Aviation, Carbon, and the Clean Air Act

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INTRODUCTION

Aircraft emit two to three percent of total global greenhouse gas ("GHG") emissions per year.[1] This amount is small compared with emissions from other sectors, such as ground transportation and electric power,[2] but it is by no means trivial. Moreover, the amount is growing quickly, with aviation emissions projected to increase between 290 percent and 667 percent by 2050.[3] There is also evidence that high-altitude aircraft emissions contribute disproportionately to climate change.[4] Until recently, however, the global aviation sector has faced no limits on its emissions.

Meanwhile, a series of recent events has left the U.S. Environmental Protection Agency ("EPA" or "Agency") as the only realistic venue for federal-level climate policy in the United States, primarily via its powers under the Clean Air Act ("CAA" or "Act").[5] Since 2009, the EPA has embarked on a regulatory program using the tools available under the CAA to regulate GHG emissions from a variety of sources, including road vehicles, certain power plants, and industrial facilities.[6]

The CAA also includes provisions granting the EPA authority to regulate air pollution from aircraft. The Agency has used this authority in the past to regulate other pollutants from aircraft, though since 1982 it has closely followed standards set by the International Civil Aviation

1. INT'L CIVIL AVIATION ORG., ICAO ENVIRONMENTAL REPORT 2010 31 (2010), *available at* http://www.icao.int/environmental-protection/Documents/Publications/ENV_Report_2010.pdf; *see also* JAMES E. MCCARTHY, CONG. RESEARCH SERV., CARS, TRUCKS, AND CLIMATE: EPA REGULATION OF GREENHOUSE GASES FROM MOBILE SOURCES 13 (2010), *available at* http://www.nationalaglawcenter.org/assets/crs/R40506.pdf.

2. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, FOURTH ASSESSMENT REPORT fig. 2.1(a) (2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4_wg1_full_report.pdf.

3. This percent increase projection is relative to a 2006 baseline. *See* Artur Runge-Metzger, Int'l & Climate Strategy European Comm'n, Aviation and Emissions Trading: ICAO Council Briefing 7 (Sept. 29, 2011), http://ec.europa.eu/clima/policies/transport/aviation/docs/presentation_icao_en.pdf.

4. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-09-554, AVIATION AND CLIMATE CHANGE: AVIATION EMISSIONS EXPECTED TO GROW, BUT TECHNOLOGICAL AND OPERATIONAL IMPROVEMENTS AND GOVERNMENT POLICIES CAN HELP CONTROL EMISSIONS 13 (2009), *available at* http://www.gao.gov/products/GAO-09-554 (noting that stratospheric nitrogen oxide emissions have a greater effect on climate than those at ground level, and that contrail and cloud formation by aircraft appear to have a warming effect, though this is not as well understood).

5. Clean Air Act, 42 U.S.C. §§ 7401–7700 (2006).

6. *See* Nathan Richardson et al., *Greenhouse Gas Regulation under the Clean Air Act: Structure, Effects, and Implications of a Knowable Pathway*, 41 ENVTL. L. REP. 10,098, 10,098–10,101 (2011).

Organization ("ICAO"). The ICAO has not issued GHG standards and appears unlikely to do so any time soon.[7] The EPA has so far shown relatively little desire to use its CAA authority to regulate GHGs independently of the ICAO—despite petitions to do so[8] and an ensuing lawsuit.[9]

GHG emissions from aviation have become a contentious international issue. In 2008, the E.U. broke with the ICAO, deciding to independently regulate aviation GHG emissions by requiring airlines to participate in its cap-and-trade system, the Emissions Trading System ("ETS"), starting in 2012.[10] Controversially, the E.U. policy requires both foreign and domestic airlines to comply, and requires purchase of ETS allowances sufficient to cover the entire flight path of any journey beginning or ending at an E.U. airport.[11] The U.S. and many other countries strongly objected to this decision, with the U.S. House of Representatives—in a rare parallel with Chinese policy[12]—passing a bill that would make it illegal for U.S. carriers to comply.[13] The Senate passed related legislation that allows the Secretary of Transportation to prohibit airlines from complying with the E.U. scheme if it is in the public interest to do so.[14] This legislation was passed by the House and signed by President Obama in late 2012.[15]

7. *See* Kirsty McGregor, *Attention focuses on ICAO as emission trading row rumbles on*, FLIGHTGLOBAL (Apr. 30, 2012, 10:00 AM), http://www.flightglobal.com/news/articles/in-focus-attention-focuses-on-icao-as-emission-trading-row-rumbles-on-371009/. The E.U.'s decision to suspend its new policy may be some evidence that the ICAO process has begun to move more quickly.

8. *See generally* State of California et al., Petition for Rule Making Seeking the Regulation of Greenhouse Gas Emissions from Aircraft (Dec. 4 2007) [hereinafter State Petition], http://ag.ca.gov/cms_attachments/press/pdfs/n1501_aircraft_petition_final.pdf; *see also* Friends of the Earth et al., Petition for Rulemaking under the Clean Air Act to Reduce the Emission of Air Pollutants from Aircraft That Contribute to Global Climate Change (Dec. 31, 2007) [hereinafter Environmental Petition], http://docs.nrdc.org/globalwarming/files /glo_07123101a.pdf.

9. Ctr. for Biological Diversity v. EPA, 794 F. Supp. 2d 151, 152–53 (D.D.C. 2011).

10. Council Directive 2008/101, 2009 O.J. (L 8) 3 (EC), [hereinafter E.U. Directive], *available at* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:008:0003 :0003:EN:PDF.

11. *Id.* at 5.

12. Mavis Toh, *China Bans Airlines from Complying with EU ETS*, FLIGHTGLOBAL (Feb. 6, 2012, 3:04 AM), http://www.flightglobal.com/news/articles/china-bans-airlines-from-complying-with-eu-ets-367796/.

13. European Union Emissions Trading Scheme Prohibition Act of 2011, H.R. 2594, 112th Cong. (2011).

14. European Union Emissions Trading Scheme Prohibition Act of 2011, S. 1956, 112th Cong. (2012) (enacted).

15. *Id.* Note that this legislation does not affect the regulatory authority discussed in this Article. Although the law allows the executive to block participation in the E.U. scheme, *see id.,* U.S.

A 2011 ruling by the European Court of Justice upheld the E.U. policy, including its extraterritorial elements.[16] This dispute shows no sign of quick resolution, and legal action under international treaty or trade law, diplomatic maneuvering, and further domestic action are likely. In late 2012, the E.U. announced that it would suspend implementation of the policy for a year, apparently in response to international criticism.[17] But the policy still remains E.U. law and is set to be implemented in 2014 unless new, international emissions regulations are implemented before then.[18]

Fortunately, the E.U. decision contains an escape clause: carriers from countries that have "equivalent" aviation GHG emissions policies can be exempted from the ETS,[19] the U.S. can craft an aviation emissions policy on its own terms and might avoid the burden of E.U. regulation. However, the current political climate in Congress may make new legislation imposing GHG limits unrealistic.[20] Therefore, if the U.S. is to adopt such a policy in the near future, the CAA appears to be the only plausible vehicle.

Can CAA regulation achieve aviation emissions regulations significant enough to establish equivalency with E.U. policy while remaining cost-effective and politically acceptable? Fully answering this question requires judgments about the range of options realistically available to the EPA in the current U.S. political environment and about the range of policies the E.U. would consider "equivalent"—judgments that would be, at best, informed guesses. But the core part of the question is legal. Specifically, what tools are available to the Agency under the CAA to regulate aviation emissions, and how might they be used for GHGs? This Article is an attempt to answer that core legal question.

regulation does not in any way rely on such participation—in fact, domestic regulation is an *alternative* to participation in the E.U. system.

16. Case C-366/10, Air Transp. Ass'n of Am. v. Sec'y of State for Energy & Climate Change (Dec. 21, 2011), http://curia.europa.eu/juris/document/document.jsf?text=&docid=117193&pageIndex=0&doclang=en&mode=lst&dir=&occ=first&part=1&cid=402424.

17. James Kanter, *E.U. Postpones Charges for Airline Emissions*, N.Y. TIMES, Nov. 12, 2012, http://www.nytimes.com/2012/11/13/business/global/eu-postpones-charges-for-airline-emissions.html.

18. *Id.*

19. E.U. Directive, *supra* note 10, at 5. The Directive explicitly mentions only other countries' policies limiting emissions from flights to the E.U., but indicates that the E.U. should seek "optimal interaction" with other countries' policies and "avoid double regulation." *Id.* This leaves ample room to exempt any emissions covered by another country's regulatory scheme from the ETS.

20. Brad Plummer, *Why has climate legislation failed? An Interview with Theda Skocpol*, WASH. POST (Jan. 16, 2013, 10:02 AM), http://www.washingtonpost.com/blogs/wonkblog/wp/2013/01/16/why-has-climate-legislation-failed-an-interview-with-theda-skocpol/.

The Agency's powers to address aviation GHGs under the Act have not been thoroughly studied. A few court decisions, EPA documents, and petitions to the Agency have looked at the issue or aspects of it, but none is a comprehensive assessment. One relatively brief scholarly treatment exists,[21] and although it is a useful introduction to many of the relevant issues, much has changed since it was published in 2009. This Article also reaches different conclusions on several points, as noted below.

EPA regulation of aviation GHG emissions under the CAA was the subject of recent litigation.[22] However, that litigation concerned whether the Agency *must* regulate such emissions. This threshold issue is relevant, but both parties to the litigation agree that the EPA has authority to regulate aviation emissions. Moreover, the suit did nothing to clarify *how* the Agency could regulate, whether it chooses to do so or is compelled. It is this latter question that this Article seeks to answer.

In short, the CAA does provide the EPA with substantial authority and flexibility to regulate aviation GHG emissions. Doing so will require the Agency to depart from its traditional use of this authority, but neither the statute nor international law appears to stand in the way. The Act further appears to give the Agency authority to implement smart regulation in the form of performance standards that give compliance flexibility to industry and perhaps allow limited use of market-based mechanisms. Political and administrative challenges remain for the EPA, however.

Part I of this Article frames the CAA and the authority it grants the EPA to regulate aviation emissions. Part II briefly summarizes the EPA's efforts to regulate GHGs using tools available under the Act. Part III and V tie aviation, GHGs, and the CAA together—the former discussing the EPA's tentative moves to date and the surrounding petitions and litigation, and the latter exploring the extent of the EPA's authority to regulate. Part V reviews possible interactions with international law, and Part VI links the EPA's regulatory authority to the current policy context driven by recent E.U. action and international responses.

21. *See generally* Daniel H. Conrad, *Into the Wild Green Yonder: Applying the Clean Air Act to Regulate Emissions of Greenhouse Gases from Aircraft*, 34 N.C. J. INT'L L. & COM. REG. 919 (2009).

22. Ctr. for Biological Diversity v. EPA, 794 F. Supp. 2d 151, 152–53 (D.D.C. 2011).

I. THE CLEAN AIR ACT AND AVIATION

The Clean Air Act grants the EPA expansive authority to regulate aviation emissions—specifically, to regulate aircraft engines.[23] The EPA has exercised this authority for a number of pollutants since the 1970s, but over the past thirty years it has always modeled its regulations under this title after international standards.[24] In part due to this link, EPA regulations have not generally forced engine manufacturers to significantly change their products. Nevertheless, the EPA's regulatory track record under the Act is relevant, as it may indicate the EPA's own judgment about the extent of its authority. This Part gives a broad overview of EPA authority over aviation under the CAA and the Agency's regulatory experience, laying the foundation for later discussion of how and whether the CAA can be brought to bear on aviation GHG emissions.

A. Aviation Provisions in the Act

Provisions granting authority to regulate aviation emissions date to the 1970 enactment of the core of the modern CAA. Title II of the statute governs emissions from mobile sources. While the vast majority of Title II is devoted to fuel and emissions standards for surface vehicles under Part A,[25] Part B is specifically aimed at aviation emissions.[26] Part B grants the EPA broad powers to set "emissions standards" for aircraft engines.[27] The Agency, however, has used these powers only infrequently and in limited fashion.

Part B is quite short—only about a page long—and its substantive provisions are even shorter. A single paragraph, Section 231(a)(2)(A), is the source of the Agency's authority:

> The Administrator shall, from time to time, issue proposed emissions standards applicable to the emission of any air pollutant from any class or classes of aircraft engines which in his judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.[28]

23. Clean Air Act §§ 231–34, 42 U.S.C. §§ 7571–74 (2006).

24. ARNOLD W. REITZE, AIR POLLUTION CONTROL LAW: COMPLIANCE AND ENFORCEMENT 316 (2001).

25. Clean Air Act §§ 202–19 ("Motor Vehicle Emission and Fuel Standards").

26. *Id.* §§ 231–34.

