SESAR

MODERNISING THE EUROPEAN SKY

founding members

EUROPEAN UNION

EUROCONTROL

Why **SESAR?**

Air Traffic Management (ATM) is an essential component in the air transport system, which is worth €8.4 billion/year* and involves:

- **58.000** Employees*
- **17.200** Air Traffic Controllers*
- **11.5** million km² of airspace*
- **63** En route centres*

Today's complex infrastructure means that Europe's ATM is not running as efficiently as it could:

- In 2010 en-route flights were delayed by an estimated **19.4 million minutes**.**
- On average, each flight was **49 km longer** than direct flights.**
- Estimated costs of airspace fragmentation amounts to **€4 billion a year**.**

With traffic expected to grow, Europe needs to take advantage of technological developments in order to keep the aviation industry sustainable.

2012	2030
9.5 million flights*	16.6 million flights*
1.6 billion passengers***	2.7 billion passengers***

* Source: Eurocontrol - **Source: European Commission - *** Source: Airports Council International Europe

With **SESAR**

SESAR is researching and developing innovative ATM solutions that **benefit Europe's society and wider economy.**

A positive impact on the EU's GDP.*

Creation of **additional jobs** in air transport industries.*

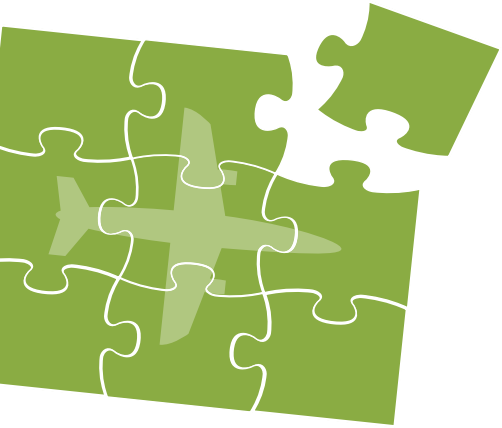
More direct flights will shorten flight times by approximately 10%, **9 minutes per flight** on average.*

A reduction in the environmental impact of flights by **10%**, through shorter waiting and taxi times, more direct trajectories and smoother landing approaches.**

Fewer cancellations and delays and increased predictability and punctuality on arrivals and departures.*

*Source: SESAR Macroeconomic Study, 2011 - ** High-level goals for the Single European Sky

Modernising the **European sky**



Europe's aviation and air transport sectors are the lifeline of Europe's economy. To stay competitive globally, these sectors need to provide reliable, safe and seamless connectivity for passengers and freight.

A **technologically-enhanced** and **performance-driven ATM system** is recognised as **critical element** for the **sustainability of these sectors.**

This is where SESAR comes in.

Established in 2007, the **SESAR Research and Innovation Programme (R&I) fast tracks ATM modernisation** through the research and development of technological and operational solutions.

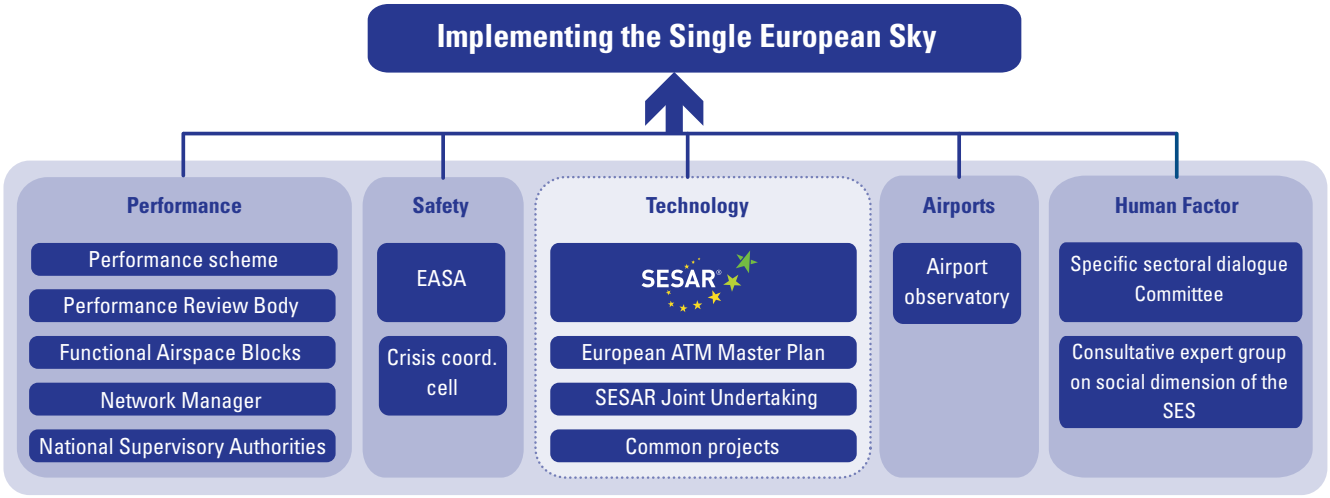
The Programme does so by **pooling together the knowledge and resources** of the entire ATM community, through a public-private partnership, the **SESAR Joint Undertaking (SJU)**.

