OPPORTUNITY GREEN

Legal research on potential options for international cooperation on avoiding contrails

Briefing note | 13 March 2025

Executive summary

1 We have undertaken and commissioned legal research into existing international treaties addressing matters of atmospheric pollution to identify: (i) key aspects of such treaties relevant for any international cooperation on contrails; (ii) key issues and risks to be considered; and (iii) recommendations for further research and matters to be considered in respect of international cooperation on contrails.

2 The research found that the key aspects of an environmental treaty that were important to its relative effectiveness in achieving its goals are the utilisation of 'executive committees' or 'working groups' to drive progress whilst promoting accountability and compliance, a narrow subject matter, the inclusion of an accountability mechanism, and the subject matter's salience with the general public.

3 The research also identified key provisions under such treaties that would be relevant for states to consider in any international agreement on contrails, including: the approach to participation (i.e., start small and grow or seek global agreement at outset); the commitments required (e.g. specific reduction levels or more collaborative/facilitative); the need for institutions (e.g., a secretariat, for research and science, and to drive progress); funding mechanisms; assistance for developing states if applicable; reporting, verification and compliance; and review mechanisms (i.e., to develop the framework over time).

4 The key issues and risks identified through our preliminary research include (see Part B for a full list):

4.1 **Type of agreement:** If a contrail avoidance scheme starts with regional implementation, for example through North Atlantic cooperation, rather than a potentially more time-consuming global approach under the International Civil Aviation Organization (**ICAO**), a new treaty between a willing coalition of states may be most appropriate. That said, we recommend consideration is given to a non-legally binding form of cooperation at the outset, as a potentially more flexible framework that could be quicker to negotiate and put in place between willing states.

4.2 **Technical aspects:** It is important to establish exactly what change is needed to current flight operations and by which actor, to aid the form and design of the agreement and establish any relevant existing regulatory frameworks that need to be considered.

4.3 **Interaction with existing legal framework(s)**: Once those changes and actors have been identified, it is critical to identify any existing regulatory frameworks that may interfere with the operation or implementation of the desired measures (for example, under the ICAO air traffic management regime) so that they can addressed. This presents both a legal risk (i.e., will the proposal work), and a political risk (i.e., will states be willing to create a new regime).

4.4 **Policy issues/considerations:** Whilst outside of the scope of this paper, we also identify some policy matters that could be considered at the outset including how to build state and industry support, the work involved leading up to international negotiations, and communications aspects.

5 Finally, this paper identifies key areas for further research and consideration, including:

5.1 further technical and policy input, including what operational changes are needed, the relevant actors, the key states/regions to target, the level of political will/momentum, and the interaction with existing climate obligations; and

5.2 further legal research and consideration, including how the proposal interacts with existing regulatory frameworks, whether or not a non-legally binding form of cooperation would be preferable in the initial stages, and whether there are other types of international agreement (outside of environmental treaties) that could be worth researching.

6 Our key recommended next step for this project is to enter into discussions with key states regarding their willingness to cooperate on this issue and potentially enter into a non-binding memorandum of understanding to facilitate work and progress on contrails. The key features of successful agreements identified in this paper can be used to help inform discussions and build towards a more formal agreement between states. Alongside those discussions, we also recommend the following actions:

6.1 **Technical work:** ascertain how the flight path management regime operates in practice and what changes are needed and by which actors to avoid contrails (e.g., what operational changes do air traffic control or airlines need to make and when should they make those changes (i.e., pre-flight or during flight)).

6.2 **Legal work:** identify any relevant regulatory framework for that regime and any issues or challenges presented by such framework.

6.3 **Political work:** providing those issues can be overcome, consideration to be given to the form of agreement between a coalition of willing states with jurisdiction and control over the relevant actors and the initial groundwork activities and discussions with states to build momentum for negotiating an agreement (see paragraphs 42.4 and 43.3 to 43.5).