27. *Id.*

28. *Id.* § 231(a)(2)(A).

Much of the remainder of Part B deals with procedural issues, such as a requirement that the EPA consult with the Federal Aviation Administration ("FAA") in issuing standards.[29] The only substantive limitation imposed is that standards may not be changed so as to significantly increase noise or decrease safety.[30] Part B also includes a preemption clause prohibiting states from adopting independent aircraft emissions standards.[31]

The core of Part B is similar to provisions contained elsewhere in the CAA that apply to other sources. In particular, its language is nearly identical to that found in the core Section of Title II, Part A (Section 202).[32] The corresponding sections in both Parts require the Agency to determine whether a given type of air pollution "endanger[s] public health or welfare" and, if so, whether emissions from the class of sources in question "causes, or contributes to" that pollution.[33] These determinations, respectively, are the "endangerment" and "cause or contribute" findings. Positive endangerment and cause or contribute findings are the prerequisites for regulation, but they also compel the Agency to regulate due to the mandatory language in both Sections.[34]

The similarities between Part A and Part B end there, however. Part A is followed by over forty pages of substantive and procedural text that clarifies, limits, and dictates the regulatory authority given to the Agency over surface vehicles.[35] As noted above, Part B contains almost no such

29. *See id.* § 231(a)(2)(B)(i) (requiring FAA consultation); *id.* § 232 (laying out an enforcement framework); *id.* § 233 (barring state regulation of aviation emissions).

30. *Id.* § 231(a)(2)(B)(ii).

31. *Id.* § 233.

32. *Id.* § 202.

33. *Compare id.* § 202(a)(1) ("The Administrator shall . . . prescribe . . . standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare."), *with id.* § 231(a)(2)(A) ("The Administrator shall . . . issue proposed emission standards applicable to the emission of any air pollutant from any class or classes of aircraft engines which in his judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.").

34. *See id.* § 202(a)(1) ("The Administrator shall . . . prescribe . . . standards"); *id.* § 231(a)(2)(A) ("The Administrator shall . . . issue proposed emission standards").

35. A share of Part A is devoted to provisions granting authority to regulate vehicle fuels. *See id.* § 211. No corresponding provision exists for aircraft fuels under the Act. Instead, the FAA is primarily responsible for regulation of aviation fuels. *See* 49 U.S.C. § 44714 ("The Administrator of the Federal Aviation Administration shall prescribe— (1) standards for the composition or chemical or physical properties of an aircraft fuel or fuel additive to control or eliminate aircraft emissions the Administrator of the Environmental Protection Agency decides under section 231 of the Clean Air Act (42 U.S.C. § 7571) endanger the public health or welfare; and (2) regulations providing for carrying out and enforcing those standards."). FAA authority to regulate these fuels may provide an alternative vehicle for regulation to reduce aviation GHG emissions, perhaps via incentives for biofuels. The scope of this authority is not examined here, however.

explanatory or limiting text.[36] This makes interpretation somewhat more difficult, as the broad grant of authority in Part B, without the structure present in Part A, gives the EPA a relatively blank slate on which to write a regulatory scheme. More specifically, a court reviewing Part B regulations has much less text in which to find an unambiguous limitation on Agency authority that would enable it to rule against the Agency on *Chevron* step one grounds.[37]

Another important difference between aviation regulation under Part B and surface vehicle regulation under Part A is that authority is divided between the EPA and the FAA under Part B. Although the EPA is solely responsible for setting environmental standards for aircraft, the FAA is charged with actual regulation of the industry,[38] and the Act requires the EPA to consult with the FAA when it decides to set standards.[39]

B. History of Clean Air Act Aviation Rules

Though Part B grants the EPA broad authority to regulate aviation emissions, in the past the Agency has exercised this authority conservatively. The Agency first issued aviation emissions standards in 1973 under Title II Part B, imposing limits on smoke, fuel venting, and specified pollutants: hydrocarbons, carbon monoxide, and nitrogen oxides.[40] The standards applied to newly produced engines, future designs, and existing engines, though the stringency of the standards differed between these types.[41] Over the next decade, the Agency revised these standards, in most cases making them less stringent—first by excluding general aviation engines,[42] then by reducing the general

36. *See* Clean Air Act §§ 231–34.

37. *See* Chevron, U.S.A., Inc. v. Natural Res. Def. Council, Inc., 467 U.S. 837, 842–43 (1984). Under *Chevron*, courts will not overturn agency interpretations of statutes if the statutory language is ambiguous (step one) and the agency interpretation is reasonable (step two). In practice, this results in substantial deference to agency interpretations. With less statutory text upon which to base an argument that Congress "unambiguously" intended to limit EPA authority in some specific fashion, it is less likely that a court would reach such a conclusion.

38. Federal Aviation Act of 1958, 85 P.L. 726; 72 Stat. 731, 731 (codified as amended at 49 U.S.C. §§ 40101–49105 (2006)) ("[T]o create a Federal Aviation Agency, to provide for the regulation and promotion of civil aviation in such manner as to best foster its development and safety, and to provide for the safe and efficient use of the airspace by both civil and military aircraft, and for other purposes.").

39. Clean Air Act § 231(a)(2)(B)(i).

40. Emission Standards and Test Procedures for Aircraft, 38 Fed. Reg. 19,088 (July 17, 1973) (regulation no longer in force).

41. *Id.* at 19,089.

42. Control of Air Pollution from Aircraft and Aircraft Engines; Amendments to the Emission Standards for Aircraft Engines, 45 Fed. Reg. 1419-02 (Jan. 7, 1980) (codified at 40 C.F.R. pt. 87).

stringency and scope of the standards in 1982.[43] The EPA loosened emissions standards in order to bring U.S. regulations in line with the ICAO's initial standards.[44]

Since 1982, the EPA standards have closely followed those issued by the ICAO.[45] Nitrogen oxide standards, for example, were revised in 1997[46] and 2005,[47] and the Agency proposed further revisions in 2011.[48] In each case, the EPA revised the regulations to match updated ICAO standards,[49] though in some cases compliance dates were more aggressive than those required internationally.[50] As a result, U.S. aviation emissions regulations today are no more stringent than international standards and do not cover pollutants—such as GHGs—not currently subject to international standards.

Because ICAO standards have not been particularly aggressive and U.S. manufacturers must comply with them to sell engines on the international market, the EPA's Title II Part B standards have not independently resulted in significant changes to engine or aircraft design—in other words, they have not been technology-forcing regulations.[51] Some states and environmental groups have criticized this approach, resulting in a federal suit, *NACAA v. EPA*, 489 F.3d 1221 (D.C. Cir. 2007), with the National Association of Clean Air Agencies ("NACAA") seeking to compel the EPA to issue stricter standards. The D.C. Circuit rejected this challenge, however, holding that Section 231 does not require technology-forcing standards and that the Agency acts within its authority when it follows ICAO standards, even if doing so

43. Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 47 Fed. Reg. 58,462 (Dec. 30, 1982) (codified at 40 C.F.R. pt. 87).

44. REITZE, *supra* note 24, at 316.

45. *See id.* (detailing series of standards adjustments by the EPA to remain consistent with international standards).

46. Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 62 Fed. Reg. 25,356 (May 8, 1997) (codified at 40 C.F.R. pt. 87).

47. Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 70 Fed. Reg. 69,664-01 (Nov. 17, 2005) (codified at 40 C.F.R. pt. 87).

48. Control of Air Pollution from Aircraft and Aircraft Engines; Proposed Emission Standards and Test Procedures 76 Fed. Reg. 45,012 (proposed July 27, 2011) (to be codified at 40 C.F.R. pts. 87, 1068).

49. *See id.* at 45,015.

50. *See* REITZE, *supra* note 24, at 317.

51. *See id*. at 316 ("[B]ecause [the 1997] EPA standard is identical to the ICAO standard that became effective in 1986, all applicable engines covered by the newly manufactured engine standard are in compliance. The more stringent requirements applicable to aircraft engines newly certified after 1995 and newly manufactured after 1999 are met by all but two aircraft gas turbine models. However, they are expected to meet the requirements with minimal compliance costs.").

means that the new standards "will not impose any additional burden on manufacturers."[52]

Note, however, that this decision is based on a reading of Title II Part B that grants the EPA sufficiently broad authority that it *may* follow the ICAO if it wishes to do so, not a reading that the Agency's authority is so narrow that it *must* follow the ICAO.[53] In other words, nothing in the decision precludes the Agency from deviating from ICAO standards in the future. Part V discusses whether international law may impose any such limitations.

In general, the EPA has applied its past aviation emissions standards to a limited set of pollutants and imposes no requirements above and beyond those required of all ICAO members. Their effect on engine manufacturers has been small. However, the language of Title II Part B is broad, and courts have found EPA's authority to be expansive. But how expansive? Can the Agency regulate aviation GHG emissions under the CAA? If so, what tools can it use? And must it do so in concert with the ICAO?

II. THE CLEAN AIR ACT AND CARBON

Before trying to answer these aviation-specific questions, it is first important to explain GHG regulation under the CAA in general. Action in the courts and inaction in Congress have enabled the EPA to pursue limits on GHG emissions from a variety of sources under provisions of the CAA. Any EPA effort to regulate GHGs from aircraft would be part of this larger program.

A. 2007: Carbon as a CAA Pollutant

The Supreme Court's 2007 decision in *Massachusetts v. EPA* opened the way for regulation of GHGs from a variety of sources under the Clean Air Act. In its decision, the Court held that, contrary to past EPA interpretation, GHGs were pollutants within the definition of the statute, and that therefore the EPA must decide—on non-arbitrary grounds—whether to issue an endangerment finding.[54] By the end of the Bush Administration in 2008, the Agency had not decided whether to issue such a finding, though it did issue an Advance Notice of Proposed

52. Nat'l Ass'n of Clean Air Agencies v. EPA, 489 F.3d 1221, 1225, 1229–32 (D.C. Cir. 2007).

53. *See id.* at 1229 ("[The Administrator's delegation of authority in § 231] to issue such regulations . . . as he deems appropriate . . . is both explicit and extraordinarily broad.").

54. *See* Massachusetts v. EPA, 549 U.S. 497, 528–29 (2007).

Rulemaking ("ANPR"), discussing possible regulatory actions and requesting comment (discussed in Part III below).[55]

B. 2009–2012: Initial CAA Carbon Regulation

In contrast, the EPA under the Obama administration has rapidly (by EPA standards) moved ahead with GHG regulations under the CAA. The Agency made formal endangerment and cause or contribute findings for motor vehicle GHGs in late 2009 under Section 202 (Title II Part A) of the Act (the subject of *Massachusetts*).[56] Since that finding, it has issued a series of regulations applying to different classes of sources, including fleet emissions standards for new vehicles[57] and inclusion of GHG emissions in permit applications for new and modified large stationary emitters.[58] It has also committed to issuing GHG performance standards for new and existing stationary sources in the two sectors with the largest emissions: steam-fired power plants (mostly coal)[59] and petroleum refineries.[60]

In the meantime, comprehensive climate legislation famously failed to pass the Senate in 2010,[61] and the political climate in Congress has turned sharply against such legislation, at least for the time being. Congress has not, however, overruled *Massachusetts* or otherwise stripped powers to regulate GHGs under the CAA from the EPA. The practical result of this dual inaction is to leave the EPA as the only viable venue for climate policy at the federal level. It is worth noting that States can, and some do, have important climate policies of their own[62]

55. Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354 (proposed July 30, 2008) (to be codified at 40 C.F.R. ch. I).

56. Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496 (Dec. 15, 2009).

57. Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule, 75 Fed. Reg. 25,324 (May 7, 2010) (to be codified at 40 C.F.R. pts. 85, 86, 600 & 49 C.F.R. pts. 531, 533, 536–38).

58. Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, 74 Fed. Reg. 55,292, 55,297 (Oct. 27, 2009) (to be codified at 40 C.F.R. 51, 52, 70, 71).

59. Settlement Agreement at 1, New York v. EPA (D.C. Cir. 2007) (No. 06-1332), *available at* http://www.epa.gov/airquality/cps/pdfs/boilerghgsettlement.pdf.

60. *See generally* Settlement Agreement, Am. Petroleum Inst. v. EPA (D.C. Cir. 2008) (No. 08-1277), *available at* http://www.epa.gov/airquality/cps/pdfs/refineryghgsettlement.pdf.

61. Gail Russell Chaddock & Tarini Parti, *Harry Reid: Senate Will Abandon Cap-and-Trade Energy Reform*, CHRISTIAN SCI. MONITOR (July 22, 2010), http://www.csmonitor.com/USA/Politics/2010/0722/Harry-Reid-Senate-will-abandon-cap-and-trade-energy-reform.

