



IFAR

**INTERNATIONAL FORUM
FOR AVIATION RESEARCH**

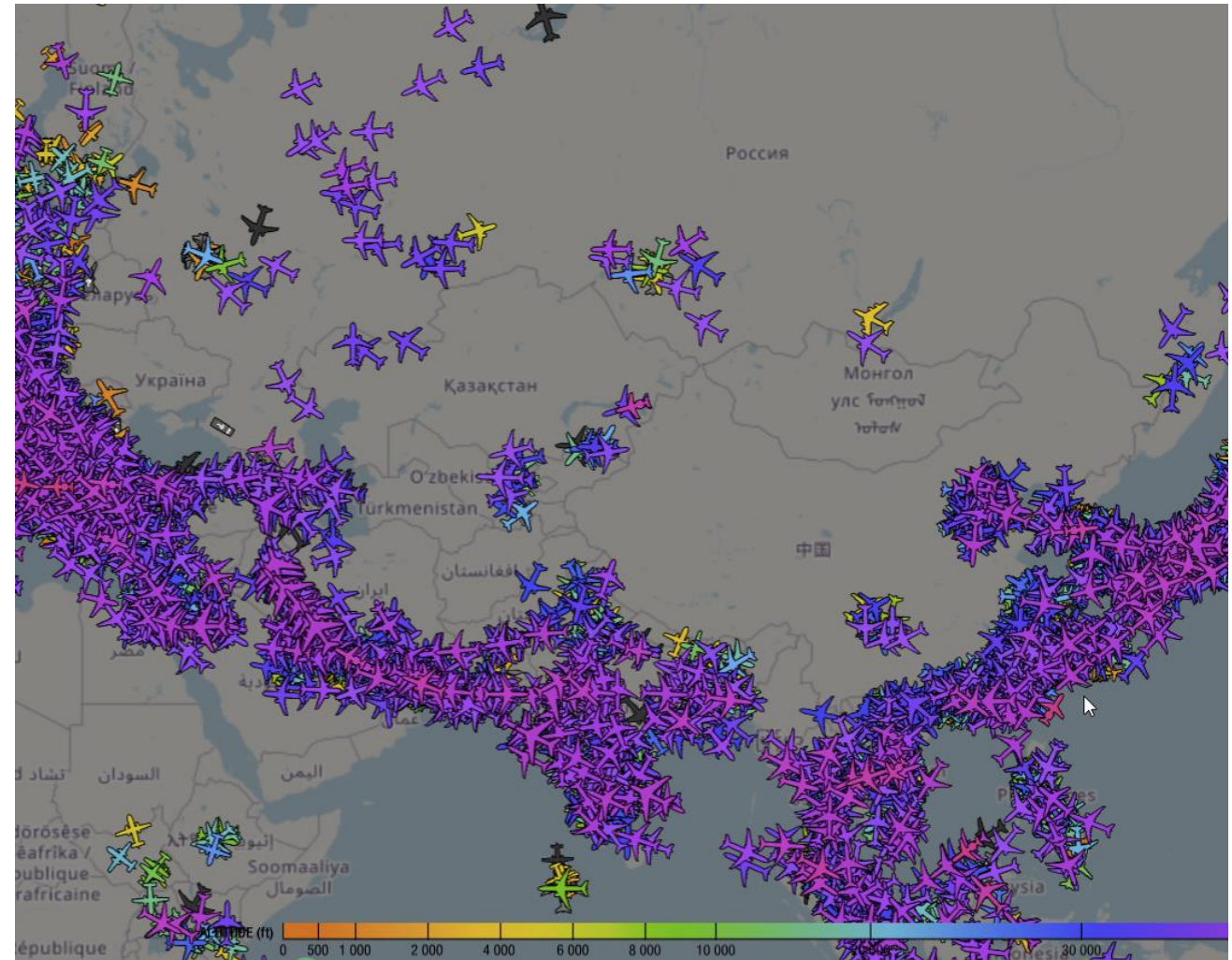
IFAR PERSPECTIVE ON ATM RESILIENCY
ICAS EMERGING TECHNOLOGY FORUM 2025
H. TÖBBEN
SEPTEMBER 9TH, BRNO, CZECH REPUBLIC

Geopolitical crises

The Russian government has closed its airspace to 36 countries or territories.

The Russian war against Ukraine has reduced the airspace available for civil aviation in Europe by around 20 %.

