction and surveillance to film-making, healthcare and emergency services. Given the scale and complexity of drone operations that are expected in the coming years, a holistic approach needs to be taken to managing the airspace. The project will develop a framework that incorporates various AI-based tools and associated information flows to enable future drone operations at scale. The proposed framework will represent a digital step change in ATM, using AI as a means to move to more automated U-space services.

Web:
www.sesarju.eu/projects/AI4HyDrop
www.ai4hydrop.eu

ASTRA - AI-enabled tactical FMP hotspot prediction and resolution

Today, air traffic congestion or hotspots are identified using flight plan data and are managed in the pre-tactical stage of the flight. However, on the day of operation, an aircraft's actual trajectory may differ significantly from its flight plan and, as a result, hotspots still occur and these have to be resolved by the controllers (ATCOs) without sufficient advance notice. With today's tools, tactical hotspots are only identified up to around 20 minutes in advance. The aim of ASTRA is to predict and resolve hotspots much earlier than today using an AI-enabled tool. The overall aim is to optimise capacity while enabling aircraft to adhere to more efficient and green trajectories.

Web: www.sesarju.eu/projects/astra

CODA - Controller adaptive Digital Assistant

Air traffic control is reputed as one of the five most stressful professions there is. Addressing the mental workload of controllers is therefore an important area of SESAR research and innovation and one that can be addressed using artificial intelligence. The project aims to develop a digital assistant capable of predicting future traffic, and assessing controllers' stress levels and attention span, and whether they would be capable of handling the anticipated workload. The assistant would decide how to act, following an adaptation strategy: it may, for instance, increase the level of automation, enable additional AI-based tools, or request changes to the airspace (sector splitting).

Web:

www.sesarju.eu/projects/coda
<https://iptc.upm.es/coda>

E-CONTRAIL - Artificial Neural Networks for the Prediction of Contrails and Aviation Induced Cloudiness

Contrails and increased cloudiness caused by aviation can trap heat and lead to a net warming effect on our planet. However their impact on climate can depend on weather, regional and seasonal variations. The project will blend cutting-edge AI techniques and climate science to better predict and understand the non-CO₂ impact of aviation on global warming and reduce uncertainties as an essential step towards greener aviation.

Web:

www.sesarju.eu/projects/e-contrail
<https://www.econtrail.com/>

Green-GEAR - Green operations with Geometric altitude, Advanced separation and Route charging Solutions

Since the early days of aviation, barometric pressure measurements have been a simple and robust method for altimetry. However, it has some drawbacks including having no direct reference to terrain and vertical profile variabilities restricting capacity and flight efficiency. The project will investigate the environmental potential of geometric altimetry enabled by satellite navigation, to increase safety, support greener climb and descent operations, while also optimising capacity. At the same time, the project will investigate the potential of environmentally-driven route charging to incentivise airspace users to avoid volumes of airspace with a high climate impact and disincentivise flight planning through high demand sectors / flight altitudes.

Web: www.sesarju.eu/projects/greengear

HUCAN - Holistic Unified Certification Approach for Novel systems based on advanced automation

The adoption in ATM of increasingly automated technologies, enabled by artificial intelligence, raises new challenges around liability and certification that must be addressed at the point of design. The project proposes a novel and holistic approach for the certification and approval of AI-enabled ATM airborne and ground systems, targeting EASA, national authorities and air navigation service providers. The project will also develop a set of suitable design guidelines and associated toolkit for streamlining the development of automation and AI-powered technologies, targeting manufacturers. A parallel analysis of certification approaches, legal and regulatory features and critical issues of such technologies will be carried out.

Web: www.sesarju.eu/projects/hucan

HYPERSOLVER - Artificial Intelligence controller able to manage Air traffic Control (ATC) and Air Traffic Flow Management (ATFM) within a single framework

In air traffic flow management (ATFM), measures are issued when traffic demand exceeds capacity usually in advance of take-off. Controllers then give different aircraft instructions to separate them when airborne. The challenges facing ATFM and air traffic control may differ and solutions to them are often developed in isolation of one another. The project aims to develop a "hyper solver" based on an advanced artificial intelligent reinforcement learning method with continuous reassessment and dynamic updates. The tool is a holistic solver from end-to-end, covering the whole process to manage density of aircraft, complexity of trajectories, interactions (potential conflict in dynamic capacity balancing timeframe) of trajectories, conflict of trajectories at medium-term and conflict of trajectories at short-term.

Web: www.sesarju.eu/projects/hypersolver

ImAFUSA - Impact and capacity Assessment Framework for U-space Societal Acceptance

Citizens' confidence and acceptance is critical to the further development of the drone services market in Europe, especially urban air mobility (UAM). The project will develop an impact and capacity assessment framework for U-space societal acceptance to assist local authorities, other U-space stakeholders and users with the implementation of socially acceptable and beneficial urban air mobility in cities. The framework and its tools will address matters which influence public opinion, such as the environment (e.g. noise, visual pollution and air quality), and safety and socio-economics (e.g. affordability, accessibility, economic development, public space use and connectivity).

Web:
www.sesarju.eu/projects/ImAFUSA
<https://www.imafusa-sesar.eu/>

MAIA - Multimodal Access for Intelligent Airports

Cooperative, connected and automated mobility and urban air mobility are the next big trends in transport, and represent viable and innovative solutions to expand mobility choices for getting to, from and around airports. The project will develop a set of data analytics and modelling tools to support the implementation of multimodal airport access solutions based on two passenger mobility innovations: shared autonomous vehicle fleets and unmanned aerial vehicle fleets. The tools will monitor and anticipate passenger behaviour changes due to these new options, optimise vehicle dispatching under multimodal disruptions and recommend appropriate locations for vertiports, with the aim of maximising the contribution of these mobility innovations to the competitiveness and sustainability of the European aviation sector. The overall goal is to enable multimodal services for airport access that balance passenger experience with capacity and environmental sustainability.

Web:
www.sesarju.eu/projects/MAIA
<https://maiasesarproject.eu/>

MultiModX - Integrated Passenger-Centric Planning of Multimodal Transport Networks

Air and rail are natural multimodal partners and their collaboration is key to assuring a more efficient, predictable, and environmentally sustainable door-to-door passenger journey. The project will develop a set of innovative solutions and decision-making tools to support the coordinated planning and management of multimodal transport networks. Specifically, the project will develop a modelling and evaluation framework, and a solution to enable the coordinated design of air and rail schedules according to expected demand behaviour.

Web:

www.sesarju.eu/projects/MultiModX
<https://multimodx.eu/>

MUSE - Measuring U-Space Social and Environmental Impact

The project will develop a set of key performance indicators, methods and tools for the comprehensive and rigorous assessment of the impact of urban air mobility (UAM) operations on the quality of life in European cities, with particular focus on drone-generated noise and visual pollution. The project will develop a new toolset capable of generating accurate drone 4D trajectories in urban areas, modelling UAM's noise and visual footprints, high-resolution dynamic population mapping and calculation of population exposure indicators segmented by type of day and time of the day, citizens' sociodemographic profile, type of activity being performed and other relevant variables.

Web: www.sesarju.eu/projects/MUSE

SEC-AIRSPACE - Cyber Security Risk Assessment in virtualised AIRSPACE scenarios and stakeholders' awareness of building resilient ATM

The digitalisation and modernisation of air traffic management will bring many advantages to aviation, but these will come with challenges in managing cyber vulnerabilities. The project aims to introduce cyber security components into the state-of-the-art security risk assessment methodology (ies) currently already in use in ATM. The project will also investigate the potential of applying the concept of people analytics (PA) to increase cyber security awareness in ATM organisations. The project results will be validated and demonstrated through two real use cases, involving relevant stakeholders.

Web: www.sesarju.eu/projects/sec-airspace

SMARTS - Smart sectors

Optimising airspace capacity is a key to accommodating current and future air traffic, while maintaining safety, improving efficiency, and reducing aviation's environmental impact. The project will focus on dynamic airspace configuration and the design of "smart sectors". This covers the design of basic volumes of airspace with optimal distribution of workload, tailored around specific safety and operational requirements, including complexity. As a by-product, the application of cost-efficient capacity actions allows for more accurate demand and capacity balancing planning, thus reducing the number of required demand measures.