Background and scope

Background

7 Aviation has contributed approximately 4% to observed anthropogenic global warming up to 2021.[1] This impact is caused by a combination of CO_2 and 'non-CO_2' pollutants (including contrails, nitrogen oxides, and soot).[2] Of these non-CO_2 impacts, the formation of contrails is the most damaging to the climate, and is estimated to cause three times more radiative forcing annually than aviation's cumulative CO_2 emissions.[3]

8 We understand that:

8.1 most observed contrails occur in the airspace above the North Atlantic, the United States of America (the **US**) and Europe;

8.2 a relatively low percentage of flights form contrails with a net warming effect (around 14% of all flights (globally) in 2019, with 2% of all flights causing 80% of the annual contrail energy forcing[4]);

8.3 'contrail avoidance' trials are underway, in which altitude adjustments are made based on contrail formation predictions, and recent studies suggest that 'per-flight detectable contrail avoidance is feasible in commercial aviation';[5]

8.4 the increased fuel requirement for such contrail avoidance is likely relatively low (an American Airlines and Google trial found a fuel increase of 2% per adjusted flight[6]);

8.5 the climate benefits of reducing contrails could be 15 to 40 times greater than the impact of the extra fuel burn;[7]

8.6 contrails are short-lived climate forcers and so reducing contrails could have a short-term impact on global temperature rise; and

8.7 there are practical and operational challenges to the implementation of a contrail avoidance system, including accurately predicting 'contrail likely zones',[8] and further technical work and trials are required to address these challenges.

Scope of the project

9 The Aviation Environment Federation (**AEF**) is working alongside Breakthrough Energy, the International Council on Clean Transportation (ICCT), Cambridge University, and Imperial College to highlight the opportunity for regional state collaboration on contrails in the near-term, building towards a global agreement to avoid contrails within ten years (the **Project**).

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[1] M Klöwer and others, 'Quantifying Aviation's Contribution to Global Warming' (2021) 16 Environmental Research Letters 104027.
[2] DS Lee and others, 'The Contribution of Global Aviation to Anthropogenic Climate Forcing for 2000 to 2018' (2021) 244 Atmospheric Environment 117834.
[3] R Teoh and others, 'Global Aviation Contrail Climate Effects from 2019 to 2021' (2024) 24 Atmospheric Chemistry and Physics 6071.
[4] ibid.
[5] Aaron Sonabend-W and others, 'Feasibility Test of Per-Flight Contrail Avoidance in Commercial Aviation' (2024) 3 Communications Engineering 184.
[6] ibid.
[7] Transport and Environment, Contrail avoidance: aviation's climate opportunity of the decade, (2024).
[8] Sonabend-W and others (n 5).

10 To support the initial stages of the Project and identify key issues and areas for further research, Opportunity Green has been asked to:

10.1 undertake research into different international legal frameworks and agreements currently in operation that could be applied to address atmospheric pollution/issues and provide a high-level summary of those agreements, including their scope, implementation, compliance, and effectiveness; and

10.2 prepare a high-level note summarising our findings and setting out potential different options for an international agreement on contrails, key considerations for such an agreement, and any recommended further research.

11 We have been asked to focus on legally binding international agreements and cooperation outside of the ICAO framework given an ICAO regime may take a long time to negotiate and implement, delaying the potential benefits of early action (although we consider such framework where relevant to the analysis of potential issues), addressing contrails in the North Atlantic region in the first instance.

12 Opportunity Green has engaged the pro bono support of Vinson & Elkins LLP and Simon Milnes KC to assist with this work and is grateful for their valuable input into this paper.

13 This note sets out our initial findings and recommendations. Please note that due to the scope provided and the time available it is not exhaustive and it is instead intended to set out initial considerations for future research and work in this area. We understand more detailed work on this may be undertaken later this year and we would be happy to assist with this as required.

14 The remainder of this note is structured as follows:

14.1 **Part A (Legal research and findings)** sets out the research undertaken into existing international environmental treaties and highlights key aspects contributing to successful treaties and relevant treaty design considerations;

14.2 **Part B (Analysis and key issues/risks)** sets out key considerations in relation to different options for an international agreement on contrails, and key issues and risks identified through our preliminary research for the parties to the Project to consider; and

14.3 **Part C (Further research)** sets out our recommendations for further research and next steps.

PART A: Legal research and findings

15 This Part A sets out the research undertaken into existing international environmental treaties regulating atmospheric pollution and highlights key aspects contributing to the success of treaties and relevant treaty design considerations that could be taken into account in any proposed treaty.