The total budget of the SESAR Programme, until 2016, is **€ 2.1 billion**, with equal contributions from the European Union, Eurocontrol and the industry.

In June 2014, the Council of Ministers of the European Union **extended the legal duration of the SJU until 2024** to pursue R&I in view of delivering the necessary technologies and operations to ensure the **execution and achievement of the European ATM Master Plan** (see page 7).

The Single European Sky

The SESAR R&I Programme is the technological pillar of the Single European Sky - an ambitious initiative launched by the European Commission in 2004 with the aim of defragmenting the European airspace.



In 2012, the European Commission set **high-level goals for the Single European Sky** to be met by **2020** and beyond:

- Enable a **3-fold increase** in capacity which will also reduce delays both on the ground and in the air
- Improve safety by **a factor of 10**
- Enable a **10% reduction** in the effects flights have on the environment
- Provide ATM services to the airspace users at a **cost of at least 50% less**

SESAR in three steps

As the technological pillar of the Single European Sky, the **SESAR Programme** aims to contribute to the SES high-level goals and has set up a **Research and Innovation (R&I)** programme clustered into **three steps.**

STEP ONE: Time-based operations

STEP TWO: Trajectory-based operations

STEP THREE: Performance-based operations

By the end of **STEP ONE**, the SESAR Programme aims to have contributed the following:

- A **27%** increase in Europe's airspace capacity

- A **40%** reduction in accident risk per flight hour - corresponding to the safety need associated with the anticipated traffic growth

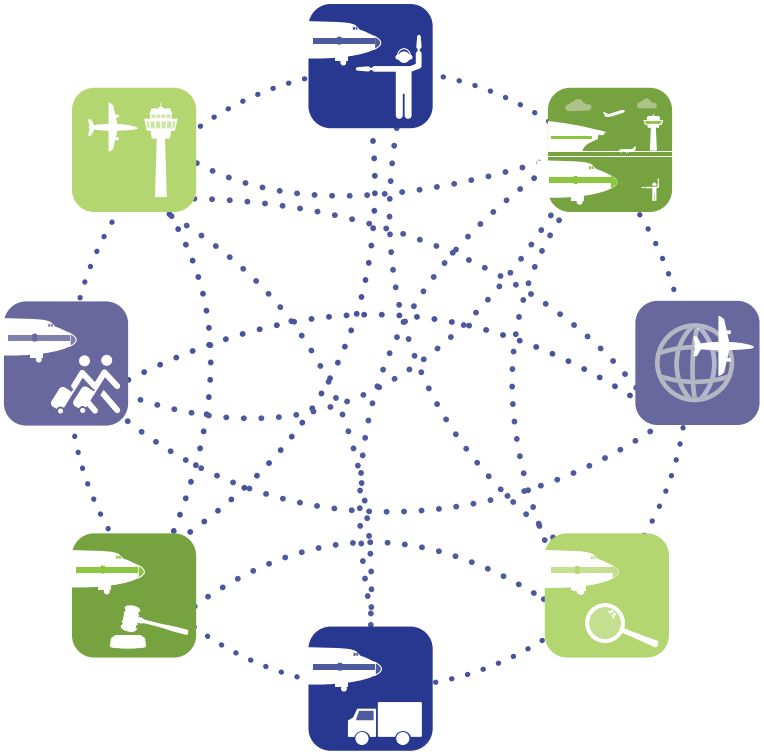
- A **2.8%** reduction per flight in environmental impact

- A **6%** reduction in cost per flight

Adding value through **partnership**

The SESAR R&I Programme brings together the expertise of the whole of ATM community, and in doing so ensures that the solutions developed meet needs of these stakeholders.

