Turning Ambition into Action: From the LTAG and Global Framework to International Cooperation

By ICAO Secretariat

As the world moves steadily beyond the challenges of the early 2020s, international aviation is not just bouncing back, it's evolving. At the heart of this transformation lies a shared commitment: to ensure that the growth of global air transport goes hand in hand with strong environmental protection and responsibility. ICAO's adoption of the Long-Term Global Aspirational Goal (LTAG) in 2022—aiming for net-zero carbon emissions from international aviation by 2050—was a major milestone in that journey.

Over the past three years, ICAO has worked with Member States and stakeholders to build the necessary frameworks, partnerships and capacities to turn ambition into action. ICAO has made significant progress, drawing on science, policy, and cooperation to guide the way forward.

Key milestones have shaped this trajectory. ICAO has been a strong advocate for the use of Sustainable Aviation Fuels (SAF), defined as renewable or waste-derived aviation fuels that meets sustainability criteria, as a key pathway to aviation decarbonization. Notably, the technical analysis we have carried out (LTAG Report) shows that SAF has the greatest potential to reduce CO_2 emissions from international aviation.

In 2023, ICAO further adopted a comprehensive ICAO Global Framework for Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF) and other Aviation Cleaner Energies, which included a Vision for reducing CO_2 emissions in international aviation by 5 per cent by 2030 through SAF and cleaner energies.

To support use of SAF and other aviation cleaner energies, ICAO has been implementing a comprehensive set of initiatives under the four building blocks of the ICAO Global Framework:

1. Policy and Planning
2. Regulatory Framework
3. Implementation Support
4. Financing

The ICAO roadmap adopted by the Council in 2024 provided a clear and structured path forward, grounded in those four interconnected building blocks.

Concrete progress has been made on all fronts, ranging from the operationalization of the ICAO Finvest Hub to enhanced ACT-SAF Programme deliverables such as the training Series and the rollout of SAF Feasibility Studies in multiple States. All these ICAO achievements will be detailed throughout their corresponding chapters in this Report.

A key ICAO activity is to showcase progress on climate and environmental action, including the latest developments across all environmental topics. Since 2019, this has been achieved through a series of annual LTAG Stocktaking events.

In 2023, the Organization held its first in-person LTAG Stocktaking event since the pandemic—an important step in reconnecting the global community around aviation decarbonization. The 2024 edition marked the largest LTAG Stocktaking gathering to date, showcasing real-world

progress and innovations across technologies, fuels, and operations and beyond with discussions on ensuring a just cleaner energy transition within the aviation sector. That same year, ICAO also hosted its first-ever Symposium on Non-CO_2 Aviation Emissions, opening a new chapter in the international conversation on short-lived climate pollutants and their role in aviation's climate impact. The event marked an important step in global understanding and cooperation around topics such as contrail formation, nitrogen oxides and particulate matter, striving to understand and enhance the climate science, potential mitigation measures and policy options.

At the same time, ICAO has continued to foster meaningful dialogue and engagement among States and stakeholders. ICAO has also delivered an ambitious series of environmental seminars across all regions, supporting States in the implementation of the ICAO Global Framework for SAF, LCAF and other aviation cleaner energies.

In parallel to its core decarbonization workstreams, ICAO has significantly expanded its environmental agenda through outreach, engagement, and collaboration with other UN bodies and international organizations. A major example is the ICAO participation at the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties or COP, in which all States that are Parties to the Convention review its implementation and any other legal instruments that the COP adopts and take decisions necessary to promote the effective implementation of the Convention. ICAO's contributions to recent COP meetings (COP27[1], COP28[2] and COP29[3]) are available at ICAO website and are further detailed in "Chapter 16 – Multistakeholder Cooperation" of this Report under the ICAO Secretariat article.

At the 2024 UNFCCC COP29[3] in Baku, Azerbaijan, ICAO actively contributed to discussions on international carbon markets and climate finance, ensuring aviation's voice was heard during negotiations on Article 6 of the Paris Agreement. With the adoption of new rules to ensure transparency and integrity in global carbon markets, ICAO is now encouraging the issuance of Letters of Authorization from host States to facilitate access to eligible emissions units under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). ICAO also reiterated the sector's concern over proposals to use international aviation as a source of climate finance for unrelated sectors, reaffirming the importance of protecting the integrity and equity of aviation's decarbonization path.

Looking ahead, ICAO is preparing for its 2025 Climate Week, scheduled for 2–4 June 2025, which will integrate the LTAG Stocktaking event and address a broader range of topics such as adaptation, infrastructure resilience, electrification and hydrogen, and green airports. The initiative aims to bring all stakeholders to a common level of understanding in advance of the 42nd ICAO Assembly and UNFCCC COP30 both in 2025. With sessions dedicated to technology, operations, finance, and implementation support, Climate Week is envisioned as a platform to showcase cross-cutting progress and facilitate knowledge-sharing on the full spectrum of environmental workstreams under ICAO's remit.

1 https://www.icao.int/environmental-protection/Pages/COP27.aspx.
2 https://www.icao.int/environmental-protection/Pages/COP28.aspx.
3 https://www.icao.int/environmental-protection/Pages/COP29.aspx.

