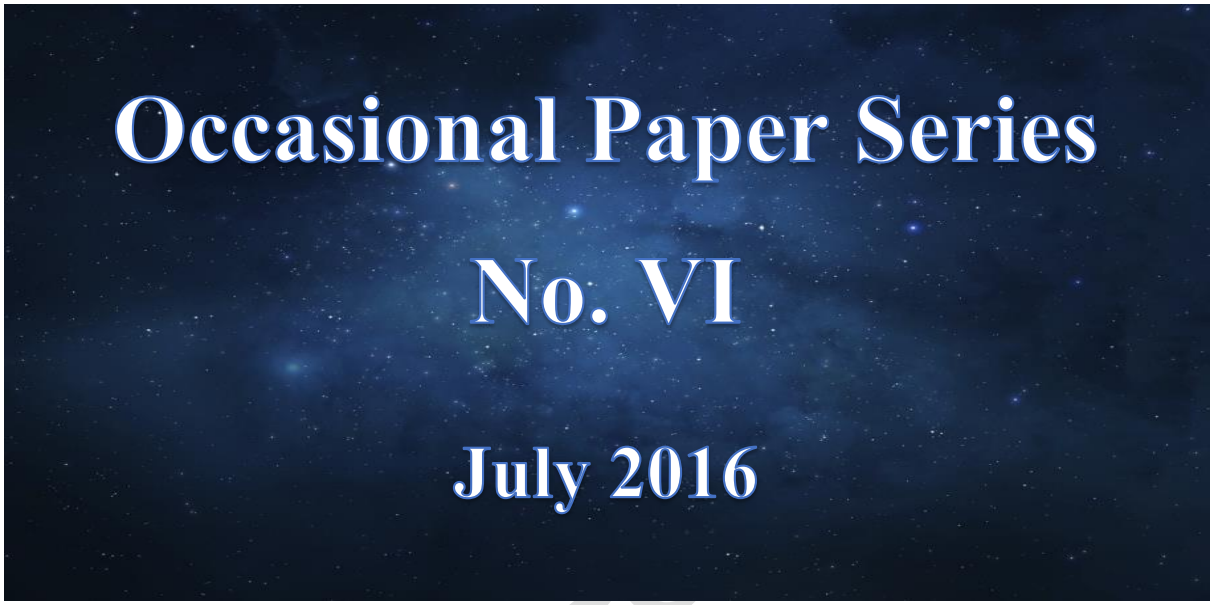
McGill | Centre for Research in Air and Space Law
Centre de recherche en droit aérien et spatial



Sustainable Flight Management and Aviation

by

P. Paul Fitzgerald and Md. Tanveer Ahmad

Occasional Paper Series:
Sustainable International Civil Aviation

The attached Occasional Papers have been prepared by a group of scholars associated with the Institute of Air and Space Law (IASL) at McGill University. They are the result of a collaborative effort between the IASL and the Centre for International Sustainable Development Law and are designed to be part of a book prepared by authors from both groups which will eventually be published by the Cambridge University Press under the title *Sustainable International Civil Aviation*.

As the title of the book suggests, bringing together these various scholars and papers is the central theme of the sustainable development of international aviation. In particular, the work of the International Civil Aviation Organization (ICAO), the primary United Nations body tasked with regulating the environmental aspects of international aviation, and the provisions of the Chicago Convention which lays down powers of the Organization and the fundamental rules of international air law, form the primary focus of this collection. At the next ICAO Assembly in September-October of 2016, ICAO has the ambitious mandate to finalise a global scheme to limit CO2 emissions from international aviation. As many of the articles contained in the book are of immediate relevance to the discussions due to take place at ICAO, publishing and disseminating these draft chapters will contribute to the growing interest and debates on the issue of the environmental impact of aviation. It is hoped that these papers will contribute to the work of the Assembly and that informed readers and delegates participating at the ICAO Assembly will have constructive comments to share with the authors.

Readers are invited to send their comments to the authors whose e-mail addresses are set out on the title page of each paper as well as a copy to the following address: edannals.law@mcgill.ca

The authors and the Editors of this collection of papers thank all readers for their attention and their comments.

Professor Armand de Mestral, Emeritus Professor, *McGill University, Canada*
Dr. Paul Fitzgerald, *McGill University, Canada*
Dr. Tanveer Ahmad, *North South University, Bangladesh*

SUMMARY

Airspace sovereignty and environmental protection: How is the concept of State sovereignty under the Chicago Convention becomes a barrier to sustainable flight management?

The issue:

- Whether improvements in flight management create environmental benefits;
- Whether the concept of airspace sovereignty is a barrier against sustainable flight management;
- Whether the concept of airspace sovereignty should be circumscribed by the mandate to protect the environment:

Its importance:

- Operational improvements alone cannot significantly reduce the environmental effects of aviation. Nonetheless, this environmental measure should not be ignored since, *inter* alia, no single environmental measure alone can effectively ensure sustainable aviation;
- Currently, the lack of cross-border air navigation service (ANS) is causing more GHG emissions as aircraft are made to take indirect or less-than-direct routings.

The treaty law:

- The concept of State's airspace sovereignty enshrined under Article 1 of the Chicago Convention, to which:

> The contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory.

- The customary international law principle according to which States have sovereign right to exploit their own resources and simultaneous responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction as recognized under various international legal instruments, for example, the *Declaration of the United Nations Conference on the Human Environment*. This principle formed the basis for the *Long-Range Transboundary Air Pollution Convention*, the *Vienna Convention for the Protection of the Ozone Layer*, and the *United Nations Convention on Climate Change*.