62. The Regional Greenhouse Gas Initiative ("RGGI") in the Northeast and California's cap-and-trade program are the best examples. California Global Warming Solutions Act of 2006, CAL. HEALTH & SAFETY CODE §§ 38550–38551 (West 2006); Regional Greenhouse Gas Initiative, Memorandum of Understanding (2005), *available at* http://www.rggi.org/docs/mou_final_12_20_05.pdf (signed by signatory states and creating the interstate trading market).

and play important roles in many EPA-led CAA programs.[63] However, the CAA[64] preempts state regulation of aviation emissions.

III. AVIATION GHG DEVELOPMENTS SO FAR

Though it has been petitioned by the states and sued by environmental groups, the EPA has yet to implement regulations of GHG emissions from aviation. Moreover, neither the EPA's statements to date nor the petitions and lawsuits shed significant light on the EPA's regulatory options. Therefore, new examination of the relevant statute is needed.

A. EPA Inaction

As noted, the EPA has not moved to regulate GHG emissions from aviation under the CAA. On one hand, this is not surprising. Although GHG emissions from U.S. aviation are not trivial, Figure 1 shows that they are dwarfed by those from the primary sectors the EPA has moved to regulate—road transportation and fossil-fuel electric power[65] (though they are comparable to those from the refining sector, which the Agency has also committed to regulate).[66] It is understandable that the EPA has chosen to address the largest GHG sources first, given its limited resources. Regulators may assume that the sectors with the greatest emissions also have the greatest potential for cost-effective reductions, though this is not necessarily the case.

Figure 1: U.S. GHG Emissions by Sector, 2010[67]

Emissions Source	**Percent of U.S. Emissions**
Electric Power	34%
Rest of Transportation	25%
Industry	21%
Agriculture	7%

63. For example, performance standards for existing emissions sources under CAA § 111(d) are implemented and enforced by states under EPA guidelines.

64. Clean Air Act § 233, 42 U.S.C. § 7573 (2006).

65. *See* DAVID MCCOLLUM ET AL., GREENHOUSE GAS EMISSIONS FROM AVIATION AND MARINE TRANSPORTATION: MITIGATION POTENTIAL AND POLICIES 5 (2009), *available at* http://www.c2es.org/docUploads/aviation-and-marine-report-2009.pdf; EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2010 ES-4 tbl.ES-2 (2012), *available at* http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2012-Main-Text.pdf.

66. *See generally* Settlement Agreement, *supra* note 59.

67. Calculations use EPA data. EPA, *supra* note 65, at ES-4 tbl.ES-2.

Commercial	6%
Residential	5%
Commercial Aircraft	2%

On the other hand, Title II Part B closely parallels Title II Part A, the CAA section that was the subject of *Massachusetts v. EPA*[68] and under which the EPA issued its 2009 endangerment finding and the ensuing road vehicle fleet emissions standards.[69] In a procedural sense, at least, aviation regulation would therefore seem straightforward—the necessary endangerment and cause or contribute findings for aircraft under Part B can parallel (though not duplicate) those under Part A. This ignores the substantial technical and structural dissimilarities between the two sectors, which would inevitably require the Agency to do new analysis.

B. The California and Environmental Petitions

States and environmental groups separately petitioned the EPA to regulate aviation GHGs shortly after the *Massachusetts* decision in 2007.[70] These petitions noted the close parallels between Sections 202 (Title II Part A) and 231 (Title II Part B) and argued that both Sections "require [the] EPA to adopt emissions control regulations for emissions that are reasonably anticipated to endanger public health or welfare."[71] The petitions called on the EPA to issue a GHG endangerment finding (recall that it would not do so until 2009) and, more specifically, a cause or contribute finding for aircraft.[72] Petitioners further argued that opportunities to reduce aviation GHG emissions via engine design, airframe design, and operational changes are available and should be targeted by EPA standards under Title II Part B.[73]

C. The 2008 Advance Notice of Proposed Rulemaking

The Agency, at least initially, did not formally respond to these petitions. Instead, it reiterated its arguments in the 2008 ANPR and requested comment.[74] The EPA also included a broad, albeit relatively

68. 549 U.S. at 504.

69. Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496 (Dec. 15, 2009).

70. *See generally* State Petition, *supra* note 8; Environmental Petition, *supra* note 8.

71. State Petition, *supra* note 8, at 15.

72. Environmental Petition, *supra* note 8, at 26; State Petition, *supra* note 8, at 13.

73. Environmental Petition, *supra* note 8, at 8–14; State Petition, *supra* note 8, at 11–13.

74. *See* Regulating Greenhouse Gas Emissions under the Clean Air Act, 73 Fed. Reg. 44,354, 44,460–62 (proposed July 30, 2008) (to be codified 40 C.F.R. ch. I).

brief, discussion of options for regulating aircraft emissions in the document.[75] In this discussion, the Agency suggests technological and operational opportunities for aviation emissions reductions,[76] echoing the petitions, and options for regulatory design.[77] The ANPR, however, gives relatively little indication of the Agency's view of the petitioners' arguments, the legal limits of regulation under Title II Part B, or its regulatory policy preferences for aircraft GHG emissions. For the most part, the document simply lays out options and requests comment.

D. Recent Litigation—Must The EPA Regulate?

The Agency's failure to respond or to regulate aircraft GHG emissions as requested led the environmental petitioners to sue in 2010.[78] The petitioners argued that not only had the Agency violated the CAA by failing to respond, but also that the statute *requires* the EPA to determine whether it will issue endangerment and cause or contribute findings, and presumably therefore to regulate aviation emissions.[79] Specifically, the environmental plaintiffs alleged that the EPA's failure to issue an endangerment decision under Section 231 (Title II Part B) constituted an unreasonable delay, given its existing Section 202 finding and the statutory text.[80]

The EPA claimed that Section 231 gives it the discretion to choose when and whether to consider an endangerment finding.[81] The Agency agreed with the plaintiffs, however, that once such an endangerment finding (and a related cause or contribute finding) has been made, the mandatory language of Section 231 requires it to regulate.[82] If the environmental plaintiffs prevail, the Agency would be compelled to make endangerment and cause or contribute determinations for aviation GHG emissions and, if those findings are positive, to impose GHG emissions standards.

The EPA moved for summary judgment on various grounds. In July 2011, the District Court granted this motion with respect to some of the

75. *Id.* at 44,468–71.

76. *Id.*

77. *Id.* at 44,472–73.

78. Ctr. for Biological Diversity v. EPA, 794 F. Supp. 2d 151, 152–53 (D.D.C. 2011).

79. Complaint at 28–30, Ctr. for Biological Diversity v. EPA, 794 F. Supp. 2d 151 (No. 10-00985).

80. *Id.*

81. Partial Motion to Dismiss at 12–13, Ctr. for Biological Diversity, 794 F. Supp. 2d 151 (No. 10-00985).

82. *Id.; see also* INIMAI M. CHETTIAR & JASON A. SCHWARTZ, THE ROAD AHEAD: EPA'S OPTIONS AND OBLIGATIONS FOR REGULATING GREENHOUSE GASES 26 (2009), *availible at* http://policyintegrity.org/files/publications/TheRoadAhead.pdf.

plaintiffs' claims, but denied summary judgment against plaintiffs' claims regarding aviation emissions regulations under Title II Part B.[83] In its decision on the motion, the court ruled that although *Massachusetts* itself cannot be read to indicate that an endangerment finding under Section 231 is mandatory, "Congress's use of mandatory language, and paragraph 231(a)(2)(A)'s role in the aircraft-emissions-regulation regime created by [S]ection 231, strongly suggest that Congress intended the predicate endangerment finding to be a compulsory step."[84] This ruling undermined the core of the EPA's argument that it has discretion over whether and when to issue an endangerment finding, at least with respect to Title II Part B.[85]

The EPA and the environmental petitioners then submitted cross motions for summary judgment with respect to the remaining Section 231 claims and in March of 2012 the Court granted the EPA's motion, finding that "Plaintiffs ha[d] not shown that Defendant EPA ha[d] unreasonably delayed in determining whether aircraft engine emissions cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare."[86] The court did, however, order the EPA to respond to the petitions within ninety days with a warning that the grant of summary judgment "d[id] not entitle Defendant EPA to delay unduly in taking the appropriate Agency action."[87]

E. Beyond Litigation

In June of 2012, the EPA duly responded to the environmental groups' petition, issuing a memorandum explaining that it was not currently working on endangerment or cause or contribute findings, but "intend[ed] to initiate such a proceeding" in the future.[88] Specifically, the Agency cited uncertainty over litigation related to the Section 202 endangerment finding and a desire to participate in the ICAO process as

83. Memorandum Opinion and Order Granting in Part and Denying in Part Defendants' Partial Motion to Dismiss at 13–19, 794 F. Supp. 2d 151 (D.D.C. 2011).

84. *Id.* at 19.

85. The court did grant the EPA's motion to dismiss the plaintiffs' separate claim that it was required to issue endangerment findings for nonroad engines under a different section of the Act. *See id.* at 13.

86. Order Granting Motion to Dismiss at 3, No. 10-985 (D.C. Cir. Mar. 20, 2012), 2012 WL 967662, *available at* http://www.gpo.gov/fdsys/pkg/USCOURTS-dcd-1_10-cv-00985/pdf/USCOURTS-dcd-1_10-cv-00985-2.pdf.

87. *Id.*

88. *See* VAN NESS FELDMAN, LLP, MEMORANDUM IN RESPONSE TO PETITION REGARDING GREENHOUSE GAS EMISSIONS FROM AIRCRAFT 4 (n.d.), *available at* http://www.vnf.com/assets/attachments/aircraft-memo.pdf.

reasons for delay.[89] It is not clear whether the environmental plaintiffs intend to appeal the court's grant of summary judgment or file a new suit challenging the EPA's refusal to consider an endangerment finding at this time.

But even if the plaintiffs had won (or were to win a future suit) and the EPA was compelled to make endangerment and cause or contribute determinations, relatively little would have been resolved. First, the Agency could make a negative endangerment finding or, much more likely, a negative cause or contribute determination, either of which would preclude regulation. This seems extremely unlikely with respect to the endangerment finding, since the Agency has issued a similar finding under Section 202.[90] The analysis of the threat to public health and welfare is identical for all GHGs, regardless of their source, because GHGs are a global, uniformly mixed pollutant. But it is conceivable that the Agency might determine that emissions from aircraft do not cause or contribute to GHG harms sufficiently to constitute endangerment. Such a finding undoubtedly would be challenged by environmental groups, but is not obviously arbitrary or unreasonable given the difference in total emissions between the two sectors (motor vehicles and aviation).[91]

Moreover, even if the Agency issues positive findings and is therefore compelled to regulate aviation emissions in some fashion, it retains broad discretion over the form and stringency of those regulations—a fact that the *CBD* court scrupulously noted in its denial of the EPA's first summary judgment motion, citing the D.C. Circuit's earlier holding in *NACAA*.[92] The breadth of the Agency's authority is rooted in the relative lack of restrictions imposed by the (brief) plain language of the statute and the Agency's discretion to interpret that language under the *Chevron* doctrine.[93]

The outcome of *CBD v. EPA* is therefore interesting and important, but did nothing to clarify the options available to the EPA when and if it actually regulates aviation GHG emissions. The 2008 ANPR is

89. *Id.* at 5–6.

90. Clean Air Act § 202(a), 42 U.S.C. § 7521 (2006).

91. Some scholars have argued that failure to issue a cause or contribute finding for aviation emissions could be rejected by a court on the grounds that it would, in fact, be arbitrary or capricious, given the volume of aviation GHG emissions and the Supreme Court's dicta in *Massachusetts* that the contribution of the U.S. transportation sector to global emissions (six percent at the time) was "enormous." *See* CHETTIAR & SCHWARTZ, *supra* note 82, at 27.

92. *See* Memorandum Opinion and Order Granting in Part and Denying in Part Defendants' Partial Motion to Dismiss, 794 F. Supp. 2d 151, 162 (D.D.C. 2011).

93. Chevron, U.S.A., Inc. v. Natural Res. Def. Council, Inc., 467 U.S. 837, 842–43 (1984) (holding that agency interpretations of ambiguous statutory language prevail unless they are not "reasonable" or "permissible").

somewhat more helpful in this regard, but its preliminary character and noncommittal language limit its value. A new look at Title II Part B is therefore needed, informed by both its past use and more recent regulatory action for GHGs under other parts of the CAA.

IV. WHAT CAN THE EPA REGULATE, AND HOW?

Whether the Agency chooses to regulate aviation GHG emissions under Title II Part B or its hand is forced by litigation, it will have three fundamental policy choices to make. The Agency must decide the scope of the regulation, its stringency, and the regulatory tool it will use—including, possibly, market-based mechanisms. The permissible scope of regulation and the set of tools available to the EPA are legal questions, and the following sections address them in some detail. Stringency is predominately a policy question, but some relevant legal constraints are worth considering.