Web:

www.sesarju.eu/projects/SMARTS
<https://wp.lancs.ac.uk/smarts-sesar/>

SynthAIR - Improved ATM automation and simulation through AI-based universal models for synthetic data generation

The availability of a wide variety of labelled data (e.g. safety related) is major bottleneck impeding the accuracy of AI models developed for ATM. One possible solution is to generate synthetic data from original data and a model that is trained to reproduce the characteristics and structure of the original data. The project will explore and define AI-based methods to generate synthetic data. These methods are attractive since they require less user knowledge expertise and better generalisation capabilities. The project will take advantage of advances in computer vision and language technology to develop a universal time series generator (UTG). The generator can be trained on a certain set of data obtained from a small number of airports in order to generate synthetic data about a new airport.

Web: www.sesarju.eu/projects/SynthAIR

TRUSTY - Trustworthy intelligent system for remote digital tower

Remote digital towers are capable of delivering affordable air traffic services as safely and efficiently as physical towers. The project aims to harness the power of artificial intelligence (AI) to enhance the capabilities of digital towers in terms of resilience, capacity and efficiency. The overall goal is to enhance the trustworthiness of AI-powered decisions in the context of remote digital towers on specific tasks, such as runway and taxiway monitoring. The project will apply information visualisation techniques like visual analytics, data-driven storytelling, and immersive analytics in human-machine interactions (HMI). In doing so, the project is at the crossroads of trustworthy AI, multi-model machine learning, active learning, and UX for human and AI model interaction.

Web: www.sesarju.eu/projects/trusty



INDUSTRIAL RESEARCH AND FAST TRACK

Digital SESAR Solutions Catalogue is live!

In March, the SESAR JU published a digital version of its Solutions Catalogue.

The SESAR Solutions Catalogue charts progress in developing the technological and procedural solutions needed for delivering the digital European sky.

The new digital interface allows visitors to view more than 200 solutions addressing key areas of the ATM value chain, notably airport operations, air traffic services, network operations, and the enabling infrastructure.

These include over 136 delivered solutions now ready for industrialisation, of which just under 70 were now part of deployment plans at local and European levels, meeting the business needs and resulting in tangible benefits in terms of performance.

The Catalogue also presents details of candidate solutions, which would be further developed within the framework of the Digital European Sky programme.

The new interface enables users to filter the contents of the catalogue according to benefits, stakeholders, implementation locations, related projects, and a lot more!

The Catalogue will be updated as more solutions became ready for industrialisation and deployment within the framework of SESAR research and innovation.

Discover the catalogue:

www.sesarju.eu/catalogue

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Every drop counts: Lufthansa invests in SESAR technology to reduce CO₂ emissions

In 2024, Lufthansa will start implementing a fleet of up to 65 Airbus aircraft equipped with SESAR technology to transmit flight trajectory information in real time, a key enabler for improving flight predictability and reducing emissions. The announcement makes Lufthansa an early mover in implementing this new technology, which is mandated for all newly delivered aircraft and air traffic ground systems in the EU from 2028.

An optimised flight path saves fuel and reduces CO₂ emissions. With the standard installation aboard A320neo/ A321neo aircraft of this new, innovative technology, known as the automatic dependent surveillance contract extended projected profile (ADS-C EPP), Lufthansa Group will be able to exchange flight profile information in real time with [ground air traffic control systems](#).

Developed within the framework of the [SESAR research and innovation programme](#), ADS-C EPP will automatically transmit 4D flight path information generated by the aircraft's flight management system to air traffic control at any time. This so-called 4D flight trajectory describes the further course of a flight in the three spatial dimensions (length, width, height) as well as time as the fourth dimension. Based on the more precise information about the further flight path of an aircraft, air traffic control can control the airspace more efficiently and optimise the routing of the aircraft.

The Lufthansa Group's new aircraft equipped with ADS-C EPP will initially be able to use the new technology in Maastricht airspace (MUAC), [which is the first airspace in Europe to meet all the requirements](#). The new technology is currently certified for aircraft of the Airbus A320 family and the Airbus A330neo. Looking to the future, the airline is working together with the [SESAR Deployment Manager](#) in the context of synchronised deployment, and air navigation service providers to ensure that it will be possible to fly even

more fuel-efficiently in an increasing number of European airspaces as quickly as possible.

"Lufthansa Group is fully committed to accelerating to the modernisation of air traffic management. It is our hope that this investment is also a clear sign about the technology readiness and importance of the SESAR Joint Undertaking to continue driving its innovation forward, developing more solutions for the aviation community," said **Michael Nachtigäller, SJU programme committee member Lufthansa Group**.

"The decision of the Lufthansa group to implement the Airbus ADS-C EPP technology is a clear recognition of the success of the SESAR collaborative work to develop, trial and demonstrate the benefits of this technology for a more digitalised and sustainable Air Traffic Management in Europe. As time comes now to implement it in real operations, Airbus is extremely proud to support the Lufthansa group in being an early adopter and early mover of this technology cornerstone of the Digital European Sky," said **Alain de Zotti, HO Aircraft Architecture & Integration, Airbus**.

Presenting flight labels in a new light reduces controller workload

At any one time, air traffic controllers may have up to twenty aircraft on their screen depending on traffic conditions and the day of the week. While the number of aircraft that a controller can manage is capped to ensure safe handling of traffic, the situation remains demanding and complex. This is where the innovative SESAR solution, attention guidance, comes in. An algorithm built into the system that can remove potentially non-conflictual aircraft from the controller monitoring by changing the label to a fade-out colour. In other words, aircraft that pose no risk to other airspace users are faded out to enable controllers to focus on the more safety-critical traffic.

"In contrast to conventional practice, the system shares responsibility between the human being and the machine," explains **Johann Pradel, Business Optimisation Manager for Skyguide,** and PROSA project partner in SESAR PJ.10-W2 96 [Attention Guidance](#). *"This solution offloads monitoring tasks from the controller, creating the ability to increase capacity"* he adds.

Knowing which flights to fade-out is determined by an algorithm developed by project partner Skysoft-ATM and applies to each and every aircraft not generating a conflict (largely) from sector entry to exit. **Jean-Paul Meira from Skysoft-ATM** explains, *"The algorithm builds a flight profile, starting from the exit point and moves backwards to the entry point, ensuring lateral separation above 20 nautical miles and no vertical interception, considering any controller input would come with an update time of four seconds. With fewer tracks to monitor, the controller can focus on the aircraft that need his/her attention."* These safety margins may be amended (offline). They are of the utmost importance for the safety case



before implementation and decisive to establish the potential for an increase in airspace capacity.

Controllers at Geneva area centre, who tested the solution at typical cruising altitudes above FL355 initially, found it hard to accept this shared responsibility with a machine. However, controllers adapted quickly and called it "a promising solution", even asking for its help during busy scenarios, according to reports by Jean-Paul Meira. *"We involved controllers from the very beginning and worked together to create a user-friendly interface."* The involvement of controllers was critical to avoid destabilising the existing human machine interface, while adding the fade-out solution.

Faded-out aircraft labels do not disappear for good once the functionality is activated.

Controllers maintain full situation awareness since faded-out labels return to normal display via an intermediate normal display, when an action taken on them or on others leads to reduced spacing (initial 20NM). The labels will instantly return to green in case of alarm or discrepancy between ground and aircraft trajectories. A "direction finder" line allows controllers to easily find a call from a faded-out aircraft, and all needed pops up are displayed in white for any action to take on these faded-out labels. A "handover" function is also available to help identify faded-out labels during handover. In case an aircraft (normal display or in fade-out mode) would

request a change to its trajectory, a detection tool informs the controller of each fade-out aircraft, above and below, that would cross closer than 10 NM, by displaying the level(s) in the cleared flight level (CFL) menu and the label of the fade out aircraft in orange. The experts liken it to a third controller taking over responsibility for fade-out aircraft and informing the controller of any action to take (climb, descent, contact), when necessary.

Johann Pradel says the technology supports further capabilities. *"Non-conflictual, faded-out aircraft are perfect candidates for controller pilot data link communications (CPDLC) messages because they are inherently "non-time critical" in terms of the instructions they may receive. Why wouldn't we use the opportunity to assign these CPDLC messages to the planner, thus not only reducing the monitoring workload of the executive controller, but also the frequency workload and congestion?"*

This solution has reached the technical readiness level 6 (TRL 6) on 21 March., meaning testing can not start on the technical elements in operational scenarios, says Pradel: *"The solution can operate in any area control centre airspace. Relieving the controller of some monitoring tasks promises plenty more opportunities."*

Check out the solution in our catalogue!

www.sesarju.eu/catalogue

On trajectory to greater flight efficiency

Airspace management relies on modern systems on the ground and in the cockpit, yet neither currently connect with each other. In an age where data sharing is routine, two SESAR modernisation projects, ADSCENSIO and 4DSkyways, developed ways to downlink flight information from the cockpit to air traffic control, and uplink data from the ground to the aircraft to fly more efficiently.