In support of this comprehensive approach, ICAO continues to strengthen cooperation with organizations such as IRENA, UNDP, the World Bank, and UNEP. These partnerships aim to mobilize financial resources, accelerate sustainable infrastructure development, and address emerging challenges including plastic pollution and wildfire risk management.

ICAO is also scaling up its outreach activities in preparation for COP30, to be held in Belém, Brazil, immediately following the Assembly. The Organization is committed to ensuring that the environmental progress achieved within international aviation is fully recognized on the global climate stage, while safeguarding the sector's ability to decarbonize effectively and equitably.

A key driver of ICAO's progress is the work of the Committee on Aviation Environmental Protection (CAEP), which continues to serve as the Organization's technical powerhouse for environmental standards and technical analysis. As ICAO continues to support Member States in delivering on the collective vision for net-zero carbon emissions by 2050, the technical expertise and consensus-building facilitated by CAEP remain fundamental. Throughout its 13th cycle (CAEP/13), the Committee has provided critical assessments and recommendations across the full spectrum of environmental priorities in aviation—ranging from CO_2 and non-CO_2 emissions, to noise, local air quality, and cleaner energies sustainability certification. Its work also supported the development of robust methodologies to monitor LTAG implementation and guided the evolution of ICAO's regulatory and analytical tools.

CAEP/13's outputs have underpinned much of ICAO's recent progress and will inform decisions by the Council and the 42nd Session of the ICAO Assembly in 2025. A comprehensive overview of the CAEP/13 cycle, including its main deliverables and technical contributions, is presented in the next article: *Overview of the Thirteenth Cycle of the Committee of Aviation Environmental Protection (CAEP/13): ICAO's technical progress towards achieving net zero carbon emissions by 2050 and environmental protection.*

Following the CAEP overview and environmental trends assessment, this Chapter includes global climate context from the World Meteorological Organization (WMO) and forward-looking insights from ICAO's Independent Experts. Acknowledging the critical role of human capacity in driving this transformation, this chapter also highlights the importance of building a sustainable aviation workforce—featuring perspectives on diversity, youth engagement, and the growing role of academic institutions in shaping the next generation of aviation professionals and researchers.

Non-CO_2 emissions articles

Recognizing the growing importance of non-CO_2 effects in aviation's overall climate impact, ICAO has expanded its technical and policy focus to include discussions on short-lived climate pollutants such as nitrogen oxides (NO_x), water vapour, soot, and the formation of contrails and cirrus clouds. These effects, while more complex to measure and mitigate than CO_2 alone, are increasingly acknowledged for their significant contribution to aviation's total radiative forcing.

In 2024, ICAO hosted its first-ever **Symposium on Non-CO_2 Aviation Emissions**[4], a milestone event that brought together scientific, regulatory, and operational experts to foster international understanding and explore pathways for mitigation. This Symposium laid the foundation for future work, including ongoing discussions on how to integrate non-CO_2 effects into ICAO's environmental assessment tools, regulatory frameworks, and guidance materials.

Reflecting the centrality of this topic, several chapters in this Report feature dedicated articles on Non-CO_2 emissions, each offering unique perspectives—from scientific research to operational strategies and institutional cooperation. These contributions include:

- **Chapter 1 – Aviation & Environmental Outlook:**
  - *ICAO's work on NO_x emissions regulation (Federal Office of Civil Aviation (FOCA), Switzerland)*
  - Aviation Non-CO_2 Experts Network (ANCEN) (EASA)
  - In-Service Aircraft for a Global Observing System (IAGOS)

4 https://www.icao.int/Meetings/SymposiumNonCO2AviationEmissions2024/Pages/default.aspx

- **Chapter 2 – Climate Change Mitigation: Overview:**
  - Exploring the Contribution of SLCPs Mitigation to ICAO's LTAG (ICCT)
  - How to Integrate Non-CO_2 Effects in Monitoring, Reporting and Verification Mechanisms (DLR German Aerospace Center)

- **Chapter 3 - Climate Change Mitigation: Aircraft Technologies:**
  - Addressing Non-CO_2 Emissions – The Way Towards Clean and Competitive Aviation (DLR, NRC, and ONERA)

- **Chapter 4:**
  - Operational Opportunities to Reduce Climate Effects of Contrails (CANSO and IFALPA)
  - Operational Opportunities and Challenges for Addressing Air Transport's Non-CO_2 Environmental Impacts (IATA)
  - Leveraging environment footprint reduction in operations, including Non-CO_2 (Airbus)

- **Chapter 11:**
  - Local Air Quality and Sustainable Aviation Fuels (SAF) (Swiss Federal Office of Civil Aviation and Aerodyne Research)
  - Jointly regulating jet fuel aromatic and sulfur content: A near-term strategy for public health and climate benefits (Environmental Defense Fund – EDF & ICSA)

Together, these articles underline ICAO's commitment to a science-based, multidimensional approach to climate action—one that addresses both CO_2 and non-CO_2 emissions to ensure aviation's full alignment with global climate objectives.