A. Scope

Past EPA regulation under Title II Part B has been limited in scope, focusing almost exclusively on new aircraft engines. The statute allows much broader regulation, however, as the following Parts explain. Even where it imposes apparent limitations, such as its focus on aircraft engines specifically, the EPA can design its regulation so as to allow operators a broad range of compliance options.

1. Traditional Standards for New Engines

In its past regulatory actions under Title II Part B, the EPA has generally used standards aimed at new aircraft engines.[94] The standards are technological in the sense that they discriminate among different classes of engines and are based, ultimately, on the ICAO's technological assessments, but they do not generally require that new engines adopt specific technological upgrades.[95] In this sense, they are really performance standards, though the Agency does not refer to them as such. Under such standards, newly designed (more accurately, newly

94. Only the EPA's initial 1973 standards covered existing engines. *See* Control of Pollution from Aircraft and Aircraft Engines, 38 Fed. Reg. 19,088 (July 17, 1973) (regulation no longer in force). Subsequent standards have applied only to new engines. *See*, *e.g.*, Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 70 Fed. Reg. 69,664 (November 17, 2005) (codified at 40 C.F.R. pt 87).

95. *See*, *e.g.*, Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 70 Fed. Reg. at 69,664 ("This action adopts standards equivalent to the [nitrogen oxide] standards of the . . . ICAO.").

certified) or in some cases newly produced engines must meet a specified emissions rate.[96] For example, the 2005 revised nitrogen oxide standards required engines with thrust rated over eighty-nine kN to achieve emissions reductions of about sixteen percent over previous standards (based on a complicated formula that considers design-specific characteristics).[97]

The Agency could undoubtedly impose similar standards on aircraft engine GHG emissions, as it notes in its 2008 ANPR.[98] Such standards would limit the GHG emissions of newly designed engines to a specified rate, presumably based on the thrust capacity of the engine. Since engine carbon dioxide emissions are essentially a function of fuel use,[99] such standards would in effect be fuel efficiency standards. Current engine testing procedures already track carbon dioxide emissions, making implementation of such standards relatively straightforward.[100]

The only differences between these GHG standards and past EPA aviation engine standards is that they would apply to GHGs and would lead, rather than follow, ICAO limits, as the ICAO has not yet developed standards for GHGs. Imposing more stringent regulations than the ICAO is probably permissible, at least for domestic U.S. carriers and engine manufacturers, as discussed in Part V below.

96. *See id*. at 69,674.

97. *Id.* Recall that in practice, this did not result in a sixteen percent emissions reduction from new engine designs, since the 2005 standards were identical to ICAO standards issued earlier with which engine manufacturers were already complying.

98. *See* Regulating Greenhouse Gas Emissions under the Clean Air Act, 73 Fed. Reg. 44,472 (proposed on July 30, 2008) (to be codified at 40 C.F.R. ch. I).

99. *See Operational Fuel Efficiency*, INT'L AIR TRANSP. ASS'N, http://www.iata.org/whatwedo/ops-infra/Pages/fuel-efficiency.aspx (last visited Jan. 10, 2012) ("Aircraft engine emissions are directly related to fuel burn. Each kilogram of fuel saved reduces carbon dioxide (CO2) emissions by 3.16 kg."). Note that this is not necessarily true for non-carbon dioxide GHGs. *See* DAVID MCCOLLUM ET AL., *supra* note 65, at 11 ("[A]ircraft and marine vessels also emit other chemical compounds that impact RF[radiative forcing]. These include methane (CH_4) and nitrous oxide (N_2O), as well as hydrocarbons (HC), particulate matter (PM), sulfur oxides (SO_x), and nitrogen oxides (NO_x). In some cases, these emissions are a function of more than just fuel consumption: altitude, humidity, fuel quality, and engine operating conditions also play a role. In addition, aircraft emit water vapor (H_2O) as a result of fuel combustion, which forms "contrails" (or condensation trails) under certain atmospheric conditions. Non-car emissions and contrails tend to be much shorter-lived than CO_2 emissions, and depending on where they occur may have a positive (warming) or negative (cooling) RF.").

100. *See*, *e.g.*, Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 70 Fed. Reg. at 69,681 (discussing calibration procedures for aircraft engine tests for carbon dioxide).

2. Existing Engines

Issuing standards for new engines would reduce future emissions only as those more efficient engines entered service. Because aircraft engines stay in service for years or even decades,[101] these reductions would come at a relatively slow pace. If the Agency desires a steeper decline in aviation emissions, could it also use Title II Part B to issue standards for existing engines, requiring either retrofit or replacement of engines that do not meet the standards?

First, the statutory language supports EPA jurisdiction over existing engines. Section 231 allows the Agency to impose emissions standards on "any class or classes of aircraft engines."[102] This language does not limit standards to new engines (or indeed, to any particular class). Section 202, on the other hand, specifically restricts the agency's authority to regulate to new motor vehicles and engines.[103] Congress therefore was aware of the significance of such a limitation and knew how to draft it. If Congress had intended to so restrict the Agency's powers for aviation standards, it presumably would have done so in Section 231. The legislative history of the 1970 CAA also provides some evidence that Congress intended to grant the EPA authority to regulate existing engines in Title II Part B.[104]

Second, the EPA has regulated existing engines in the past, requiring retrofits for some engines as part of its first set of emissions standards in 1973.[105] Although the Agency has not imposed standards on existing engines in more recent regulation[106] (and in fact has been at pains to

101. For example, the GE CF6 family of engines was originally designed for military applications in the 1960s and remains in widespread commercial airline use today. *The CF6 Engine Family*, GE AVIATION, http://www.geaviation.com/engines/commercial/cf6/ (last visited Jan. 27, 2013).

102. Clean Air Act § 231(a)(2)(A), 42 U.S.C. § 7571 (2006).

103. *Id.* § 202(a)(1), 42 U.S.C. § 7521 (2006).

104. *See* 116 CONG. REC. 691,210 (1970) (statement of Sen. Edmund Muskie) (discussing the reasons for regulating emissions from jet engines and identifying methods of regulation for both new and existing jet engines); 116 CONG. REC. 700,610 (1970) (statement of Rep. Joe Skubitz) (describing the effect of aviation emissions standard as driving retrofits of new and existing aviation engines); 116 CONG. REC. 700,922 (1970) (statement of Sen. Jerry Cooper) (describing the intent of the CAA as to regulate both new and existing aviation engines).

105. Control of Pollution from Aircraft and Aircraft Engines, 38 Fed. Reg. 19,088 (July 17, 1973) (regulation no longer in force).

106. The Agency did consider "retrofit kits" as part of a voluntary program associated with its 2005 nitrogen oxide standards, but these were not widely used and the efforts to build a voluntary program broke down. *See* Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 70 Fed. Reg. 69,664, 69,683 (Nov. 17, 2005) (codified at 40 C.F.R. pt. 87).

clarify that new standards do not require retrofits),[107] the 1973 standards provide important precedent should it choose to do so again.

3. Engines or Airframes?

In principle, efficiency improvements from aircraft and corresponding reductions in GHG emissions might be available from changes in design of airframes as well as engines.[108] Environmental groups have asked the EPA to consider issuing airframe-level standards in their 2007 petition, citing a variety of possible efficiency improvements from weight reduction to "blended wing" airframes.[109]

However, all past EPA aviation standards have applied only to aircraft engines, not to aircraft as a whole. Section 231 specifically refers to aircraft engines,[110] unlike Section 202, which separately refers to motor vehicles and motor vehicle engines.[111] This implies that Congress intended EPA aviation standards to apply only to engines. In his 2009 article, Daniel Conrad concludes, based on this language, that "Section 231 [Title II Part B] limits the EPA's authority to regulate 'aircraft engines' rather than the entire aircraft."[112] Yet evidence from the legislative history indicates that Congress intended to grant the EPA authority to regulate aircraft in general via Section 231 standards. For example, the Conference Report for the 1970 CAA amendments notes that aviation standards apply to both "civil aircraft and aircraft engines."[113]

Congressional intent is therefore difficult to determine, and it is hard to predict how a court would rule if the Agency were to pursue standards directly aimed at airframe design choices. It is plausible that a court would find that the plain language of the CAA rules out standards that apply directly to airframes.[114] And the EPA, fearing such a result, might

107. *See, e.g.*, *id.* at 69,664, 69,667 n.18.

108. *See generally* GAUDY M. BEZOS-O'CONNOR ET AL., AM. INST. OF AERONAUTICS & ASTRONAUTICS, FUEL EFFICIENCIES THROUGH AIRFRAME IMPROVEMENTS (2011), *available at* http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20110014055_2011014329.pdf.

109. *See* Environmental Petition, *supra* note 8, at 12; *see also* U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 4, at 22–26.

110. Clean Air Act § 231(a)(2)(A), 42 U.S.C. § 7571 (2006).

111. *Id.* § 202(a)(1).

112. Conrad, *supra* note 21, at 948.

113. 116 CONG. REC. 42,386 (1970), *reprinted in* 5 CLEAN AIR ACT AMENDMENTS 135 (1970) (statement of Sen. Edmund Muskie).

114. Under *Chevron*, courts will first determine whether statutory language is ambiguous (step one). If there is no ambiguity, that interpretation is binding. If there is ambiguity, however, under step two an agency's reading of statutory language prevails if it is reasonable. *See* Chevron, U.S.A., Inc. v. Natural Res. Def. Council, Inc., 467 U.S. 837, 842–44 (1984).

conclude that breaking with past practice and regulating airframes is not worth the risk. As noted below, however, this limitation on the Agency's authority may not matter much in practice.

4. Operational Standards

Similarly, the aviation industry could reduce its overall emissions through operational changes independent of engine or airframe design. Reductions in idle times, flight speeds, taxiing, use of reverse thrust, and other practices would reduce fuel use and therefore emissions.[115] Could the EPA impose operational standards on airlines that would require changes to these practices? Superficially, this question seems tied to the previous one—if Section 231 is limited to aircraft engines, it would appear to rule out operational standards as well as aircraft design standards. Conrad is highly skeptical toward the permissibility of operational standards, largely for this reason.[116]

Conrad also argues that other sections of the CAA effectively limit EPA authority to issue operational aviation standards.[117] Specifically, he points to language in Section 108 of the CAA that requires the EPA to publish "transportation control measures" that states could implement in order to comply with national air quality standards.[118] Section 108 provides examples of such measures, which, though stated in terms that clearly refer to motor vehicles, are similar in many respects to operational standards that the EPA might seek to impose on air carriers.[119] This requirement in Section 108, Conrad argues, indicates that Congress intended policies aimed at operational transportation practices to be part of the national air quality standards program under Sections 108–10, not mobile source regulation under Title II.[120] Conrad bases this argument on a traditional canon of statutory interpretation stating, "however inclusive may be the general language of a statute, it will not be held to apply to a matter specifically dealt with in another part of the same enactment."[121]

Conrad's interpretation of Section 108's significance is too broad, however. First, the language in Section 108 likely refers to operational policies targeted at ground transportation and especially motor

115. *See* State Petition, *supra* note 8, at 9–11; *see also* U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 4, at 26–30.

116. Conrad, *supra* note 21, at 948.

117. *Id.* at 932–33.

118. Clean Air Act § 108(e)–(f), 42 U.S.C. § 7408 (2006).

119. *Id.*

120. Conrad, *supra* note 21, at 932–33.

121. *Id.* at 933 (citing Doe v. Nat'l Bd. of Med. Exam'rs, 199 F.3d 146, 155 (3d Cir. 1999)).

vehicles.[122] None of Section 108's examples are relevant to aviation, at least not without creatively broad interpretation.[123] This interpretation is strengthened by the fact, noted above, that federal standards for motor vehicles are restricted to new vehicles.[124] Even if Section 108 did not exist, the EPA could not impose operational requirements on motor vehicle owners because it lacks the authority to regulate existing vehicles or engines. Together, therefore, Sections 202 and 108 divide authority over motor vehicle regulation between the EPA, which handles standards for new vehicles, and states, which—via their State Implementation Plans—may impose operational requirements or other, broader transportation policies to reduce overall emissions from motor vehicles.

Second, Congress cannot have intended that the EPA leave operational standards for aviation to states, whether based on federal recommendations under Section 108 or not. Regulation of the aviation industry is highly federalized, and states lack the authority to implement most—if not all—plausible operational standards for the industry.[125] Title II Part B itself explicitly preempts state regulation of aviation emissions.[126] If states cannot regulate such emissions, whether through operational standards or otherwise, the division of aviation regulatory authority implied by Conrad's interpretation of Section 108 is impossible and cannot have been intended by Congress.

