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Why contrails matter for aviation's climate future

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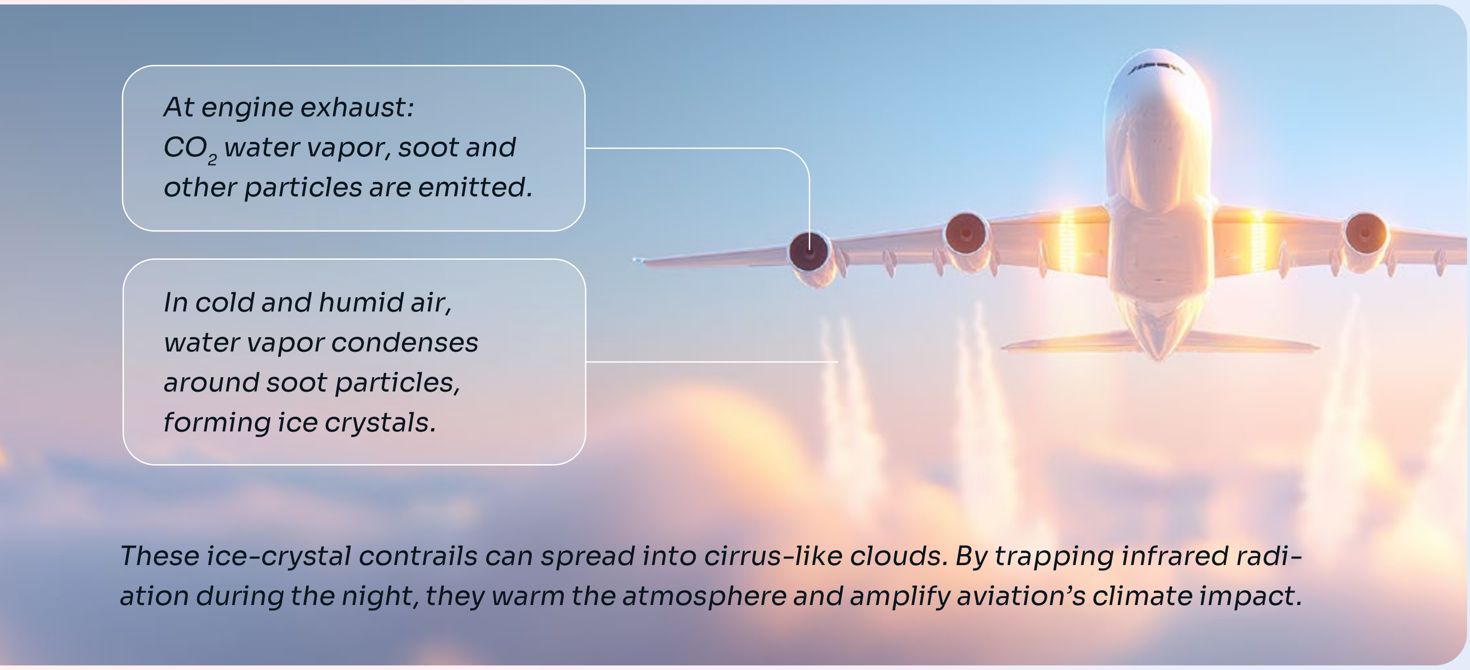

These ice-crystal contrails can spread into cirrus-like clouds. By trapping infrared radiation during the night, they warm the atmosphere and amplify aviation's climate impact.

Contrails are emerging as an important part of aviation's climate footprint, though their effects are difficult to quantify. Rather than a blind spot, they are now a new frontier for innovation and collaboration, with the potential to accelerate progress toward a lower-impact future.

Here's the key challenges ahead.

x2

Traffic will double within 20 years

- 9.2 billion passengers expected by 2045 (vs 4.9 billion in 2024).
- More flights mean more potential contrails, amplifying aviation's climate footprint.

1,800

A sky under pressure

- The North Atlantic corridor handles 1,800 flights/day, a region that alone accounts for nearly half of contrail-induced warming.
- Tackling this hotspot is key to unlocking rapid climate gains.

