



Digital   
European  
Sky

# Blueprint





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As the European Commission's new Transport Commissioner, it is my mission to develop a European transport system that remains safe, reliable and affordable while becoming more sustainable and efficient, taking benefit of all the opportunities offered by the new technologies and by accelerated digitalisation. Aviation, with its entire value chain, has a key role to play in bringing this vision to reality.

Aviation provides enormous benefits to citizens, economies and society around the world by enabling freedom of movement, travel and trade. However, taking into account the continuing growth of air traffic and the new types of air vehicles that will have to share the airspace, transforming the aviation sector to become truly sustainable is an ambitious challenge.

If there is one main objective that we should aim to achieve and where we can generate a massive positive global impact in the coming years, it is to make the European airspace the most efficient and environmentally friendly sky to fly in the world. This requires a substantial transition from current ATM systems to the new vision fostered by SESAR.

Indeed, it will take time, a collective effort and smart investments. This is why we need to start now so that we can bring forward the necessary changes as quickly as possible.

Modernising Europe's ATM infrastructure through a renewed and invigorated research and innovation partnership, built on the success and the momentum generated by the SESAR Joint Undertaking, to deliver the Digital European Sky will contribute to two of the Commission's top priorities: the "European Green Deal" and a "Europe fit for the digital age". This is just the type of investment in transport networks and digital innovation that will help make a real difference for citizens and drive Europe's leadership and competitiveness globally.

Adina-Ioana Vălean  
European Commissioner for Transport

A handwritten signature in blue ink, reading "Adina-Ioana Vălean".

Why a digital European sky?

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## Why a digital European sky?

Air transport has been a key driver for European integration and economic prosperity. Europe's citizens, businesses, communities and cultures are connected today like never before thanks to the 23,400 daily flights carrying one billion passengers per year.

However, an outdated aviation infrastructure means that air traffic in Europe is hitting its limits both in the air and on the ground, resulting in growing delays and unnecessary emissions. Add to that the multitude of new types of air vehicles, such as delivery drones and air taxis, that will soon be seeking access to the airspace, and the need for action becomes clear and urgent.

While an energy transition is the only way in the long term to ensure carbon neutral air transport in the future, the aviation infrastructure can be modernised at a more rapid pace and bring environmental benefits in the shorter term. Advancing innovations applied today in the digital economy will result in radical transformation of Europe's aviation infrastructure, making air transport smarter, more sustainable, connected and accessible to all.

Europe has a unique opportunity, as the world leader in aviation infrastructure technology, to usher in a smarter and greener aviation.

# What is the digital European sky?

The digital European sky was first proposed by the SESAR Joint Undertaking in 2017 <sup>(1)</sup>, and then further detailed in 2019 in a commonly agreed roadmap by stakeholders from across the aviation community <sup>(2)</sup>. Further support for the digital European sky was provided by the Wise Person's Group, established by the European Commission to provide recommendations on the future of the Single European Sky <sup>(3)</sup>, and a joint declaration by industry <sup>(4)</sup>.

The digital European sky leverages the latest digital technologies to transform Europe's aviation infrastructure enabling it to handle the future growth and diversity of air traffic safely and efficiently, while minimising environmental impact. This transformation centres on technologies that can increase the levels of automation, cyber-secure data sharing and connectivity in air traffic management (ATM), as well as the virtualisation of its infrastructure and air traffic service provision in all types of airspace, including for very-low and high altitude operations. In doing so, these technologies enable the system to become more modular and agile, while building resilience to disruptions, traffic growth and diversity of air vehicles.

To bring the maximum benefits, the digital transformation will be holistic and passenger-centric, covering air travel door-to-door and involving everyone that plays a role in that experience, from the airports, airlines and air navigation service providers, to the regulatory, standardisation and safety bodies.

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(1) Digitalising Europe's aviation infrastructure, October 2017

(2) European ATM Master Plan, 4<sup>th</sup> edition, December 2019

(3) A report of the Wise Person's Group, established by the European Commission to provide recommendations on the future of the Single European Sky, April 2019

