

Aviation Emissions Report



A bi-weekly update on research, technology, and reduction strategies

Volume 3, Number 13

February 1, 2011

Outlook

AER'S NEW EDITORIAL ADVISORY BOARD OFFERS PREDICTIONS FOR 2011 AND BEYOND

In this special issue of *Aviation Emissions Report*, members of the Editorial Advisory Board get out their crystal balls and offer predictions on what to expect in the coming year in the area of aviation emissions reduction.

It's a tough assignment considering the uncertainty brought about by the Republican's new majority in the House of Representatives, their promise to sharply cut federal agency budgets, and their expected attempt to block the Environmental Protection Agency from regulating greenhouse gas emissions.

But Advisory Board members say there are some changes they are confident will happen in 2011 and beyond: airports will face more intense scrutiny on the local effect of airport pollution; the aviation industry will need to focus more on criteria pollutants – especially ozone, nitrogen dioxide, and particulate matter – because the EPA has begun to tighten National Ambient Air Quality Standards; and a greater number of airports are will find themselves within nonattainment areas under the Clean Air Act and subject to general conformity requirements.

There are research programs in place that promise significant reductions in aviation emissions but funding cuts could affect the speed and robustness of these efforts, some Board members warn. Under some reduced budget scenarios, several of the most important of these research programs would end.

However, predictions are hardly gloomy. Board members see huge opportunities to reduce aviation emissions in the near future through airlines' use of RNP procedures, new aircraft technology, and the development of sustainable biofuels.

The Editorial Advisory Board's predictions begin below.

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A Year of Possibilities (As Always)

Each new calendar year brings a host of possibilities, and a corresponding likelihood for inaction due to the press of political issues higher up on the agenda. Looking ahead to 2011, and assuming that airports and air quality are the subject of some debate, there are a number of potentialities that could unfold. We have elected to highlight below what we believe to be some of the more pressing controversies that require resolution and could be addressed in 2011 due to rising levels of concern.

In This Issue...

Special Report ... In what will be an annual exercise in AER, the eight members of the recently-announced Editorial Advisory Board offer their predictions on the regulatory, legislative, technological, and R&D activity in the area of aviation emissions reduction they expect to see occur in the coming year and beyond.

Their predictions cover a range of topics as broad and deep as their considerable expertise.

Addressed in their Outlook for 2011 are federal research efforts and policy development, EPA and state regulatory action on criteria pollutants and greenhouse gas emissions, and the environmental recommendations of the Future of Aviation Advisory Committee, among other topics.

But, cautions Dr. Lourdes Maurice, who serves as chief scientific and technical advisor in FAA's Office of Environment and Energy, "If there is one word that characterizes the Outlook for 2011, is it "uncertain."

(Continued on p. 93)

Outlook, from p. 92

First, of course, we must ask ourselves: Will the U.S. Environmental Protection Agency (Agency) and the Republican-dominated House of Representatives be able to get along? What the country needs is a cohesive climate change policy. However, recent happenings, including mounting legal challenges and political rhetoric, suggest that serious efforts to rein in the Agency's rulemaking authority on matters pertaining to greenhouse gases are imminent. Should an effort to preempt, repeal, or delay the Agency's regulations be successful, the likely outcome will be greater fragmentation amongst the states as "maverick" states endeavor to compensate for the Agency's lost ground, assuming that Congress fails to act with expediency in enacting its own legislative scheme. What is needed, then, irrespective of whether it comes from Congress, the Agency, or a combination thereof, is comprehensive (and perhaps preemptive) federal action on greenhouse gases. Currently, we have states acting in isolation and creating potential inequities in regulatory controls. For example, California's recently adopted cap-and-trade program, which will take effect in 2012, creates unique regulatory controls that are atypical of many states. This is not good for business and it is not good for airports.

Second on the agenda is the reconciliation of the National Environmental Policy Act (NEPA) with various state environmental laws. In February 2010, the Council on Environmental Quality issued draft guidance on the consideration of climate change and greenhouse gases under NEPA. The guidance, almost one year later, remains in draft form, leaving federal agencies with continuing uncertainty regarding the assessment of greenhouse gases associated with airport-related projects. On the other hand, for example, the California Environmental Quality Act (CEQA) made strides in the assessment of greenhouse gases when amendments to its regulatory guidelines became effective in March of 2010. However, California's advancements, to some extent, only serve to exacerbate the differences between federal and state environmental laws and standards. While identical standards would be ideal, if not also a pipe dream, what is needed for both federal and state agencies is clear direction on the scope, methodologies and standards by which to assess greenhouse gases.