The analysis:

- Performance-based navigation (PBN) is a great tool in improving the efficiency of air traffic management. However, PBN suffers from various difficulties including a long and difficult implementation process; a lack of global expertise; difficulty understanding the PBN Manual due to technical incompetence and language barriers; shortcomings in co-ordination between stakeholders; lack of standardization; few older aircraft equipped for PBN; lack of PBN procedures at some airports; and difficulty of PBN-capable aircraft to fit in with non-PBN capable aircraft on same flight tracks.
- The concept of airspace sovereignty of States enshrined under the Chicago Convention makes States reluctant to delegate their air navigation system provision to other States or any entity. This makes air navigation less efficient and thereby causes more GHG emissions.
- The concept of airspace sovereignty also allows States to restrict foreign aircraft access to certain areas of its territory. Again, this makes aircraft take indirect or less-than-direct routings increasing their fuel consumption.
- The notion of sovereignty is an evolving doctrine. The customary international law principle that States have sovereign right to exploit their own resources and simultaneous responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction, which was brought about by the *Trail Smelter* arbitration, lays down the basis for a new understanding and characterization of airspace sovereignty.
- This evolving concept of airspace sovereignty, which should not negatively affect the substance of State sovereignty, is required to evade all the obstructions that impede necessary operational improvements.

Options for decision-makers:

1. States may opt to overcome strict adherence to the concept of airspace sovereignty for the sake of operational efficiency by delegating their ANS to another State or an entity, and reduce, or allow more access for civil aircraft to, restricted areas or prohibited airspace.
2. Authorize airlines to obtain access to restricted areas that will allow them to fly direct routings.
3. No action on the part of decision-makers which may result to the non-immediate realization of the environmental benefits that an efficient air navigation system may bring.

SUSTAINABLE FLIGHT MANAGEMENT AND AVIATION*

by

P. Paul Fitzgerald and Md. Tanveer Ahmad•

I. INTRODUCTION

Reducing aviation emissions is central to achieving environmentally sustainable aviation, and the International Air Transport Association [IATA] believes that genuine progress in reducing greenhouse gas [GHG] emissions from aviation cannot be achieved without "necessary investments and reforms to optimize and modernize air traffic management."[1] Former International Civil Aviation Organization [ICAO] Council President Roberto Kobeh González agrees that current air traffic management [ATM] practices are an impediment to major efficiency gains.[2]

Operational improvements alone cannot ensure sustainable aviation since such improvements cannot reduce emissions to the level necessary to significantly diminish aviation's contribution to atmospheric pollution from human activities. Nevertheless, this environmental measure should not be ignored for at least two reasons: (a) every milligram of gases emitted due to human activities should be taken into account; and (b) no single environmental measure alone can effectively ensure sustainable aviation. Improvements in operations to ensure sustainable flight management should continue, and new concepts for the purpose of improving flight management should continue to be developed.

II. CURRENT STATE OF FLIGHT MANAGEMENT

Improving the ATM system is not a new strategy. The aviation industry has been gradually "working on ATM operational improvements…since the 1920s. The work accelerated with the onset of communications, navigation, surveillance and air traffic management [CNS/ATM] systems". [3] ICAO has been facilitating operational

• The authors can be contacted at: ppaul.fitzgerald@gmail.com and md.ahmad@mail.mcgill.ca

* This chapter has been adapted from authors' article "Efficient Air Traffic Management: A Precondition for Reducing Hazardous Emissions from Aviation: Is Sovereignty Getting in the Way of Progress?" (2014) 63:3 ZLW: German Journal of Air & Space Law 386.

[1] See online: Fact Sheet: Global Sectoral Approach for Addressing Aviation Carbon Emissions, Fact Sheets, Facts & Figures, Pressroom, online: IATA <www.iata.org/pressroom/facts_figures/fact_sheets/Pages/emissions-approach.aspx>.

[2] See Roberto Kobeh González, "Towards a Transformed ATM environment – Working together" (Opening address by the President of the ICAO Council to the World ATM Congress 2013, Madrid, 12 – 14 February 2013) [unpublished].

[3] See ICAO Secretariat, "ICAO's Global Air Traffic Management (ATM): Operational Concept and Global

improvements in various ways. For example, ICAO, in close conjunction with IATA and the Civil Air Navigation Services Organisation [CANSO], introduced a new aviation system flight plan in November 2012 that would assist "aviation to more efficiently manage growing air traffic volumes and related capacity challenges while reducing" its carbon dioxide (CO_2) emissions.[4] "[I]n order to provide States and other stakeholders with information on a state-of-the-art variety of measures and best practices to reduce aviation emissions, ranging from weight reduction, to airport operations, as well as other operational improvements", ICAO's Committee on Aviation Environmental Protection [CAEP] developed and updated the guidance material on operational opportunities to minimize fuel use and reduce emissions.[5] Additional guidance material on conducting CNS/ATM environmental assessment, referred to as *Environmental Assessment Guidance for Proposed Air Traffic Management Operational Changes*, was also developed by the CAEP and endorsed by the ICAO Council.[6] ICAO publishes and updates Global Air Navigation Plan [GANP], which is "an overarching framework that includes key civil aviation policy principles to assist ICAO Regions, sub-regions and States with the preparation of their Regional and State air navigation plans".[7] The fourth edition of the GANP is "designed to guide complementary and sector-wide air transport progress over 2013-2028 and is approved triennially by the ICAO Council."[8] Furthermore, "ICAO continues to develop and make available new tools to provide States with the ability to assess the environmental impacts of aviation operations".[9] ICAO has also developed the Aviation

Air Navigation Plan" in ICAO, *ICAO Environmental Report 2010: Aviation and Climate Change* (Montreal: ICAO, 2010) 98 at 100 [ICAO Secretariat, "ICAO's Global Air Traffic Management"].

[4] ICAO, Press Release, COM 19/12, "Aviation Groups Unite to Achieve Instantaneous Global System Upgrade" (15 November 2012), online: ICAO <www.icao.int/Newsroom/Pages/aviation-groups-unite-to-achieve-instantaneous-global-system-upgrade.aspx>.