Introduction to binding international legal agreements

16 A treaty is a legally binding written agreement between states. Various terms may be used to describe a treaty, including 'convention', 'agreement', 'protocol', 'covenant', 'pact', and 'act', but in essence if such documents create legally binding obligations between states then they are all treaties.[9] Whilst there are no rules prescribing the exact form a treaty must take, the 1969 Vienna Convention on the Law of the Treaties does address key matters such as entry into force, interpretation and termination.[10]

17 There are two principal options for a new treaty: (i) a standalone treaty; or (ii) an 'add-on' (often called a protocol or an agreement) to an existing framework treaty. Framework treaties are common in environmental matters; for example, the 1992 UN Framework Convention on Climate Change (the **UNFCCC**), under which the parties entered into the 1997 Kyoto Protocol (the **Kyoto Protocol**) and the 2015 Paris Agreement (the **Paris Agreement**).

18 Options for negotiating a treaty include: (i) a standalone negotiating process (whereby a group of willing countries come together to negotiate the treaty without a formal mandate); (ii) a United Nations General Assembly resolution providing a negotiating mandate (this requires a two-thirds majority); or (iii) a mandate under another international body or framework treaty (e.g., the UNFCCC; this would require the consensus of all parties).[11]

19 Once a treaty text is adopted (i.e., agreed at the end of negotiations), it is usually opened for signature but only enters into force and becomes binding on the parties once formally ratified/acceded to (which typically first requires national level approval, e.g. through parliament).[12] Parties can 'join' treaties over time by ratification/accession, and so participation and effectiveness can increase. Note parties may also 'leave' treaties, in such manner as prescribed in the relevant treaty.

20 Treaties can include (but can also prohibit) the ability for a contracting state to make 'reservations' whereby it objects to certain provisions of the treaty but agrees to be bound by the remainder of the treaty. This can promote wider participation in the treaty as states can 'pick and choose' which elements they subscribe to, but is often prohibited in environmental treaties to preserve the integrity of the agreement.[13]

International environmental treaties governing atmospheric pollution

21 Vinson & Elkins LLP undertook research for Opportunity Green into current international environmental treaties governing atmospheric pollution, to identify key aspects and considerations for the Project.

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[9] Alan Boyle and Catherine Redgwell, *Birnie, Boyle, and Redgwell's International Law and the Environment* (4th edition, OUP Oxford 2021) 18.
[10] ibid 18–19.
[11] Fossil Fuel Non-proliferation Treaty Initiative, Pathways towards international cooperation on fossil fuel supply, (2021) 4.
[12] ibid 19.
[13] ibid.

22 The agreements reviewed are as follows:

22.1 the 1979 Geneva Convention on Long-Range Transboundary Pollution (**CLRTAP**));

22.2 the eight protocols to the CLRTAP, namely: (i) the 1984 Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (**EMEP**); (ii) the 1985 Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent (the **Helsinki Protocol**); (iii) the 1988 Protocol concerning the Control of Emissions of Nitrogen Oxides (the **NOx Protocol**); the 1991 Protocol on the Control of Emissions of Volatile Organic Compounds (the **Protocol on VOCs**); the 1991 Protocol on Further Reduction of Sulphur Emissions (the **Oslo Protocol**); the 1998 Protocol on Heavy Metals (as amended in 2012) (the **Aarhus Protocol**); the 1998 Protocol on Persistent Organic Pollutants (as amended in 2009) (the **Protocol on POPs**); and the 1999 Gothenburg Protocol (as amended in 2012) (the **Gothenburg Protocol**);

22.3 the 1985 Vienna Convention for the Protection of the Ozone Layer (the **Ozone Convention**);

22.4 the Carbon Offsetting and Reduction Scheme for International Aviation (**CORSIA**);

22.5 the 1987 Montreal Protocol (the **Montreal Protocol**);

22.6 the UNFCCC;

22.7 the Kyoto Protocol; and

22.8 the Paris Agreement.

23 From that research, we set out below:

23.1 key aspects that appear to contribute to the effectiveness and success of an environmental treaty; and

23.2 key considerations in relation to treaty design for the purposes of the Project.

<u>Key aspects contributing to the effectiveness and success of an environmental treaty</u>

24 The research found the following key aspects which were important to the relative effectiveness of a treaty in achieving its goals:

24.1 **The utilisation of 'executive committees' or 'working groups'** to drive forward progress in state discussions, research and development, and any policy initiatives, whilst promoting accountability and compliance.