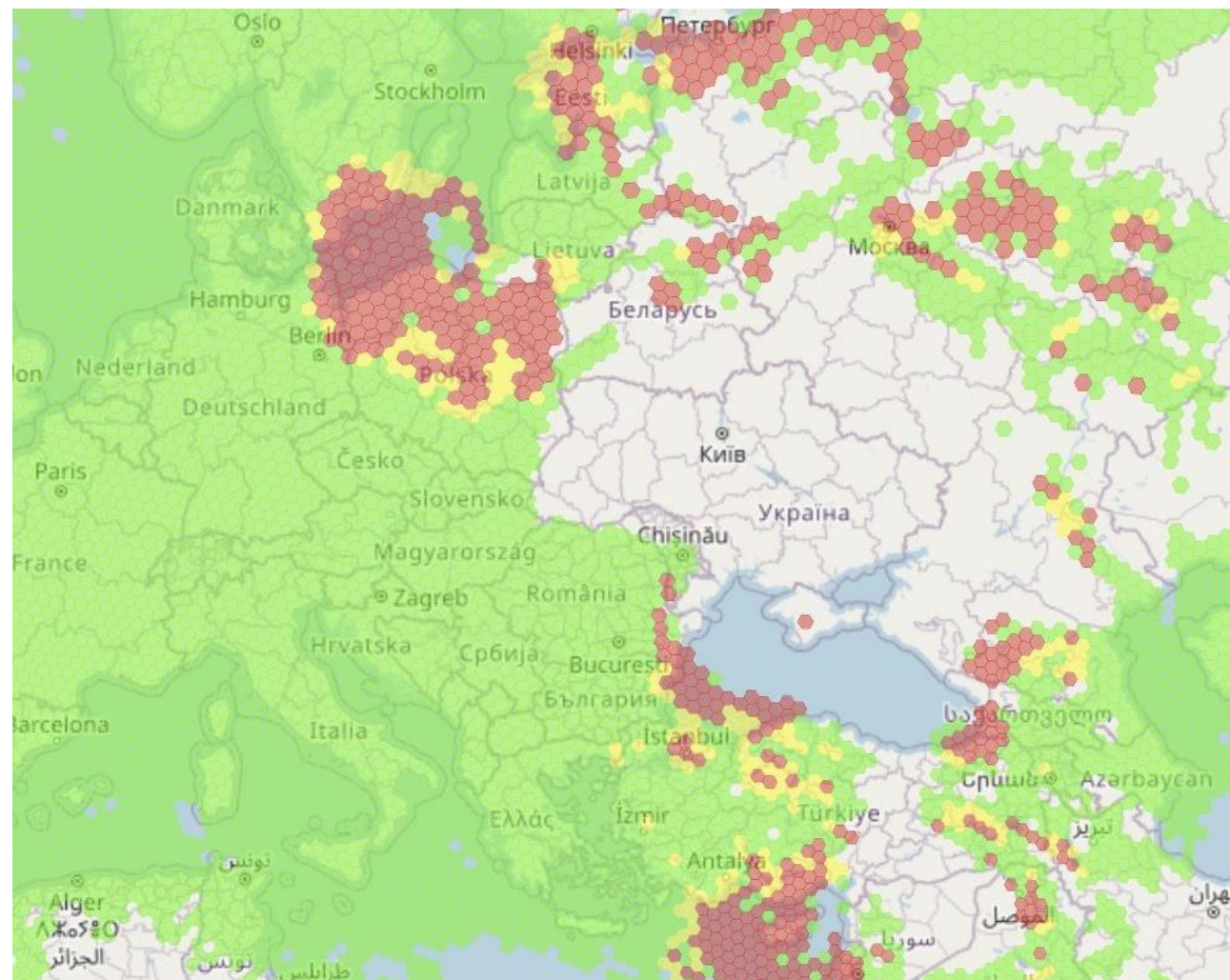
The unavailability of Russian airspace to most carriers and the closure of Ukrainian airspace has resulted in a spate of lengthy, uneconomical rerouted flights.



Security threats

GPS jamming and spoofing puts a serious threat on the ATM system.