SESAR was founded by the **European Union** and **Eurocontrol**, and has **16 members** which together with their affiliate associations represent over **70 companies** working in Europe and beyond. The Programme also works closely with staff associations, regulators, airport operators and the scientific community.



Providing **benefits for all**

Through their **involvement** in **SESAR**...

- AIR NAVIGATION SERVICE PROVIDERS (ANSPs) can deliver a better quality of service at a lower unit cost for airspace users, and can seamlessly interoperate with service providers across the network and beyond.
- AIR TRAFFIC CONTROLLERS, PILOTS AND ENGINEERS have tools and systems that are built to their needs and support their ability to operate in an increasingly complex environment.
- AIRPORT OPERATORS have access to more integrated systems and data sharing to enable greater predictability and more efficient operations.
- AIRSPACE USERS (CIVILIAN AND MILITARY) can operate closer to their business or mission needs, while reducing fuel costs, service charges and reducing impact on the environment.
- AIR PASSENGERS AND EUROPEAN CITIZENS can benefit from shorter and more reliable journeys, lower costs and enhanced safety.
- REGULATORS AND ADMINISTRATORS can build their activities based on validated solutions agreed across the European ATM stakeholder community.
- SUPPLIERS can gain access to the market, allowing them to develop their products in an innovative and competitive environment, confident that the user requirements are commonly agreed.
- SCIENTIFIC EXPERTS also have the opportunity to make an important contribution to the future of ATM in Europe.

Responding to **business needs**

The SESAR R&I Programme develops solutions in response to the business needs of the entire ATM community:

Traffic Synchronisation: refers to the tactical organisation of air traffic in real time in order to optimise airport, runway and airspace use.

Airport integration and throughput: ensures the full integration of airports within the ATM environment through an Airport Operations Plan, agreed and shared by all stakeholders.

Moving from airspace to 4D trajectory management: creates an environment where air and ground stakeholders share a common view of the aircraft's trajectory, to optimise the flow of air traffic.

Network collaborative management and dynamic/capacity balancing: achieves an efficient network of operations based on collaboration and information sharing among all actors.

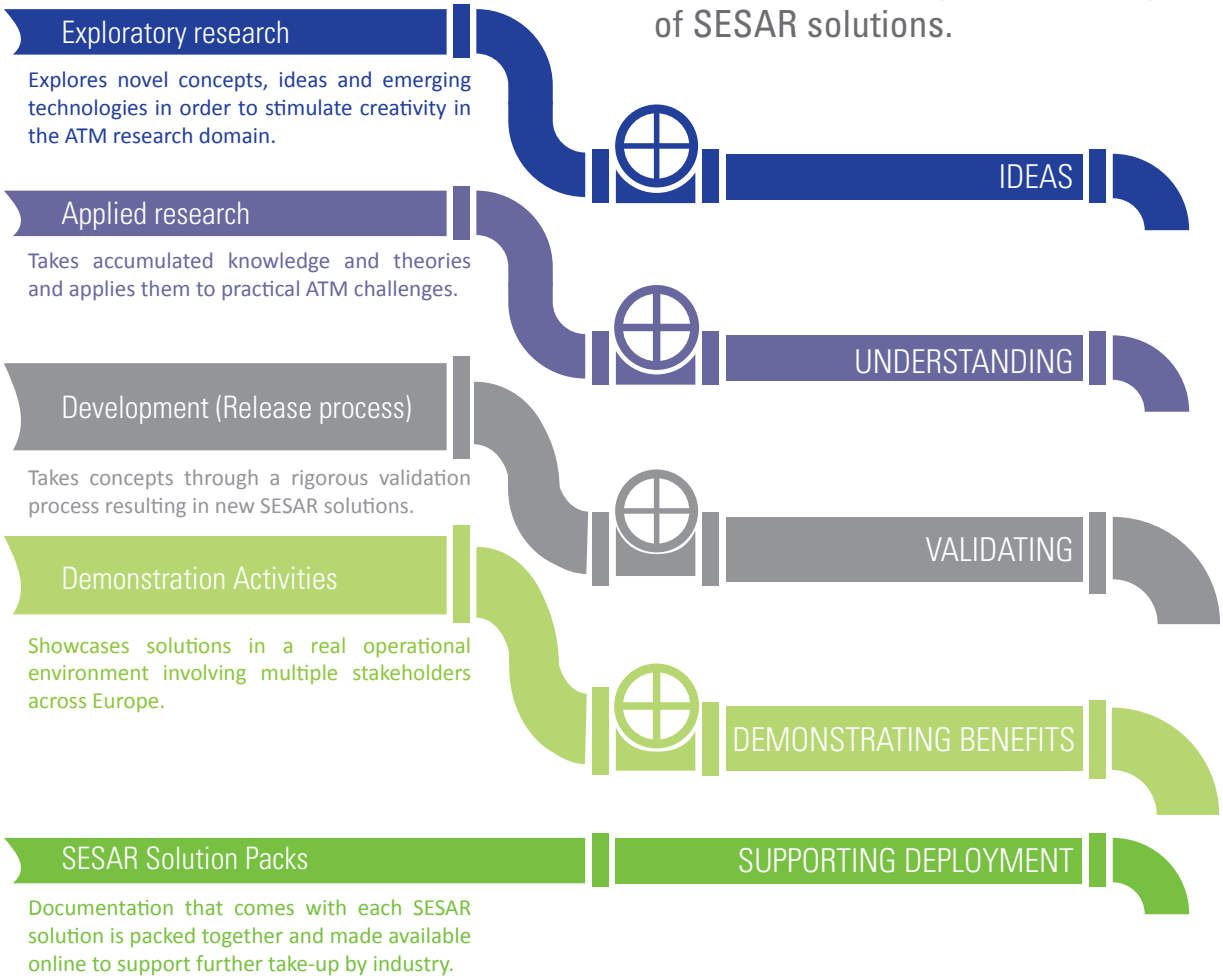
Conflict Management and Automation: limits the risk of collision through the management of aircraft trajectories.