24.2 **A narrow subject matter**. For example, the Montreal Protocol, considered to be one of the most successful environmental treaties, narrowly focuses on the regulation of chlorofluorocarbons (CFCs).

24.3 **Inclusion of an accountability mechanism.** For example, trade restrictions in respect of countries not part of the treaty, as an incentive for participation and compliance.

24.4 **Salience with the general public.** Where the issue the treaty is seeking to address has salience with the general public. For example public support for the development of the Montreal Protocol was very high, due to the increased risks of skin cancer that ozone depletion presents.

Key considerations in relation to treaty design

25 We highlight the following key considerations for states in relation to the design of any treaty:

25.1 **Participation and geographical scope**

(a) *Expansion over time:* Most (but not all) of the treaties assessed have increased the number of contracting states since adoption.

(b) *Regional focus:* Participation in some treaties (e.g., the CLRTAP) is more concentrated in specific regions, whereas other treaties (e.g., the Ozone Convention and the Paris Agreement) are global or near-global. Consideration should be given to the most relevant regions where contrails need to be addressed (including in the future, following any successful agreement in the North Atlantic region).

(c) *Approach to participation:* The need to build momentum and start with those states that are most willing, which reduces the risk that comes with wide participation and requirements for unanimity. It is worth considering a 'small club' of willing states (e.g. the five North Atlantic ATC states or a subset of those) and then expanding participation over time. However, this needs to be balanced against the value of broad participation, for example in facilitating the exchange of information/capital as needed.

(d) *Role of the private sector:* The combined effort of public and private sectors can be valuable to the success of a treaty.

25.2 **Implementation**

(a) *Collaboration:* A number of treaties assessed include provisions encouraging research, development, monitoring and cooperation. Given the state and expected development of the science relating to contrail management, such provisions would be worth considering in relation to the Project. It may be that the precise operational changes required cannot be ascertained at this stage, in which case any agreement could seek to provide a mechanism for cooperation on research and development to help establish these elements.

(b) *Commitments:* Consider whether to include quantifiable targets/strict commitments. There are three alternatives:

(i) *Mandatory commitments*: This can be helpful in respect of funding commitments (e.g., EMEP) and has also been used to set specific reduction targets for emissions or emissions ceilings (e.g., the Kyoto Protocol and the Gothenburg Protocol). Some treaties (e.g., the Protocol on POPs) seek to implement outright bans.

(ii) *Flexibility in commitments:* Alternatively, different states could have different commitments under the agreement, depending on particular circumstances (e.g., the VOC Protocol allows states to select different metrics/baselines upon signing or ratification).

(iii) *No quantifiable goals*: Whilst on its face this would seem to be a drawback, imprecision can be an asset when it offers flexibility and facilitates participation (e.g. CLRTAP) and may be appropriate where there is uncertainty.

(c) *Legally binding / 'soft law' requirements:* Consider what elements should be legally binding and what elements should only be encouraged.

(d) *Institutions:* Consider what institutions should/could be set up under the treaty. For example:

(i) the Ozone Convention does not contain any legally binding obligations but it did set up a number of key institutions – the Conference of the Parties, the Ozone Secretariat, the Ozone Research Managers, and the Bureau of the Conference of the Parties – that ultimately led to the advancement of the Montreal Protocol, which provided effective, binding obligations; and

(ii) the UNFCCC established the Intergovernmental Panel on Climate Change and the Conference of the Parties.

(e) *National measures:* Consider what is required (e.g., of ATCs) and how the agreement can encourage/require the implementation of the necessary national measures to bring about that (e.g., under the NOx Protocol, states are expected to utilise best available technologies that are economically feasible to reduce NOx emissions from existing sources).

(f) *Technical and financial:* Consider who is responsible for the funding/costs of any programmes of work, and monitoring and evaluation under the treaty.

(i) *Central funding mechanism or specific funding protocol*. The CLRTAP regime lacks a central funding mechanism, but has a protocol specifically addressing the funding of monitoring and evaluation (EMEP). This relies on mandatory contributions from a few lead states, with other states providing voluntary contributions. Outside of EMEP, funding relies on donor countries or limited resources of UNECE.

(ii) *Technical and financial assistance*: To the extent that the treaty proposes to include developing countries, consideration could be given to the need or desire for technical and financial assistance for implementation from developed countries (see, for example, the Montreal Protocol).