Automatic dependent surveillance – Contract (ADS-C) enables aircraft to automatically log on and transfer accurate trajectory information from the flight management system to the ground. This extended projected profile (EPP) gives the controller a better understanding of where conflicts may arise and, along with ground-based conflict resolution algorithms, enables the controller to upload optimised flight profiles in the trajectory clearance. SESAR’s 4DSkyways industrial developed solution within the framework of trajectory-based operations (TBO) improves conflict detection and resolution, and enables controllers to handle increasingly complex traffic. It also enhances safety by automatically checking routes, saves time spent on the voice frequency, and reduces errors.

“We want to push the envelope during the flight execution phase,” says 4DSkyways Project Manager, Peter Alty, EUROCONTROL. “Network performance is key, and more accurate, timely, trajectory information can support innovative use cases such as tactical resolution advisories and descent when ready.” During one of the project’s validation exercise in Geneva, aircraft equipped with ADS-C technology successfully downlinked intent flight management system information, and controllers uplinked controller pilot datalink communications (CPDLC) messages compliant with ATN-B2 standards. Transmissions

included complex clearances including latitudinal and longitudinal coordinates to facilitate optimum trajectories. *“TBO is about sharing the common plan for a flight among all the stakeholders to improve capacity and performance.”* In a first implementation, Maastricht area control centre began exchanging ADS-C EPP messages in May 2022 and Airbus reports more than 100 equipped aircraft in operational service. *“As more aircraft equip with ATN-B2, the more benefits we can deliver,”* adds Alty.

SESAR is developing technical and operational solutions to meet the [Common Project #1](#) requirement for European air navigation service providers (ANSPs) to exchange trajectory data with flights in Europe from 2027. The [ADSCENSIO](#) very large-scale demonstration evaluated real-life flights in several operational scenarios, looking in particular at four functions. In the case of “facilitating optimised descent”, trajectory information downlinked from the aircraft at top of descent enables the controller to provide speed modifications to improve fuel consumption, explains

Project Manager, Didier Velay, DSNA. *“Another example is consistency management, where ADS-C data can be used to verify estimated time of arrival at specific waypoints.”* Consistency checks ensure the synchronisation of the air and ground trajectories. The project also addressed complimentary connectivity using SATCOM and VDL data link with the aim of minimising frequency congestion, and tested automatic downlink tracks without crew login.

“Results so far are extremely positive,” says Didier Velay: “We validated a prototype ADS-C common service and delivered a document for standardisation that sets the solution on the way to industrialisation. We have built a library of data from 5,000 live operational flights and controller feedback is extremely positive about what can be done with more accurate trajectory data.”

More about [4DSkyways](#): <https://www.sesarju.eu/projects/4DSkyways>

More about [ADSCENSIO](#) <https://www.sesarju.eu/projects/ADSCENSIO>



GEESE: How migrating birds are inspiring more sustainable aviation

SESAR partners are joining forces to test wake energy recovery (WER) in order to optimise fuel use and reduce CO₂ emission. Gain Environmental Efficiency by Saving Energy (GEESE) is a new SESAR industrial research project funded within the framework of the Digital European Sky, which will map out how to enable WER operations for transatlantic and continental flights.

Migratory birds such as geese often fly in formation to save energy by taking advantage of the changed airflow in each bird's wake. Like a bird, a moving airplane leaves a wake of disturbed air, creating an updraft that allows the following aircraft to cut down on engine thrust, fuel use and emissions.

Led by Airbus, the EUR 10 million project funded by Horizon Europe and industry will bring together a range of stakeholders, including EUROCONTROL, DSNA, Air France, On, Indra, ENAC, DLR, AirNav, Bulatsa, CIRA, UAB, Frequentis, Boeing, French Bee, NATS, Virgin and Delta Airlines, to investigate how to introduce WER into air traffic operations.

Specifically, the project will elaborate an initial concept of operations ([CONOPS](#)) to enable Europe to North Atlantic WER operations, analysing safety aspects and the impact on legacy systems. The project will also provide operational solutions for the extension of WER operations within European domestic airspace. As an enabler to operations, the project will investigate non-CO₂ potential benefits of formations, in addition to better known CO₂ benefits.



WER sees a pair of aircraft flying in formation, one around 1.5nm (3km) behind the other, allowing the trailing jet to benefit from the lift generated by the preceding aircraft's vortices, reducing the thrust required from its engines. The initial modelling suggests airlines could save between five and ten per cent of fuel per trip.

The project will make use of a fast- and real-time simulation platform, feeding it with operational data, in order to mimic live operations and prepare for a series of dry run test flights. Airline partners will work together to update their flight plans to find suitable aircraft to pair, taking into account routing and other considerations.

Critical to its success is that both Boeing and Airbus have joined forces on the project, thereby ensuring that the concept of operations is aligned across manufacturers and interoperability

can be achieved for different aircraft types. Equally critical is the participation of air navigation service providers, such as DSNA, Bulatsa and NATS, given the importance of making WER operational feasible from an air traffic control perspective. In addition to the fuel-saving – and CO₂ emissions reduction – the benefits of the WER it could also have a positive impact on contrail formation. This will be assessed by project partner DLR at its aerospace research institute.

More about GESE:

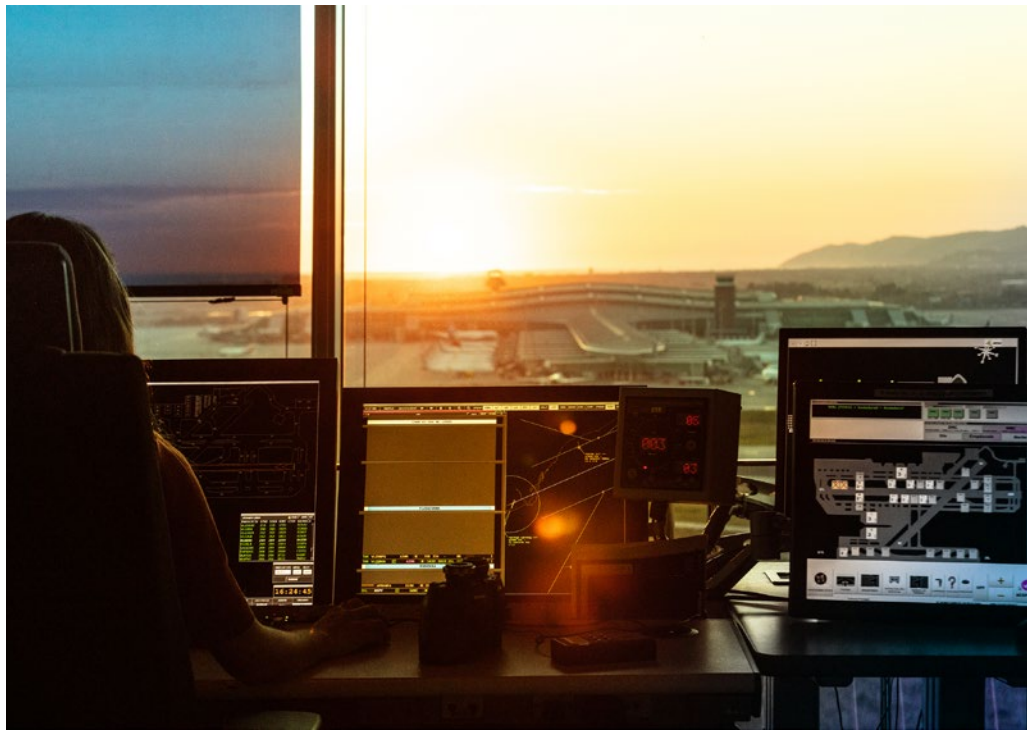
www.sesarju.eu/projects/geese

Making controller rostering more flexible

IFAV3 is a new SESAR JU three years project whose main focus is to increase flexibility of air traffic controllers (ATCO) rostering in the upper airspace, and transfer the know-how about flexible ATCO endorsements from SESAR 2020 to remote tower centres (RTCs). The project will be made reality thanks to the joint work of a consortium composed of 13 companies from 7 different countries, highly specialised in the field of aviation. The consortium will be guided by DLR – German Aerospace Center.