There is some support for this interpretation in the legislative history. For example, the House Debate of the Conference Report on the 1970 CAA notes that Section 231 standards "may well specify a limitation upon the number of civil aircraft which may land at any airport within such areas."[127] Such a limitation is clearly operational in effect. Conrad, however, cites some statements in the legislative history that could be interpreted to indicate Congress had a narrower view of the standards.[128]

The 2008 ANPR also implies that the EPA does not view Section 231 as limiting standards to aircraft engines. In the document, the Agency

122. Clean Air Act § 108(f) (referring to "programs for improved public transit," "restriction of certain roads or lanes," and "traffic-flow improvement programs").

123. For example, the Clean Air Act §108(f)(1)(A)(xi) mentions "programs to control extended idling of vehicles." At a strech, this might be analogized to programs aimed at reducing aircraft idle times while taxiing. But in the context of the remainder of § 108(f) and its explicit reference to road vehicles, this reading is implausible.

124. Clean Air Act § 202(a)(1).

125. *See, e.g.,* Garden State Farms, Inc. v. Bay, 77 N.J. 439, 447 (1978) ("State and local authority over the operation and navigation of aircraft is supplanted by . . . federal regulation.") (internal quotation marks ommitted).

126. Clean Air Act § 233.

127. 116 CONG. REC. 42,386 (1970), *reprinted in* 5 CLEAN AIR ACT AMENDMENTS 147 (1970).

128. Conrad, *supra* note 21, at 934–35.

discusses both airframe changes and operational measures as opportunities for GHG emissions reduction that might be targeted by EPA regulation.[129] This discussion would make little sense if the Agency believed such measures were beyond the reach of the Act.

Nevertheless, directly mandating operational changes via Section 231 standards would be a break with the Agency's past practice. As with standards aimed at airframes, such regulation would be at some risk of being rejected by courts, and a cautious Agency might therefore decide not to take the risk. As explained in the next Part, however, this limitation may not matter in practice.

It should be noted that many aspects of airline operational practices are governed by FAA regulations.[130] Airlines' ability to make emissions-reducing operational changes may therefore be limited even if they are given incentives to do so by EPA regulation. The EPA and the FAA should coordinate any future regulations required by statute.[131] For example, FAA regulations already tightly regulate aircraft speed,[132] altitude,[133] and other in-flight and ground operations.

5. Aviation Standards as Performance Standards

If the EPA cannot include airframe design or operational practices in its aviation standards, its ability to achieve GHG emissions reductions—and, in particular, cost-effective reductions—is sharply limited. Standards for new engines, as noted, will take time to show emissions benefits.[134] Retrofits for some existing engines may be available, but these opportunities are likely to be limited and may be less cost-effective than operational changes.[135] It is therefore not only in the EPA's (and environmentalists') interest that operational changes be available as compliance options, but in industry's interest as well. A wider set of compliance options almost certainly means less costly regulation for industry, holding stringency constant.

129. *See* Regulating Greenhouse Gas Emissions under the Clean Air Act, 73 Fed. Reg. 44,470–71 (July 30, 2008) (to be codified at 40 C.F.R. ch. I).

130. *See* 14 C.F.R. §§ 21-49 (2012) (governing airworthiness standards and certifications); *id.* §§ 61-67 (pilot certification); *id*. §§ 91-105 (air traffic and general operating rules).

131. Clean Air Act § 231(a)(2)(B)(i) (requiring FAA consultation).

132. *See* 14 C.F.R. § 91.116.

133. *See id.* § 91.515.

134. *See supra* Part IV.A.1.

135. Historical evidence is suggestive. The Agency considered "retrofit kits" as part of a voluntary program associated with its 2005 nitrogen oxide standards, but these were not widely used and the efforts to build a voluntary program broke down. *See* Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 70 Fed. Reg. 69,664, 69,683 (Nov. 17, 2005) (codified at 40 C.F.R. pt. 87).

The EPA is probably not as limited as the above analysis of the statute suggests. Even if Title II Part B standards must use engine emissions as the *measure* of compliance, operational and airframe changes can still likely be valid compliance options. By framing requirements as performance standards, the regulation would nominally target engines but leave discretion over compliance options to carriers. Such regulations would achieve a similar (and perhaps superior) practical result to regulations that explicitly set standards for airframe design and operational practices, but they would place decision-making power in the hands of those with the best information—the industry.

The key to such a regulatory approach is a simple insight: all GHG emissions from aircraft come from engines. Therefore, even if the CAA is interpreted as giving the EPA authority to regulate only engines, this is all the authority the Agency needs. The problems described above with airframe and operational-level standards appear only when engines are treated as discrete devices, rather than the emitting part of a larger system. This is a natural understanding when regulation is focused on new engines, which might be installed on any of a variety of aircraft, operating in a variety of conditions. In reality, however, emissions from engines depend in large part on the airframe to which they are attached and the conditions under which they are used.[136]

EPA regulation can implement an inclusive performance standard by expressing the standard for existing engines in terms of an emissions rate, such as tons of carbon dioxide emitted per mile traveled. In such a program, airlines, not engine manufacturers, would be the point of regulatory compliance. The EPA would set a benchmark emissions rate for each airline (or for the sector as a whole, if trading is to be permitted). An airline whose emissions rate exceeds that benchmark would have a variety of options to bring its performance in line with the standard. It could retrofit the engines on its aircraft, replace them with new engines, make retrofits to its airframes, or upgrade to entirely new aircraft. It could also make operational changes. If trading is allowed, it could purchase credits from other airlines or over-comply and sell credits. Any of these moves would, in principle, reduce emissions associated with the airline's flights (or in the case of buying credits,

136. This is because of the direct relationship between fuel consumption and emissions, and the degree to which fuel consumption depends on flight characteristics. *See* P.M. PEETERS ET AL., NETH. NAT'L AEROSPACE LAB., NLR-CR-2005-669, FUEL EFFICIENCY OF COMMERCIAL AIRCRAFT: AN OVERVIEW OF HISTORICAL AND FUTURE TRENDS 9 (2005), *available at* http://www.transportenvironment.org/sites/te/files/media/2005-12_nlr_aviation_fuel_efficiency.pdf (noting aerodynamic efficiency, weight including cargo and passenger density, and engine characteristics as the drivers of aircraft fuel efficiency).

overall emissions in the sector). And these reductions would ultimately come (physically, at least) from aircraft engines, the target of the EPA's Title II Part B standards.

As noted above, even traditional EPA aircraft engine standards are properly described as performance standards, since they require compliance with a specific emissions rate target but do not require that any specific technology be used.[137] The key difference between such standards and the broader, hypothetical performance standards described in this Part is in what is being measured. By targeting emissions per mile of engines in use, rather than a one-time lab measurement of emissions from each engine model, the range of compliance options is greatly expanded.[138]

The EPA suggested and requested comment on a broadly similar regulatory approach in the 2008 ANPR, though it did not call it a performance standards program:

> [I]n the case of aircraft, it may be more practical and flexible to directly regulate airline fleet average GHG emissions. Under such an approach we would set a declining fleet average GHG emission standard for each airline[] . . . Although we might develop such a declining fleet average emissions program based on engine emissions . . . [it] could potentially be designed to consider the whole range of engine, aircraft and operational GHG control opportunities . . . .[139]

The EPA requested comment on this suggestion, in particular on implementation and administrative issues,[140] but showed no indication that it believed such an approach would be legally problematic.

Performance standards are widely used under the CAA, most notably for stationary sources under Section 111.[141] In fact, the Agency is currently in the process of designing GHG performance standards for

137. *See, e.g.*, *id.* (implementing standards requiring new engines with various performance characteristics to meet emissions standards specified in g/kN rated output, without reference to any required control technologies).

138. One-time lab measurements of engines do have an important advantage over measurements of in-use per-mile emissions: they are much less complex and costly, at least for nitrogen oxide and other traditionally-regulated pollutants. The reason is simple—it's much easier to make a single measurement for each engine model than to measure the emissions from every engine in real time. For carbon, however, measurement is easy. Carbon dioxide emissions are determined by fuel burned. If you know the carbon content of fuel, the amount burned, and the distance traveled, calculating emissions per mile is trivial.

139. Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,472-73 (July 30, 2008) (to be codified at 40 C.F.R. ch. I).

140. *Id.* at 44,473.

141. Clean Air Act § 111(b), (d), 42 U.S.C. § 7411 (2006).

coal plants and other large sources pursuant to a settlement agreement.[142] The Agency[143] and observers[144] have discussed setting these standards in terms of emissions rates, in part to take advantage of possible opportunities for efficiency upgrades at existing coal plants. Performance standards for aircraft engines under Title II Part B could work in a similar fashion.

One might argue that aircraft engine performance standards are not permissible under Section 231, presumably relying on the fact that the Section refers only to "standards" without the "performance" modifier.[145] Because standards under Section 231 have traditionally been narrowly focused on engine design characteristics,[146] and because Congress clearly knows how to instruct the EPA to issue performance standards,[147] performance standards may be outside the scope of the statutory grant of authority.

But this argument is relatively weak. Nothing in the statute precludes performance standards, and Congress may have intended to give the Agency broad discretion under Section 231 by not specifying what kind of standards it must use. Any lack of precedent for such standards would not be legally determinative and, in any case, may have as much to do with the fact that the EPA has historically avoided regulating existing aircraft engine emissions (for which performance standards are the best fit), as with any previous belief on the Agency's part that performance standards were not permissible under the Act. The Agency appears never to have claimed that performance standards are impermissible, and even if the Agency once had that view, it would likely be entitled to change it.[148]

142. Settlement Agreement, *supra* note 59; *see* Dallas Burtraw et al., *Tradable Standards for Clean Air Act Carbon Policy*, 42 ENVTL. L. REP. 10,338, 10,338 (2012).

143. *See* Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, 77 Fed. Reg. 22,392, 22,392 (proposed Apr. 13, 2012) (to be codified at 40 C.F.R. pt. 60) (proposing GHG new source performance standards for fossil fuel power plants set at an emissions rate of 1000 lbs. of carbon dioxide per megawatt-hour of electricity output).

144. *See* Dallas Burtraw et al., *Greenhouse Gas Regulation under the Clean Air Act: A Guide for Economists*, 5 REV. ENVTL. ECON. & POL'Y 293, 299–305 (2011).

145. Clean Air Act § 231(a).

146. *See supra* Part I.B.

147. This is evidenced by the explicit grant of such authority over stationary sources in Clean Air Act § 111.

148. *See* Rust v. Sullivan, 500 U.S. 173, 186 (1991) (holding that "[t]his Court has rejected the argument that an agency's interpretation 'is not entitled to deference because it represents a sharp break with prior interpretations' of the statute in question" (quoting Chevron U.S.A., Inc. v. Natural Res. Def. Council, Inc., 467 U.S. 837, 862 (1984))).

Finally, any argument for a narrow reading of Section 231 must confront the Agency's discretion over interpreting its own statutes under *Chevron*.[149] This is a particularly high bar here since the relevant part of the statute is so short—there is little on which to hang a plain language argument. The court in *NACAA* appears to agree that this brevity and the language of the Section give the Agency broad interpretive authority.[150]

To claim that the EPA cannot issue performance standards under Title II Part B is, in effect, to claim that the Agency cannot give the industry flexibility to comply with those standards. This is bad policy, and such a position is unlikely to be supported (or advanced in litigation) by industry. Moreover, it is inconsistent with precedent. Past EPA aviation emissions standards have been framed in terms of emissions rates for given classes of engines, but the Agency has not necessarily prescribed specific emissions-reducing technologies.[151] Engine manufacturers therefore have been free to adopt whatever measures they deem appropriate to meet the standard in their new designs. In this sense, past EPA regulations have really been performance standards, simply restricted to new engines (or new designs). To issue regulations allowing airlines to comply via airframe design or operational changes, it is necessary to apply the standards to existing engines and to restate the benchmark in terms of emissions per mile (or some similar metric), but it is not necessary to change the fundamental tool that has been used in the past. In other words, the Agency has always used performance standards under Title II Part B, and any argument that it cannot do so must confront that precedent.

It therefore appears very likely that the Agency could issue performance standards for existing engines and frame them in such a way as to allow use of airframe design and operational measures to comply with the standards. Indeed, the EPA should assume that such measures would be used. To the extent possible, the Agency would need to model the measures' impact when it determines the appropriate stringency of the standards and estimates their costs. This would require consultation with industry and environmental groups on what emissions-reducing measures are available, and how costly they are.

If the Agency can issue such performance standards, it would still have important scope-related decisions to make. For example, it may decide

149. *See* Chevron, 467 U.S. at 842–44.