System Wide Information Management (SWIM): facilitates greater sharing of ATM system information between all stakeholders, making sure that each stakeholder has the right information at the right time to make the right decisions.

The roadmap for responding to these business needs is known as the **European ATM Master Plan**. This roadmap sets out the necessary steps involved for the development and deployment of SESAR technologies and procedures, linking them to the Single European Sky performance objectives and ensuring consistency with the ICAO Global Air Navigation Plan.

From **innovation** to **solution**

■ The **SESAR R&I Programme** has developed an **innovation pipeline** towards deployment which is stimulating new thinking in the ATM domain, and demonstrating the viability and benefits of SESAR solutions.

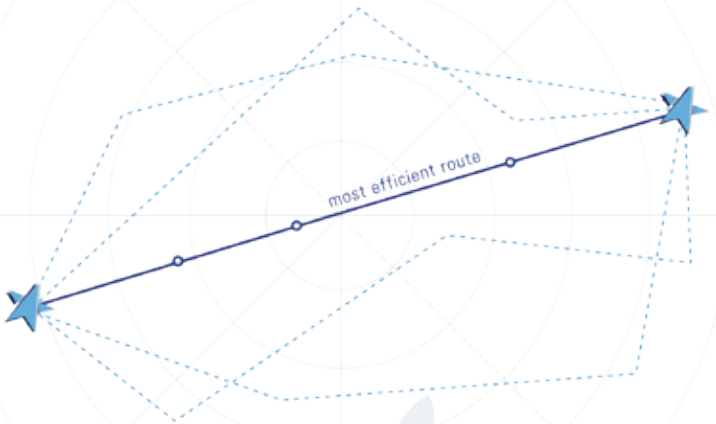


SESAR is delivering!

SESAR is already delivering the ATM industry with **viable solutions** to meet their **business needs**. These solutions are systematically validated in real operational environments in order to have conclusive and sufficient proof to support a decision for their industrialisation.

The following factsheets present a summary of just some of the solutions that are already mature enough for industrialisation.