Nowadays airspace is organised in sectors and each sector has its own specificities. To be allowed to work on a specific one, the ATCO must hold a license, be trained to deal with the local specificities and obtain a certification with a rating and a unit endorsement. Once these requirements are fulfilled, the ATCO is finally allowed to manage traffic in that specific sector, with the obligation on a regular basis to complete a refresher training and a minimum number of working hours per sector. Consequently, controllers are competent in a limited number of sectors. Due to a long and complex procedure and increasing demand for ATCOs capable of working in several sectors, the industry is facing a staffing challenge

*"With IFAV3, we start a new episode of research on new strategies to make the ATCO rostering more flexible, by enabling them to hold and maintain more endorsements on specific sectors / sector groups than today. New tools and processes will not only help to improve cost efficiency of air traffic control, but they will also contribute to a compensation of possible staff shortages," says **Michael Finke, Project Coordinator** from DLR – German Aerospace Center "I'm looking forward to learn more and design the next generation air traffic control procedures together".*



Building on from the previous SESAR research (e.g. PJ.33-01a and PJ.10-73 IFAV), IFAV3 aims to find and validate solutions to:

1. Simplify the procedure for ATCO validation through the investigation of ready-to-use procedures, advanced tools, automation, as well as training, rating maintenance and regulatory changes, while creating a standard and methodological framework that will ensure the increase of safety;
2. Use and further validate solutions from previous projects applying them into RTCs.

What are the advantages of IFAV3's solutions?

- Increasing flexibility in the deployment of air traffic controllers to sectors
- Increasing safety
- Increasing cost efficiency of air traffic control service provision
- Increasing resilience against staff shortages

- Reducing the stress levels during worktime thanks to more flexible schedules, trainings and duties
- Fostering standards to lower the probability of "human error" during operations

Solutions will be tested in several use cases of upper area control such as night shifts, low complexity periods, regular operations with up to 70% capacity and contingency situations. The validation of IFAV3 applied in the remote tower centre will consist of workshops with operational experts, enriched with simulation elements.

www.sesarju.eu/projects/ifav3

Ongoing industrial research projects

ATC-TBO - The Air Traffic Control - Trajectory Based Operations

The project proposes to validate TBO SESAR Solutions for flights in the tactical execution phase for en-route and TMA operations, thus contributing to the finalisation of the SESAR Phase C developed in SESAR 2020 and the realisation of the Digital European Sky vision in SESAR Phase D. The results are expected to contribute to capacity, operational efficiency, safety, environment and cost efficiency.

Web: <https://www.sesarju.eu/projects/ATC-TBO>

CICONIA - Climate effects reduced by Innovative Concept of Operations - Needs and Impacts Assessment

As much as the goal of reducing aviation's carbon emissions is critical, the warming impact of aviation caused by the other chemicals emitted by jet engines should not be overlooked. In this respect, the project will focus on non-CO₂ effects of aviation, and how they can be measured. The project will work closely with airlines, the network and air traffic control to ensure these effects can be taken into account in operational planning and design.

Web: www.sesarju.eu/projects/CICONIA

CONCERTO - Dynamic Collaboration to Generalize Eco-friendly Trajectories

The project aims to make eco-friendly trajectories an everyday occurrence in order to reduce the CO₂ and non-CO₂ impact of aviation. The project aims to integrate green ATC capacity into the system, with the appropriate level of automation, and support stakeholders in balancing regularity and environmental performance at local and network levels. The project will do so by leveraging state-of-the-art climate science and data to allow ATM stakeholders to take their "eco-responsibility" to the next level. At the same time the project aims to demonstrate that mitigation measures can be deployed progressively at network level, in sync with scientific progress.

Web: www.sesarju.eu/projects/concerto

DYN-MARS - Dynamic Management of Aircraft Configuration and Route Structures

The way an aircraft climbs or descends can make a significant difference to the environment, from reducing fuel burn, to minimising gaseous emissions and noise over the surrounding airport communities. The project aims to minimise the environmental footprint of flights during climb, descent and approach through novel avionics functions and improved arrival routes and procedures. It provides, for the first time, a holistic solution that combines airborne and ATM improvements enabled by enhanced communication capabilities.

Web: <https://www.sesarju.eu/projects/dyn-mars>

ECHO 2 - European Concept for Higher Altitude Operations Phase 2: Towards the integration between Air Traffic Management and Higher Altitude Operations

The higher airspace (airspace approximately 60,000 ft) is no longer exclusive to space rockets and military planes, but hosts an expanding range of vehicles, including long-endurance balloons, high altitude platform stations (HAPS), supersonic and hypersonic aircraft. With missions varying from connectivity and surveillance to passenger transport and satellite services, these vehicles with vastly different operating characteristics present a new airspace management challenge. The project will build on research from the ECHO project on developing a concept of operations (CONOPS) for higher airspace. Specifically, the project will focus on introducing to the CONOPS a module on space launch real-time monitoring, and packages covering ground and air-ground operational integration procedures.

Web: <https://www.sesarju.eu/projects/ECHO2>

FCA - Flight Centric ATC Project

European airspace is divided into flight information regions, which are subdivided into sectors to provide safe separation services for aircraft travelling through the airspace. Changing this to a flight-centred structure without reference to geographical sectors opens up the opportunity to distribute the traffic more evenly, and to avoid lost productivity in under-loaded sectors. The project will develop the flight-centric concept for an ECAC-wide implementation in medium density traffic areas considering the existing national boundaries. Furthermore, the project includes the development of *ECAC-wide deployment scenarios, which are consistent with the limitations of the VHF spectrum for voice communications.

Web: <https://www.sesarju.eu/projects/FCA>

FCDI - Future Connectivity and Digital Infrastructure

The project aims to specify and develop the future communications, navigation and surveillance technologies to support and manage the operational services, like the four-dimensional trajectory management, in the future ATM system. Performance requirements for CNS systems are becoming increasingly complex and demanding and need to be considered as part of an integrated and holistic system of systems, which includes air and ground CNS solutions considering convergence towards a common infrastructure, and a unified concept of operations, where possible. In parallel, CNS systems and infrastructure for both airborne and ground must take a more business- and performance oriented approach with efficient use of resources delivering the required capability in a cost-effective and spectrum efficient manner.

Web: <https://www.sesarju.eu/projects/FCDI>

GALAAD - Green Aviation – Lean Arrivals And Dynamicity

The project will develop and validate a concept for dynamic required navigation performance (RNP) route allocation in the terminal area in order to make air traffic control operations more sustainable, resilient, responsive and adaptive towards changes in operational conditions and variations in traffic demand. The aim is to deliver an end-to-end concept, including relevant decision-support tools evolution and taking into account cross-border operations. A move to dynamic routing is expected to result in improved fuel efficiency and environmental sustainability without negatively impacting capacity, while improving safety and cost efficiency.

Web: www.sesarju.eu/projects/galaad

GEESE - Gain Environmental Efficiency by Saving Energy

Migratory birds such as geese often fly in formation to save energy by taking advantage of the changed airflow in each bird's wake. Like a bird, a moving airplane leaves a wake of disturbed air, creating an updraft that allows a following aircraft to cut down on engine thrust, fuel use and emissions. The project will seek to introduce this notion of wake energy retrieval (WER) into air traffic operations within Europe. Specifically, the project will elaborate an initial concept of operations (CONOPS) to enable Europe to North Atlantic WER operations, analysing safety aspects and the impact on legacy systems. The project will also provide operational solutions for the extension of WER operations within European domestic airspace. As an enabler to operations, the project will investigate non-CO₂ potential benefits of formations, in addition to better known CO₂ benefits.

