PANEL DISCUSSION I: Sustainability in air transport system

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Sustainability in the air transport system goes beyond reducing emissions; it requires rethinking how aviation operates to become more efficient, environmentally friendly, and resilient. The European Commission's Green Deal aims for net-zero carbon emissions by 2050, and the aviation sector is fully mobilised behind this target. While the airborne industry is developing and implementing solutions like sustainable aviation fuels (SAF), hydrogen, and electric propulsion, air traffic management (ATM) also plays a critical role in reducing aviation's environmental footprint.

Today, Europe's Air Traffic Management (ATM) faces multiple challenges. In 2024, arrival punctuality stands at 72%, with delayed flights experiencing an average delay of around 18 minutes. These delays have a direct impact on sustainability, as they often result in aircraft idling on runways, extended taxiing times, or circling in holding patterns before landing. Such inefficiencies lead to increased fuel consumption and higher emissions, negatively affecting the aviation sector's environmental footprint.

While CO2 emissions are currently 1% lower than in 2019, this modest reduction is primarily due to reduced flight numbers. As air traffic continues to increase, CO2 emissions are expected to rise unless ATM operations are optimised for greater efficiency. Although Europe maintains an exceptional safety record, sustaining these high standards will require innovative solutions to manage the anticipated traffic growth.

To achieve sustainability, we must move from a system where airspace users merely comply with ATM restrictions to one where ATM proactively supports the needs of users by optimising flight profiles and minimising environmental impacts. A key enabler of this transformation is trajectory-based operations (TBO), which enables flights to follow their optimal, real-time trajectories. This approach significantly reduces inefficiencies, fuel consumption, and emissions.

The SESAR Joint Undertaking has already delivered over 130 innovative solutions to enhance ATM, including cross-border arrival management to optimise airport arrival throughput, the Airport Operations Centre (APOC) to streamline flight management on the airport platform and at the gate, and satellite-based procedures to improve flight descents, reducing both fuel consumption and noise. These innovations, along with trajectory-based operations (TBO), ensure that ATM aligns more effectively with the operational needs of airspace users while actively contributing to sustainability goals

The path forward is outlined in the European ATM Master Plan, which provides a clear roadmap of *what* needs to be done and *when* it should be implemented. The updated vision of the Digital European Sky emphasises the importance of accelerating the deployment of key solutions. The ATM Master Plan sets out 10 strategic deployment objectives to be achieved by 2035, focusing on solutions that will deliver the greatest benefits. These objectives serve as a guiding framework for investments and regulatory decisions, ensuring maximum impact across the aviation sector.

The ATM Master Plan also addresses emerging challenges, such as integrating zero-emission aircraft and enabling innovative air mobility operations. By 2045, the aim is to fully deploy the Digital European Sky, creating an airspace that is not only efficient but also environmentally sustainable. The environmental

benefits of this transformation are substantial: projections indicate that by 2050, SESAR's efforts could save 400 million tonnes of CO2, equivalent to three years' worth of European aviation emissions.

Addressing non-CO2 effects, particularly contrails, is also a key priority. While CO2 is a major contributor to climate change, contrails and other non-CO2 emissions have a significant impact as well. SESAR is working to reduce the scientific uncertainty surrounding these effects and is developing a contrail monitoring system that integrates satellite data with ground-based sensors to differentiate between warming and cooling contrails. Additionally, new procedures will need to be defined for identifying and managing air traffic that may generate warming contrails.

For this vision to become a reality, certain conditions must be met. First, we need a regulatory framework that is both economically viable and technically robust. As the technological pillar of the Single European Sky initiative, SESAR collaborates closely with other pillars to ensure that investments are directed toward priority areas that will bring the greatest benefits. Second, it is crucial to encourage early adopters and leverage financial instruments, such as Digital Sky Demonstrators, to validate solutions at scale under real-world conditions. Finally, it is essential to engage all stakeholders—from researchers to operators—to keep them mobilised in developing the next generation of innovations.

In conclusion, decarbonising aviation is essential. While new aircraft technologies will play a significant role, modernising Air Traffic Management offers an immediate and cost-effective impact. SESAR has already delivered innovative ATM solutions that reduce aviation's environmental footprint, but the pace of implementation must be accelerated. The SESAR Joint Undertaking is committed to developing the technologies and systems required to make Europe the most efficient and environmentally friendly sky to fly in the world, ensuring aviation's future in a net-zero world.

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