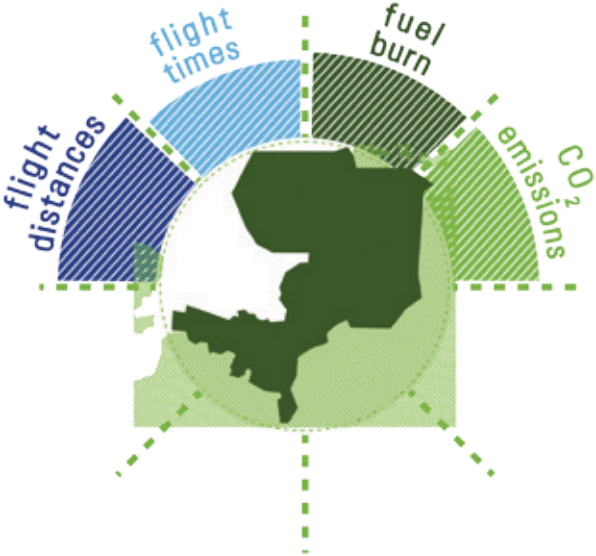
USER PREFERRED ROUTING



User Preferred Routing (UPR) enables aircraft to **freely plan a route between published entry and exit points**, subject to airspace availability, without referring to the Air Traffic Services (ATS) network. User Preferred Routing is a step towards the European Free Route Airspace Concept and is an **essential component for a modern air traffic management system.**

The operator's flight planning system calculates the most efficient route between departure and destination, taking into consideration **wind speed and direction, turbulence, temperature,** the **aircraft type** and **performance.**

Validation exercises in the Maastricht Upper Airspace Control Centre (MUAC) have made **initial steps towards User Preferred Routing** by focusing on extending the use of direct routing inside a complex area. They found that **flight distances can be reduced by 5%, and flight times by two minutes.** Direct routing also proved to be cleaner, with up to **12% reductions in fuel burn and CO_2 emissions.**



AUTOMATED SUPPORT FOR DYNAMIC SECTORISATION

Today's ATM systems can detect high traffic density, but **have no airspace tools to find alternative solutions. Automated support for Dynamic Sectorisation** provides an alternative, enabling air traffic controllers to adapt airspace configurations in order **to best meet traffic demand at peak times.**

With **Automated Support for Dynamic Sectorisation,** airspace sectors are grouped or de-grouped to **match capacity with evolving demand, making better use of available airspace and human resources.**

Tests in Barcelona demonstrated that, thanks to Automated Support for Dynamic Sectorisation, **traffic capacity is increased by 10% even in saturated periods, while the number of delayed flights is reduced by 5%.** Not only that, but because **they receive advanced warning, the ATC system is better prepared** to manage these situations.

TIME BASED SEPARATION

Today, **airplanes** when making their final approach to land **are obliged to maintain minimum distances.** These distances are fixed whatever the weather.

When keeping to these distances **in strong headwinds, longer gaps of time** develop between airplanes. This means **fewer flights landing per hour, delays and increased holding** at busy times, all of which increases fuel burn.

Time Based Separation (TBS) replaces current distance separations with time intervals in order to adapt to weather conditions.

Tests at London Heathrow demonstrated that TBS **allows up to five more airplanes to land per hour in strong wind conditions**, while reducing holding times by up to 10 minutes. TBS offers **increased safety, fewer delays and improved environmental performance.**

REMOTE TOWERS

Small or local airports are life lines to local and regional economies, generating mobility of goods, services and people. But keeping these airports open with air traffic services is a challenge given the costs involved in running them compared to the number of flights they handle. **SESAR's Remote Tower Services offers new possibilities** for places where it is too expensive to maintain and staff conventional tower facilities and services, or at airports where such services are currently unavailable.

Using video cameras with zoom-in and infrared and panoramic high resolution screens, **air traffic controllers have a 360-degree coverage of an airport, allowing them to remotely manage the traffic situation in real time**. Like at onsite manned control towers, controllers at their remote workstations have access to information from supplementary sensors and controller tools to ensure that flights take off and land safely and smoothly.

Validation exercises in Norway, Sweden and Germany have shown that **Remote Tower Air Traffic Services are safe and cost-effective**, enabling smaller airports to ensure a continuity of operations and provide services on-demand at single airports.

This is only the start. In the future, SESAR Remote Tower Services will be **further developed to serve multiple small-to-medium sized airports or as contingency solutions for airports of any size**. Ultimately with Remote Towers, air traffic services could be provided at more airports, opening up ever more destinations across Europe.