(iii) *Technical changes*: Consider the inclusion of an adjustment mechanism to quickly respond to advances in scientific understanding (see, for example, the Montreal Protocol).

25.3 **Compliance**

(a) *Reporting and verification:* Consider (i) the need for reporting obligations on states, and what reporting obligations in turn are required from ATCs and/or airlines for monitoring and evaluation purposes; and (ii) how will this reporting be verified – will it be published and subject to review by the other parties or by an independent reviewer (and who has the capability to undertake such a review)?

(b) *Non-compliance:* Generally, compliance is monitored by specific bodies under the treaty, for example the Implementation Committee under CLRTAP and its various protocols (which reports to the Executive Body) and the Conference of the Parties under the Ozone Convention.

(c) *Dispute resolution procedures:* Whilst it is common for treaties to contain dispute resolution procedures whereby a contracting state or member organisation can initiate dispute resolution proceedings for alleged non-compliance, such procedures are generally not included in the treaties listed in paragraph 22.[14] Instead, alternative dispute provisions are generally provided. For example, the CLRTAP provides that in the event of a dispute the parties 'shall seek a solution by negotiation or by any other method of dispute settlement acceptable to the parties'.[15] Given the collaborative nature of the proposed agreement we consider it unlikely to be suitable to include a strict dispute resolution procedure, which may be unlikely to be used by the parties in any case.

(d) *Incentivisation*: It is therefore important to incentivise parties to comply and consideration should be given to the means of such incentivisation.

25.4 **Effectiveness**

(a) *Review mechanism:* As the understanding of contrails is developing and more scientific studies are being undertaken, it would be worth considering including a mechanism whereby the regime can be regularly reviewed and updated, for example through commissioning objective scientific reports.

(b) *Transparency:* The salience of the issue the treaty is addressing with the general public bolsters the effectiveness of the treaty. It may be worth considering how the measures being taken (and why) is explained to the general public.

(c) *Scientific assessment*: Generally, with some exceptions, having an international agreement in place correlates with emissions reductions (where measured).

(d) *Uptake and commitment*: The commitment and involvement of public and private sector actors is beneficial to the ultimate success of the treaty.

[14] Some treaties do provide mechanisms whereby following negotiation/mediation disputes can in certain circumstances be submitted to arbitration and/or the International Court of Justice (see, for example, the Montreal Protocol and the UNFCCC).
[15] Convention on Long-Range Transboundary Air Pollution, Nov. 13, 1979, 1302 U.N.T.S. 217.

PART B: Analysis and key issues/risks

26 This Part B sets out different options for international cooperation on contrails, and key issues and risks identified through our preliminary research for the parties to the Project to consider.

Type of agreement

27 As noted at paragraph 17, a treaty on contrails could potentially be adopted under an existing framework regime, for example under the ICAO regime, as an international aviation matter, or under the UNFCCC regime, as a climate change matter. However, we understand that:

27.1 the parties consider that an ICAO regime may take a long time to negotiate and implement, delaying the potential benefits of early action, and we have been asked to focus on options outside of that regime; and

27.2 the intention is to start with a small group of willing states in the North Atlantic, and as such the UNFCCC regime with its wide participation (and need for consensus) may not be an appropriate framework either.

28 A new agreement between a coalition of willing states may therefore be the most suitable option and could proceed without a specific negotiating mandate (subject to the risks we highlight in relation to interaction with existing regimes, see paragraphs 34 to 37).

29 However, we also suggest that consideration is given to non-legally binding forms of cooperation. Whist we have been asked to focus on *legally binding* international agreements in this paper, it is worth noting that negotiating international treaties can be complex, time-consuming, and may ultimately be unsuccessful. Given the Project's initial objective of small scale, regional cooperation, a potential alternative that could be considered is a memorandum of understanding (**MoU**) between willing states.

