



**WORKING PAPER**

**ASSEMBLY — 41ST SESSION**

**EXECUTIVE COMMITTEE**

**Agenda Item 17: CO<sub>2</sub> emissions reduction scenarios and options for a long-term global aspirational goal for international aviation**

**INDUSTRY VIEWS ON DELIVERING A LONG-TERM CLIMATE GOAL FOR AVIATION**

(Presented by Airports Council International (ACI), Civil Air Navigation Services Organisation (CANSO), International Air Transport Association (IATA), International Business Aviation Council (IBAC) and International Coordinating Council of Aerospace Industries Associations (ICCAIA) coordinated by Air Transport Action Group (ATAG))

**EXECUTIVE SUMMARY**

The working paper presents industry's view that adoption of a long-term aspirational goal for international civil aviation is critical to supporting industry action to address its climate impacts and enable it to achieve net-zero carbon emissions by 2050. The air transport sector has taken a proactive, collaborative and ambitious approach to dealing with its climate change impact.

**Action:** The Assembly is invited to:

- a) recognise the progress the sector has made on climate action and acknowledge the ambitious industry long-term goal to reach net-zero carbon emissions from global civil aviation by 2050;
- b) note industry's view that adoption by Governments of a long-term aspirational goal for international civil aviation is critical to supporting industry action to address its climate impact;
- c) adopt a sector-wide ICAO long-term aspirational goal for aviation climate action, in line with the Paris Agreement stretch goal of 1.5°C;
- d) request Council to develop, with the full support and collaboration of industry, a work-programme to determine the means of implementation for such a long-term goal for aviation climate action; and
- e) encourage States to take action to support progress towards the long-term aspirational goal.

<i>Strategic Objectives:</i>	This working paper relates to Strategic Objective – <i>Environmental Protection</i> .
<i>Financial implications:</i>	
<i>References:</i>	

<sup>1</sup> English, Arabic, Chinese, French, Russian and Spanish versions provided by IATA.

## 1. AVIATION'S COMMITMENT TO ADDRESS ITS CLIMATE IMPACT

1.1 After significant analysis, in October 2021 the collective air transport industry raised its climate ambition with a new long-term commitment: global civil aviation operations will achieve net-zero carbon emissions by 2050, supported by accelerated deployment of a comprehensive programme of effective emission reduction, energy transition and innovation across the aviation sector and in partnership with governments around the world.

1.2 This follows the Paris Agreement and IPCC 1.5°C special report and an earlier commitment: In 2009, the civil aviation industry set three global goals to address its climate impact: a short-term efficiency improvement goal of 1.5% per annum; a mid-term goal to cap net CO<sub>2</sub> emissions through carbon-neutral growth; and a long-term goal to halve net aviation CO<sub>2</sub> emissions by 2050 compared with 2005 levels.

1.2.1 Through the introduction of new aircraft technologies, more efficient operations and infrastructure improvements, the industry has exceeded its short-term climate action goal with analysis showing a 2.1% improvement on a rolling average – an efficiency improvement of 22.8% between 2009 and 2019<sup>2</sup>. Fuel use and CO<sub>2</sub> emissions per RTK have reduced by 54% since 1990.

1.3 The industry is determined to continue and accelerate the efficiency improvements and CO<sub>2</sub> emissions reductions that it has achieved so far. But it also understands the climate challenge requires an even greater commitment, including critical partnership with governments and the energy sector.

1.4 The industry is now starting to progress an energy transition away from fossil fuels. This includes accelerating deployment of sustainable aviation fuels (SAF) produced from a range of sources, including waste, sustainable biomass and power-to-liquid options such as renewable electricity and carbon capture. In addition, significant innovation and research is underway into potential use of hydrogen and electric propulsion solutions for some aviation operations.

1.5 The industry was encouraged by the significant step taken by the ICAO High-level Meeting on the feasibility of a long-term aspirational goal for international aviation CO<sub>2</sub> emissions reductions (HLM-LTAG) to identify net-zero carbon by 2050 as a suitable long-term aspirational goal for the sector.