150. Nat'l Assoc. of Clean Air Agencies v. EPA, 489 F.3d 1221, 1225, 1229–32 (D.C. Cir. 2007).

151. *See* Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 70 Fed. Reg. 69,664, 69,674 (Nov. 17, 2005) (codified at 40 C.F.R. pt. 87) (setting emissions rate-based nitrous oxide standards without reference to any specific control technology).

that technology-based standards are more appropriate for new engines and apply performance standards only to existing engines—or use a hybrid approach. If it bases performance standards on an emissions-per-mile benchmark, it would need to decide how to account for emissions associated with ground operations. The Agency would also need to determine the point of compliance—would emissions be measured on a per-flight, per-aircraft, or per-firm basis?

6. Foreign Aircraft

Finally, the Agency would need to determine how and whether to include foreign aircraft within the scope of its regulation. The E.U., as noted above, has taken an ambitious approach, requiring carriers to purchase ETS allowances for any flights that leave from or arrive at European airports.[152] These allowances must cover the entire emissions for the flight, even those portions of the flight outside of Europe.[153]

As the E.U. approach illustrates, regulation of "foreign" aircraft emissions has two components: regulation of foreign-flag aircraft emissions, and regulation of emissions that occur outside the regulating country. Legal analysis of each component is different.

Nothing in the CAA prevents the EPA from regulating emissions from foreign-flag aircraft in the United States. Foreign carriers already must comply with FAA and EPA regulations, including existing EPA emissions standards for nitrogen oxide and other pollutants.[154] There is no reason for the EPA to take a different approach with carbon emissions standards. Doing so would effectively favor foreign carriers over domestic carriers with no environmental benefit. Although the CAA does not limit the Agency's authority over foreign carriers, international law might (see Part V below). If so, this raises competitiveness concerns, which are also discussed in Part V.

The Agency's authority likely does not reach aviation emissions from portions of flights that take place outside the United States, however. The CAA does not explicitly limit the Agency's authority over these emissions, no more than it does for foreign-flag carriers. Yet, because

152. E.U. Directive, *supra* note 10, at 5 ("In order to avoid distortions of competition and improve environmental effectiveness, emissions from all flights arriving at and departing from Community aerodromes should be included from 2012.").

153. *Id.* (making no distinction between emissions inside and outside E.U. territory).

154. *See* 14 C.F.R. § 91.1 (2012) ("This part prescribes rules governing the operation of aircraft . . . within the United States, including the waters within [three] nautical miles of the U.S. coast . . . Each person operating an aircraft in the airspace overlying the waters between [three] and [twelve] nautical miles from the coast of the United States must comply [with subsequent sections].").

these emissions occur outside U.S. borders, the Agency would be acting extraterritorially if it sought to regulate them. Courts interpret statutes to grant such authority only when explicitly specified by Congress.[155] No such grant exists in Title II Part B. Other parts of the CAA, such as Section 115, do give the Agency the authority to regulate U.S. emissions whose harms are felt in other countries,[156] so Congress was clearly aware of cross-border pollution problems. Nevertheless, it chose not to grant any extraterritorial authority to the Agency in Title II. Even under Section 115, the Agency must consult with the Department of State and can impose regulations on emissions sources only in the United States.[157] This presumption against extraterritoriality effectively trumps the deference shown to Agency interpretation of the statutes under *Chevron*.

Furthermore, this limitation applies equally to foreign and domestic carriers.[158] The EPA has no more authority to regulate GHGs emitted over the Atlantic Ocean from a Delta flight than from a Lufthansa flight. This example illustrates a potential problem. If the United States does not regulate its carriers' emissions outside the United States, the European Union might continue to do so—creating continued tension. If the European Union does not, these "Atlantic" emissions would not be regulated at all. This problem is one illustration of why internationally-coordinated aviation emissions regulation is superior to a country-by-country approach.

Note, however, that many regulatory approaches that are permissible under the CAA, and many possible industry responses to performance standards would effectively reduce emissions not only in the United States, but also outside it. If the EPA were to implement traditional engine emissions standards for carbon dioxide, compliant engines would have lower associated emissions wherever they operate. Similarly, if carriers were to adopt different airframe or engine designs in response to performance standards, their emissions would be reduced on a per-mile basis wherever they operate. This is not true, however, with most

155. *See* Pamala Karten Bookman, *Solving the Extraterritoriality Problem: Lessons from the Honest Services Statute*, 92 VA. L. REV. 749, 751 (2006) ("Extraterritoriality doctrine creates a presumption against the application of domestic statutes to conduct committed abroad. It presumes that Congress intends to regulate only domestic conduct unless it specifies otherwise. The presumption is triggered when two criteria are met: (1) the alleged conduct is committed abroad and (2) the statute regulating that conduct does not specify whether it is intended to apply domestically or abroad.").

156. Clean Air Act § 115(a), 42 U.S.C. § 7415 (2006).

157. *Id.*

158. This is because it is the location of the regulated activity, not the nationality of the actor, that would make regulating aircraft emissions outside the U.S. extraterritorial.

operational measures airlines might adopt to comply with a performance standard, such as lower cruise speeds or reduced taxiing.

B. Stringency and Consideration of Costs

Unlike other Sections of the Act, Title II Part B does not provide even an abstract measure of how stringent the EPA regulations must be. Ambient air quality standards under Section 109 of the Act, for example, must be adequate to protect health and welfare (the former "with an adequate margin of safety"),[159] while performance standards under Section 111, as noted above, must reflect the "best system of emission reduction."[160] The only guidance given in Title II Part B is that the EPA must consult with the FAA and that aviation standards must not significantly increase noise or adversely affect safety.[161] Within these limits, the EPA is free to choose any level of stringency it can reasonably justify. The Act also imposes no limits on the Agency's ability to revise its standards, nor does it require the agency to do so at any specified time. Based on this authority, the Agency has claimed that standards that decline over time are permissible.[162] Finally, and also unlike some other Sections of the Act,[163] the EPA is permitted to consider cost.

A frequent criticism of EPA regulation of GHGs under the CAA is that it will inevitably cause a "train wreck," because the Agency lacks the tools under the statute to cost-effectively regulate such a ubiquitous pollutant.[164] At least for aviation regulation under Title II Part B, such a result is implausible. First, the Agency retains nearly unlimited discretion over the stringency of its regulations. It is simply directed to "issue . . . standards" without any requirement that they be sufficiently stringent to achieve even ambiguous goals such as protecting the public health or welfare.[165] The Agency therefore is not compelled to regulate stringently. A useful parallel here is the Agency's Tailoring Rule, under which it has restricted consideration of GHGs in permit applications to

159. Clean Air Act § 109(b)(1).

160. *Id.* § 111(a)(1).

161. *Id.* § 231(a)(2)(B).

162. *See* Regulating Greenhouse Gas Emissions under the Clean Air Act, 73 Fed. Reg. 44,473 (proposed July 30, 2008) (to be codified at 40 C.F.R. ch. I).

163. *See* Whitman v. Am. Trucking Ass'ns, 531 U.S. 457, 464 (2001) (holding that the EPA is not permitted to consider costs when setting national ambient air quality standards under § 109 of the CAA).

164. *See, e.g.*, AM. LEG. EXCH. COUNCIL, EPA'S REGULATORY TRAIN WRECK: STRATEGIES FOR STATE LEGISLATORS (2011), *available at* http://www.alec.org/docs/EPA-TRAIN-WRECK-2011-Final-Full-printres.pdf (characterizing a suite of recent and near-future EPA regulations, including those on GHGs).

165. Clean Air Act § 231(a)(2)(A).

certain large emitters, despite the plain language of the statute requiring such consideration for any emitter of over 250 tons of a pollutant.[166] No such ambitious interpretation of the statute is necessary here for the Agency to have control over the breadth and stringency of the standards it proposes.

Second, and perhaps more important, Title II Part B explicitly directs the Agency to consider cost when determining the compliance schedule for the standards it issues.[167] The Agency could therefore adopt stringent standards and give emitters more time to comply (perhaps to allow time for engine and airframe upgrades in due course) or choose less stringent standards and require quick compliance from emitters. Stringent, short-term standards that would impose large costs on the industry are not a realistic danger.

C. Regulatory Tools—Can the EPA Allow Trading?

In addition to determining the reach of aviation standards, the EPA also must choose how carriers may comply. One approach is simply to require that every engine or every flight meet the relevant standard. However, the Agency might also make compliance flexible.

Economists are nearly unanimous in their view that market-based tools are the most cost-effective means for regulating emissions, particularly those of globally-mixed pollutants like GHGs.[168] The E.U.'s ETS is itself such a market-based system.[169] Additionally, a 2009 Government Accountability Office ("GAO") report favors market-based tools for regulating aviation emissions.[170] If the EPA can create a market-based regulatory system for aviation GHGs, it would almost certainly be more cost-effective than traditional performance standards and more likely to be deemed "equivalent" to E.U. regulation. But is the grant of authority in Title II Part B sufficiently broad to allow the Agency to implement such a program? Maybe.

166. *Id.* §169(1).

167. *Id.* § 231(b).

168. *See, e.g.*, INST. FOR POLICY INTEGRITY, ECONOMISTS AND CLIMATE CHANGE: CONSENSUS AND OPEN QUESTIONS 5 (2009), *available at* http://policyintegrity.org/files/media/11409_Economists_Survey_MEDIA_RESOURCE_KIT.pdf (finding large majorities of economists in favor of a carbon price).

169. *See Emissions Trading System*, EUR. COMMISSION, http://ec.europa.eu/clima/policies/ets/index_en.htm (last updated Jan. 4, 2013) (stating that "the EU ETS works on the 'cap and trade' principle").

170. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 4, at 35–46 ("[E]conomic research indicates that market-based policies are more likely to better balance the benefits and costs of achieving reductions in greenhouse gases and other emissions.").

1. Trading Under Title II

The EPA has used trading elements in past Title II regulation. Averaging, banking, and trading ("ABT") approaches are used in various programs for on-road vehicles.[171] These programs allow manufacturers to average emissions across all relevant models they build, bank current over-compliance for future use, and in some cases trade with other manufacturers.[172] Such programs provide at least a basic model for a trading approach under Title II Part B, and the EPA suggested such an approach for aircraft engines in its 2008 ANPR.[173]

There are important differences between these ABT programs and a hypothetical trading program for aviation emissions. First, they are implemented under different statutory provisions, though as noted above, the language in Title II Part B governing aircraft emissions is very similar to that in Title II Part A governing on-road vehicle emissions.[174] Second, these programs are restricted to manufacturers of new vehicles or engines.[175] They therefore provide evidence of the theoretical compatibility of trading with Title II regulation, but are not directly applicable models—at least, if the Agency intends to go beyond regulating new engines.

2. Aviation-Sector Trading Under Title II Part B

The language of Section 231 does not plainly rule out a market-based approach, unless one adopts a very narrow definition of "emissions standards." As noted, the statute itself does not define the term. However, similar terms are defined elsewhere and have been subject to Agency and outside interpretation regarding this question. One parallel is with Section 111 of the Act, which governs performance standards for new and existing stationary sources. The EPA and outside observers, myself included, have argued that Section 111 performance standards can allow trading among regulated sources.[176] If "performance

171. *See* Regulating Greenhouse Gas Emissions under the Clean Air Act, 73 Fed. Reg. 44,472 (proposed July 30, 2008) (to be codified at 40 C.F.R. ch. I).

172. *Id.*

173. *Id.*

174. *See supra* note 32 and accompanying text.

175. CAA Title II Part A regulation is limited to new vehicles. *See* Clean Air Act § 202(a)(1), 42 U.S.C. § 7521 (2006).

176. *See* Nathan Richardson, *Playing without Aces: Offsets and the Limits of Flexibility under Clean Air Act Climate Policy* 10–18 (Res. for the Future, Discussion Paper 11-49, 2011), *available at* http://www.rff.org/RFF/Documents/RFF-DP-11-49.pdf. *See generally* Gregory E. Wannier et al., *Prevailing View on Compliance Flexibility under § 111 of the Clean Air Act* (Res. for the Future, Discussion Paper 11-29, 2011), *available at* http://www.rff.org/RFF/Documents/RFF-DP-11-29.pdf

standards" can be flexible, is there any reason to treat "emissions standards" differently?

The argument that Section 111 standards can permit trading is based in part on language in the statutory definition of "performance standards" indicating that they must "reflect" the "best system of emission reduction."[177] Trading, the argument goes, is the "best system."[178] Section 231 does not refer to a "best system" or have any equivalent language, and this argument is therefore unavailable there.[179] As noted above, however, Section 231 gives the EPA broad discretion over the form and substance of aviation standards; the Section does not bar the EPA from basing standards on the "best system" or any other principle.[180] The term "Emissions standards" is arguably broader than "performance standards"—if the latter is interpreted to include trading, then the former may feasibly be read to include trading as well.