[5] ICAO Secretariat, "Overview: Global Emissions" in ICAO, *ICAO Environmental Report 2013: Aviation and Climate Change* (Montreal: ICAO, 2013) 96 at 96 – 97 [ICAO Secretariat, "Overview: Global Emissions"]. To view the updated manual, see ICAO, *Operational Opportunities to Reduce Fuel Burn and Emissions*, Circular 303-AN/176, ICAO Doc 10013 (2014). See also ICAO Secretariat, "Operations: Operational Improvements to Reduce Global Emissions" in ICAO, *ICAO Environmental Report 2013: Aviation and Climate Change* (Montreal: ICAO, 2013) 112 at 112 [ICAO Secretariat, "Operations"].

[6] ICAO Secretariat, "Overview: Global Emissions", *supra* note 5 at 97; ICAO Secretariat, "Operations", *supra* note 5 at 112. "ICAO has emphasized to States that early implementation of new communications, navigation, surveillance and air traffic management (CNS/ATM) systems would be an effective means of reducing fuel burn and avoiding unnecessary emissions." ICAO, "Environmental Protection: Operational Measures", online: ICAO <www.icao.int/environmental-protection/Pages/operational-measures.aspx>.

[7] ICAO, *Global Air Navigation Plan*, 4th ed, ICAO Doc 9750-AN/963 (Montreal: ICAO, 2013) at 15, online: ICAO <www.icao.int/publications/Documents/9750_4ed_en.pdf> [ICAO, *Global Air Navigation*]. "The objective of the GANP is to increase capacity and improve efficiency of the global civil aviation system whilst improving or at least maintain safety. The GANP also includes strategies for addressing the other ICAO Strategic Objectives." *Ibid*. "The GANP outlines ICAO's ten key civil aviation policy principles guiding global, regional and State air navigation planning." *Ibid*.

[8] *Ibid* at 4. "The GANP represents a rolling, 15-year strategic methodology which leverages existing technologies and anticipates future developments based on State/industry agreed operational objectives. The Block Upgrades are organized in five-year time increments starting in 2013 and continuing through 2028 and beyond." *Ibid*.

[9] ICAO Secretariat, "Overview: Global Emissions", *supra* note 5 at 97. "For instance, ICAO recently launched the ICAO Fuel Savings Estimation Tool (IFSET), which was developed to assist States to estimate the fuel savings and corresponding environmental benefits from the implementation of operational improvements". *Ibid*.

System Block Upgrade [ASBU].[10]

The ASBU concept has been developed to help the aviation community meet its dual challenges: "safety and operational improvements on a globally harmonized basis, while being environmentally responsible and cost-effective."[11] In fact, "[a] key challenge for the aviation community in recent years has been to prioritize and build consensus around the latest technologies, procedures and operational concepts…[since] a wide variety of national and regional ATM modernization programmes have been emerging worldwide."[12] ASBU aims to ensure at reasonable cost that:[13]

- aviation safety is maintained and enhanced;
- air traffic management improvement programs are effectively harmonized; and
- barriers to future aviation efficiency and environmental gains are removed.[14]

The ASBU "concept allows for a flexible global systems approach, enabling all States to advance their Air Navigation capabilities based on their specific operational requirements." [15] ICAO GANP includes ASBU "framework, its modules and its associated technology roadmaps covering *inter alia* communications, surveillance, navigation, information management and avionics."[16] At its heart, ASBU "is a pragmatic system of [m]odules".[17] Each module is "comprised of technologies and procedures that are organized towards achieving a specific performance capability. Each of these modules is then linked to one of four specific and interrelated performance improvement areas".[18] These four areas are: airport operations, globally interoperable systems and data, optimum capacity and flexible flights, and efficient flight paths.[19] These modules apply several other concepts which include continuous descent operations [CDO], continuous climb operations [CCO], collaborative decision making to improve airport operations [A-CDM], and performance-based navigation [PBN].[20]

In particular, PBN is crucial since it is essential for the implementation of ASBU, and is an enabler for CDO and CCO.[21] PBN "allows aircraft to fly even closer to their preferred 4D trajectory. Developed after the improvement of the air navigation system in

---

[10] *Ibid*.
[11] ICAO Secretariat, "Operations: ICAO Block Upgrades Minimizing Adverse Environmental Effects of Civil Aviation Activities" in ICAO, *ICAO Environmental Report 2013: Aviation and Climate Change* (Montreal: ICAO, 2013) 114 at 114 [ICAO Secretariat, "Operations: ICAO Block Upgrades"].
[12] ICAO Secretariat, "Operations: Operational Improvements", *supra* note 5 at 113.
[13] ICAO Secretariat, "Operations: ICAO Block Upgrades", *supra* note 11 at 114.
[14] *Ibid*.
[15] *Ibid*.
[16] ICAO, *Global Air Navigation*, *supra* note 7 at 15 [emphasis added].
[17] ICAO Secretariat, "Operations: ICAO Block Upgrades", *supra* note 11 at 114.
[18] *Ibid*.
[19] See *ibid*.
[20] See *ibid*.
[21] See ICAO, "PBN iKit", online: ICAO <www.icao.int/safety/pbn/PBN%20iKit%20V2/story.html>.

the vertical plane, PBN improves the efficiency in the horizontal plane."[22] ICAO defines PBN as "[a]rea navigation based on performance requirements for aircraft operating along an [air traffic service] route, on an instrument approach procedure or in a designated airspace",[23] where "[p]erformance requirements are expressed in navigation specifications in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept".[24] PBN provides the methods "for flexible routes and terminal procedures"[25] by applying Area Navigation [RNAV][26] and Required Navigation Performance [RNP][27] specifications.[28] The PBN concept represents a move "from sensor-based to performance-based navigation".[29] Under this concept, "generic navigation requirements are defined based on operational requirements".[30] Operators then assess options with respect to available technology and navigation services that "could allow the requirements to be met".[31]

