EASA
European Union Aviation Safety Agency

Updated analysis of the non-CO_2 climate impacts of aviation and potential policy measures pursuant to EU ETS Directive Article 30(4)

Aviation & Covid: towards a green recovery?
1 December 2020

Promoting sustainable aviation.

Your safety is our mission.

An Agency of the European Union

Background

- Based on past analyses in 2006 and 2008, the scientific understanding was not considered sufficiently mature to propose policies to address non-CO_2 impacts.

- Since 2012, EU ETS regulates the CO_2 emissions from applicable flights, which correlates directly with fuel burn.

- **To fulfil the requirement of Article 30(4) of the EU ETS Directive, a report was commissioned by the European Commission to the European Union Aviation Safety Agency (EASA) in 2019.**

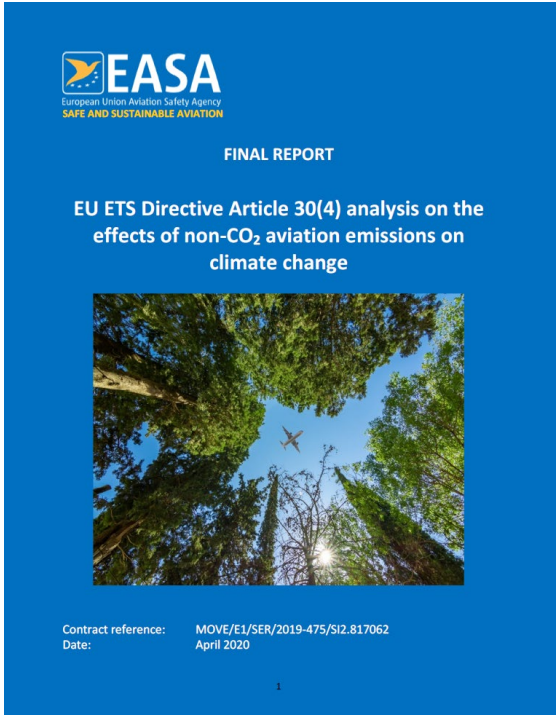
Study Team

- Project team comprised of key European climate experts.

- Stakeholder Groups comprised of wider atmospheric scientific community, technical experts and policymakers.

Terms of Reference

- **Task 1**: Current status of science and remaining uncertainties on climate change effects of non-CO_2 aviation emissions.
- **Task 2**: Existing technological and operational options used to limit or reduce non-CO_2 impacts from aviation and related trade-off issues.
- **Task 3**: Potential policy action to reduce non-CO_2 climate impacts, pros/cons and associated knowledge gaps.



Task 1: Climate Science

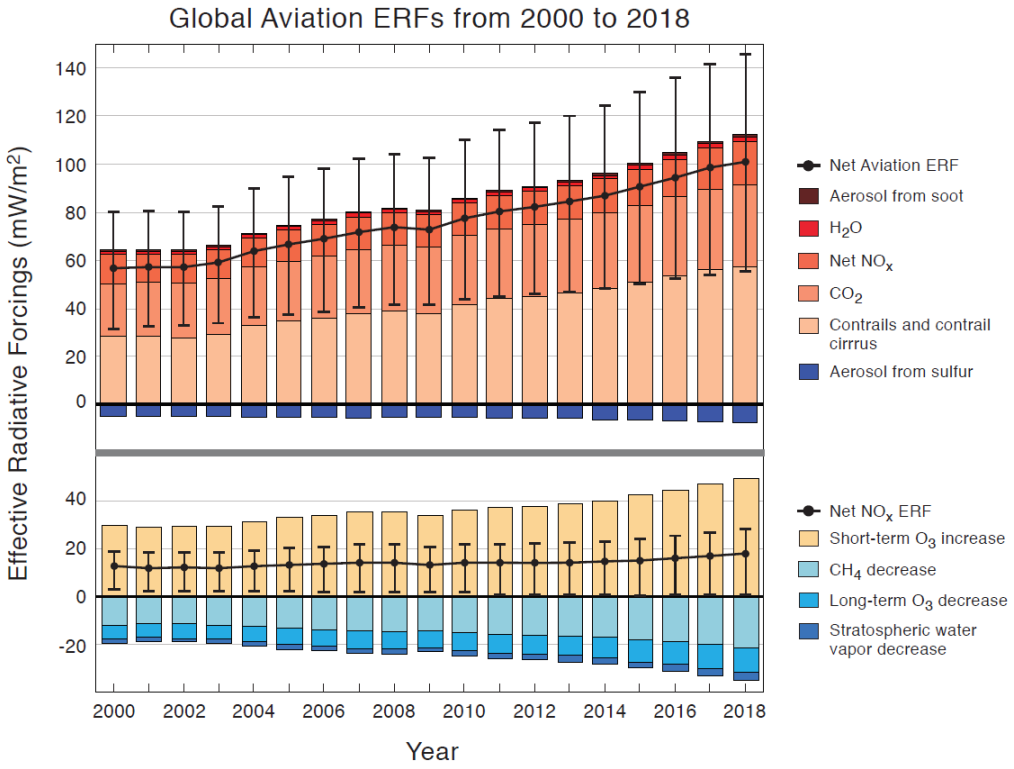
- Non-CO_2 impacts arise from emissions of oxides of nitrogen (NO_X), soot particles , oxidised sulphur species (SO_2, H_2SO_4) and water vapour.