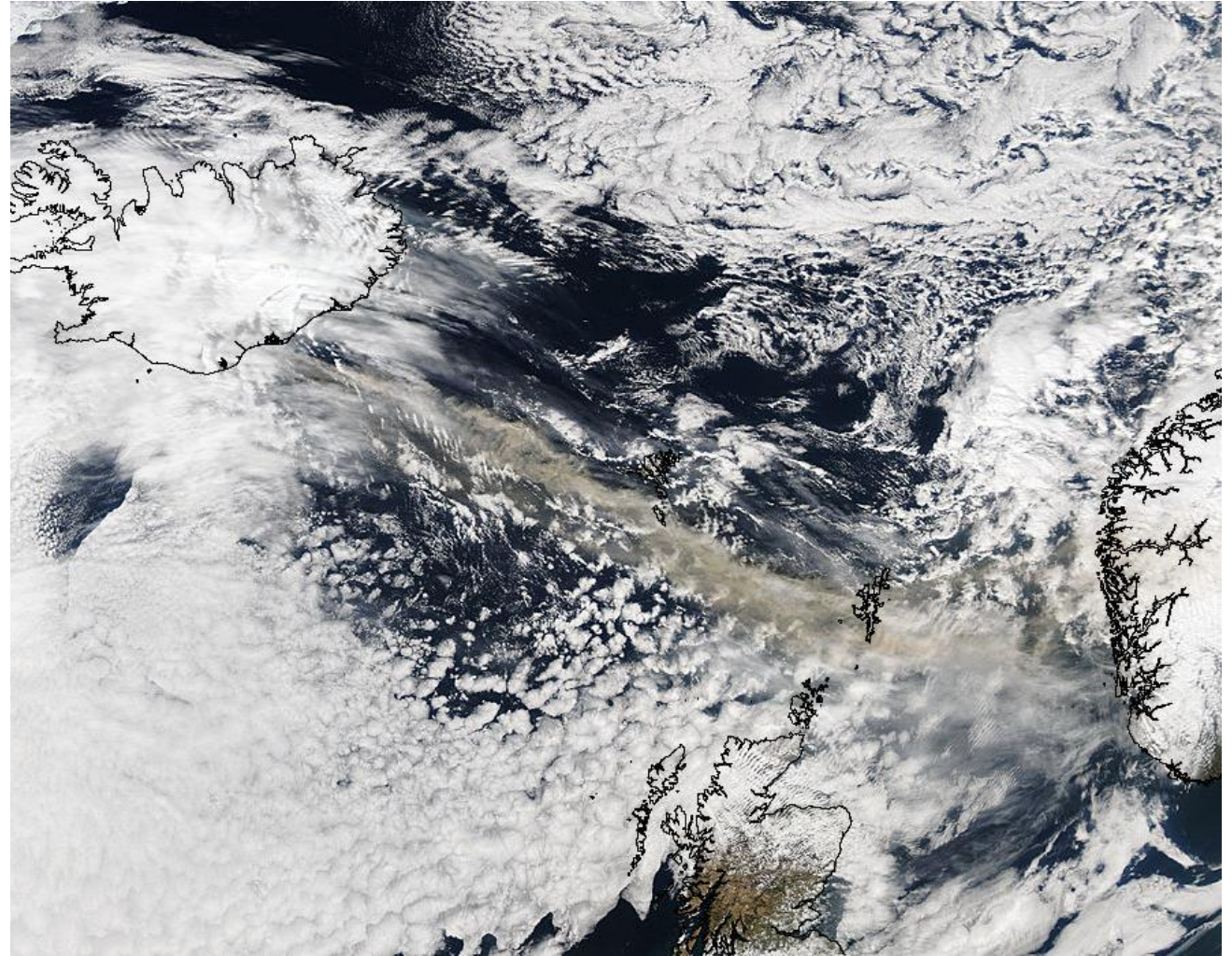
Since Russia's intervention in the Syrian civil war in 2015 and its subsequent invasion of Ukraine in 2022, GPS jamming has become a serious threat in the Middle East and along the eastern borders of Central Europe.



Natural events

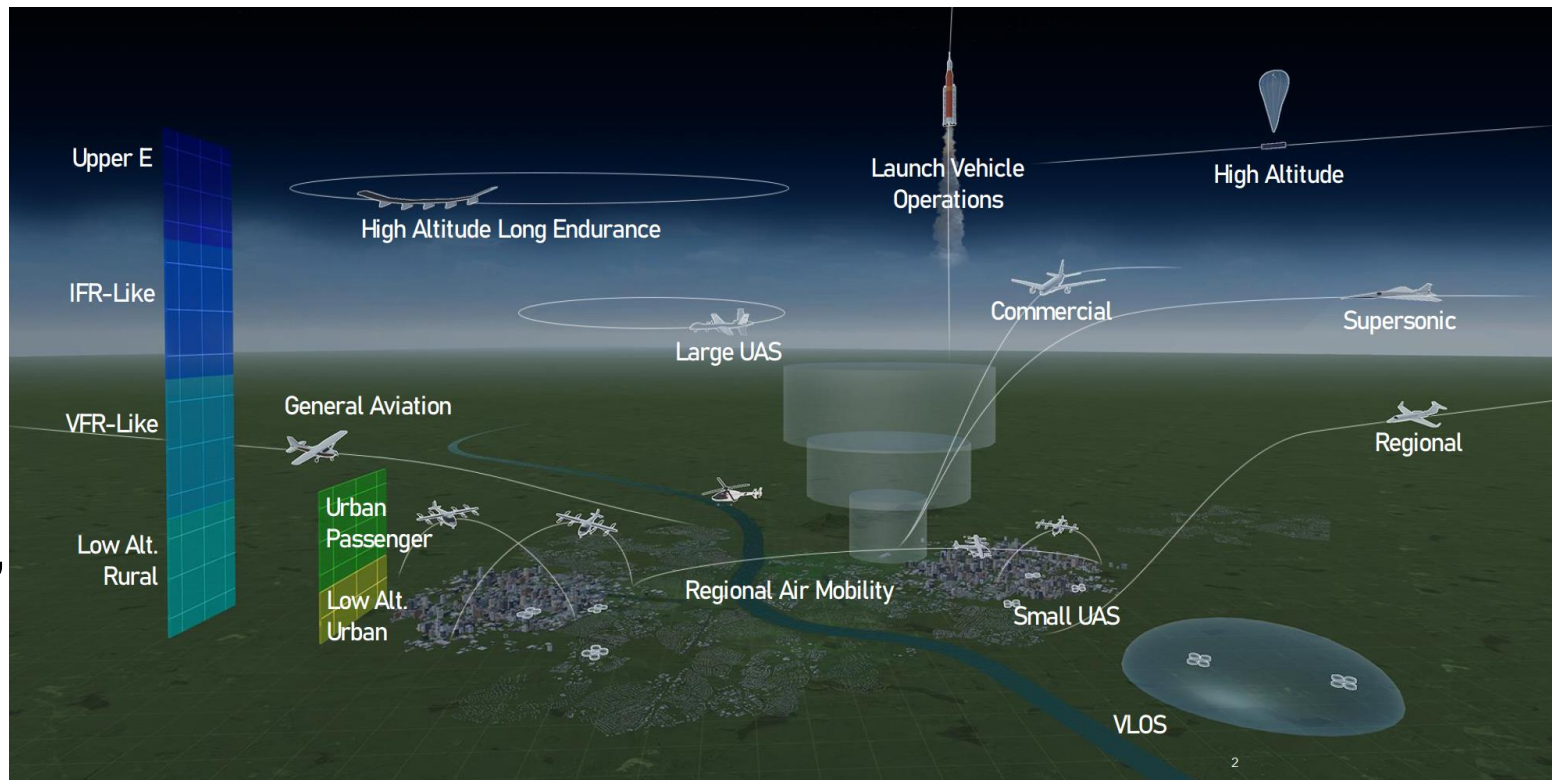
In April 2010, the Eyjafjallajökull volcano erupted beneath a thick layer of ice. This caused the lava to suddenly produce vapourising water, leading to an extremely explosive ash cloud.