Nonetheless, PBN suffers from various difficulties including a long and difficult implementation process;[32] a lack of global expertise;[33] difficulty understanding the PBN Manual[34] due to technical incompetence and language barriers;[35] shortcomings in co-ordination between stakeholders;[36] lack of standardization;[37] few older aircraft equipped

[22] ICAO Secretariat, "ICAO's Global Air Traffic Management", *supra* note 3 at 100.
[23] ICAO, *Performance-based Navigation (PBN) Manual*, 3rd ed, ICAO Doc 9613/AN/937 (Montreal: ICAO, 2008) at I-(xx) [ICAO, *PBN Manual*]; ICAO, (2001) 13 International Standards and Recommended Practices: Annex 11 to the Convention on International Civil Aviation: Air Traffic services: Air Traffic Control Service: Flight Information Service: Alerting Service, at 1-10 [*Annex 11*].
[24] ICAO, *PBN Manual*, *supra* note 23 at I-(xx); *Annex 11*, *supra* note 23 at 1-10.
[25] ICAO, "Safety: ICAO Performance Based Navigation Programme", online: ICAO <www.icao.int/safety/pbn/Pages/default.aspx> [ICAO, "Safety: PBN"].
[26] RNAV is "[a] method of navigation which permits aircraft operation on any desired flight path within the coverage of station-referenced navigation aids or within the limits of the capability of self-contained aids, or a combination of these." ICAO, *PBN Manual*, *supra* note 23 at I-(xix).
[27] RNP system is "[a]n area navigation system which supports on-board performance monitoring and alerting." *Ibid* at I-(xx).
[28] ICAO, "Safety: PBN", *supra* note 25. "RNAV and RNP systems are fundamentally similar. The key difference between them is the requirement for on-board performance monitoring and alerting. A navigation specification that includes a requirement for on-board navigation performance monitoring and alerting is referred to as an RNP specification. One not having such requirements is referred to as an RNAV specification." ICAO, *PBN Manual*, *supra* note 23 at I-(v).
[29] ICAO, *PBN Manual*, *supra* note 23 at I-(iii).
[30] *Ibid*.
[31] *Ibid*.
[32] See e.g. Shane Sumner, "Regional Forum: "Creating More Lift": ICAO Asia/Pacific Region" (Presentation delivered at the ICAO Performance-based Navigation (PBN) Symposium and Workshops, Montreal, 16 – 19 October 2012) [unpublished]; Alan Stealey, Address (Presentation delivered at the ICAO Performance-based Navigation (PBN) Symposium and Workshops, Montreal, 16 – 19 October 2012) [unpublished]; Carlos Cirilo, "PBN: Global Implementation Situation" (Presentation delivered at the ICAO Performance-based Navigation (PBN) Symposium and Workshops, Montreal, 16 – 19 October 2012) [unpublished].
[33] See e.g. Cirilo, *supra* note 32; Stealey, *supra* note 32; Michael S Lewis, "PBN – A Commercial Data and Service Provider Perspective – Are we ready to go?" (Presentation delivered at the ICAO Performance-based Navigation (PBN) Symposium and Workshops, Montreal, 16 – 19 October 2012) [unpublished].
[34] ICAO, *PBN Manual*, *supra* note 23.
[35] See e.g. Sumner, *supra* note 32.
[36] See e.g. Stealey, *supra* note 32; Cirilo, *supra* note 32.
[37] See e.g. Benoit Roturier, "RNP Approaches" (Presentation delivered at the ICAO Performance-based

for PBN;[38] lack of PBN procedures at some airports;[39] and difficulty of PBN-capable aircraft to fit in with non-PBN capable aircraft on same flight tracks.[40] Those difficulties need to be overcome to obtain full environmental benefit from the application of PBN, since ASBU cannot be implemented without PBN thus frustrating the ICAO's GANP.

In line with the ICAO, States, groups of States, and regional organizations are also working to improve ATM system. For example, in the United States [US], the Federal Aviation Administration [FAA] is developing NextGen, which is an upgrade from World War II era technology to satellite-based technology.[41] The European Union [EU], in an initiative to improve its ATM system, has established the Single European Sky [SES] initiative backed by the Single European Sky ATM Research [SESAR] Programme. The SES is an "initiative of organising airspace into functional blocks, according to traffic flows rather than to national borders".[42] Another laudable initiative is Asia & South Pacific Initiative to Reduce Emissions [ASPIRE] created by the Airservices Australia, the Airways New Zealand and the FAA,[43] and later joined by the Japan Civil Aviation Bureau, the Civil Aviation Authority of Singapore and AeroThai.[44] ASPIRE "is designed to lessen the environmental impact of aviation across Asia and the South Pacific with each partner to focus on developing ideas that contribute to improved environmental standards and operational procedures in aviation".[45]

III. LEGAL BARRIERS TO ACHIEVING SUSTAINABLE FLIGHT MANAGEMENT

The concept of State sovereignty, the undisputed customary international law principle enshrined in the *Chicago Convention*,[46] is a stumbling block to achieving sustainable flight management. Article 1 of the *Chicago Convention* provides that each State has "complete and exclusive sovereignty over the airspace above its territory".[47]

Navigation (PBN) Symposium and Workshops, Montreal, 16 – 19 October 2012) [unpublished].