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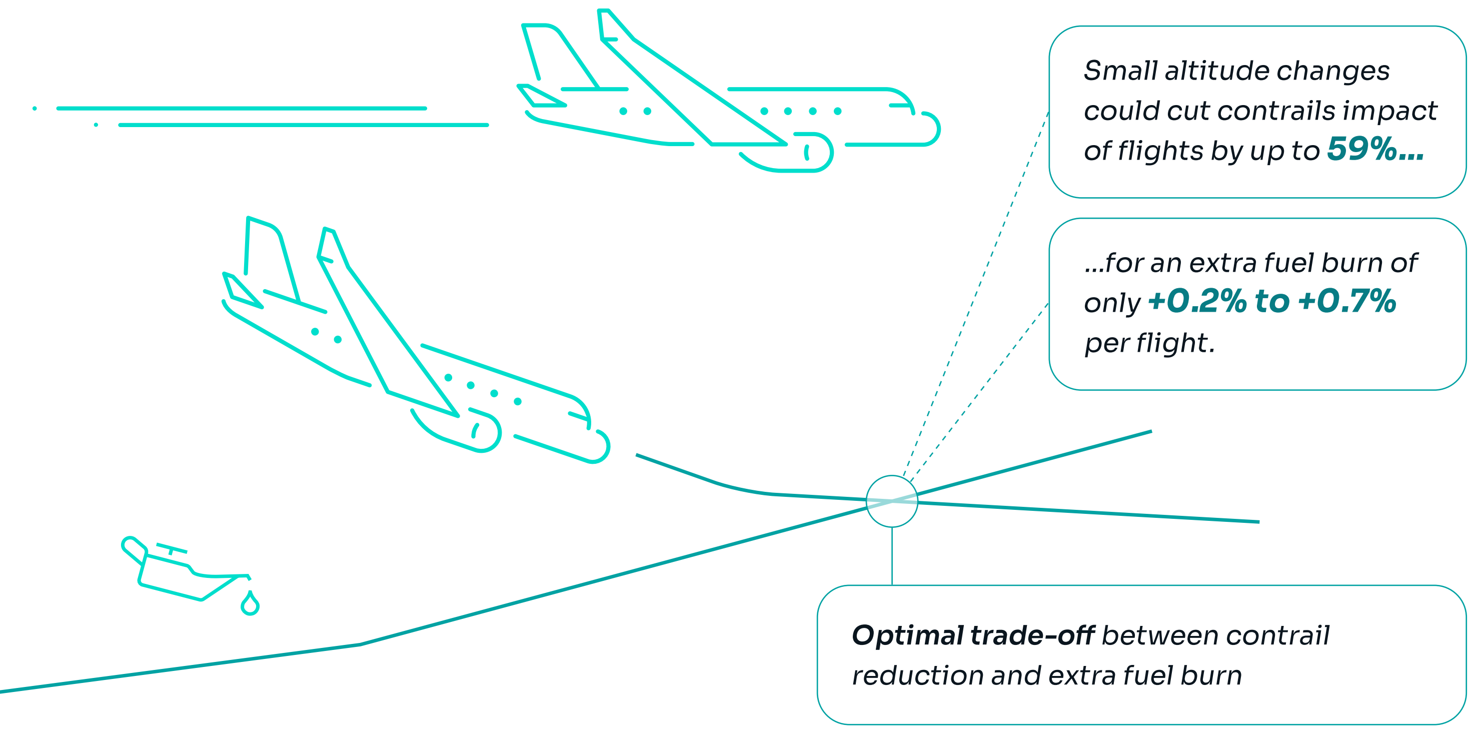
A tightening regulatory framework

- The EU would require airlines to report non-CO2 effects in ESG disclosures and reporting once a year.
- Climate accountability is moving beyond CO2 only.

Optimizing flights trajectories for immediate gains



Initiatives leveraging **predictive AI and data analytics** are underway to reduce contrails, such as:

- **Thales**, in coordination with **Amelia** airline, is testing its Flight Footprint system to identify and adjust routes likely to form contrails, thereby reducing their climate impact.
- **Airbus and Air France**, through CICONIA project, are working together with simulations covering 10,000 flights and will move to real-world testing in 2026 to assess how predictive models and operational adjustments can minimize contrail formation.

But with weather, operational, and congestion constraints, flight path optimization cannot solve the contrail problem on its own.

Deploying SAFs as a lever toward greener aviation

-56% ice crystal formation

-26% contrail impact

Other SAFs are even more promising than HEFA-SPK at reducing contrails, but their large-scale adoption is limited by blend restrictions and production costs.