This paralysed air traffic in large parts of Europe for several days, as the ash particles can damage aircraft engines. More than 100,000 flights were cancelled during this time, affecting millions of passengers and causing immense losses for the aviation industry.



New entries

Air traffic management (ATM) systems are presented with challenges when it comes to integrating a wide range of new aircraft into existing crowded airspace. These aircraft include high-altitude long-endurance aircraft, drones, space launches, balloons and supersonic aircraft.



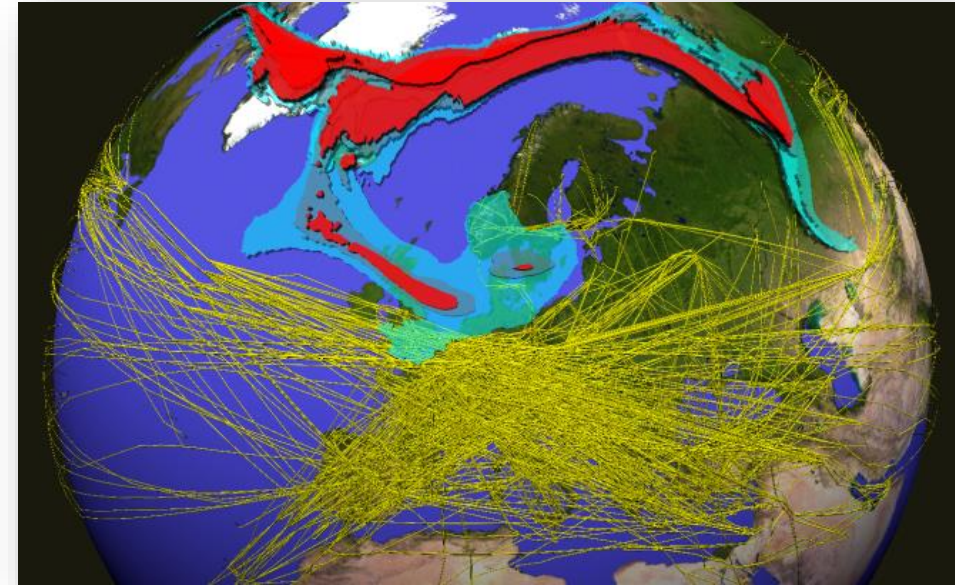
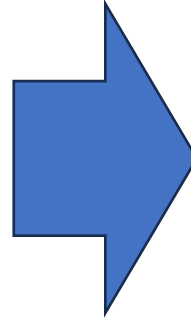
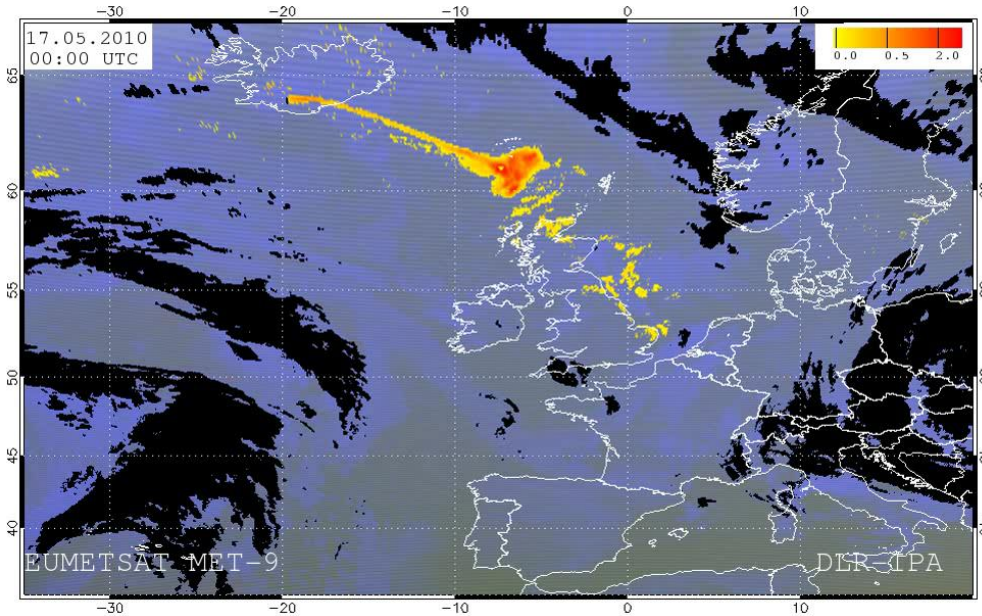
Climate change