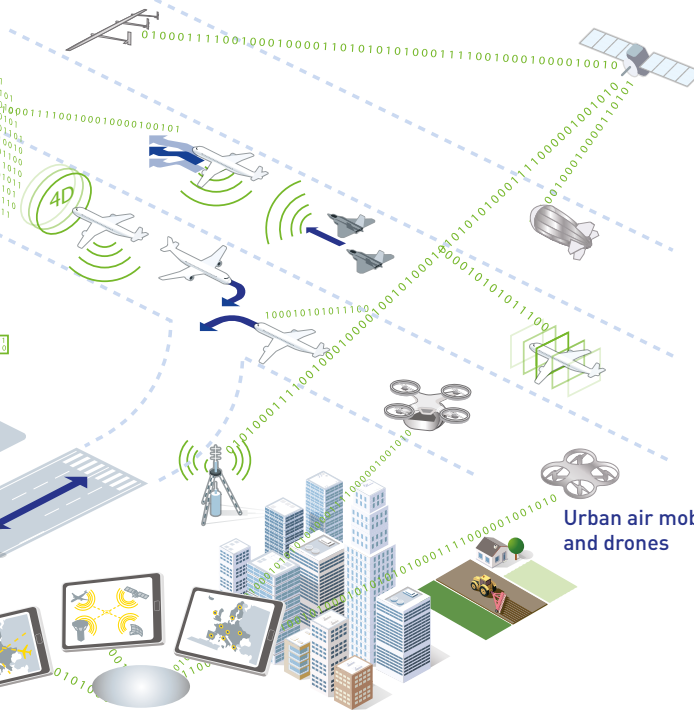
(4) Joint Stakeholder Declaration for a Digital European Sky, September 2019

Digital ecosystem enabling free flow of data among trusted users across borders



Digital & connected airports

Higher airspace operations



More autonomous aircraft connected with each other and the infrastructure

Fully exploits the potential offered by the next generation aircraft for cleaner and quieter flights

Fully scalable ATC system with strong air-ground integration

Urban air mobility and drones

The world of aviation is changing. Aircraft are becoming more autonomous, more connected, more intelligent, and more diverse. Air passengers increasingly expect eco-friendly, smart and personalised mobility options that allow them to travel seamlessly and efficiently. They want quick and reliable data to inform their travel choices, not only on schedules, prices and real-time punctuality, but increasingly also on environmental impacts. To deliver this new era in aviation, leveraging technology is key.





# Digital European sky innovation portfolio

To deliver the digital European sky a portfolio of research and innovation activities are required <sup>(5)</sup>, focusing on a number of key areas:



## Connected and automated ATM

The future ATM system will deliver hyper connectivity between all stakeholders (vehicle-to-vehicle, vehicle-to-infrastructure) via high bandwidth, low latency fixed and mobile networks. Highly automated systems with numerous actors will interact with each other seamlessly, making the system scalable and even safer than today.



## AI for aviation

Tomorrow's aviation infrastructure will be more data intensive. Thanks to the application of machine learning, deep learning and big data analytics, we will be able to design an ATM system that is smarter and safer by constantly analysing and learning from the ATM environment.



## Air-ground integration and autonomy

The progressive move towards autonomous flying enabled by self-piloting technologies requires a closer integration between vehicle and infrastructure capabilities so that the infrastructure can act as a digital twin of the aircraft.



## U-space and urban air mobility

A digitally native traffic management system will ensure the safe and secure integration of drones in the airspace especially in urban areas, taking into account new and existing air vehicles and autonomous operations. One of the most challenging use cases from U-space will be to enable urban air mobility, which is expected to advance autonomous technologies in a number of areas.



## Capacity-on-demand and dynamic airspace

Technology will enable the dynamic reconfiguration and the activation of cross-border capacity-on-demand services to maintain smooth traffic services at busy times.



## Civil/military interoperability and coordination

Dual-use technologies such as those for communications, navigation and surveillance, and other solutions that allow real-time exchange trajectory information will improve the predictability of military operations and overall network capacity.



## Virtualisation and cyber-secure data sharing

Service provision will be decoupled from the physical infrastructure, enabling air traffic and data service providers, irrespective of national borders, to plug in their operations where needed in a secure manner.

(5) European ATM Master Plan, 4<sup>th</sup> edition, December 2019

Accelerating market uptake and aviation green deal through a network of demonstrators

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# Accelerating market uptake and aviation green deal through a network of demonstrators

Many of the innovations needed to deliver the digital European sky are not “business as usual”, but breakthrough solutions that combine digital and physical infrastructure capabilities. Bringing these innovations to scale in the market is challenging considering the high degree of technological, regulatory or market risk the aviation industry faces, which has so far deterred or delayed private investment in its infrastructure.

The following principles will underpin the demonstrators:



## For early movers

The demonstrator network will be continental in scale and will act as a global showcase of European leadership, establishing an initial critical mass of early movers on breakthrough innovations.



## People

The digital European sky will encourage a shift away from a traditional product-centric strategy to one that focuses on the end-user, stimulating entrepreneurship, a risk-taking culture and creating buy-in from operational staff.