Third, and relatedly, as CEQA practitioners, we believe there is a great need for 2011 to offer further clarity on the significance standards by which airport-related projects are assessed. While the California Natural Resources Agency has adopted some generic significance criteria, many local air districts are moving forward with the development of their own criteria. The concern is that the guidance being developed by these air districts often focuses on discrete categories of projects: stationary sources; residential projects; non-residential projects; and, mixed use projects. In many cases, these criteria are not easily applied to airport-related projects. Further, due to the lack of certainty regarding significance criteria for projects of all types, the matter is routinely being

litigated in various courts throughout the State of California, and the potential exists for those courts to issue conflicting decisions. Therefore, what applicants of all project types in California need is a clear determination regarding what constitutes defensible significance criteria. Such a determination would lend a level of certainty to the airfield development process.

Fourth and finally, and a departure from the greenhouse gas-centric perspective found in the previous paragraphs, we believe that 2011 and the years ahead will be accompanied by more intense scrutiny on the local effects of air pollutants associated with airport activity. Various studies recently have attempted to determine, in part, the relative contribution of airport- and aircraft-related emissions to ambient pollutant concentrations. (See, e.g., South Coast Air Quality Management District, General Aviation Airport Air Monitoring Study (August 2010).) While the results of these studies are subject to some debate, suffice it to say that local communities are continuing to show signs of less interest in noise and more interest in air, particularly the health effects attributable thereto.

In closing, and as highlighted by the other members of the AER Editorial Advisory Board, there is room for and need for change in the regulation and study of air quality associated with airport-related activity. And, 2011 could prove to be a year of change.

Billy M. Glover
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Huge Opportunities to Reduce Emissions

One of my colleagues told me that the secret to success, in today's world where most of us have many balls in the air, is to "make sure you know which ones are crystal balls – those are the ones that you definitely do not want to drop!" Well, the outlook for 2011 certainly includes some "crystal balls" that represent huge opportunity to reduce aviation emissions. I will just focus on three:

1) Operational procedures – RNP (Required Navigation Performance) implementation is accelerating. More than 1,000 Boeing-built airplanes in the US fleet are RNP-capable and airlines will implement RNP on many routes this year. Some airlines, including Alaska Airlines and Southwest Airlines, are leading the charge and pioneering new procedural applications or implementing it across their entire fleet/route system. Each use of RNP enables more efficient operations, and lower emissions. Other operational improvements (e.g. "Direct Routes" service) can be implemented on any aircraft and any route – reducing emissions and improving schedule performance too. Add to this the transformational work being pursued on NextGen, SESAR and the like. Expectations for 2011 are high.

2) New aircraft technology – Fleet modernization is a tremendous opportunity to improve emissions performance. Ongoing aircraft improvements can offer important incremental emissions improvements, and a full replacement with new aircraft can result in as much as a 40 percent reduction in fuel use and emissions. Manufacturers are delivering new technology and airlines are utilizing it, just as fast as the availability and economics will allow. With fuel being one of the top operating expenses, the incentive to find the most efficient aircraft is a clear and ever-present driver for decisions.

3) Sustainable biofuels – Considerable and unprecedented progress has been made in development of low carbon lifecycle “drop-in” biofuels for aviation in the past few years. In 2011 we will see that trend continue. ASTM International is working to approve hydrotreated renewable jet (HRJ) for inclusion in the jet fuel specification, and work on other promising approaches is already underway. Producers, fuel users and other stakeholders are having serious dialog about scaling up commercial availability. We will see these new fuels in revenue service use when they are market-ready – marking the beginning of a very bright future where aviation can use clean renewable energy on a routine basis with no sacrifice on quality or performance.

Those are my picks for “crystal balls” for 2011. These are so important to the future of the aviation industry which serves the world by connecting people and economies like nothing else can. Let’s keep these crystal balls in the air so we can continue to reduce emissions while meeting demand for air transport

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Word for 2011 Is ‘Uncertain’

If there is one word that characterizes the Outlook for 2011, it is “uncertain.” From budgets to policies, our crystal balls appear totally opaque. Will federal budgets return to 2008 levels or even lower? Remain at 2010 levels? Will federal budgets remain somewhere in between? What is the outlook for energy prices and policies? Will there be Federal regulation or legislation to mitigate greenhouse gases? What action can we expect on air quality emissions that might impact aviation? The answer to all of those questions is “I don’t know.”