Aviation has an impact on climate change, but climate change also has an impact on the global air transportation system.

- Runways and airports under water
- Unavailable routes and airspace due to extreme weather and clear air turbulence
- Hotter, thinner air, which in turn is affecting the runway length



Volcanic Ash: from improved forecasts to optimized flight planning - re-analysis of Eyjafjallajökull 2010

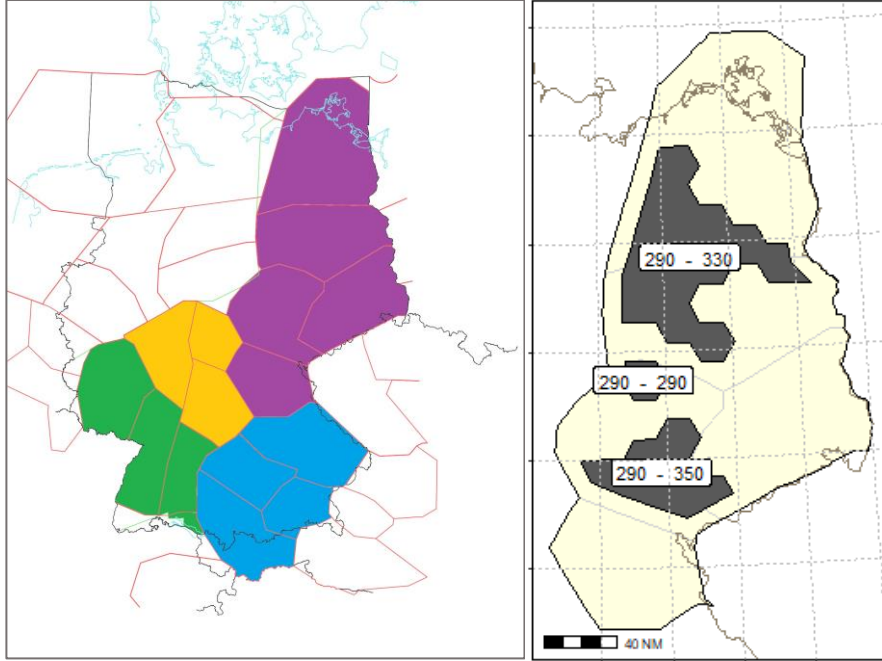


- This Europe-wide forecast is based on the analysis of satellite images, which are available every 15 minutes
- Operational for European airspace through collaboration with the German Meteorological Service (DWD)



- Three-zone model with high, medium low "ash concentration" available.
- Regulation: Planning through "medium ash" is permitted! + Airline Procedure: Avoid visible ash!
- Doubles the number of feasible flights!

Avoidance of Contrail induced Cloudiness - The Air Traffic Control Perspective -



DFS Deutsche Flugsicherung

Contrail induced Cloudiness: Avoiding
areas in which persistent contrails
might occur
→ Reduction in Aispace Capacity

DFS Karlsruhe Upper Airspace Area Control

What we need:

- More Airspace Capacity
- Increase flexibility in ATM

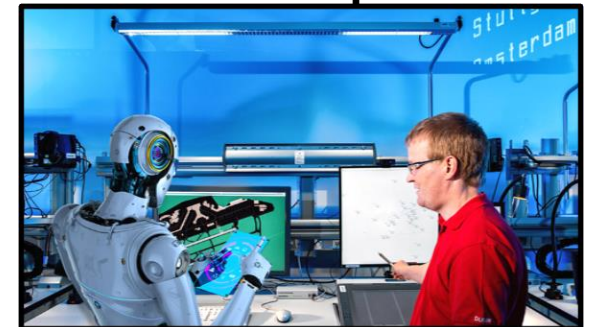


e.g. **Flight-Centric ATC**

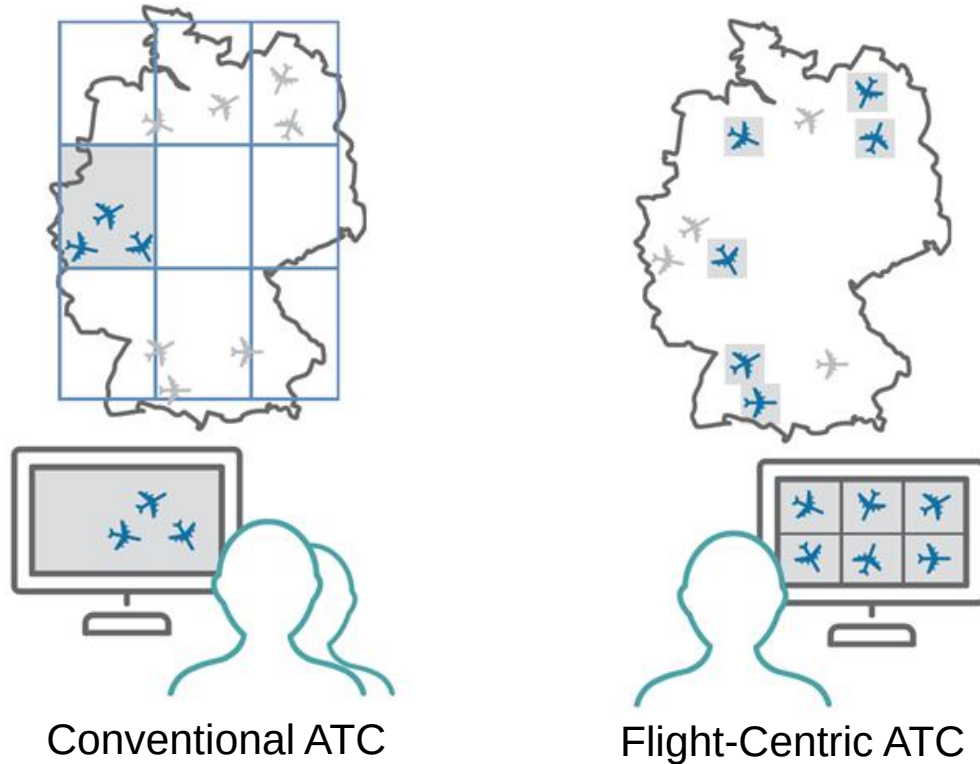
More Automation in ATC

- D/L Communication
- Trajectory based Operations

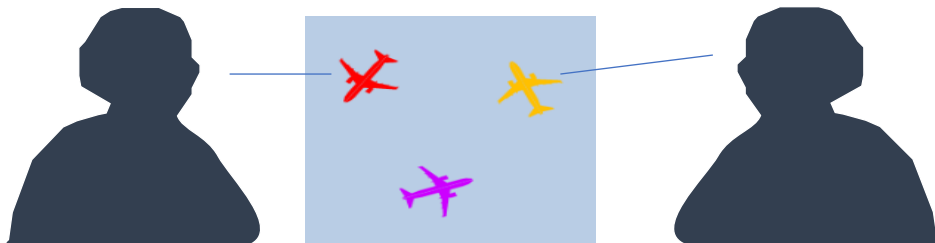
e.g. **AI supported Single
Controller Operations**



What is sectorless ATM or Flight Centric ATC?



4-eyes-principle remains!



Validation in Human in the Loop Simulations:
> 200% increase in air traffic controller's productivity⁹