## Focus

The demonstrators will focus on the breakthrough innovations that can bring the greatest benefits, attract the best innovators and connect local and regional ecosystems.



## Standards & certification

To keep pace with technological advances, the demonstrator network will closely involve the relevant authorities and bodies to develop the next generation standards that are responsive to policy needs, agile, open and joined up.



## Regulation

A key added value of the network should be to facilitate interactions between breakthrough innovators, early movers and regulators to help develop regulatory frameworks that allow the benefits of digital technologies to be fully realised.



## Aviation green deal

Europe should be the world’s most environmentally friendly continent to fly. One of the flagship initiatives of the demonstrator network will be oriented towards accelerating market uptake of solutions enabling “perfect flights” from an emissions perspective, eliminating unnecessary ATC interventions that would result in a degradation of the optimum trajectory and generate extra emissions. This flagship will also facilitate the integration of the next generation of aircraft that will be cleaner and quieter.

# Driving collaboration and open innovation

Transforming the infrastructure supporting European aviation cannot be done by any one organisation or country. It requires close collaboration between all the stakeholders that contribute to it, from the European and national decision-makers that regulate it, the organisations and staff that operate it to the academic and industry stakeholders that research, design and manufacture it.

A public-private partnership that is strongly linked to policy and regulation through an institutional partnership offers the best means to coordinate all the stakeholders, pooling the critical mass of resources and expertise needed to deliver a digital European sky. To ensure its effectiveness, the partnership should have the following attributes:



## Policy/mission oriented

Embedding the partnership within the EU's policy and regulatory framework ensures that research is oriented towards the right priorities, bringing real added value to Europe's economy and society. This requires close cooperation with the European Commission, Council and Parliament and relevant regulatory authorities, notably the European Union Aviation Safety Agency (EASA) and the national aviation authorities in the Member States.



## Inclusive

Blending the expertise from established aviation players and new entrants (digital start-ups, SMEs, academia, research centres) as well as other industries, such as the automotive and mobile communication sectors, gives rise to new ideas and innovations.



## Accelerated

Innovating together reduces the innovation lifecycle from 20-30 years to 5-10 years, while demonstrating the scalability of technology solutions in real operations encourages accelerated uptake.



## Agile

Working in small teams under time pressure of 2-3 years encourages risk taking and more agility to address emerging trends both within aviation and in the broader industry landscape.



## Global

Engaging with international partners and the International Civil Aviation Organisation under the umbrella of the EU's external aviation policy is an essential means of ensuring global interoperability and promoting the competitiveness of European industry.



## Integrated

Establishing a roadmap with commonly agreed priorities maximises resources and ensures an integrated approach to the transformation process.

# Benefits for European society and economy

Delivering the digital European sky will bring substantial value for every stakeholder in the aviation value chain; it will also significantly benefit the European economy and society in general at a relatively small investment cost.

It is estimated that, by 2040, the digital European sky would amount to EUR 80 billion in annual recurring benefits for Europe. Realising the benefits will largely depend on the ability of the sector to create the conditions to shorten the innovation life cycle for infrastructure modernisation. If these conditions are not created, the transformation is likely to be completed only by 2050 with negative implications for the environment, jobs and growth in Europe.



**Zero environmental waste:** eliminates environmental inefficiencies caused by the aviation infrastructure, ensuring that it offers solutions that will fully exploit the potential offered by the next generation aircraft for cleaner and quieter flight.



**Cyber-resilient:** delivers the intended continuity of services despite adverse events.



**Safer:** relies on the talent of both humans and new technologies to advance the level of safety beyond current levels.



**Fully scalable:** creates the capacity needed to handle traffic in the most efficient way where and when capacity is needed.



**More productive:** enables resources (including data) to be shared across the network.



**Enabling advanced mobility services:** offers smart and personalised mobility options to passengers, allowing them to travel seamlessly and efficiently across modes of transport.

The network of demonstrators will help create buy-in from the supervisory authorities and operational staff, providing tangible evidence of the performance benefits in terms of environment, capacity, safety, security and affordability.



## What does this mean for citizens?



A digital European sky could save 28 million CO<sub>2</sub> tonnes per year, which is roughly equivalent to CO<sub>2</sub> produced by 3.2 million people or the population in the metropolitan area of a city like Madrid.



A digital European sky will ensure that passengers do not lose time at airports or in the air in Europe. In doing so, it could save yearly up to 14.5 million hours that passengers will be able to spend instead with their family or at work.



An aviation infrastructure that opens up digital opportunities for people and business and enhance Europe's position as a world leader in the digital economy.



Position Europe as the most environmentally friendly sky to fly in the world.



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