## 2. IMPLEMENTING MEASURES TO UNLOCK EMISSIONS REDUCTION OPPORTUNITIES THROUGHOUT THE AVIATION SECTOR

2.1 Industry's *Waypoint 2050* analysis<sup>3</sup> identified several illustrative pathways that will allow global aviation to reach net zero carbon emissions by 2050, confirming a significant reliance on sustainable aviation fuels to meet the decarbonisation needs of the sector. The scenarios provide for different adoption rates and deployment of a range of ambitious new technology aircraft (including a push towards hydrogen and electric propulsion from around 2035). Depending on the scenario:

- Between 53% and 71% of aviation decarbonisation will need to be delivered through a shift to sustainable aviation fuels – including an evolution from today's SAF sources to opportunities such as power-to-liquid as the production processes mature and costs reduce.

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<sup>2</sup> The impact of the global slowdown in traffic during Covid-19 and the subsequent disruption to normal operating procedures and efficiencies in 2020 and 2021 have been removed from these numbers. ATAG Fact Sheet, 2021

<sup>3</sup> Air Transport Action Group *Waypoint 2050*, 2021: [www.aviationbenefits.org/W2050](http://www.aviationbenefits.org/W2050)

- Between 12% and 34% of the emissions reductions will need to come from the development and deployment of new technologies, including both evolutions in conventional airframe efficiency and radical new technology options such as hydrogen in the more ambitious scenarios.
- Between 7% and 10% of the emissions reductions will come from continued improvements in operational and infrastructure efficiency. Although this is a small part of the 2050 decarbonisation profile, it is vital for both early climate action in aviation, as well as maintaining overall air transport system efficiency. Projects such as air traffic management modernisation are key.
- Finally, 6% to 8% of the net-zero goal may need to be achieved through out-of-sector opportunities, dealing with any residual emissions that have not been reduced through mitigation options within the sector.

2.2 The ICAO CAEP ‘LTAG’ analysis follows a very similar trajectory, although adopts a bottom-up approach as opposed to the target-driven approach seen in industry analysis such as *Waypoint 2050*, regional roadmaps<sup>4</sup> and a range of national industry roadmaps. The LTAG report confirms that sustainable aviation fuels will provide the most significant opportunity for carbon reduction before 2050.

2.3 A shift to options such as hydrogen or electric propulsion would still require significant quantities of sustainable aviation fuel to meet the net-zero target<sup>5</sup>. However, analysis in the *Fueling Net Zero* report<sup>6</sup> shows that the ramp-up in SAF production is achievable, with the right policy support and market signals. Investment in this new energy ecosystem could more fairly distribute energy production across the world and generate or sustain up to 14 million jobs. Importantly, any SAF being used by the sector must meet globally-agreed sustainability criteria to provide the necessary assurance that there is no harm to biodiversity, land-use, food or water systems, or local populations.

### 3. INDUSTRY-LED MEASURES TO REDUCE EMISSIONS

3.1 All parts of the air transport industry are working on their own emissions reductions opportunities, and as a collaborative effort to meet the long-term goal. Additional details on how each part of the industry is responding to the challenge can be found in Information Papers from IATA, IBAC, ACI, CANSO and ICCAIA.

### 4. SUCCESSFULLY DELIVERING LONG-TERM CLIMATE ACTION WILL REQUIRE PARTNERSHIP, COOPERATION AND MUTUALLY REINFORCING COMMITMENTS

4.1 The aviation industry strongly believes the adoption of a long-term aspirational goal at ICAO 41st assembly will: help the sector unlock resources to achieve emissions reductions by de-risking long-term investments and providing certainty to the capital markets; avoid a market imbalance between competing operators on international routes; ensure a common global framework and ambition on climate action; and a deliver a strong foundation for concerted international action by maintaining ICAO’s leading role in this area.