AI supported Single Controller Operations



A TEAM OF HUMAN AND DIGITAL CONTROLLERS



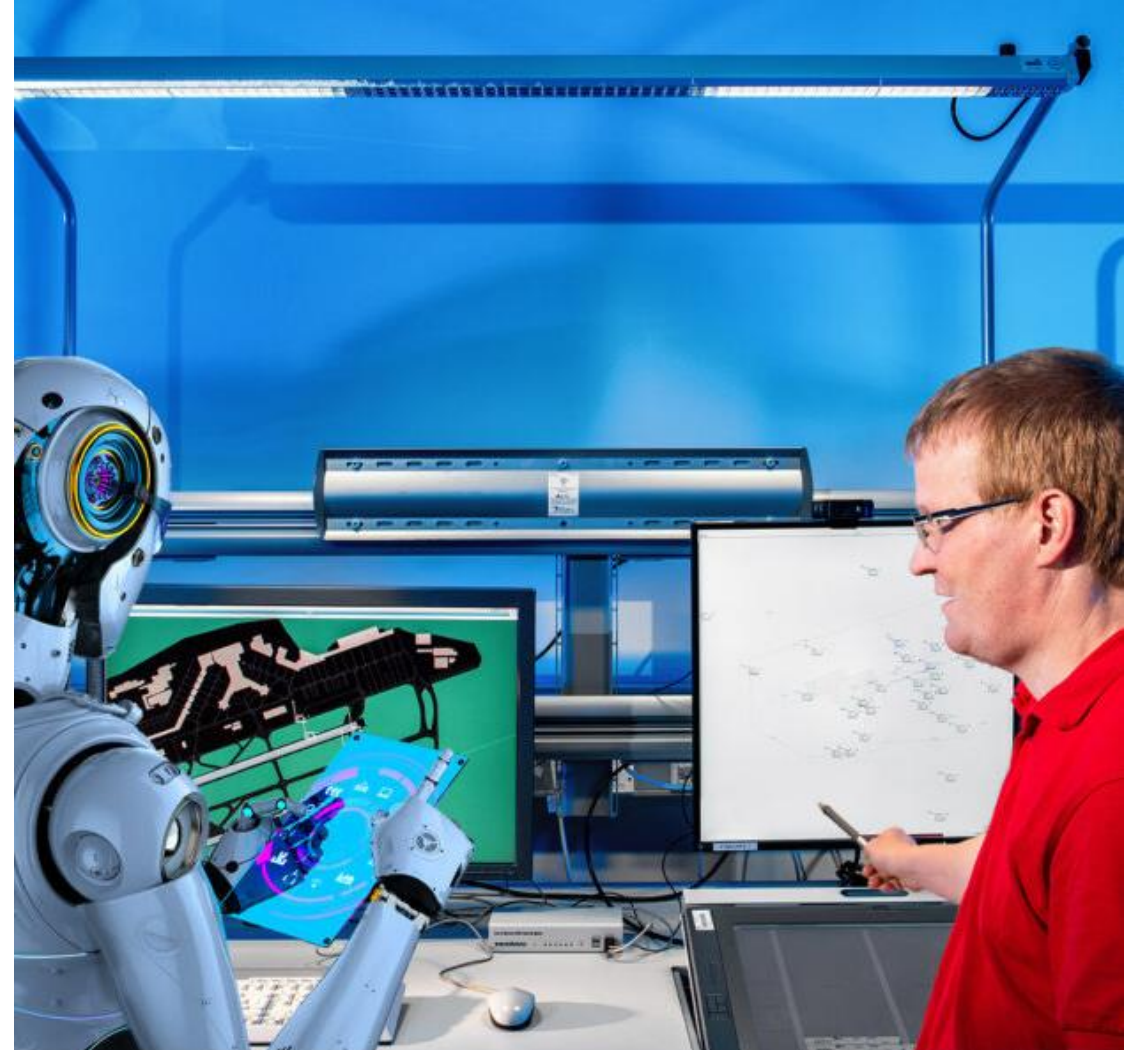
Energy-efficient and
contrail-reducing trajectories



Detection of and guided
response to cyber-attacks



On-time flight guidance
through optimal ATC workshare





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**INTERNATIONAL FORUM
FOR AVIATION RESEARCH**

GLOBAL NETWORK OF PUBLIC AERONAUTICAL R&D INSTITUTIONS



NRC-CNRC



**40 000
researchers**

1

**Information exchange
and networking among the
principals
at IFAR Summits**

2

**Information exchange &
discussion on technical
issues to enable bilateral /
multilateral international
collaboration**

3

**Human resources
development
(empowering early career
employees)**

4

External partnership
Partners such as:
ICAS (2014)
ICAO (2020)





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**INTERNATIONAL FORUM
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**IFAR WORKING GROUP: AIR TRANSPORT MANAGEMENT
WITH FOCUS ON SKY FOR ALL (2050)**

AKBAR SULTAN

**DIRECTOR OF NASA AIRSPACE OPERATIONS AND SAFETY
PROGRAM**

Workgroup Focus

- The focus will be on development of future aviation for sustainable aviation and for seamless integration of emergent and future vehicles.
- Joint NASA/FAA/CANSO/SESAR JU/IFAR/Industry Workshop
- Share aviation research underway across partners
- Identify 2025-2050 research challenges for transformation of aviation operations and safety
- Jointly Develop the long-term Capabilities and R&D Roadmap
- Partner and exchange concepts on validation of concepts