Web: www.sesarju.eu/projects/geese

<p>HARMONIC - Harmonised network through smart technology and Collaboration</p>	<p>The project aims to complete key aspects of the demand and capacity balancing (DCB) operational concept in those areas where improvements would make the implementation of the operational concept more efficient. Solutions will cover automatic support for spot analysis and resolution, integration of constraints and dynamic airspace configuration (DAC). The overall aim prepare these solutions for early deployment, integrating the new architecture of integrated Network Management (iNM).</p> <p>Web: https://www.sesarju.eu/projects/HARMONIC</p>
<p>IFAV3 - Increased flexibility of ATCO validations</p>	<p>Air traffic controllers are a key resource in air traffic management. Deploying controllers more flexibly to specific portions of en-route airspace, sectors and working positions, when and where needed, can help ATM become more resilient and responsive to unexpected events, changes in traffic demand or staff shortages. The project aims to advance the concept behind increased flexibility of controller validations (IFAV) based on technical enablers, such as specific controller assistance systems that provide support on sector specific procedures and rules. The project will focus on the use of IFAV in upper area control and in remote tower centres.</p> <p>Web: www.sesarju.eu/projects/IFAV3</p>
<p>IRINA - IFR RPAS Integration into European Airspace</p>	<p>Remotely-piloted aircraft System (RPAS) is a specific set of unmanned aircraft, which is remotely operated by a pilot in a control station. Managing RPAS traffic is challenging for controllers since RPAS fly significantly slower than conventional jet airliners and experience latency in communicating or loss of communications link with the ground. The project will build on the results of the ERICA project to continue the research work on the integration of IFR RPAS into the airspace, addressing the required infrastructure, services and detect and avoid functionalities.</p> <p>Web: https://www.sesarju.eu/projects/IRINA</p>
<p>ISLAND - Intelligent suite for local and network demand and capacity balance</p>	<p>Managing demand for access to the airspace and available capacity is a balancing act in ATM. The project will develop dynamic airspace configuration solutions by leveraging artificial intelligence (including machine learning), various virtualisation models, digital integrated network and ATC planning (INAP) applications, as well as network-wide monitoring. The project addresses the need for on-demand air traffic services reflective of traffic demand, and the continuity of ATM services despite disruptions. The solutions are expected to enable increased en-route capacity and improved cost-efficiency of air traffic service provision, without compromising the current safety levels.</p> <p>Web: https://www.sesarju.eu/projects/ISLAND</p>
<p>ISNAP - iTEC SkyNex ATC platform</p>	<p>iTEC SkyNex ATC platform This project aims at evolving the iTEC platform architecture to support the virtual centre concept, by making use of state-of-the-art digital technologies and underlying architectural principles.</p> <p>Web: https://www.sesarju.eu/projects/isnap</p>

JARVIS - Just a rather very intelligent system

Digitalisation holds great promise especially for complex ecosystems like the aviation value chain (aircraft, air traffic control – ATC, airports). By teaming up with their human counterparts (pilots, ATC operators, airport operators), digital assistants (DAs) can support the execution of tasks to ensure safe and efficient operations in complex scenarios. The project will develop three AI based solutions: an airborne digital assistant to support crew and single pilot operations; an ATC digital assistant to support more efficient and green tower operations; and an airport digital assistant will increase the level of automation in airports, enhancing safety and security for intrusion detection scenarios.

Web: www.sesarju.eu/projects/JARVIS

MIAR - Making I-CNSS a Reality

The L-band digital aeronautical communication system - LDACS – is a digital broadband radio link that enables a connection between an aircraft and the terrestrial infrastructure, just like in cellular telephony. This secure, scalable and spectrum efficient data link also boasts of having navigation and surveillance capabilities, thereby offering an attractive integrated CNS solution for the sector. The project will carry out flight tests to demonstrate how LDACs can enable optimised separation between aircraft in real time and the use of multiple non-GNSS technologies to provide an integrated navigation solution.

Web: <https://www.sesarju.eu/projects/MIAR>

MITRANO - Mission Trajectory in ATC and Network Management Operations

Europe's armed forces operate more than 150,000 flights per year. To accommodate these flights, the airspace is often closed, sometimes at short notice, to civil traffic. Given the growth of air traffic demand and complexity, SESAR is developing operational and technical solutions that allow more flexible civil-military cooperation to maximise the use of airspace. Key to this cooperation is the integration of military operations. The project aims to advance solutions to manage mission trajectories and collaborative decision-making at network level and in ATC operations, including advanced design principles for military access to the airspace.

Web: www.sesarju.eu/projects/MITRANO

NETWORK TBO - Network Trajectory Based Operations

Trajectory-based operations (TBO) is a cornerstone of the SESAR vision paving the way for more predictable air traffic management. TBO is about sharing a common plan for a flight's trajectory; matching that trajectory to the performance needs of the circumstances; and delivering the trajectory via ATC clearances. The project aims to deliver several solutions to enable trajectory-based operations during the planning and execution phases, taking a network view. Specifically, solutions will address flight and flow in a collaborative environment, making use of downlinked data from the aircraft (EPP) and improving both ATC and network processes through synchronisation of network and local trajectories.

Web: <https://www.sesarju.eu/projects/NetworkTBO>

SOLO - Single pilot Line Operations

Under current EU regulations, at least two pilots must be present within the cockpit of commercial flights. But new advances in technologies open up the possibility to certify single pilot operations (SPO), either for certain portions of the journey, such as when cruising, or for the whole flight once the technology is mature. The introduction of greater levels of automation in the cockpit would therefore allow the pilot to focus on more strategic and safety-critical tasks. The project aims to develop a concept for single pilot operations, ensuring minimal changes to current ATC tools and procedures. The aim is to feed standardisation and regulatory developments on SPO.

Web: <https://www.sesarju.eu/projects/SOLO>

Ongoing fast track innovation and uptake projects

CNS DSP - Demonstration of a CNS data service provision

Communication, navigation, and surveillance (CNS) infrastructure is the foundation for the provision of air navigation services. To make CNS more resilient and efficient, the Digital European Sky will see a move away from CNS as physical assets towards a service-based approach. Mindful of this needed change, the project will develop digital platforms and services leveraging state-of-the-art technologies to enable future data-sharing service delivery models. It aims at sharing CNS data between air navigation service providers (ANSPs) and other aviation stakeholders (e.g. civil and military airspace users, airports, national authorities, etc). The project will carry out tests using data from several ANSPs for the use by third-party application/service developers.

Web: <https://www.sesarju.eu/projects/CNS-DSP>

DARWIN - Digital Assistants for Reducing Workload & Increasing collaboration

AI-based automation for cockpit and flight operations are the key enabler for single pilot operations (SPO). The project aims to develop digital assistants to support SPO operations, assuring the same (or higher) level of safety and same (or lower) workload as operations with a full crew today. The project will deliver solutions that enable operational efficiency and route flexibility, taking into account the complexity of the future airspace. The results will support the commercial and operational viability of those new airspace users.

Web: <https://www.sesarju.eu/projects/DARWIN>

ENSURE - ATM-U-space Interface and Airspace Reconfiguration Service

Ensuring an interoperable and effective interface between unmanned and conventional traffic and air traffic control is critical for the delivery of the future Digital European Sky. This project aims to refine and complete the definition of a common interface and services for U-space and ATM. The project will develop a standardised data model, architecture and an operational methodology. The project will also develop a dynamic airspace configuration service to help ATC actors in charge of airspace reconfigurations to maintain traffic segregation and to avoid proximity between manned and unmanned aircraft within the designated U-space airspace.

Web: <https://www.sesarju.eu/projects/ensure>

EUREKA - European Key solutions for vertiports and UAM

Air taxis are an exciting development in air mobility, but to get off the ground, these vehicles rely on infrastructure like vertiports and accompanying air traffic management procedures. The project will develop the complete arrival, departure and turnaround process for vertiports. The proposed solutions will take into account collaborative traffic management, how to deal with emergencies and disruptions and network flow and capacity management. The project will provide recommendations for regulation/standardisation and any information that will accelerate and harmonise the development of UAM, VTOL operations and vertiports across Europe.

Web: <https://www.sesarju.eu/projects/EUREKA>

FASTNet - Future Data Services and Applications for airports and Network

Every flight begins and ends at airports, which makes them essential nodes in the aviation network. The project will make use of advances in data technologies to help fully integrate airport operations into the network (AOP-NOP integration). The project focuses on the pre-tactical and strategic planning, using artificial intelligence to enable airport-to-airport collaborative planning within the network operations plan. The project also aims to extend the timeframe of the AOP-NOP integration, from months to days in advance of departure. The project will rely on state-of-the-art technologies to integrate new datasets available at local level, such as local restrictions, pre-tactical flight information and strategic local information in order to enrich demand and capacity balancing information and ensure efficient planning from the strategic phase.