4.2 As noted in Paragraph 1.1, the industry is committed to reaching net-zero carbon emissions by 2050 across global civil operations (domestic and international). In order to achieve this and continue to

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<sup>4</sup> For example, *Destination 2050* is a regional aviation industry roadmap to reach net-zero carbon emissions from European aviation: [www.destination2050.eu](http://www.destination2050.eu)

<sup>5</sup> It is estimated between 330 and 445 million tonnes of SAF may be required in 2050.

<sup>6</sup> ICF and Air Transport Action Group *Fueling Net Zero*, 2021: [www.aviationbenefits.org/W2050](http://www.aviationbenefits.org/W2050)

provide the benefits of connectivity to the world in a sustainable way, it will require assistance from stakeholders:

4.3 Governments at a global level are encouraged to support action by ICAO to deliver a long-term aspirational goal for aviation climate action at the 41<sup>st</sup> Session of the ICAO Assembly, and any subsequent work on means of implementation, including capacity building, technology transfer (particularly for SAF deployment), consider any human implementation factors such as re-training as part of a just transition, and financing of the decarbonisation of the air transport sector.

4.4 Governments at a regional and national level should implement supportive policy environments for: technology deployment; infrastructure efficiency improvements (including the full scope of the ICAO GANP); and particularly the energy transition to renewable energy, low-carbon options, sustainable aviation fuels and consideration of aviation needs as part of government hydrogen strategies. Smart regulation and policymaking can provide long-term sustainable and stable investment environments as opposed to short-term punitive measures. The coming decade will be vital in making the investment in infrastructure to meet the needs of the sector out to 2050 and beyond. A range of supportive policy measures are identified in the Appendix (in English).

4.5 The energy sector will need to support the energy transition, with significant scale up in SAF and alternative energy production, including green hydrogen and low-carbon electricity, around the world.

4.6 Financial institutions – including the multilateral development banks – must understand the strategic importance of air transport connectivity and provide needed investment for the industry in deploying carbon reduction technology, infrastructure and energy systems.

4.7 Customers – including corporate purchasers of airline tickets and individual passengers – can support voluntary offsetting of CO<sub>2</sub> emissions and purchase of sustainable aviation fuel, particularly in the short- and medium-term as ways to help mitigate emissions and support the shift to SAF.

## 5. ACTION BY THE ASSEMBLY

5.1 The 41st ICAO Assembly is invited to:

- a) recognise the progress the sector has made on climate action and acknowledge the ambitious industry long-term goal to reach net-zero carbon emissions from global civil aviation by 2050;
- b) note industry's view that adoption by Governments of a long-term aspirational goal for international civil aviation is critical to supporting industry action to address its climate impacts and enable it to achieve net-zero carbon emissions by 2050;
- c) adopt a sector-wide ICAO long-term aspirational goal for aviation climate action, in line with the Paris Agreement stretch goal of 1.5°C and backed by the latest scientific advice on limiting the worst impacts of climate change;
- d) request Council to develop, with the full support and collaboration of industry, a work-programme to determine the means of implementation for such a long-term goal for aviation climate action including, for example: the need for global policy action on sustainable aviation fuel deployment; assistance with State Action Plans in line with the new goal; and capacity building for States in need of support; and

- e) *encourage* States to take action, such as those described in Paragraphs 4.3 and 4.4 to support progress towards the long-term aspirational goal within their own capabilities and with assistance from ICAO and other States in capacity building, technology transfer and financing.

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## APPENDIX

### ACTION ITEMS FOR MEMBER STATES TO HELP DELIVER NET ZERO 2050

There are a number of broad means of implementation that ICAO can assist with, but much of the policy work needs to be done at a national (or regional) level to help ensure aviation’s long-term climate goal and support industry decarbonisation. Below is a list of potential action items from governments. The full list, including action items for other stakeholder groups, can be found in the *Waypoint 2050* report.