30 An MoU is not normally legally binding, but can be used 'where it is considered preferable to avoid the formalities of a treaty - for example, where there are detailed provisions which change frequently or the matters dealt with are essentially of a technical or administrative character [...] or where a treaty requires subsidiary documents to fill out the details'.[16] In this case, there may be certain advantages to an MoU over a formal treaty, including, for example:

30.1 an MoU does not create legally binding obligations, instead relying on good faith expectations of the state parties (but states nonetheless tend to take those expectations seriously). That may make the document easier to negotiate and finalise (especially in light of the procedural formalities states need to observe before entering into treaties[17]) leading to quicker implementation of agreed measures. Building the momentum and political will required to negotiate and enter into treaties can be very time-consuming;[18]

30.2 an MoU offers greater flexibility which may be appropriate to the circumstances given the rapidly evolving scientific understanding of contrails;

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[16] UK Government, Foreign, Commonwealth and Development Office, Treaties and MOUs: Guidance on Practice and Procedures (2022).
[17] See, for example, "Treaty Procedures" in UK Government, Treaties and MOUs: Guidance on Practice and Procedures (2022) paragraphs 5-10.
[18] For example, negotiations on a global plastics treaty began in 2022 and were due to be complete by 2024 (but that deadline was missed) and the proposal for a fossil fuel non-proliferation treaty was made in 2015 and now has a coalition of 13 states seeking a mandate to negotiate the treaty).

30.3 a non-binding agreement does not preclude a treaty eventually, and may act as a useful, more easily attainable interim step to build momentum and understanding in the short-term.

Geographical scope and participation

31 In order to determine the appropriate geographical scope of the agreement and which states to approach, the following should first be established: (i) what change is required to current flight operations / behaviour; and (ii) the identity of the relevant actors that exercise control over that change.

32 We understand that:

32.1 the key change the Project is seeking is the implementation of a procedure whereby flight paths can be altered to avoid 'contrail likely zones'; however, it is not yet established precisely what changes are required (e.g., the degree of altitude change) and when such changes can be implemented (i.e., pre-flight or during flight); and

32.2 depending on when those changes are needed, the two key actors exercising control over flight paths are likely to be (i) air traffic control (**ATC**); and/or (ii) airlines.

33 Following our discussions with AEF we note that it is assumed that ATCs are likely the most practical choice of actor to implement the flight path changes required due to their control over international airspace, and that the international airspace over the North Atlantic is controlled by just five ATCs, based in the United Kingdom, US, Canada, Portugal and Iceland respectively. However, as at the date of this paper we understand that AEF is awaiting further information from the UK's National Air Traffic Services (**NATS**) as to how the flight path system operates in practice, and any limitations on ATCs' ability to make the changes to flight paths needed to minimise contrails.

Interaction with existing legal framework(s)

34 Once the key actors and changes required have been ascertained, it is important to establish any relevant existing international legal frameworks that may interfere with the operation or implementation of the desired measures.

35 We are aware, for instance, that the zones of international airspace are established under ICAO, and that ICAO sets out certain procedures for air traffic management.[19] We consider that ICAO's role in international aviation presents various possible risks to the Project, including whether or not:

35.1 the changes required by the ATCs and/or airlines can be implemented without contravening or affecting the current air traffic management regime under ICAO;

35.2 states will be willing to adopt a new international regime for this, rather than an extension of the existing ICAO regime, whether because of concerns about unreasonable use of another treaty regime or due to political considerations; and

[19] Including, as we understand it, under Annex 2 (Rules of the Air) and Annex 11 (Air Traffic Services) to the Chicago Convention On International Civil Aviation (1994) 15 U.N.T.S. 295; PANS-ATM (Doc 4444) Procedures for Air Navigation Services – Air Traffic Management; Regional Supplementary Procedures (Doc 7030); and, in relation to the North Atlantic, the NAT Air Navigation Plan and guidance published by the North Atlantic Systems Planning Group.

35.3 ICAO, other states, or airlines will object to regional interventions in international airspace (and may raise arguments of extraterritoriality).

36 As agreed with AEF, we have not reviewed the ICAO air traffic management regime for the purposes of this initial paper, and pending responses to certain preliminary questions that AEF is awaiting from UK's NATS. However, we do consider this a potential risk for this Project and suggest that this question is addressed in further research (see paragraph 43.8).

37 Finally, whilst we understand it is the current aim of the Project to seek international cooperation on this matter outside of ICAO, we note that pursuing a unilateral/regional initiative could also have the effect of catalysing action at ICAO. For example, the EU Emissions Trading System (**ETS**) precipitated the adoption of CORSIA, and the US Environmental Protection Agency being mandated to define national fuel-efficiency standards led to the ICAO Council adopting the first International Standards and Recommended Practices on CO_2 emissions.[20] As such, a regional proposal to act on contrails could potentially be used strategically to advance negotiations and action at ICAO should that be desirable (noting that is not the present aim of the Project).