Web: <https://www.sesarju.eu/projects/FASTnet>

KAIROS - Unlocking the potential of AI-based Weather forecasts for Operational Benefits

Bad weather can play havoc with the best-laid plans. This is especially true in air traffic management, where poor meteorological conditions are a primary cause for traffic delays in Europe. Performing better during adverse weather relies on timely and accurate forecasts, which is easier said than done given how quickly the conditions can evolve. The project aims to improve the quality of meteorological information through the use of artificial intelligence. Specifically, it will integrate live weather information from AI forecasts with existing decision support tools and platforms to assess the operational benefits to several end-users. The aim is to improve the management of demand and capacity balancing across the network level, but also for local flow management, and urban air mobility.

Web: <https://www.sesarju.eu/projects/KAIROS>

OperA - Operate Anywhere

The OperA (Operate Anywhere) project will enable safe and efficient operations in all types of airspace (controlled, uncontrolled and U-space) and conditions by validating 3 different complex IAM - piloted air taxi and unmanned cargo - operations in real-life ATM conditions including contingency and non-nominal situations. It will stimulate the uptake of new sustainable Innovative Air Mobility services by addressing Air/Ground integration and the critical transition steps from piloted towards automated flights for 5 key autonomy-enabling technologies at TRL7 (Technology readiness levels). In addition, it will ensure environmental sustainability compared to the next best transport alternative, and enhance it, by optimising flight routing for minimum noise footprint and aircraft energy utilisation.

Web: <https://www.sesarju.eu/projects/OperA>
<https://project-opera.eu/>

<p>SAFIR - Ready</p>	<p>The project aims to develop new U-space advanced services together with a central command and control centre (C2C), as well as an automated ground integration (Drone Cargo Port - DCP) to facilitate automated time-critical drone-based services for medical and non-medical use cases. Specifically, research will focus on a dynamic capacity management system (U3), detect and avoid algorithms (U3) and machine to machine communication and decision making (U4). The project will extend use cases to non-medical critical missions, such as shore to ship for the transport of materials and the inspection of railway and electric grids in case of unforeseen issues with the infrastructure (e.g. tree fallen on high tension cable).</p> <p>Web: https://www.sesarju.eu/projects/SAFIR-ready</p>
<p>SIGN-AIR - Implemented Synergies, data sharing contracts and Goals between transport modes and AIR transportation</p>	<p>The project will develop and pilot a new platform for the sharing of data in multimodal travel. The platform will provide the means for transport service providers (TSPs) to register, reach data sharing agreements with other TSPs and manage their contractual relationships. The project will address contract templates to simplify the legal management, the electronic management and information provision about each specific contract, routing information for travel companions (TCs) with enriched information about the specific contracts for their customers. The ultimate aim is to facilitate single ticketing through a comprehensive understanding of the contracts and the data managed, among others.</p> <p>Web: https://www.sesarju.eu/projects/sign-air</p>
<p>SPATIO - U-Space Separation Management</p>	<p>Keeping aircraft safely separated is one of, if not the core function of air traffic management today. As larger numbers of unmanned aerial systems (UAS) take to the skies, separation management becomes more important to avoid mid-air collisions. The project will address separation between unmanned air vehicles, in particular, strategic and tactical conflict resolution services and the relationship between separation and capacity in U-space airspace.</p> <p>Web: https://www.sesarju.eu/projects/SPATIO</p>
<p>VITACY - Virtual center with Triangle Architecture and Cyber-resilience</p>	<p>Today, ATM in Europe mostly consists of country-based systems and processes, which require customised systems and solutions at each ATM provider. This has led inevitably to a lack of interoperability and higher costs of air navigation services across Europe and an inefficient usage of resources. The virtual centre refers to the decoupling air traffic management (ATM) data services, such as flight data, radar, and weather information, from the physical controller working position (CWP). The project will develop a "triangle architecture", a powerful type of architecture based on disaggregating services currently offered by one main ATM data service provider (ADSP) into new specific functionality-oriented ADSPs for arrival management, time-based separation and conflict detection and resolution. The project will also develop cyber-resilience tools focused to monitor attacks and display alerts if detected.</p> <p>Web: https://www.sesarju.eu/projects/VITACY</p>

Ongoing traversal projects

Engage 2 - The SESAR Knowledge Transfer Network

The Engage knowledge transfer network (KTN) aims to share the resources and findings of the SESAR research and innovation programme with a view to informing future fundamental research, as well as transferring results towards application-oriented work. The network will build on the work of its predecessor, which developed a number of instruments to facilitate knowledge transfer, including a knowledge hub, thematic challenges, catalyst funding and summer schools, to name but a few.

Web: <https://www.sesarju.eu/projects/engage2>

AMPLE3 - SESAR ATM Master Planning and Monitoring

The project will support the SESAR JU in planning and reporting on deployment activities in both industrialisation and implementation, and to update the European ATM Master Plan, when needed. The project will carry out content integration (CI) activities to support the SESAR JU's programme management of development activities and the delivery of a coherent set of SESAR Solutions aligned at content level with the direction and ambitions set by the Strategic Research and Innovation Agenda and the European ATM Master Plan.

Web: <https://www.sesarju.eu/projects/ample3>

PEARL - Performance Estimation, Assessment, Reporting and simulation

Performance is at the heart of the SESAR research and innovation programme. In support of this, the project will carry out the SESAR performance management process, under the leadership of SESAR JU. The project will assess every solution and research outcome and how they contribute to meeting the overall performance ambitions of the European ATM Master Plan. The project will maintain the SESAR Performance Framework and related material, as well as provide support to project maturity gates.

Web: <https://www.sesarju.eu/projects/pearl>



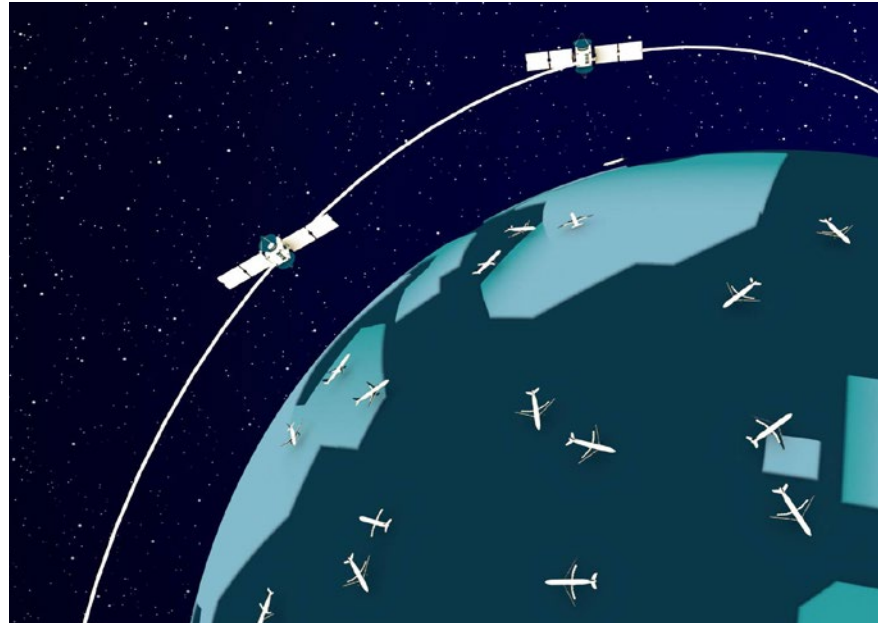
DIGITAL SKY DEMONSTRATORS

Taking air traffic control into low orbit

Plans are underway by SESAR members and partners to demonstrate the feasibility of using low-orbit satellites to provide communications to manage aircraft in oceanic and remote regions of the world. ECHOES is a three-year Digital Sky Demonstrator that aims to show how space-based communications navigation and surveillance (CNS) technologies can help optimise air traffic while reducing the carbon footprint and maintaining safety levels. In this interview, Jose Alberto Gonzalez Pita from STARTICAL, lead partner, outlines the rationale and planned activities of this ambitious Demonstrator.

Why is it challenging to manage aircraft in oceanic or isolated regions? What are the impacts on cost efficiency/environment/safety?

Air transport is one of the safest modes of transport, thanks in part to communications, navigation and surveillance (CNS) services. Up until now, the infrastructure providing such services has been mostly ground-based. While these terrestrial services have allowed controllers to maintain contact and assure safe separation to ensure safety, controllers must increase separation minima between the aircraft, when there is no CNS coverage. This impacts not only the cost efficiency for airspace users but also increases the environmental footprint of these flights.



What is the rationale of the ECHOES demonstrator and what are its main objectives?