[38] See e.g. Angela Gittens, "Airports and PBN, will it make a difference?" (Presentation delivered at the ICAO Performance-based Navigation (PBN) Symposium and Workshops, Montreal, 16 – 19 October 2012) [unpublished]; Pierre Alibert Marchi, "PBN and Regional Aircraft: Legacy, turboprop and regional issues" (Presentation delivered at the ICAO Performance-based Navigation (PBN) Symposium and Workshops, Montreal, 16 – 19 October 2012) [unpublished].

[39] See e.g. Gittens, *supra* note 38.

[40] See e.g. *ibid*.

[41] See US, Federal Aviation Administration, "NextGen", online: FAA <www.faa.gov/nextgen/slides/?slide=1>.

[42] EUROCONTROL, "Single European Sky", online: EUROCONTROL <www.eurocontrol.int/dossiers/single-european-sky>.

[43] See ASPIRE – Asia and Pacific Initiative to Reduce Emissions, "About ASPIRE", online: ASPIRE <www.aspire-green.com/about/default.asp>.

[44] *Ibid*.

[45] *Ibid*.

[46] See *Convention on International Civil Aviation*, 7 December 1944, 15 UNTS 295, Can TS 1944 No 36, ICAO Doc 7300/9, art 1 [*Chicago Convention*]. See e.g. *Air Transport Association of America and others v Secretary of State for Energy and Climate Change*, C-366/10, [2011] ECR I-13833 at I-13885 – I-13886; Ian Brownlie, Principles of Public International Law, 7th ed (New York: Oxford University Press, 2008) at 105.

[47] *Chicago Convention*, *supra* note 46, art 1.

This principle is responsible for indirect or less-than-direct routings, and States' resistance to cross-border air navigation service [ANS] provisions.[48]

Due to this principle, States are reluctant to delegate their ANS provision to other State or any entity therein. Lack of cross-border ANS provisions is causing more GHG emissions in the EU. The expanding GHG emissions caused by the well-known inefficiencies of the EU air traffic control system are intimidating.[49] For example, the pilot of LOT flight 434 from Madrid to Warsaw[50] will speak to 45 different air traffic controllers during the 3:35 flight,[51] or a different air traffic controller every 4.7 minutes![52]

According to Article 68 of the *Chicago Convention*, Contracting States to the Convention possess the right to designate the international air routes and airports in their territory,[53] and, according to Annex 11, these States must determine, *inter alia*, those portions of the airspace over their territories where air traffic services will be provided.[54] In recognition of State sovereignty, Article 9 of the Convention authorizes Contracting States to uniformly restrict or prohibit national and foreign aircraft engaged in international scheduled airline services from flying over certain areas of its territory for military or public safety reasons.[55] Aircraft entering the restricted or prohibited areas may be required to promptly land at some designated airport within the State's territory.[56] Commercial flights must avoid those restricted or prohibited airspace to avoid forced landing and, hence, these flights often have to choose indirect or less-than-direct routings.[57] During the Cold War, "the need to avoid Russian restricted airspace resulted in indirect routings that made non-stop U.S.-China services commercially unviable and required en-route stops in Anchorage or Japan".[58]

In order to reduce fuel consumption, aircraft should fly more direct routings, and more cross-border ANS provisions are required.[59] In this regard, States should either

[48] See also P Paul Fitzgerald, "Europe's Emissions Trading System: Questioning its Raison d'Etre" (2011) 10 Issues in Aviation L & Pol'y 189 at 216 (HeinOnline).

[49] Most airlines that service EU airports would like to see a revamp of Eurocontrol, the European Air Traffic Control system. See James Andrew Lewis & Anne Witkowsky, *Transforming Air Traffic Management Beyond Evolution: A Report of the CSIS Technology and Public Policy Program* (Washington, DC: Center for Strategic and International Studies, 2004) at 11.

[50] The flying distance between them is 2,270 km or 1,410 miles.

[51] Helga Kleisny, "European airspace – acting as one" (2 December 2010), online: EuroScientist, <euroscientist.com/2010/12/european-airspace-%E2%80%93-acting-as-one/>.

[52] This is the 215 minutes duration of the flight divided by the number of Air Traffic Controllers contacted.

[53] *Chicago Convention*, *supra* note 46, art 68.

[54] *Annex 11*, *supra* note 23 at 2-1.

[55] *Chicago Convention*, *supra* note 46, art 9(a).

[56] *Ibid*, art 9(c).

[57] See also Fitzgerald, *supra* note 48 at 217.

[58] *Ibid*.

[59] See e.g. Fitzgerald, *supra* note 48 at 216; Assad Kotaite, "Is there a Lessening of State Sovereignty or a Real will to Co-operate globally?" (1995) 20 Air & Space L 288 at 291 (Kluwer Law Online). See also Terry Barker et al, "Technical Summary" in Bert Metz et al, eds, *Climate Change 2007: Mitigation: Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (New York: Cambridge University Press, 2007) 25 at 51.

reduce the size of, or grant civil aircraft additional access to, those restricted areas or prohibited airspace at least during peak hours.[60] Additionally, States should opt for more cross-border ANS provision. Greater cooperation and coordination between civil and military authorities, and between States, "which is still based largely on notions of sovereignty",[61] are required.[62] States need to recognize that the concept of State sovereignty is an evolving concept, influenced by prevailing factors that are crucial for the society at a given time and circumstance. Environmental impacts of aviation are a prevailing concern now and, hence, may influence the notion of sovereignty of States over their airspace.