#### Action items and policy proposals for governments: technology

Action item	Description	Timeline	Difficulty
<b>Continue to fund research programmes where they exist and develop projects where they do not</b>	In the coming years, government must ensure that access by aerospace industry to ongoing funding for high-value collaborative R&D, essential for delivering highly efficient future aircraft and propulsion systems, remains in place. Examples include the Clean Aviation Partnership project in the EU.	2020-2030	■ ■ □ □ □
<b>Provide strong guidance to green aviation research</b>	Execute a national or supra-national research agenda that places the highest priority on; advances in environmentally friendly aviation, including radical new aircraft concepts, new sustainable propulsion energies, such as electricity and hydrogen, and highly efficient operations and infrastructure.	Possible today	■ ■ □ □ □
<b>Research into non-CO2 impacts also vital</b>	Expand the focus from ‘CO2 emissions reduction’ to ‘climate impact mitigation’, considering also the impact of non-CO2 effects and how technology and adapted flight operations can reduce these effects. Some research is already ongoing in this space and while there is better understanding, the work has so far not provided conclusive operational or technology fixes and answers for the industry.	Already underway, can be expanded immediately.	■ ■ ■ □ □
<b>If putting in place a market-based measure, invest a portion in R&amp;D</b>	As global and regional market-based measures are adopted, Governments should invest a portion of any funds collected in aircraft and propulsion technology that accelerates the sector’s path to reducing CO2.	Available today	■ □ □ □ □
<b>Implement ICAO aircraft CO2 Standard</b>	The ICAO CO2 Standard should be implemented in national legislation.	Required today	■ □ □ □ □
<b>Develop a wider hydrogen economy strategy for all potential users of hydrogen</b>	Build a coalition of potential users and providers of green hydrogen in your country / region to start planning for a significant increase in hydrogen use by transport, including aviation. More generally, the changing energy needs of the aviation sector should be included in national energy strategies.	Possible today	■ ■ ■ ■ □

<p><b>Ensure sufficient infrastructure and provision of renewable energy, low-carbon electricity and green hydrogen across your economy</b></p>	<p>Support the introduction of hybrid-electric and full-electric propulsion, as key enablers to reach medium- and long-term CO2 emissions reduction goals. Low-carbon energy supply will also enable reduced CO2 emissions from ground operations including airport terminals, for example, as well as provisions for power-to-liquid SAF production.</p>	<p>2020-2050</p>	<p>■■■■□</p>
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**Action items and policy proposals for governments: operations and infrastructure**

Action item	Description	Timeline	Difficulty
<p><b>Implement the ICAO Aviation System Block Upgrades</b></p>	<p>The ICAO Global Air Navigation Plan (GANP) sets out a series of Aviation System Block Upgrades or technology modernisation projects focused on four performance improvement areas: airport operations; global interoperable systems and data; optimum capacity and flexible flights; and efficient flight paths. The initiatives reflect consensus around the series of technologies, procedures, and operational concepts needed to meet future capacity and ATM challenges.</p> <p>An analysis by ICAO found that if implemented Block 0 and 1 elements would deliver global fuel and CO2 savings of between 1.6 – 3.0% in 2025. Governments must carry through implementation plans for this vital project.</p>	<p>Already underway, block 1 technologies are scheduled for 2019-2023</p>	<p>■■■□□</p>
<p><b>Ensure programmes such as single European sky are implemented</b></p>	<p>The single European sky initiative was launched in 1999 to improve the performance of air traffic management through better integration of European airspace. Whilst some of the early building blocks of single European sky have delivered efficiency improvements through better cooperation between ANSPs in the region and a range of operational initiatives, the full scope of the project could triple airspace capacity, halve the costs of ATM, improve safety tenfold and reduce the environmental impact of aviation by 10%. Slow or no progress is being made by Governments towards the full implementation of the plan.</p>	<p>Early actions underway, but full scope some time away</p>	<p>■■■□□</p>
<p><b>Make military air space flexible use</b></p>	<p>Large blocks of airspace are controlled by military and are often unavailable for civil operations. A number of States have successfully implemented flexible use of this airspace – handing it over to civil air traffic management when not in use by military and allowing much more direct routing of aircraft. Could reduce emissions significantly over a number of States.</p>	<p>Available immediately</p>	<p>■■□□□</p>
<p><b>Develop new systems for regulators to progress on national, regional and global harmonisation of standards</b></p>	<p>Regulators need to accelerate the change process without sacrificing safety. With closer aircraft manufacturer, regulator and ANSP focused collaboration, the development of guidance material, criteria, and policies for new operational capabilities could likely be reduced from 5-10 years to 3-5 years. Having regulator participation supports the assurance that new investments will be returned in the form of cost savings, capacity enhancements, and other direct benefits.</p>	<p>Possible today</p>	<p>■■□□□</p>