By deploying the CNS infrastructure in space, we can provide CNS services regardless of location. In fact, ECHOES will be the first to attempt to use a space-based technology to provide very high frequency (VHF) communications (voice and datalink).

Can you describe the activities that you are planning?

The aim is to launch two satellites into low earth orbit at around 650 km and install the necessary ground infrastructure on both sides of the Atlantic ocean. Once in place, the project partners and subcontractors will carry out a series of use cases in order to validate not only the technology but its operational use.

We will also examine regulatory and standardisation considerations, which will be critical if we want to use it in a safe and synchronised manner with the existing infrastructure and services.

How will the demonstrator build on the work of the very large-scale demonstration VOICE? What is different/new about ECHOES compared to VOICE?

VOICE was intended to validate some initial concepts and an initial part of the technology. ECHOES will go far beyond and focus not only on the technical part, but also on the end-to-end performance analysis. Our aim is to demonstrate that services and technology are ready to go to market; in other words that the two satellites are operational with all the necessary functionalities to provide a commercial service, such as inter-satellite links, enabling communications with

aircraft located thousands of kilometres away from the controller.

What is novel about the Demonstrator’s approach?

There are a few things, but I think the most relevant one is the fact that aircraft do not need retrofits. Everyone will be able to use this new technology without changing the avionics and that will make it much easier to adopt. The second important point to highlight is that the coverage will be extended to a huge area of operations in comparison with previous projects.

Digital Sky Demonstrators are key to encouraging the uptake of SESAR Solutions - how will you work to make this happen?

We believe this solution has many applications. We want to make our solution the cornerstone of many future applications and the enabler of many existing applications that were not ready due to the lack of infrastructure and/or adoption.

When will we see satellites in low orbit supporting ATM?

In order to provide ATM services, the full constellation has to be deployed. We think that technically-complete services can be expected before the end of this decade, although regulatory work and the frequency allocation process will need to be agreed for this kind of technology, as was done in the past for space-based [ADS-B](#) and other satellite-based systems.

How could the results of your Demonstrator be used by the authorities, ANSPs, Network, end users?

The Demonstrator is a game changer. Results of from the Demonstrator can be used as real end-to-end performance input for standardisation and regulation. Additionally, the results from this Demonstrator will help stakeholders understand that space-based technologies enable a much faster adoption than traditionally in the aeronautical industry.

What benefits do you hope your project will bring?

We expect to see safety levels improve as well as increased operational efficiency and a reduction in the environmental footprint of aviation all over the world.

More about ECHOES:

www.sesarju.eu/projects/echoes

Belgian partners trial a new landing procedure to reduce environmental footprint of aviation

[Brussels Airport](#) and [skeyes](#) are investing together in research to develop new landing procedures that can improve the local environmental quality. The research that will be conducted by skeyes and Brussels Airport, with the support of [EUROCONTROL](#), is one of the components of HERON, a SESAR JU Digital Sky Demonstrator led by [Airbus](#). Co-funded by [European Climate, Infrastructure and Environment Executive Agency \(CINEA\)](#) will analyse whether



landings with steeper descent gradients have an advantage in terms of reducing the local noise impact, as well as CO₂ emissions and fuel consumption.

HERON aims to carry out a series of ambitious developments and tests to reduce noise, flight delays, fuel consumption and CO₂ emissions from air transport by proposing reduction measures, including more efficient flight operations. HERON includes 26 partners from 11 countries and will be supported by 6 airlines, 8 Air Navigation Service providers and 5 airports from all across Europe.

skeyes and Brussels Airport Company will contribute to the project by validating operational flight demonstrations of green approaches by introducing increased second glide slopes (ISGS) on two runways (i.e. Approaches at a descent angle of 3.2 - 3.5 degrees instead of 3.0 degrees, see figure below). [ISGS is an operational solution](#) validated in the SESAR programme and aims to provide benefits in terms of noise impact and, to a lesser extent, fuel consumption. This will be the first time it will be tested in a fully operational environment.

skeyes and Brussels Airport, as well as [TUI fly](#), [DHL](#) and [Brussels Airlines](#), who have expressed their explicit support to the project, met for the first time at skeyes for the kick-off of the project and to define the schedule for the real-life

demonstrations at Brussels Airport. These demonstrations will take place in 2024.

More about HERON:

www.sesarju.eu/projects/heron

Welcoming a new era in urban air mobility

U-ELCOME is a three-year SESAR Digital Sky Demonstrator project, involving 51 partners whose overall aim is to support the implementation of services for the safe and secure integration of drones. With demonstrations taking place in three European countries, the project aims to support the interoperability and harmonisation of services within the framework of U-space. The Demonstrator is co-funded by the Connecting Europe Facility.

Drones, or unmanned aircraft systems (UAS), have the potential to greatly support Europe's shift towards a green and digital economy, aid in post-COVID 19 recovery, and enhance the EU's economic resilience. With a range of applications, from daily commuting to global supply chain management, drones play a vital role in our social and economic life. U-space services and smart traffic management solutions will be key in enabling drone operations and reaching

the necessary high level of integration with air traffic management (ATM).

U-ELCOME relies on real U-space systems that are either already in operation or are waiting to be deployed by organisations such as ENAIRE, ENAV, ASLOGIC, ITG, D-Flight and Thales. Led by EUROCONTROL, the aim of the project is to further the scalable market uptake of U1 and U2 U-space services, including e-registration, e-identification and geofencing (U1), and initial services for drone operations management including flight planning, flight approval, and tracking interfacing with conventional air traffic control (U2). U-ELCOME will be performing a series of tests and demonstrations throughout the year in various operational environments across 15 locations in Spain, Italy and France.

Combining digital and physical infrastructure capabilities, U-ELCOME will set up, deploy, and demonstrate the following SESAR solutions up to Technology Readiness Level (TRL) 8:

- **U-space U1** — foundation services: these will identify drones and operators, and inform operators about known restricted areas. With the deployment of U1, more drone operations are enabled, especially in areas where the density of manned traffic is low. The U-space foundation services include e-registration, e-identification and geo-awareness.
- **U-space U2** — initial services: the main purpose of these is to support the safe management of "beyond visual line of sight" (BVLOS) operations and a first level of interface and connection with ATM/ATC and manned aviation. With the deployment of U2, the range of operations at low levels will increase, including some operations in controlled airspace. Drone flights will no longer be considered on a case-by-case basis, and some BVLOS operations will become routine. At least the following initial U-space services will be included: tactical geo-



fencing, emergency management, strategic deconfliction, weather information, tracking, flight planning management, monitoring, traffic information, drone aeronautical information management, and a procedural interface with ATC.

Through U-ELCOME demonstrations, the U-space architecture and interoperable standards will be used to enable information exchange and coordination between U-space Service Providers (USSPs), the Common Information Service Provider (CISP) and ATM. This will allow for automated drone traffic management and situational awareness among all U-space stakeholders.

The project, working in close cooperation with EASA and other national and international authorities, will contribute to the consolidation of standardisation and regulatory requirements of the proposed U-space services to further accelerate their deployment along with the interoperability between U-space and ATM.

Spain's Zaragoza will become the first European city to have a vertiport in an urban environment. The City Council has set aside a 7,500 m² space in the city for 10 years for an urban vertiport to be co-developed by Expodrónica under the umbrella of the U-ELCOME project. One of the first services will be the development of pharmaceutical logistics air routes in Zaragoza with the participation of Novaltia.

More about U-ELCOME:

www.sesarju.eu/projects/u-elcome
<http://u-elcome.eu/>

Gearing up for U-space implementation

Antwerp, Brussels and Liège have been selected to test and implement a set of services for the integration of drones into the airspace within the framework of U-space. The trials are part of the work of BURDI, one of several Digital Sky Demonstrators that were launched in 2022. In this article, Luc Antoon



from [skeyes](#), Belgium's air navigation service provider (ANSP), and BURDI coordinator, gives an insight into the work of this ambitious demonstrator.

The Belgium-Netherlands U-space Reference Design Implementation (BURDI) is a SESAR JU Digital Sky Demonstrator co-funded by The European Climate, Environment and Infrastructure Executive Agency ([CINEA](#)) within the framework of the Connecting Europe Facility. Coordinated by [skeyes](#), the Demonstrator brings together 18 highly complementary partners, representing all stakeholders necessary to implement [U-space](#) in complex environments, including an ANSP, airports, a common information services provider (CISP), a U-space Service Provider (USSP), drone operators and other relevant ecosystem supporters.