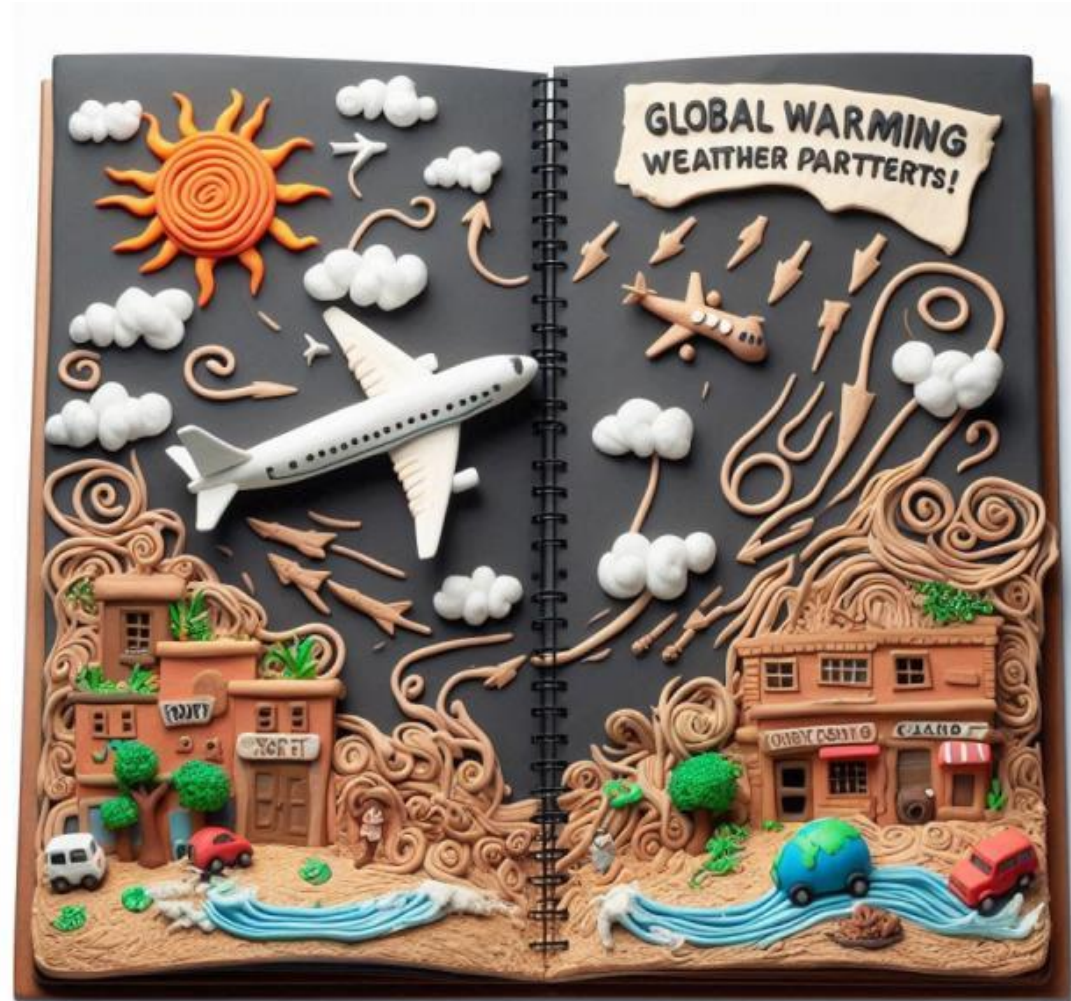
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**INTERNATIONAL FORUM
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**IFAR WORKING GROUP: BUILDING RESILIENCE IN
AVIATION SYSTEMS (BEAR)
PARIMAL KOPARDEKAR (PK)
DIRECTOR OF NASA AERONAUTICS RESEARCH INSTITUTE**

Workgroup Focus

- Identify scenarios as conditions of a temperature rise of 1.2, 1.5, 1.8 or 2.0 degrees Celsius.
- Develop models to understand the impact on the aviation network, and share methodologies, models, metrics and the key impacts on global city pairs
- Analyse the economic impact on each nation and across the globe
- Provide an initial recommendation to maintain as much resiliency as possible



IFAR gives me awareness (and new ideas) of the important work being done internationally on AAM. H. Barber, NRC

IFAR is a community where the exchange of knowledge is free and where we share.

VTT gained extensive knowledge about practices in other countries and regions worldwide and established numerous excellent partnerships for collaboration. V. Kramar, VTT

IFAR provides an avenue to connect with other researchers around the world working on similar aviation-focused problems, improving our awareness of work around the world and helping find ways to advance aviation more quickly. M. Patterson, NASA

IFAR is giving me an opportunity to hear about global issues with AAM. K. Cate, NASA



IFAR is a great catalyst for international collaborations on global aerospace challenges. K. Cate, NASA

Alone we go faster, but not always in the right direction, whereas together we can go further.

The ICAO-IFAR collaboration presents a fantastic opportunity to collaborate with the world's top experts in shaping the future of AAM. V. Kramar, VTT

IFAR gives me the opportunity to connect easily with like-minded researchers around the world. B. Schuchardt, DLR

ICAO-IFAR collaboration can support by design facing safety and security concerns.

IFAR provides an international platform to be updated with the current research and technology in AAM. N. Nair, DLR

Collaboration with ICAO really helps understanding the global vision for AAM, and can ultimately help align research with gaps to enable this vision. C. Vidal, NRC

IFAR is a family of like-minded experts, real achievers who move the modern aviation domain forward. V. Kramar, VTT

IFAR represents the future of aviation research and has an opportunity to collaborate with international researchers. P. Selvam, DLR

IFAR allows aviation researchers to cooperate on scientific-technical challenges demanding for a global view to remove obstacles and overcome barriers (standardization, public acceptance, safety, security, operational,...)

IFAR AAM WG is an excellent way of gaining insight into great ongoing R&D projects in other countries, helps build an international network and really makes it easier to exchange ideas and collaborate on future project proposals.

Through IFAR, I got to meet many like-minded individuals working on similar topics, often with a different approach, which is an enriching experience.

IFAR offers me the opportunity to be part of a strong global network and actively contribute to advanced research shaping the future of aviation.

IFAR can serve as platform for integration and alignment of research and provide outstanding opportunity for representation of common AAM industry interest in world forum.