<b>Ensure balanced comparison of transport modes</b>	Designing the solutions for the future sustainable mobility of citizens requires a thorough assessment of all environmental aspects for those transport modes (air, road, rail, sea) which can be complimentary. Bringing together particularly rail and aviation operations for seamless mobility between transport modes can provide benefits in some geographies, but there is a need to avoid policy decisions made by only considering operational emissions and not the full lifecycle environmental impact.	Possible today	■□□□
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### Action items and policy proposals for governments: sustainable aviation fuels

Action item	Description	Timeline	Difficulty
<b>Clean energy transition push across government, including SAF, renewable energy, low-carbon electricity and green hydrogen.</b>	Commit to supporting an energy transition through significant investment in sustainable aviation fuels. This can help drive new energy industries and re-use refining and other infrastructure.	Required from today	■■■■□
<b>Pursue partnerships for SAF scale-up</b>	Launch SAF partnership and cooperative projects bringing together local aviation industry stakeholders, energy suppliers, research institutions and potential feedstock suppliers.	Possible today	■□□□
<b>Pursue partnerships for SAF scale-up</b>	Engage in public-private partnerships for sustainable aviation fuel production and supply, including the necessary import regulations for SAF in the early years.	2020-2025	■□□□
<b>If putting in place a market-based measure, invest a portion in SAF</b>	As global and regional market-based measures are adopted, Governments should invest a portion of the funds collected in SAF and SAF R&D that accelerates the sector's path to reducing CO2.	Available today	■□□□
<b>Prioritise aviation (and other hard-to-abate sectors) as a user of alternative fuel</b>	Set priorities for the sustainable energy mix in your country to ensure that the right type of low carbon energy is developed for each sector – aviation does not have alternatives at this time, particularly for long-haul operations and so should be seen as a priority user of feedstocks for liquid fuels.	Possible today	■□□□
<b>Prioritise aviation (and other hard-to-abate sectors) as a user of alternative fuel</b>	Road transport has historically had more advantages for feedstock use, making aviation use of these resources uneconomical – this situation should be reversed.	Possible today	■□□□
<b>Explore potential for SAF development at a national or regional level</b>	Undertake local supply opportunity assessments to investigate where potential SAF could be developed.	2020-2025	■■■□□
<b>Support innovation into new energy alternatives</b>	Support sustainable aviation fuel R&D and demonstration plants with academic and research organisations across the range of feedstock sources.	2020-2040	■□□□

<b>Support development of SAF production</b>	Attract capital to expand SAF capacity through loan guarantee programmes for construction of SAF production facilities (de-risking the early investment anxiety for new technologies).	2020-2035+	■■■□□
<b>Support development of SAF industry</b>	Direct research and development activities for local SAF production pathways and new energy industries.	2020-2025	■■■□□
<b>Support development of SAF industry</b>	Commit to policy certainty, or, at a minimum, policy timeframes that match investment timeframes.	2020-2030	■■□□□
<b>Support development of SAF infrastructure</b>	Support and facilitate the availability of SAF at airports where appropriate, and if needed the implementation / adaptation of necessary airport infrastructure and operations. Ensure existing infrastructure is available for SAF use, including pipelines (i.e. the NATO jet fuel pipeline)	2020-2035	■■□□□
<b>Demonstrate leadership</b>	Commitment for government travel to be undertaken on SAF, either directly or through book-and-claim options initially.	Possible today	■■□□□
<b>Demonstrate leadership</b>	Adopt globally-recognised sustainability standards and work to harmonise global standards, including the standards required for a globally-aligned book and claim system to provide flexibility and rapid scale-up of SAF use worldwide.	2020-2025	■■□□□
<b>Demonstrate leadership</b>	Encourage user-friendly sustainable aviation fuel accounting methods and work to harmonise global standards.	2020-2025	■■□□□
<b>Provide incentives for airline use of SAF</b>	Make SAF zero-rated under carbon taxation or other market-based measures, if they are being developed.	2020+	■■■□□
<b>Blending or production incentives for SAF producers or suppliers.</b>	Ensure existing policy incentive frameworks, often designed for ground transport, also include aviation and evaluate higher incentives for aviation over ground transport which has other energy alternatives.	2025+	■■□□□
<b>Take a global leadership role in managing the aviation energy transition.</b>	Showcase Government action at a regional and global level by championing SAF opportunities with other governments and at ICAO.	2020-2030	■■□□□