As a Digital Sky Demonstrator, our goal is market uptake so we are focussed on reaching a very high degree of technology maturity, building on the results of several previous SESAR projects, such as [CORUS XUAM](#), [SAFIR-Med](#), or [DACUS](#).

BURDI aims to implement the U-space airspace concept to manage various, dense and complex unmanned air system (UAS) operations in controlled and uncontrolled airspace, as well as in an urban air mobility environment. With this in mind, we are addressing the current

key challenge of drone integration within high complex environments.

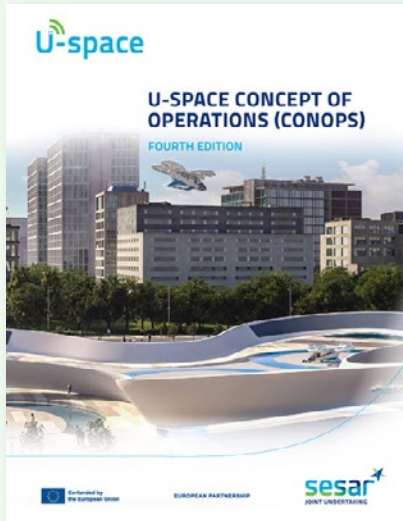
We will develop safe and secure solutions fitting for real-life operations, to be considered for future implementation in Europe. Indeed, BURDI aspires to make these solutions a reference to develop best practices, standardisation, harmonisation and/or interoperability requirements that would foster operational deployment of U-space airspace elsewhere in Europe.

The second objective focuses on market uptake of these solutions. We want to ensure that the solutions that will be proposed will also be economically sustainable and socially acceptable/ supported so that they will actually benefit all stakeholders, including the general public.

The BURDI project will be implemented around the cities of Antwerp, Liège and Brussels. These locations have been chosen due to the proximity of international airports, an active maritime port and the proximity of the border with the Netherlands. These environments are considered as highly relevant for the development of "UAS operations as a service" in multiple domains like delivery of goods, inspections, support to medical as well as security operations.

<https://sesarju.eu/projects/BURDI>
<https://www.burdi.eu>

Latest U-space Concept of Operations published



The fourth and latest edition of the U-space Concept of Operations (ConOps) was published by the SESAR JU's [CORUS-XUAM](#) project, expanding the scope to urban air mobility (UAM).

The ConOps extends the previous edition from 2019 and looks into the future with the goal to serve as a reference manual for delivering U-space, Europe's enabling framework for the safe and secure integration of uncrewed aerial systems, or drones, into the airspace.

Specifically, this latest edition of the ConOps:

- addresses urban air mobility needs, in particular processes at vertiports, airspace structure and flight rules, and eVTOL passenger-carrying operations;
- is aligned with EU U-space regulations (1);

- includes inputs coming from other SESAR research and innovation projects.

A preliminary version of the fourth edition of the ConOps, labelled 3.10, was released in July 2022 for comments, which were addressed in this consolidated final edition.

The ConOps aims to reach a consensus on what U-space means operationally. The document provides the terminology and a general model of the overall system of U-space, which consists of the seven services, matching what is captured in EU U-space regulations.

Download the publication:

www.sesarju.eu/publications

WANTED: Digital Sky Demonstrators for greener, more scalable and resilient ATM

In September, the European Climate, Infrastructure and Environment Executive Agency (CINEA) launched a call under the Connecting Europe Facility, containing provisions for a series of Digital European Sky Demonstrators for greener, more scalable and resilient air traffic management (ATM).

The demonstrators are a key tool to support the SESAR JU's vision of making Europe the most efficient and environmentally friendly sky to fly in the world. The selected demonstrators are expected to be launched in 2024 and to run until 2027.

The demonstrators will contribute to 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

call will also enable a more flexible, scalable, resilient, safe and secure ATM that can withstand disruptions in the aviation system.

The SESAR-related topics covered by the call (CEF-T-2023-SIMOBGEN-SESAR-DSDU-WORKS) support several of the nine flagships outlined

in SESAR JU's multiannual work programme. The demonstrators will integrate technological solutions, which have been matured in SESAR research, into live operational environments in order to deliver the Digital European Sky.

The selected demonstrators will be announced in early 2024.



Ongoing Digital Sky Demonstrators

BURDI - BeNe U-space Reference Design Implementation

The project aims to implement a U-space airspace concept able to manage various, dense and complex UAS operations in controlled, uncontrolled and UAM environment. The aim is to make this implementation a reference to develop best practices, standardisation, harmonisation and/or interoperability requirements fostering operational deployment of U-space airspaces in Europe. The project will also ensure that solutions to be deployed are economically sustainable and socially acceptable/ supported for the benefit of the general public.

Web:

www.sesarju.eu/projects/BURDI
<https://www.burdi.eu/>

DEVICE - DElegation through VIRTUAL Centres

The project will showcase the delegation of airspace using a virtual centre setup between air traffic service units operating in the same flight information region. It will also demonstrate data exchange and interoperability between vendors. Specifically the demonstrator will demonstrate several new air traffic service (ATS) operating models and the feasibility of delivering cross border services even through different platforms (iTEC SkyNex and COOPANS).

Web: www.sesarju.eu/projects/DEVICE

EALU-AER - Enhanced Automation for U-Space/ATM integration

The project aims to establish Ireland's first Digital Sky Demonstrator, located at Future Mobility Campus Ireland's recently established vertiport site, in Shannon, Ireland. To demonstrate a range of UAM operations, across the range of U-space services projected through the SESAR U-space CONOPS (Concept of Operations), the project will execute a number of use-cases across the period of the programme that capture the operational requirements, vehicle dynamics, and technology demonstrations associated with the projected near-term UAM services market, such as local inspection, light-freight, long distance logistics, air-taxi operations, etc.

Web:

www.sesarju.eu/projects/EALU-AER
<https://research.dblue.it/ealu-aer/>

ECHOES - Extended Communications in vHf Over Enhanced Satellite segment

The project aims to demonstrate the feasibility of space-based solution for very high frequency (VHF) communications (voice and datalink) in air traffic management. Building on initial technical proofs of concept carried out by the VOICE project, the ECHOES Digital Sky Demonstrator will investigate some key functionalities, such as inter-satellite links, on-board processing of data in the satellite or simultaneous transmission and reception of VHF communications. In addition, the Demonstrator will focus on operational aspects of the technologies will also comprise operational topics, involve more stakeholders (airlines and ANSPs) and contribute to the regulatory and standardisation of the space-based VHF technology based on the analysis of end-to-end system performances.

Web: <https://www.sesarju.eu/projects/ECHOES>

ESMA - European Sky Multilink ATN

ESMA will address the need to increase the level of automation in air traffic management (ATM) through the implementation of a multi-link communications infrastructure, with a focus on datalink using satellite communication (SATCOM Datalink) alongside VHF Data Link (VDL) Mode 2.

The demonstration will focus on long-term data collection in an operational multi-link environment to demonstrate that technology meets the technological requirements and business needs of air navigation service providers and airspace users.

Web: www.sesarju.eu/projects/ESMA

EXODUS - COOPANS EXODUS Project

EXODUS aims to demonstrate the viability of a common system for members of the COOPANS Alliance based on a virtual centre (VC) model that geographically separates the ATM data service provider (ADSP) from the location of the air traffic service unit (ATSU). The goal is to prove the operational and business viability of a future common COOPANS operating model based two SESAR Solutions on the rationalisation of infrastructure (PJ.16-03) and delegation of ATM services (PJ.10-W2-93A) for test and training including supervisory positions.

Web: www.sesarju.eu/projects/exodus

HERON - Highly Efficient Green Operations

The HERON project aims to mitigate CO₂ emissions, introducing digital technologies and new procedure designs to optimise air traffic operations gate-to-gate. The demonstration will bring together mainline aircraft operators, airports, air navigation service providers, who will carry out some 1,000 flights across Europe.

Web: <https://www.sesarju.eu/projects/HERON>

U-ELCOME - U-space European COMMon dEpLoyment

U-ELCOME project is aiming at the fully scalable market uptake of U1 and U2 U-space services through a set of tests and demonstrations in various operational environments and European locations. To do so, U-ELCOME develops, tests and demonstrates SESAR solutions across 15 locations distributed in Spain, Italy and France.

Web:
www.sesarju.eu/projects/U-ELCOME
<http://u-elcome.eu/>

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