IV. THE EVOLUTION OF THE CONCEPT OF STATE SOVEREIGNTY

The French philosopher Jean Bodin introduced the concept of State sovereignty to the Western world.[63] State sovereignty essentially means the right of a State within its territory to exercise its functions to the exclusion of other States.[64] This normative perspective of exclusivity of the notion of sovereignty commenced to turn to an approach accommodating globalization and democratization in the 1960s and 1970s, as viewed by legal scholars,[65] due to "a shift in focus of international law, later fuelled by the end of the Cold War".[66] Starke aptly asserts that "it is probably more accurate today to say that the sovereignty of a state means the *residuum* of power which it possesses within the confines laid down by international law."[67] Back in 1981, Professor Matte predicted that the notion of sovereignty "will be overtaken by…a new international legal order",[68] and

[60] See also Lee Merry Brown, "Operations: Impact of Operational Changes on Global Emission Levels — Findings of the Operational Goals Group" in ICAO, *ICAO Environmental Report 2013: Aviation and Climate Change* (Montreal: ICAO, 2013) 119 at 121.
[61] Aldo Armando Cocca, "The Chicago Convention and Technological Development in Air and Space" (1994) 19:2 Ann Air & Sp L 135 at 148.
[62] See González, *supra* note 2 at 3.
[63] See Jean Bodin, *Les six livres de la repvbliqve de I. Bodin Angeuin. A Monseignevr dv Favr, Seigneur de Pibrac, conseiller du Roy en son conseil priué* (Paris: Iacques du Puys, 1576). See also Ruwantissa Abeyratne, *Convention on International Civil Aviation: A Commentary* (London: Springer International, 2014) at 16; Stephen M Shrewsbury, "September 11th and the Single European Sky: Developing Concepts of Airspace Sovereignty" (2003) 68:1 J Air L & Com 115 at 117 (HeinOnline).
[64] See generally Bodin, *supra* note 63 at 125; JG Starke, *Introduction to International Law*, 10th ed (London: Butterworths, 1989) at 157; Sharon A Williams & Armand LC de Mestral, *An Introduction to International Law: Chiefly as Interpreted and Applied in Canada*, 2nd ed (Toronto: Butterworths, 1987) at 108; Abeyratne, *supra* note 63 at 17. "The competence of states in respect of their territory is usually described in terms of sovereignty[.]… The normal complement of state rights, the typical case of legal competence, is described commonly as 'sovereignty'[.]… In brief, 'sovereignty' is legal shorthand for legal personality of a certain kind, that of statehood". Brownlie, *supra* note 46 at 105–06.
[65] See Francis P Schubert, "The Creation of a Single European Sky: The Shrinking Concept of Sovereignty" (2000) 25 Ann Air & Sp L 239 at 246.
[66] Abeyratne, *supra* note 63 at 17.
[67] Starke, *supra* note 64 at 100 [emphasis in original]. Interestingly, Kelsen advises "not to use the *ambiguous* term "sovereignty" at all in relation to the state." Hans Kelsen, *Principles of International Law* (New York: Rinehart, 1952) at 113 [emphasis added].
[68] Nicolas Mateesco Matte, *Treatise on Air-Aeronautical Law* (Montreal: ICASL, McGill University, 1981) at 79.

"will evolve so that the order of importance, such as is presently drawn from conventions on aerial navigation will be changed, making State sovereignty conditional upon the freedom of international movement."[69] Matte's predictions are coming true.

Two decades later, it was noted that "changes in the understanding and the characterizations of airspace sovereignty have marched on in steady fashion",[70] and "the move towards a different kind of airspace sovereignty regime will continue as economic and other forces drive change".[71] Judge Manfred Lachs argues that "sovereignty may be curtailed and that the maxim *cujus est solum ejus usque ad coelum*, from which the concept of State sovereignty over airspace flows, is not absolute nor determinative".[72] In reality, "a thorough reading of the Chicago Convention would reveal that the Convention does not authorize unrestricted freedom to contracting States."[73] This is also apparent from Article 9 that, although sanctioning States the right to establish restricted or prohibited zone, requires, among other things, that "[s]uch prohibited areas shall be of reasonable extent and location so as not to interfere unnecessarily with air navigation".[74] Furthermore, according to Article 22, Contracting States agree "to adopt all practicable measures, through the issuance of special regulations or otherwise, to facilitate and expedite navigation by aircraft between the territories of contracting States, and to prevent unnecessary delays to aircraft, crews, passengers and cargo".[75]

V. PROTECTION OF THE ENVIRONMENT: NEW FORCE IN THE EVOLUTION PROCESS

Environmental protection is one of the new forces and the concern over protection of the environment can, and should, drive change in the understanding and characterizations of sovereignty of airspace.[76] The issue of air pollution has already circumscribed the exercise of State sovereignty as appears from the famous *Trail Smelter* arbitration.[77] The arbitration gave birth to the established customary international law principle according to which States have sovereign right to exploit their own resources and simultaneous responsibility to ensure that activities within their jurisdiction or

---

[69] *Ibid*.
[70] Shrewsbury, *supra* note 63 at 116.
[71] *Ibid*. See also Schubert, *supra* note 65 at 259.
[72] Cocca, *supra* note 61 at 148 [emphasis in original][footnote omitted].
[73] Md Tanveer Ahmad, "Achieving Global Safety in Civil Aviation: A Critical Analysis of Contemporary Safety Oversight Mechanisms" (2012) 37 Ann Air & Sp L 81 at 115. See also Cocca, *supra* note 61 at 145; Paul Stephen Dempsey, *Public International Air Law* (Montreal: McGill University, Institute and Center for Research in Air & Space Law, 2008) at 44.
[74] *Chicago Convention*, *supra* note 46, art 9(a).
[75] *Ibid*, art 22.
[76] A similar argument concerning right of overflight is made by Jae Woon Lee. Lee argues that "global environmental concern… demands universal freedom of overflight as an effective measure to mitigate climate change." Jae Woon Lee, "Revisiting Freedom of Overflight in International Air Law: Minimum Multilateralism in International Air Transport" (2013) 38:4/5 Air & Space L 351 at 367 (Kluwer Law Online).
[77] *Trail Smelter Arbitration (United States v Canada)* (1938 & 1941) 3 RIAA 1905 (Arbitrators: Charles Warren, Robert AE Greenshields, Jan Frans Hostie).