Another argument in favor of trading under Section 231 is that it refers to EPA regulation of "classes" of aircraft engines:[181] it is these classes, not individual engines, that are the object of regulation. This is not just compatible with trading, but it is essentially the definition of a market-based regulatory scheme. Under such a scheme, some measure of class performance is required, but individual members of the class may deviate from that standard, with trading (or averaging) acting as the mechanism for assuring class-wide compliance. Further, the EPA has claimed that it has the authority under Section 231 to at least include averaging, banking, and trading programs, which allow manufacturers of new engines to comply with a fleet average standard while retaining some forms of flexibility.[182]

Whether trading is permissible under Section 231 is a difficult question, but on balance, the case for it is stronger than the case against it. The broad grant of authority in the Section and its lack of restrictions on that authority, confirmed by the D.C. Circuit's holding in *NACAA*,[183] are significant. Even more important is the deference to which the

(describing how the degree to which the EPA enables regulated entities to use flexible approaches to achieve performance standards under Section 111 of the CAA will shape the effectiveness of the regulations).

177. Clean Air Act § 111(a).

178. *See* Wannier et al., *supra* note 176, at 4–5.

179. Clean Air Act § 231.

180. *See* Wannier et al., *supra* note 176, at 4–5.

181. Clean Air Act § 231(a)(2)(A).

182. *See* Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354, 44,472 (proposed July 30, 2008) (to be codified at 40 C.F.R. ch. I).

183. *See* Nat'l Assoc. of Clean Air Agencies v. EPA, 489 F.3d 1221, 1225, 1229–32 (D.C. Cir. 2007).

Agency is entitled under *Chevron*. For trading to be ruled incompatible with the statute, a court would have to decide either that it is forbidden by the plain language of the statute (step one) or that the EPA's interpretation is unreasonable (step two).[184] The former interpretation is unlikely given the brevity of the Section, and the latter is such a permissive standard that agencies lose rarely, if ever.[185] Nevertheless, there is real risk that trading could be ruled incompatible with Section 111, most likely on *Chevron* step one grounds, and the probability of such a ruling is greater under Section 231 because of the absence of the helpful "best system" language.

3. Revenue

Even if the Agency were able to implement a market-based regulatory scheme for aircraft engines, it would not be able to auction allowances and generate revenue. The EPA has never raised revenue under an emissions trading scheme without explicit congressional authorization, and doing so might be unconstitutional.[186] For similar constitutional reasons, the EPA could not impose a tax on aviation emissions without legislation granting new authority.

Under the EPA's existing stationary-source trading programs, states (which are not bound by the EPA's limitations in this regard) have been delegated allocation authority and in principle could have auctioned allowances and raised revenue.[187] But this option is unavailable because aviation standards, unlike many other CAA programs, are not federalist in design—one of the few explicit limitations Congress put on aviation emissions regulations is a bar on state regulation.[188] Therefore, barring new legislation, if the EPA were to implement a market-based approach

184. Clean Air Act § 231(a)(2)(B)(i).

185. The Supreme Court has never ruled against an agency on *Chevron* step two grounds, though some appellate courts have done so. *See* STEPHEN G. BREYER ET AL., ADMINISTRATIVE LAW AND REGULATORY POLICY: PROBLEMS, TEXT, AND CASES 247 (6th ed. 2006).

186. The power to raise revenue is restricted to Congress (and specifically the House) under the Constitution. U.S. CONST. art. I, § 7, cl. 1. The EPA has argued that this and other factors make it difficult or impossible for the Agency to raise revenue via allowance auctions. *See* Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354-01, 44,411 (proposed July 30, 2008) (to be codified at 40 C.F.R. ch. I). Note that even if the EPA were to raise revenue, it would go directly to the Treasury under the Miscellaneous Receipts Act, 31 U.S.C. § 3302(b) (2006), not remain with the EPA for promotion of environmental goals, such as climate finance. Separate legislation would therefore be necessary to direct any auction or other revenues toward environmental objectives.

187. *See* ANDREW AULISI ET AL., GREENHOUSE GAS EMISSIONS TRADING IN U.S. STATES: OBSERVATIONS AND LESSONS FROM THE OTC NO_x BUDGET PROGRAM 18 (2005), *available at* http://pdf.wri.org/nox_ghg.pdf.

188. Clean Air Act § 233.

to aviation emissions regulation, it would have to either adopt an approach that does not require any allocation at all, such as a tradable standard,[189] or freely distribute allowances.

V. INTERNATIONAL LAW LIMITATIONS ON EPA AUTHORITY

Congress' grant of authority to the EPA under the CAA may not be the only limitation on the EPA's ability to regulate aviation emissions. As a signatory to the 1947 Chicago Convention,[190] U.S. powers to regulate the aviation sector are circumscribed. As noted above, the Agency traditionally has used its CAA powers to regulate in parallel with ICAO emissions standards.[191] Regulating GHGs using these powers would require a departure from this practice, since the ICAO appears unlikely to issue standards for GHGs any time soon.[192]

Interpretations of the Convention and other international agreements were key issues in the European Court of Justice's recent decision upholding the E.U.'s move to include foreign aircraft emissions in the ETS[193] and will factor significantly in any further legal action over that decision. In many ways, understanding the scope of EPA authority requires similar analysis of relevant international law. Unfortunately, matching the depth of analysis in that case and in other discussion of E.U. policy is beyond the scope of this Article. Nevertheless, a brief overview of the relevant part of the Convention and related arguments is useful. If the Convention does substantially restrict the Agency's

189. *See* Dallas Burtraw et al., *supra* note 142, at 5–7 (describing tradable standards as a policy tool in the GHG context).

190. Convention Between the United States of America and Other Governments Respecting International Civil Aviation, Dec. 7, 1944, 61 Stat. 1180, 15 U.N.T.S. 295 [hereinafter Chicago Convention].

191. *See* Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 62 Fed. Reg. 25,356 (May 8, 1997) (codified at 40 C.F.R. pt. 87).

192. *See US Representative to ICAO Says General Consensus Remains That Market Measures Should Only Be Implemented from 2020*, GREENAIR (Apr. 27, 2012), http://www.greenaironline.com/news.php?viewStory=1454 ("The current directive to the ICAO Council following the 2010 Assembly was a derivative of the 2007 Assembly resolution, [the U.S. ambassador to ICAO] said. 'This is hardly surprising since the general consensus had not changed much at all between 2007 and 2010.'"). *But see* Allison Martell & Susan Taylor, *U.N. Aviation Body Says Emissions Proposal by Year-End*, REUTERS, Mar. 2, 2012, 5:12 PM, *available at* http://www.reuters.com/article/2012/03/02/us-airlines-emissions-idUSTRE8211M820120302 (reporting comments by the head of the ICAO that the organization plans to propose international GHG emissions limitations by the end of 2012).

193. *See* Case C-366/10, Air Transp. Ass'n of Am. v. Sec'y of State for Energy & Climate Change ¶ 33 (Dec. 21, 2011), http://curia.europa.eu/juris/liste.jsf?language=en&num=c-366/10.

regulatory authority, the range of options under the CAA described above might be largely irrelevant.[194]

A number of Articles in the Convention are relevant to this question. Article 37 instructs the ICAO to "adopt and amend . . . as may be necessary, international standards and recommended practices and procedures" toward a variety of ends.[195] Although polluting emissions are not specifically mentioned, the ICAO has issued such standards under its powers in Article 37.[196] Although it encourages "the highest practicable degree of uniformity,"[197] the Convention in Article 38 does allow states to deviate from ICAO standards, requiring only that they notify the ICAO of their decision to do so.[198] However, the Convention also requires member states to recognize aircraft certifications issued by other member states, so long as those certifications are based on standards at least as stringent as those issued by the ICAO.[199] Article 12 also requires member states to "to keep [their] own regulations in these respects uniform, to the greatest possible extent, with those established from time to time under [the] Convention."[200]

A. Domestic Aircraft

The Convention appears to indicate that states issuing more stringent standards can enforce those standards against their own aircrafts and airlines, but must allow (the Convention uses the phrase "recognize[] as valid") incoming or outgoing flights by foreign aircrafts that comply only with the less-stringent (or in the case of GHGs, non-existent) ICAO regulations.[201] Indeed, the EPA appears to take this view of the obligations under the Convention. In its 2005 aviation nitrogen oxide rulemaking, the Agency claims:

194. Note that this Part considers only potential limitations international law may impose on the ability of the EPA to regulate emissions from foreign aircraft. As discussed in the Introduction, critics of E.U. policy have also argued that the Convention prohibits regulation of extraterritorial emissions as well. But because the CAA almost certainly does not grant such authority to the EPA, the question is not relevant here. *See supra* Part IV.A.6.

195. *See* Chicago Convention, *supra* note 190, art. 37.

196. *See id.* Annex 16 vol. II, *available at* http://ia700407.us.archive.org/25/items/gov.law.icao.annex.16.v2.2008/icao.annex.16.v2.2008.pdf (detailing Standards and Recommended Practices [SARPs] for reducing engine emissions). ICAO SARPs are enacted under Article 37 authority. *See id.*, art. 37 ("To this end the International Civil Aviation Organization shall adopt and amend from time to time, as may be necessary, international standards and recommended practices.").

197. *See id.* art. 37.

198. *Id.* art. 38.

199. *Id.* art. 33.

200. *Id.* art. 12.

201. *Id.* art. 33.

> The Chicago Convention does not require all Contracting States to adopt identical airworthiness standards. Although the Convention urges a high degree of uniformity, it is expected that States will adopt their own airworthiness standards, and it is anticipated that some states may adopt standards that are more stringent than those agreed upon by ICAO . . . . As long as a participating nation of ICAO adopts aircraft emission standards that are equal to or more stringent than ICAO's standards, the certificates of airworthiness for such nations are valid. Thus, aircraft belonging to countries with more stringent standards are permitted to travel through the airspace of other countries without any restriction . . . if a nation sets tighter standards than ICAO, air carriers not based in that nation (foreign-flag carriers) would only be required to comply with the ICAO standards.[202]

Both California and the environmental groups petitioning the Agency agree with this position, at least with respect to domestic carriers.[203] In short, the Chicago Convention does not restrict EPA authority to regulate GHG emissions from U.S. aircraft or to regulate U.S. aircraft engine manufacturers.

B. Foreign Aircraft

The implications of the Convention for EPA regulation of foreign aircrafts operating in the United States are less clear. However, as noted above, in 2005 the EPA took the position that such regulation is not permissible under the Convention (at least in cases where the ICAO has issued standards for the pollutant in question).[204] Industry groups have taken a similar position, most notably in litigation over the E.U.'s aviation ETS decision.[205]

California and the environmental groups, however, have argued in their petitions that international law imposes no such limitation.[206] The environmental groups argue that "obligations under the Chicago Convention do not constrain the EPA's authority to adopt a program to

202. *See* Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 70 Fed. Reg. 69,664-01 (Nov. 17, 2005) (codified at 40 C.F.R. pt. 87).

203. *See* Environmental Petition, *supra* note 8, at 24–25; State Petition, *supra* note 8, at 15.

204. *See* Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 70 Fed. Reg. 69,664-01 (Nov. 17, 2005) (codified at 40 C.F.R. pt. 87).

205. *See* Press Release, Int'l Air Transp. Ass'n, IATA Disappointed with CJEU Opinion—Urges Global Solution through ICAO (Oct. 6, 2011), *available at* http://www.iata.org/pressroom/pr/pages/2011-10-06-01.aspx ("While the Advocate General of the CJEU believes that Europe is within its rights to move forward with this extra-territorial measure, that opinion is not shared in the international community. Many governments are rightly concerned about the infringements on sovereignty and the Chicago Convention that Europe's plans pose.").