Interaction with other environmental regulation

38 Whilst the CO_2 penalty of contrail management may be small, it does potentially lead to increased liability under carbon pricing mechanisms such as the EU ETS (to the extent applicable to the relevant flight path, noting the current restricted scope of the ETS) and CORSIA. There is a risk that airlines would not willingly assume this additional liability and may seek to oppose the measures or argue for relief under CORSIA or the EU ETS, as applicable (notwithstanding that we understand the extra fuel burn is expected to be in the normal parameters for deviations relating to adverse weather).

39 There is also a potential risk of double counting, i.e., misappropriation of the mitigation achieved through the measures; for example, states or other actors seeking to claim the mitigation benefits counting towards their other commitments (e.g., under CORSIA or the Paris Agreement).

Implementation matters

40 There are various implementation matters that need to be considered, including those relating to required research, development, monitoring, commitments or collaboration, institutions, financing, reporting, verification, and mechanisms for non-compliance and review, among others. These matters are discussed in detail in Part A (see paragraph 25).

41 The detail of these matters is more relevant at the negotiating stage, however, a key preliminary question is whether the agreement is capable of specifying measures to be taken at the outset, or whether it will be designed to promote collaboration over research and development (with a view to adopting measures in the future).

Policy issues / considerations

42 Whilst beyond the scope of this paper, the following are policy issues and considerations identified during our research and discussions which may need to be considered in relation to proceeding with an international agreement on contrails:

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[20] Benoit Mayer and Zhuoqi Ding, 'Climate Change Mitigation in the Aviation Sector: A Critical Overview of National and International Initiatives' (2023) 12 Transnational Environmental Law 14, 26–27.

42.1 **'Buy-in' from states:** Generally, it needs to be considered which states are likely to drive this initiative forward and persuade other states to join. We note that a 'climate focused' treaty may be unlikely to gain support from the US until at least 2029. [21] In that regard, it may be worth considering focusing on a European agreement in advance of an agreement in respect of the North Atlantic.

42.2 **'Buy-in' from industry**: Industry support would be beneficial in gaining momentum and ensuring success (and likely a pre-requisite to US involvement in the short-term). We consider there are some potential levers to promote industry support, including: (i) action is an environmental clear win in a sector that has few decarbonisation options; (ii) it is relatively cheap when compared to the costs of alternative fuels (in terms of climate savings; although as targets are generally based on CO_2 this is perhaps not that strong an incentive); and (iii) pre-emptive action ahead of potential future liability under carbon trading schemes (e.g. the EU is considering bringing forward a legislative proposal to include non-CO_2 in the EU ETS).

42.3 **Does anyone 'lose' from the changes and how can they be persuaded?** Airlines may incur increased fuel costs and a potential increase in ATC fees (as a result of additional flight time in a given airspace block). ATC and/or airlines may face increased compliance/resource requirements. Effective communication to and incentivisation of these actors will therefore be beneficial to the effectiveness of any agreement.

42.4 **Process leading to negotiations:** Significant work is required in laying the groundwork for the negotiation of any treaty. The Campaign for a Fossil Fuel Non-Proliferation Treaty identifies several key aspects in its approach to building the foundations for a new treaty, including public campaigning, evidence base building, working towards a set of institutions, working with existing multilateral fora and building partnerships with major stakeholders and UN agencies.[22] This process is likely more important in the short term than the details of treaty design, which will follow in the negotiating stage.

42.5 **Communications:** Relatedly, communications about the initiative can help galvanise public support (see paragraph 24.4) and convince other states and stakeholders. Care may need to be taken to guard against the risk of this initiative being used to perversely justify other initiatives that increase demand for fossil fuels without a net climate benefit.

[21] Action on contrails may not be impossible in the US, however. In 2024, Tennessee's Senate Bill 2691 (2024) took effect (albeit inspired by 'chem-trail' conspiracy theories) that includes broad language that could potentially capture contrails: "The intentional injection, release, or dispersion by any means, of chemicals, chemical compounds, substances, or apparatus within the borders of this state into the atmosphere with the express purpose of affecting temperature, weather, or the intensity of the sunlight is prohibited" (2024 Tenn. Pub. Acts 709.).
[22] Fossil Fuel Non-proliferation Treaty Initiative (n 11) 3.