- Scientific understanding on the impacts of non-CO_2 emissions has evolved over the last decade.

- Largest aviation non-CO_2 impacts that can be calculated with 'best estimates' are those from '**net-NOx**' and **contrail cirrus**, both of which have significant uncertainties in their magnitude, particularly contrail cirrus.

- Greater understanding of the indirect cloud effects of soot particles and sulphur, through **aerosol-cloud interactions**, is also required.

Task 1: Climate Science



- **ERF** provides a view of current climate impact based on historic emissions.
- **Net climate impact**: Increasing over time (mainly CO_2, NO_X, contrail/cirrus).
- **Contrail/cirrus**: Increasing impact but also high uncertainty.
- **NO_X**: Net impact a composite of +ve and –ve effects.

- **GWP100** estimates an overall CO_2 multiplier of approx. 1.7 to account for future impacts of non-CO_2 impacts.

- Significant uncertainties remain with non-CO_2 forcing terms contributing about 8 times more than CO_2 to the overall uncertainty in the aviation net forcing in 2018.

Task 2: Current policies to reduce non-CO_2 emissions

- **ICAO aircraft engine emissions certification standards** already exist for NO_x and soot (non-volatile Particulate Matter number) emissions.
- Improvements in aircraft fuel efficiency generally provide a win-win situation for both CO_2 and non-CO_2 emissions. Commercial pressure recently reinforced by the **ICAO aeroplane CO_2 certification standard**.
- Certified engine emissions LTO data used in modelling methodologies to estimate aircraft emissions in cruise.

Task 3: Potential policy action

→ Six policy options were shortlisted to be considered in greater detail

Type of Measure		Main non-CO_2 effect(s) addressed by the measure
Financial	1. NO_X charge	NO_X
	2. Inclusion of aircraft NO_X emissions in EU ETS	NO_X
Fuel	3. Reduction in maximum limit of aromatics within fuel specifications	Soot particulates and contrail-cirrus
	4. Mandatory use of Sustainable Aviation Fuels (SAF)	Soot particulates and contrail-cirrus
ATM	5. Avoidance of ice-supersaturated areas	Contrail-cirrus
	6. A climate charge	All (NO_X, water vapour, soot, sulphates, contrails)

Task 3: Financial Related Measures

- **NO_X emissions charge / Inclusion of NO_X in ETS**
- Key issues:
  - Reduce scientific uncertainty on climate impact from aircraft NO_X emissions
  - Select appropriate CO_2 equivalent emissions metric and time horizon
  - Agree on climate damage costs to determine level of charge
- Uncertainty of climate impact, and potential unintended consequences, introduces a political risk for the integrity of the EU ETS.
- Implementation through SES Performance and Charging Scheme
- Timescale: Mid term (5-8 years) / Long term (8+ years)

Task 3: Fuel Related Measures

- **Reduction in aromatics through fuel spec or SAF blending mandate**
- Key issues:
  - Reduce scientific uncertainty on climate impact from a reduction in contrail-cirrus formation as a result of cleaner fuels and lower aircraft nvPM emissions.
  - Facilitation initiative to ensure uptake of SAF by the aviation sector.
  - System to monitor fuels used and environmental benefits delivered.
- SAF mandate is as a potential 'holistic' approach with simultaneous reductions in CO_2, soot particulates and sulphur emissions (leading to a reduction on contrail-cirrus).
- Timescale: Mid term (5-8 years) / Short term (2-5 years)

Task 3: ATM Related Measures

- **Avoidance of ice supersaturated areas / Climate charge**
- Key issues:
  - Reduce scientific uncertainty on climate benefit from optimization of flight paths and reduction in persistent contrail-cirrus formation (CO_2/contrail cirrus trade-off).
  - Enhanced meteorological forecast models capabilities needed to predict persistent contrails correctly in time and space.
  - Select appropriate CO_2 equivalent emissions metric and time horizon.
  - Agree on climate damage costs to determine level of charge.
- Pilot project operating over the Atlantic needed to assess feasibility and costs/benefits. Limited feasibility within congested European continent airspace.
- Communication on benefits, as well as incentives, to ensure buy-in.
- Implementation through SES Performance and Charging Scheme.
- Timescale: Mid term (5-8 years) / Long term (8+ years)

Summary

- Regularly review latest scientific understanding on non-CO_2 impacts.
- Maintain and regularly review existing ICAO environmental certification standards (CO_2, NO_x, nvPM).
- Use of Sustainable Aviation Fuels (SAF) has shown a reduction in both non-CO_2 emissions (soot and sulphur), as well as CO_2. ReFuelEU initiative currently considering policy options to incentivize the uptake of SAF.
- Further research, potentially through Horizon Europe at EU level, to:
  - increase certainty on climate impact from non-CO_2 emissions.
  - consider different metrics and time horizons that could be used to assess the impact of potential policy measures.
  - enhance existing analytical methods to estimate aircraft non-CO_2 emissions in cruise based on ICAO certified LTO emissions data.
  - enhance capability to predict accurately the formation of persistent contrails.

EASA
European Union Aviation Safety Agency

Thank you

Questions?

Promoting sustainable aviation.
Your safety is our mission.

easa.europa.eu/connect

An Agency of the European Union