206. *See* Environmental Petition, *supra* note 8, at 25; State Petition, *supra* note 70, at 16.

address aviation's global warming impacts that includes foreign aircraft."[207] Their petition offers no justification for this position based on the Convention itself, claiming only that "numerous State Parties . . . have endorsed this view."[208] The only example the petition provides is the E.U.'s decision to regulate foreign aircraft.[209]

As noted above, this decision is controversial.[210] In its 2008 decision to incorporate aviation emissions into the ETS, the E.U. claimed that doing so is permissible under the Convention.[211] It noted that the ICAO in 2007 urged member states not to unilaterally incorporate aviation emissions into trading schemes, but the E.U. reserved its right to do so at that time.[212] In the 2008 decision, the E.U. claimed that "the Chicago Convention recognises expressly the right of each Contracting Party to apply on a non-discriminatory basis its own air laws and regulations to the aircraft of all States," and that therefore imposing emissions regulation on foreign aircraft is permissible.[213]

Regardless of the Convention, the environmental petitioners argue that "[i]nternational law requires nations to ensure that activities within their territory do not cause transboundary environmental harm."[214] International law, they argue, not only allows but requires the U.S. to regulate aviation GHG emissions (from both foreign-flag and domestic aircraft).[215] The petition cites documents in which supporting statements appear, such as the 1992 Rio Declaration,[216] but these documents are not treaties or international agreements creating binding obligations.[217] The cited environmental goals should therefore be interpreted as aspirational principles. Even if they did create a binding obligation or codify a

207. *See* Environmental Petition, *supra* note 8, at 25.
208. *Id.*
209. *Id.*
210. *See* sources cited *supra* notes 8–13 and accompanying text.
211. *See* E.U. Directive, *supra* note 10, at 4.
212. *Id.*
213. *Id.*
214. *See* Environmental Petition, *supra* note 8, at 24.
215. *Id.*
216. *Id.*
217. With the exception of the 1992 United Nations Framework Convention on Climate Change, the cited language appears only in the preamble of that agreement. *See* Convention on Climate Change pmbl., *opened for signature* May 9, 1992, S. TREATY DOC. NO. 102-38, 1771 U.N.T.S. 107 ("States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the 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 . . . .").

principle of customary international law, such general principles should not trump the specific treaty obligations under the Chicago Convention.

In short, these arguments made by the petitioners are relatively unconvincing and are unlikely, on their own, to persuade the EPA to change its position on the regulation of foreign aircraft emissions. Nevertheless, the EPA is legally entitled to change its interpretation. The Agency may also argue that its past statements do not apply to aviation GHG emissions because those statements apply only to cases in which the ICAO has issued relevant standards, because the Agency has not deviated from ICAO standards in more than thirty years. In cases where the ICAO has no standards, such as GHGs, the Agency might take a different view—including the E.U. view that the Convention imposes no real limits on regulation of foreign aircraft. There does not appear to be a strong basis in the Convention for such an interpretation, however.

This is not to say that the Convention unambiguously forbids regulation of foreign aircraft emissions; creative arguments exist to the contrary. For example, Article 35 of the Convention allows—for reasons of public safety—member states to "regulate or prohibit the carriage in or above its territory of [specified] articles," provided that similar limits apply to domestic aircraft.[218] A country might argue that inefficient aircraft engines are "articles" and ban them on domestic and foreign aircraft for "public safety" reasons related to climate change. Doing so would appear to allow application of technological engine standards to foreign aircraft, though it might not allow performance standards given the focus on specific "articles." Other interpretations of the Convention that might allow regulation of foreign aircraft are possible. Scholars have argued both sides of this issue in the context of the E.U. ETS policy.[219]

In any case, imposing EPA aviation emissions standards on foreign-flag aircraft would be internationally controversial, and might be challenged in court—as noted, many countries beside the U.S. have strongly opposed the E.U.'s similar move.[220] No matter what the Agency does to regulate aviation emissions, some litigation by industry groups is

218. *See* Chicago Convention, *supra* note 190, art. 35.

219. *See* GOV'T ACCOUNTABILITY OFFICE, *supra* note 4, at 65 (contrasting the view that the ICAO, not the E.U., is the appropriate venue for aviation GHG limits with the view that ETS coverage of aviation emissions is not precluded by the Chicago Convention or other international agreements); *see also* Daniel B. Reagan, *Putting International Aviation into the European Union Emissions Trading Scheme: Can Europe Do It Flying Solo?*, 35 B.C. ENVTL. AFF. L. REV. 349, 371-378 (2008) (arguing the former); Gisbert Schwarze, *Including Aviation into the European Union Emissions Trading Scheme*, 16 EUR. ENVTL. L. REV. 10, 13 (2007) (arguing the latter).

220. *See, e.g.*, Mavis Toh, *supra* note 10.

likely. If the Agency regulates foreign aircraft, it will need to explain why its understanding of the Chicago Convention has changed since 2005—or, if not, why its earlier statements do not apply in the GHG context.

This assumes, however, that a U.S. court would be willing to enforce the requirements of the Chicago Convention. The Convention is almost certainly a non-self-executing international agreement.[221] It also predates the CAA, which, as noted in Part IV.A.6 above, includes no limitation on the EPA's authority over foreign aircraft. Pointing to this evidence, and depending on the judges' views on international law, a court might find no basis in U.S. law for restricting the Agency's authority.

Even if a court were to reach this result under U.S. law, it appears likely (though by no means certain) that EPA regulation of foreign-flag aircraft would violate U.S. obligations under the Convention. Perceptive readers will have noted that this is in tension with the E.U.'s plan to regulate such emissions, action which is itself at least partly the motivation for EPA regulation. The implications of the Convention for E.U. policy remain unclear: the European Court of Justice avoided analysis of the Convention's implications in its decision by determining that it did not apply because the E.U. is not a signatory.[222] This position is likely to be challenged in any future international litigation and is certainly a point of dispute in diplomatic negotiations.[223]

Limiting regulation to U.S. carriers would reduce the environmental benefits of regulation (since foreign carriers would not need to reduce their emissions) and, as discussed in the next section, create competitiveness problems.

221. *See* James A. Turner, *The Post-Medellin Case for Legislative Standing*, 59 AM. U. L. REV. 731, 733 (2010) (intepreting Supreme Court doctrine to mean that a "treaty term is not domestically enforceable without further action unless the language in the treaty clearly indicates that the parties intended the term to be self-executing" (citing *Medellin v. Texas*, 552 U.S. 491, 507–11 (2008)) and arguing that this creates a presumption of non-self-execution). Note that the question of self-execution is controversial among legal scholars, both in general and in reference to specific treaties. *See, e.g.*, Carlos Manuel Vazquez, *The Four Doctrines of Self-Executing Treaties*, 89 AM. J. INT'L. L. 695, 695 (1995) ("The precise nature of this distinction—indeed, its very existence—is a matter of some controversy and much confusion.") (internal citation omitted).

222. Case C‑366/10, Air Transp. Ass'n of Am. v. Sec'y of State for Energy & Climate Change ¶ 71–72 (Dec. 21, 2011) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:62010CJ0366:EN:HTML.

223. Letter from Hillary Clinton, U.S. Sec'y of State, & Raymond LaHood, U.S. Sec'y of Transp., to Jose Manuel Barroso, European Union President (Dec. 16, 2011), *available at* http://www.nbaa.org/ops/environment/eu-ets/20111216-eu-ets-us-state-department-clinton.pdf ("The EU's application of the ETS to airlines of non-EU States is inconsistent with the legal regime governing international aviation. . . .").

C. Competitiveness

If the EPA were to regulate GHG emissions from domestic airlines, but not similar emissions from foreign carriers, U.S. airlines would be at a competitive disadvantage relative to foreign airlines (with the exception of transatlantic routes, whose emissions would be subject to the ETS).[224] Japan Airlines, for example, could charge a lower price for flights to Japan than United Airlines could, all else being equal, because of the two airline companies, only United Airlines is required to comply with EPA regulations.

This problem illustrates the long-term desirability of internationally standardized aviation emissions regulations. Without such standardized rules, measures to address competitiveness are necessary. Options include excluding certain flights by U.S. carriers from regulatory requirements, subsidizing flights on routes where U.S. airlines compete with unregulated foreign airlines, or imposing taxes on foreign carriers. The last two options create further problems, however, since they are functionally identical to the E.U.'s move to impose extraterritorial regulation. They not only would expose the United States to claims of hypocrisy, but also may make its legal position untenable, because the same trade and international law arguments being made against the E.U. could be directed at the United States. Both options would also require new legislation.

The only viable option therefore might be to exclude many international flights by U.S. carriers from regulation under the CAA. Doing so could open the EPA to charges of arbitrary regulation, however, because the reasons for discriminating in this way have nothing to do with either the public health benefits of the regulation or its cost.

VI. CONCLUSION

The aviation sector is responsible for a small but significant part of the world's GHG emissions. Stalled efforts to limit these emissions through the ICAO and the E.U.'s recent decision to regulate these emissions unilaterally have presented the U.S. with an opportunity to regulate aviation emissions on its own terms.

The Clean Air Act gives the EPA powerful tools to regulate these emissions. In the past, the Agency has used these powers only to implement limits that have already been agreed on at the international level. But neither the Act, nor apparently international law, prevents the

224. *See* E.U. Directive, *supra* note 10, at 17.

Agency from acting on its own initiative (at least domestically). Courts will soon decide whether the Agency *must* regulate aviation GHG emissions. But, even if it is not required to do so, the EPA *could* regulate at least some aviation emissions at any time.

When, and if, the Agency does move to regulate these emissions, the statute gives it broad discretion over the scope, stringency, and regulatory mechanism. By framing regulations in the form of performance standards, the Agency can provide incentives not only to reduce direct emissions from engines, but also to make changes in operational practices and, over time, aircraft design that would increase efficiency and lower both GHG emissions and fuel costs.[225] Furthermore, the Agency can use at least some market-based tools to increase the cost-effectiveness of these regulations.

The statute requires the EPA to consider costs in the timing of its rules and permits it to do so generally.[226] There is also some evidence that the Agency could adopt flexible compliance approaches, including trading. This is important because cost-effective regulation not only reduces regulatory burdens (both social costs and industry costs), but also allows the Agency to pursue greater emissions reductions at similar cost. In other words, more cost-effective regulation increases the size of the pie, which can then be divided between environmental outcomes and economic impacts.

There are important limits to the Agency's capabilities, however. For example, the Agency could not auction allowances under a tradable system or otherwise use the regulatory program to generate revenue. CAA regulation therefore would be unable to contribute meaningfully to climate finance projects in the United States or elsewhere. Ironically, imposing CAA regulation could *reduce* the amount of money globally available for climate finance, because it would presumably allow U.S. carriers to escape the ETS, which does generate such revenue.[227] U.S. policy would reduce domestic emissions that the ETS cannot reach, but (at least without new legislation) at the cost of revenue to support other mitigation or adaptation projects.

225. The aviation industry already has market incentives to keep fuel costs down—this has driven the significant gains in efficiency over the last few decades. The rationale for regulation requiring further reductions in fuel use is that the climate change externalities associated with carbon emissions are not internalized by firms under current regulations.

226. Clean Air Act § 231(b), 42 U.S.C. § 7571 (2006).

227. *See, e.g.*, GERMANWATCH, AN INNOVATIVE APPROACH: THE GERMAN USE OF ETS REVENUES FOR NATIONAL AND INTERNATIONAL CLIMATE FINANCING 1 (2011), *available at* http://germanwatch.org/klima/clifin-ets11.pdf (stating that U.S. carrier participation in the ETS may be used for climate finance).

Moreover, it is unclear what type of regulation and what level of stringency would be sufficient for the E.U. to determine that U.S. regulation is "equivalent," allowing U.S. airlines to escape the ETS. The one-year suspension of the E.U. policy in late 2012 gives the U.S. (and the ICAO) more time to consider equivalent policies. But some response will be necessary if the U.S. is to avoid incorporation of its air carriers into the ETS and an ensuing trade dispute. Even if the ICAO is successful in developing an international GHG emissions limitation standard or trading system, the CAA would likely still be the primary vehicle for U.S. compliance, perhaps along similar lines to those discussed here.

Determining the policy tools available to the EPA does not determine how stringent any aviation GHG regulations should be, or even whether they should be implemented at all. Some in the aviation industry have argued that existing market pressures to reduce fuel costs already provide adequate incentives to reduce fuel consumption and, therefore, emissions.[228] If this view is correct, then cost-effective opportunities for emissions reduction may not be available, and the Agency should not regulate (and is likely entitled to refuse to do so on these grounds). This argument is weaker in a world in which some U.S. aircraft emissions are subject to E.U. regulation because associated regulatory burdens must be borne whether the EPA regulates or not. In any case, if the Agency believes cost-effective technological or operational measures are available, it has the tools necessary to require or incentivize their adoption.

Regulating aviation emissions is politically sensitive, as U.S. outrage over E.U. policy shows. The political impact of the E.U. policy for U.S. emissions regulation is ambiguous. On the one hand, it could make domestic regulation more palatable, because it would be done on U.S. terms rather than European ones. On the other hand, the EPA could more easily be portrayed as caving to European pressure. Although it is difficult to predict what the EPA will do regarding aviation emissions, it is clear that Title II Part B of the CAA gives the Agency the necessary authority to implement environmentally significant and cost-effective aviation emissions standards. When, and if, the Agency decides to (or is forced to) use these powers, it can do so effectively—provided it is both bold and smart.

228. *See* Beth Gardner, *Steep Fuel Prices Driving Push for Efficient Aircraft*, N.Y. TIMES, July 8, 2012, http://www.nytimes.com/2012/07/09/business/global/steep-fuel-prices-driving-push-for-efficient-aircraft.html.