control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.[78] This principle is also recognized under various international legal instruments,[79] and "already forms the basis for"[80] the *Long-Range Transboundary Air Pollution Convention*,[81] the *Vienna Convention*,[82] and the *United Nations Convention on Climate Change*.[83] Concern over protection of the environment will and has already commenced to bring a new way of exercising national sovereignty – "an *evolution* in the *exercise* of national sovereignty"[84] – that will accommodate environmental concerns.[85] The new understanding and characterization of airspace sovereignty, which should not negatively affect the substance of State sovereignty, is required to evade all the limitations that impede necessary operational improvements.[86]

Call for a new understanding of and a new way of exercising sovereignty to accelerate operational improvement is coming from the aviation industry as well. Roberto Kobeh González emphasized the need to "consider sovereignty within the context of the global, harmonized air navigation framework",[87] and stated that "[s]overeignty must not be an obstacle to progress in making institutional the required changes for a more efficient management of the global air navigation system."[88] CANSO, "the global voice of air navigation service providers (ANSPs) worldwide",[89] argues that, since "a global, seamless, and performance-based approach to management of airspace,

---

[78] See e.g. Michel Adam, "ICAO Assembly's Resolution on Climate Change: A 'Historic' Agreement?" (2011) 36:1 Air & Space L 23 at 28 (Kluwer Law Online).

[79] *Declaration of the United Nations Conference on the Human Environment*, 16 June 1972, 11 ILM 1416, Principle 21, online: UNEP <www.unep.org/Documents.multilingual/Default.asp?DocumentID=97&ArticleID=1503>; *Rio Declaration on Environment and Development*, 14 June 1992, 31 ILM 874, Principle 2, online: UNEP <www.unep.org/Documents.Multilingual/Default.asp?documentid=78&articleid=1163>.

[80] Patricia Birnie, Alan Boyle & Catherine Redgwell, *International Law and the Environment*, 3rd ed (New York: Oxford University Press, 2009) at 339.

[81] *Convention on Long-Range Transboundary Air Pollution*, 13 November 1979, 1302 UNTS 217, Can TS 1983 No 34 (entered into force 16 March 1983).

[82] *Vienna Convention for the Protection of the Ozone Layer*, 22 March 1985, 1513 UNTS 293, Can TS 1988 No 23 (entered into force 22 September 1988).

[83] *United Nations Framework Convention on Climate Change*, 9 May 1992, 1771 UNTS 107, Can TS 1994 No 7 (entered into force 21 March 1994).

[84] Peter Haanappel, "The Transformation of Sovereignty in the Air" (1995) 20:6 Air & Space L 311 at 317 (Kluwer Law Online) [emphasis in original].

[85] See e.g. Schubert, *supra* note 65 at 248, 259; Civil Air Navigation Services Organisation (CANSO), *AIR SPACE SOVEREIGNTY*, ICAO Worldwide Air Transport Conference (ATCONF), 6th Mtg, Agenda Items 1, 1.1, Working Paper, Doc ATConf/6-WP/80 (4 March 2013), online: ICAO <www.icao.int/Meetings/atconf6/Documents/WorkingPapers/ATConf.6.WP.080.1.en.pdf> [CANSO, *AIR SPACE*].

[86] See Schubert, *supra* note 65 at 259; Cocca, *supra* note 61 at 148.

[87] González, *supra* note 2 at 3.

[88] *Ibid* at 4.

[89] CANSO – Civil Air Navigation Services Organisation, "About CANSO", online: CANSO <www.canso.org/about-canso>. "CANSO Members support over 85% of world air traffic. Members share information and develop new policies, with the ultimate aim of improving air navigation services (ANS) on the ground and in the air. CANSO represents its Members' views in major regulatory and industry forums, including at ICAO, where it has official Observer status. CANSO has an extensive network of Associate Members drawn from across the aviation industry." *Ibid*.

rather than one based on national borders",[90] is required for air navigation services, "all stakeholders need a fully developed understanding of the meaning of national sovereignty consistent with present and future political, economic and social realities".[91]

VI. EFFORTS TO ENSURE SUSTAINABLE FLIGHT MANAGEMENT FROM A STATE OR GROUP OF STATES

The EU has taken various initiatives to ensure sustainable flight management that are facilitating a new understanding of sovereignty of airspace within the European airspace. Among those initiatives, the SES backed by the SESAR Programme is a laudable step.[92] The EU has shown that "the basis of the Chicago Convention's complete and exclusive sovereignty can be overcome to the benefit of all players".[93] The creation of the SES exhibits that factors, which were and will continue to be primarily economic,[94] distinct from State interests in maintaining sovereignty over airspace are gradually "drawing states away from the Chicago Convention's absolute sovereignty formula".[95]

With regard to prohibited area, an admirable step has been taken by NAV Canada, a corporatized entity "that owns and operates Canada's civil air navigation service".[96] To ensure access of civil aircraft to a segment of airspace in eastern Quebec, which was historically reserved as a military flying area, NAV Canada finalized an arrangement with the Department of National Defence, 3 Wing at Bagotville in Spring 2012 under which civil aircraft would have access to that airspace when not required for military operations.[97] If required for military operations, 3 Wing will secure the airspace by NOTAM.[98] As a consequence of this arrangement, "on most days what had been approximately a six minute route diversion can be avoided, saving an estimated $2 million in fuel costs per year".[99]