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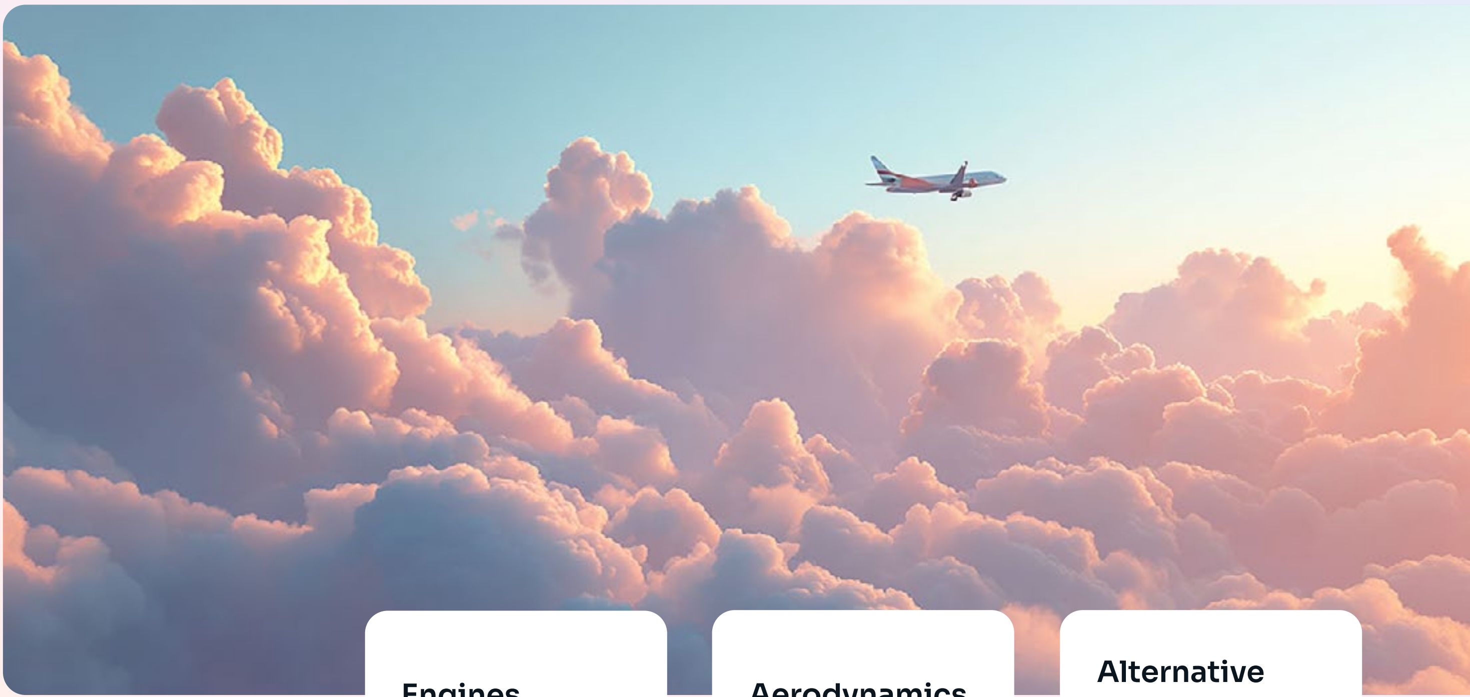
certified SAFs exist today, with the greatest climate benefits coming from low-aromatic fuels, which reduce soot and contrails.

/ The **Airbus ECLIF3 project with Neste** used 100% low-aromatic **HEFA-SPK** SAF and achieved a **56% reduction in ice crystal formation and 26% lower contrail impact** compared to Jet-A1.

Rethinking aircraft and propulsion for the next generation



	Engines	Aerodynamics	Alternative fuels
Technologies	*Open fan, advanced propulsion*	*Longer wings, active control surfaces, ultra-light structures*	*SAFs, electric, hydrogen*
Fuel reduction	**20%**	**30%**	***80%** for SAFs **Zero CO_2 emissions** for electric and H_2*
Contrails reduction	**30%**		**100%** *for eletric*

How to make it happen?

In the short run, adjusting routes and altitudes through solutions such as **AI-based prediction, large-scale simulation, and augmented decision-support systems** provides immediate levers to reduce contrails, as long as they are deployed in coordination with flight safety and air traffic management.

Looking ahead, contrails mitigation is more than an option, it's an opportunity to accelerate the transition towards the future aircraft: smarter, more efficient, and more sustainable. Next-generation aircraft will feature cutting-edge technologies: **more efficient engines, aerodynamic enhancements, hybrid-electric capabilities and lightweight materials & integrated systems**. Industry players have already embraced these innovations, working together to achieve net-zero aircraft by 2050, with next-gen single-aisle expected to enter service in the mid 2030s.

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Sources and References:

Our information is drawn from industry organizations (IATA, NATS), research projects (ECLIF3, RISE, SAE, CORAC, Imperial College, etc.), and relevant ASTM and European Commission standards.

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