PART C: Further research

43 This paper has identified potential options for international cooperation on treaties, and identified some key potential issues and risks that should be considered at the preliminary stage. The scope of this paper has necessarily been high level, and intended to identify the key issues / questions for further research. In our opinion, the following are key areas for further research:

Further policy and technical research / input

43.1 **What are the technical requirements (and how precisely can they be stated)?**

(a) what changes are needed to the existing international aviation model and flight paths (or what changes are needed to current structures to allow that information to be established);

(b) which entity/ies can implement those changes;

(c) what stage of the flight planning or flight those changes need to take place;

(d) how does flight routing work as between different ATCs and between regions potentially captured by the agreement and those not; and

(e) how is the necessary contrail data captured, who makes it available, and when.

The more information and detail that can be gathered at this stage, the more targeted the legal framework can be. However, it is also possible (and may be helpful in this case) to consider a framework that facilitates any required research and development.

43.2 **Once the key actors are identified, which are the key states to target? If a North Atlantic cooperation is successful, which would be the next region to try to include?** The states can only be identified once it is clear which entities can implement the changes, and therefore in which jurisdiction those entities are based (noting the risk identified at paragraph 35.3 of claimed extraterritoriality and/or acting outside of the agreed international framework under ICAO).

43.3 **What is the level of political will / momentum, and how can this be increased?** A successful treaty relies on political will. Are there potential partners for the Project that could help galvanise such political will amongst the relevant states, for example through the means suggested at paragraph 42.4?

43.4 **What are the key desirable elements as outlined in paragraph 25 of Part A to be included in any agreement?** Whilst the detail of these matters is something for the negotiating stage, it may be worth considering in outline what the key elements the agreement needs to cover are (for example, whether it can include specific measures or whether it is designed to facilitate greater cooperation and research).

43.5 **What communications strategy could be adopted to maximise the prospects of success?** How can support be galvanised amongst industry, states, and the general public? How can those actors who may 'lose' financially or otherwise from the measures be persuaded to support the measures?

43.6 **How does the regime sit alongside CORSIA and carbon-based mechanisms such as the ETS?** If airlines liabilities under such regimes are increased by these measures, how

can the integrity of the respective regimes be maintained and arguments trying to 'water down' measures be counteracted?

43.7 **How does this proposal compare / relate to other action on non-CO2 impacts**: For example, we understand regulation of the aromatic content of fuel could also reduce contrail formation. To consider relative effectiveness of each against the respective difficulties of regulating, or whether the approaches could be pursued in parallel.

Further legal research/considerations

43.8 **How does the proposal interact with existing regimes/frameworks?** As at the date of this paper, we note that AEF is awaiting a response from UK NATS to queries as to its competence and regulatory restrictions which may prevent ATCs from implementing contrail avoidance. We are also happy to undertake research into this question if helpful. In particular, we consider that the ICAO air management frameworks may need to be reviewed to ensure that ATCs have the ability to make the changes required under the proposal and to address any issues that may be raised in opposition by ICAO, other states, or airlines.

43.9 **Would a non-legally binding agreement be suitable, at least at first?** This paper has focused on legally binding international agreements (i.e., treaties) that address matters of atmospheric pollution. That research suggests an appropriate starting point for this Project may be a small-scale regional agreement between willing states. We have also recommended that consideration is giving to a non-binding form of cooperation at the outset, as a potentially more achievable goal that may be quicker to implement.

43.10 **Are there other types of international agreement that would be worth researching in relation to the Project?** In addition to environmental treaties addressing atmospheric pollution, there are other types of international agreements that we could consider and whilst beyond the scope of the present paper, these could be considered in a subsequent piece of research. For example, we could consider the possibility of promoting an international agreement or protocol calling for select states (in coordination with the relevant state regulator) to consider adopting Private-Public Partnerships (PPPs) with private industry (e.g., airlines) in the area of contrails avoidance. A key consideration is how the states (or state regulator) can provide incentives for private industry to participate, finance and contribute to PPP projects.

44 We consider the above matters would be important to clarify prior to looking in detail at any specific treaty design, and we would recommend further research on these points to inform the proposed action.

45 Please let us know if you have any questions or would like to discuss any aspect of this note.

Opportunity Green

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