- In addition, *Guidance on potential policies and coordinated approaches for the deployment of Sustainable Aviation Fuels* has been developed by ICAO.
- The Governments of Kenya, the Netherlands, Singapore, the United Arab Emirates and United Kingdom developed the Sustainable Aviation Fuel Policy Toolkit in 2021: [www3.weforum.org/docs/WEF\\_Clean\\_Skies\\_for\\_Tomorrow\\_Sustainable\\_Aviation\\_Fuel\\_Policy\\_Toolkit\\_2021.pdf](http://www3.weforum.org/docs/WEF_Clean_Skies_for_Tomorrow_Sustainable_Aviation_Fuel_Policy_Toolkit_2021.pdf)

**Action items and policy proposals for governments: market-based measures**

Action item	Description	Timeline	Difficulty
<b>Support CORSIA</b>	Volunteer for the early stages of CORSIA (as of publication, 112 countries have done so) and take part in capacity building to ensure CORSIA is successful. For those States exempted from the mandatory phase from 2027, commit to participation in CORSIA anyway.	2020-2035	■□□□□
<b>Ensure CORSIA continues to evolve</b>	Work with other States at ICAO to ensure CORSIA meets the intended environmental motivation, remains fit for purpose and balances the need to deal with the growth in international aviation CO <sub>2</sub> with the desire for inclusive action across a large number of countries. Ensure CORSIA's standards are maintained and new offset and carbon removal opportunities are evaluated (based on rigorous sustainability criteria) on a regular basis.	2020-2035	■■■■□□
<b>Set a long-term CO<sub>2</sub> goal</b>	Through ICAO, set a long-term CO <sub>2</sub> goal for international aviation at the 2022 ICAO Assembly compatible with the most recent scientific evidence from the Intergovernmental Panel on Climate Change.	2020-2022	■■■■□□
<b>Do not duplicate market mechanisms, base any domestic measures on CORSIA principles</b>	CORSIA should be the single robust market mechanism on international flights, to avoid duplication and danger of market distortions. If States wish to deploy market-based measures on domestic flights for climate reasons, the industry encourages the use of the CORSIA framework to ensure ease of compliance and a reduction in duplication of systems and monitoring.		■□□□□
<b>If putting in place a market-based measure, invest in in-sector CO<sub>2</sub> reductions</b>	As global and regional market-based measures are adopted, Governments should invest a portion of the funds collected in SAF, SAF R&D and technology R&D (among other opportunities) that accelerate the sector's path to reducing CO <sub>2</sub> .	Available today	■□□□□
<b>Promote development of carbon capture opportunities</b>	Carbon capture – particularly direct air capture – is a vital component of long-term carbon removal and is a key component for allowing the world to meet the Paris Agreement goals	2020-2050	■■■■□□
<b>Develop robust forestry accounting standards with other States and promote forestry offset development</b>	Cooperation is needed between private sector and government-led forestry programmes, e.g. jurisdictional-level approaches and nested REDD+ projects, within national or subnational accounting systems.	2020-2025	■■■■□□