---

90 CANSO, *AIR SPACE*, *supra* note 85 at 1.
91 *Ibid*.
92 However, this is not the first time that the EU ignored national borders for the advancement of aviation. "[R]egulation has been set at the Community level in the field of competition law, slot allocation, computerized reservation systems, harmonisation of safety rules, common rules for personnel licenses, aircraft noise, etc." Karl-Heinz Böckstiegel & Paul Michael Krämer, "Filling in the Gaps of the Chicago Convention: Main Features of the New Legal Framework for Aviation in the European Community" (1994) 19:1 Ann Air & Sp L 127 at 133.
93 *Ibid* at 138.
94 See Shrewsbury, *supra* note 63 at 150.
95 *Ibid*.
96 NAV Canada, "About Us", online: NAV Canada, <www.navcanada.ca/en/about-us/Pages/default.aspx>.
97 NAV Canada, *CIFER 2013: Collaborative Initiatives for Emissions Reductions: Forward thinking for a smaller footprint* (2013) at 7, online: NAV Canada <www.navcanada.ca/EN/media/Publications/CIFER-Report-2013-EN.pdf>.
98 *Ibid*. "A NOTAM is a notice distributed by means of telecommunications containing information concerning the establishment, conditions or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations." NAV Canada, *Canadian NOTAM Procedures Manual*, P-NOF-101 Version 11 at 1, online: NAV Canada <www.navcanada.ca/EN/media/Publications/NOTAM-Manual-EN.pdf>.
99 *Ibid*.

Concerning cross-border ANS provisions, there exist a good number of examples in all regions of the world.[100] There is a mutual delegation of ANS authority between the US and Canada; "Tonga and Samoa have a delegation to New Zealand; there are various delegations in Europe from and to Finland, France, Norway, Sweden and Switzerland".[101] It should be noted that not only that all these provisions have been successfully operating since their inception but also no question about the legal basis for these delegations ever arose.[102]

VII. CONCLUSION

In 2008, Emirates Airlines negotiated with the governmental agencies in the United Arab Emirates, Russia, Iceland, Canada, and the US to secure access to an "over the pole" route Dubai and San Francisco.[103] As a result of the negotiations, the non-stop flight operates over a route that is not significantly longer than the 8,090 miles (13,000 kilometers) that separate the two cities and avoids congested airspace over the EU. Over the flight's nearly 16-hour duration,[104] pilots will talk to fewer than a dozen air traffic controllers. Were the flight to cover a similar distance in EU skies or territories of small countries with similar ATM policies, the route would not be as direct and non-stop service might not be possible.[105] Undoubtedly, its GHG footprint would be bigger. Indeed, Emirates' negotiations were predicated upon the concept that PBN and a specific over the pole route would allow the fuel savings that would make the flight viable, and consequently result in reduced aviation emissions. Emirates was able to succeed because three of the countries with whom it negotiated control most of the territory that the flight will overfly.

Emirates' negotiations were clearly in furtherance of a commercial objective but they illustrate the potential of air traffic management to contribute to reducing aviation emissions. Where some observers might discount ATM's potential, Emirates clearly understood that even if one uses a very environmentally friendly plane (the Boeing 777-200 LR) and adopts environmentally conscious practices like using electrical power at the

---

[100] See CANSO, AIR SPACE, *supra* note 85 at 2. See generally Niels Van Antwerpen, *Cross Border Provision of Air Navigation Services with Specific Reference to Europe: Safeguarding Transparent Lines of Responsibility and Liability* (Austin: Wolters Kluwer Law & Business, 2008); Skybrary, "Delegation of Air Traffic Services", online: Skybrary <www.skybrary.aero/index.php/Delegation_of_Air_Traffic_Services>.

[101] CANSO, *AIR SPACE*, *supra* note 85 at 2.

[102] See *ibid*.

[103] See Emirates, News, "Emirates Airline Launches San Francisco Service With World's Longest Green Flight Trial" (10 December 2008), online: Emirates <www.emirates.com/english/about/news/news_detail.aspx?article=389973> [Emirates, News, "Emirates Airline"].

[104] Ibid.

[105] See *supra* notes 50, 51, 52, and accompanying text.

gate, taxiing on one engine and using reduced thrust on landing, efficient ATM is still a precondition to an energy-efficient, sustainable Dubai-San Francisco flight. Absent these initiatives, Emirates argues that each flight would consume an additional 2,000 gallons of fuel, and produce 30,000 more pounds of carbon emissions than would otherwise be the case.[106]

Without the necessary efficiency in ATM system, Emirates' flight might not have been viable. Emirates operates worldwide, it has considerable expertise in operating long distance flights, and it has a very modern fuel-efficient fleet. That it saw the need to negotiate over-flight rights with Canada, Iceland, Russia, and the US confirms its recognition of the potential of ATM to help reduce emissions from aviation. Emirates is clearly the first to negotiate such a route with so many disparate countries but the precedent has been set, and other carriers such as Etihad, Qatar Airways and Turkish Airlines will undoubtedly follow suit. It is hoped that their engagement, and perhaps even that of airlines from other regions of the world, will underscore ATM's potential in the campaign to reduce emissions from aviation and incite ATM to find ways to further reduce aviation emissions on routes long and short all over the world.

[106] Emirates, News, "Emirates Airline", *supra* note 103.

About Centre for Research in Air and Space Law

The McGill University Centre for Research in Air and Space Law is the principal research and educational outreach arm of McGill's Institute of Air & Space Law, established in 1951. The Institute provides the core degree-granting educational programme, while the Centre produces research, publishes books and other literature, and offers educational products around the world.

Since its inception in 1976, the Centre has published a number of monographic studies, proceedings of symposia, reports and books, and held numerous workshops, seminars and conferences in Montreal and various other international venues.

McGill

Centre for Research in Air and Space Law
Centre de recherche en droit aérien et spatial
McGill University
3690 Peel
H3A 1W9
Quebec, Canada
514 398 5095

For more information, please visit:
Institute of Air and Space Law
https://www.mcgill.ca/iasl/

Centre for Research in Air and Space Law
https://www.mcgill.ca/iasl/centre