

Joint Statement from Chief Technology Officers Advocating for Advancing Science on Aviation's Non-CO₂ Impacts on Climate Change

Tuesday, July 23, 2024, Farnborough, UK

As Chief Technology Officers representing organizations across the industry, we fully support the civil aviation industry's commitment to achieve net zero CO₂ emissions by 2050. At the Paris 2023 Air Show, we highlighted the importance of the production, distribution, and uptake of qualified Sustainable Aviation Fuels (SAF), advanced aircraft and propulsion technologies, and improved aircraft operations for achieving net zero CO₂ emissions.

To address the full climate impact of aviation, the sector is also accelerating efforts critical to understanding and reducing aviation's non-CO₂ effects including from nitrogen oxides (NO_x), sulfur, aerosols, soot and contrails. In collaboration with research institutions, universities and other key stakeholders, our industry is actively working on multiple large-scale projects and research programs aiming at improving the understanding of non-CO₂ emissions and their impact on the climate, which could enable mitigation solutions from fuels, engine technology and flight operations. Efforts such as FAA-ASCENT and CLEEN, SESAR projects such as CICONIA, Airbus led ECLIF3 and VOLCAN, and the Boeing ecoDemonstrator Explorer projects include significant research and flight test campaigns across both Europe and North America.

A key part of non-CO₂ emissions from aviation, persistent contrails are estimated to have a warming climate impact. Several scientific studies¹ have sought to quantify their climate impact, but estimates are highly uncertain based on limited understanding of the physical and chemical properties and mechanisms, as well as atmospheric conditions, that influence contrail formation and evolution. Similarly, NO_x emissions and their secondary reactions depend on engine design, operating conditions, and atmospheric conditions. Research and collection of data is essential to accurately quantifying the interactions and impacts of non-CO₂ emissions.

AIRBUS



¹ Myhre et al. (2009); Chen et al. (2012); Chen and Gettelman (2013); Bock and Burkhardt (2016); Kaercher (2018); Gettelman et al. (2021); Lee et al. (2021); De Leon and Lee (2023); Lee et al. (2023); Teoh et al. (2023); Maerkl et al. (2024)

We jointly call for increased research funding to develop the science needed to underpin technology choices, operational changes and policy decisions. We will continue to engage academia, the global climate and weather modeling community, government research organizations and industry partners to advance seven priorities for research:

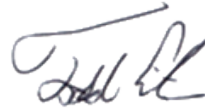
1. **Improve understanding of contrail formation, persistence, and climate impact.** Progressing the science of contrail physics combined with increasing the fidelity of upper tropospheric humidity data in global climate and weather modeling will enable more accurate contrail forecasts and analysis data sets for performing impact assessment.
2. **Improve understanding of emissions properties.** The properties of fuels such as conventional jet fuel, SAF, and hydrogen as well as the combustion characteristics of engine technologies impact emissions properties that play a role in contrail formation and persistence.
3. **Build research on aerosol cloud interactions.** Aerosol cloud interactions result from the ability of aerosol particles to cause the formation of droplets or ice particles, affecting the radiative properties of clouds. Research is required to better understand these interactions and their potential impacts.
4. **Improve understanding of the radiative impact and modeling uncertainty of NO_x emissions.** The effect of NO_x emissions depends on where and when emissions are released into the atmosphere as well as atmospheric conditions. Further studies are needed to fully characterize these dependencies.
5. **Improve understanding of the interdependencies and trade-offs of aviation emissions (NO_x, soot, contrails, CO₂, and noise).** To enable management of aviation emissions for total climate impact reduction, the challenges of comparing impacts across emissions species with different characteristics and interactions need to be addressed.
6. **Establish and improve common models for quantifying the effect of aviation on climate.** Collaboration across communities working on contrails and cloud physics, atmospheric chemistry, fuels properties and chemistry, and aircraft data collection to support this research is essential and can benefit climate science and weather prediction.
7. **Research on airspace network impacts of mitigation should be further investigated.** Large scale research projects and operational analysis should be developed to better understand potential impacts to civil airspace operations.

As the industry aims to mitigate the impact of non-CO₂ emissions, we are unified in focusing our efforts on research, flight testing and data transparency to advance these seven priorities alongside our academic and government stakeholders. Through industry, academic and institutional stakeholders effectively working together, we can achieve meaningful progress toward a more sustainable aviation industry.

Signed,



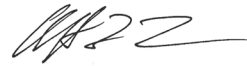
Sabine Klauke
Chief Technology Officer
Airbus



Todd Citron
Chief Technology Officer
The Boeing Company



Gérard Leflour
Chief Technology Officer
Dassault Aviation



Chris Lorence
Chief Engineer
GE Aerospace



Simon Burr
Group Director of Engineering,
Technology and Safety
Rolls-Royce



Juan M. de Bedout
Chief Technology Officer
RTX



Eric Dalbiès
EVP, Strategy and
Chief Technology Officer
Safran