SYSTEM WIDE INFORMATION MANAGEMENT (SWIM)

SWIM is the intranet of the air traffic management. It enables **seamless information interchange** between all providers and users of ATM information. They share aeronautical, airport, flight, meteorology, surveillance, flow, capacity and demand information.

SWIM gives the right person access to the right information at the right time and in the right and secured way. Demonstrations so far confirm that SWIM allows greater ATM operations efficiency and ATM infrastructure cost reduction thanks to **interoperability** of systems based on standard technology and information services.

It also opens the opportunity for the development of new SWIM-compliant applications and systems.

I4D TRAJECTORY

The first **i4D trajectory** flight trial took place in February 2012. It was a world premiere. 4D means **three spatial dimensions, plus time**. Time represents a key element in the transition from constrained flights in the current ATM system to optimised flights.

i4D operations establish far ahead of time a sequence for aircraft converging on a merging point, which is particularly crucial in congested areas. After coordination between the ground systems and the aircraft, **each aircraft is allocated a time slot for its arrival** at a merging point, and in compensation is allowed to fly to that point, without any vectoring instruction from the controllers.

Current validation exercises and flight trials **have demonstrated several reductions**: in average time spent in holding (up to -100%), in distance flown per flight (-6.34%), in number of potential conflicts (by -68%), and in average fuel consumption per flight (-11.42%).

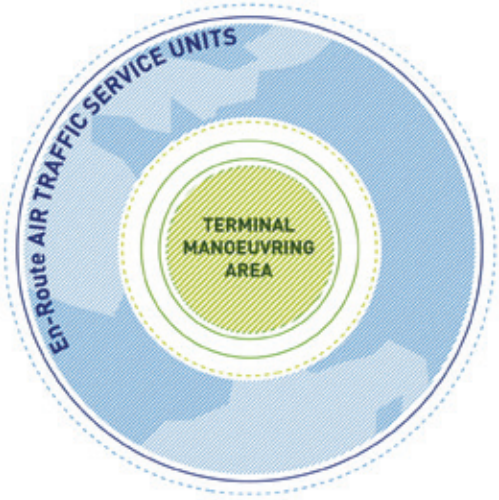
In the future, thanks to i4D trajectory, **ATM operations will be automated to a greater extent** than they are today, and the European sky will be able to cater for more efficient flights than it can today.

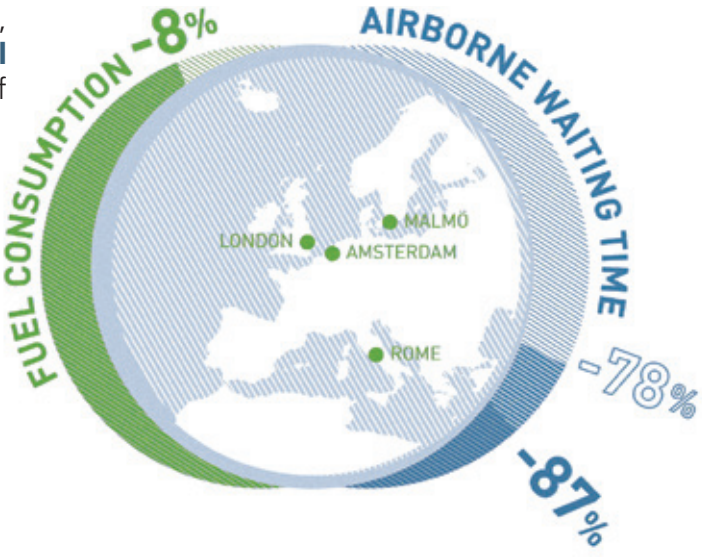
EXTENDED AMAN (ARRIVAL MANAGER) HORIZON

Extended Arrival Manager Horizon allows handling of air traffic much earlier for the **preparation of the landing sequence**, thanks to the coordination of Terminal Manoeuvring Area and en-route Air Traffic Service Units.

Air traffic controllers are able to extend the borders of the Terminal Manoeuvring Area into the upstream airspace sector and instruct pilots to modify aircraft speed before the Top of Descent. They can thus **calculate a smooth and optimal arrival flow** to maximise runway throughput, relieve congestion, and minimise arrival queuing time.

Flight trials have already taken place in Rome, Amsterdam, Malmö and London, achieving **an average reduction of 8% of fuel consumption per flight**, and a reduction of 78 to 87% of airborne waiting time.





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