I often find that the best way to deal with this type of uncertainty is to look beyond the immediate and ask myself, what will this situation likely be in five, ten, twenty years from now. In other words, what is likely not to remain constant when it comes to aviation emissions?

The impacts of aviation emissions on human health and welfare and the global climate are not likely to change in the absence of concerted action to deal with these impacts. The

Clean Air Act (CAA), the National Environmental Protection Act (NEPA), the National Ambient Air Quality Standards (NAAQS) and the global aircraft emissions standards negotiated under the auspices of the International Civil Aviation Organization (ICAO) will remain drivers. In addition, we can expect continued international pressure to reduce aviation greenhouse gas emissions and to address particulate emissions.

Aircraft burn petroleum derived jet fuel or aviation gasoline. Aviation emissions impact surface air quality in similar ways as emissions from other fossil fuel sources. However, as lead has been removed from many sources, leaded aviation gasoline is the primary source of lead emissions in the U.S. In recent years we have learned that aircraft related health impacts are primarily due to an incremental change in particulate matter (PM) – locally and regionally. Emissions of nitrogen oxides (NOx) contribute to PM emissions, so our efforts to reduce NOx have helped mitigate this impact. However, as air quality standards are tightened, we need to do more to address PM emissions. This is hard; despite much progress we still do not have a standardized method for measuring PM. Under the auspices of ICAO’s Committee on Aviation Environmental Protection (CAEP) we are working on a certification requirement for aircraft engine PM. This is challenging and requires close collaboration between governments and industry, as well as substantial investment. Efforts under the U.S. Aviation Emissions Characterization Roadmap, an Interagency, industry and academia coordination on characterization of aviation emissions, with a focus on aircraft engines, are supporting research that underpins an aircraft engine PM emissions measurement procedure that will feed into the development of the certification requirement. Clearly, if budgets are reduced, scientific input into the national and international decision making process will be both slowed and reduced. Will this result in delays? Or will we forge ahead but with less robust and well-informed decisions and policies? We at FAA continue to be committed to basing decisions and policies on the best available science, but we also have to base decisions and policies on the best available information at the time.

When it comes to climate, aviation CO2 emissions impact climate in the same manner as those from any other source. There is no question that the aviation enterprise has realized phenomenal improvements in fuel efficiency and in turn CO2 reductions. In 2010 the U.S. burned less jet fuel than in 2000. Yes, part of the decrease is due to less demand, but a lot is due to efficiency improvements. However, we are concerned about the potential for growth in emissions as air traffic demand returns. Also, while we do understand the impact of CO2 emissions reasonably well, there are many uncertainties surrounding the impacts of non-CO2 emissions. And of course there are interdependencies between some of these emissions, and potential tradeoffs to consider. We can reduce contrails-induced cirrus via operational means, but is an increase in fuel burn worth it? What about trades between NOx and CO2. The Aviation Climate Change Research

Initiative (ACCRI), an FAA funded effort, with support from other government agencies, is seeking to address these uncertainties. Again, the future of this program is highly uncertain. But the pressure to address these emissions, with the best knowledge available at the time, is not.

The U.S. national goal, originally established in the *Report to Congress: Aviation and the Environment in 2005*, has not changed. We are seeking to enable increased mobility while reducing impacts in absolute terms. The solution is a five-pillar strategy. Advancing our scientific knowledge on the source and extent of aviation environmental impacts through development of analytical models is one. In addition, we are seeking to mature new aircraft technology. The Next Generation Air Transportation System (NextGen) Continuous Low Energy, Efficiency and Noise (CLEEN) program funded by FAA and the Environmentally Responsible Aviation (ERA) effort funded by NASA are two new activities supporting this pillar. We are accelerating operational changes and air traffic management modernization through NextGen efforts. We are developing alternative fuels and coordinating government and industry efforts through the Commercial Aviation Alternative Fuels Initiative (CAAFI) to secure their qualification, certification and deployment. We are pursuing and/or exploring policies, standards and market based measures. A NextGen Environmental Management System, that will integrate the efforts of government and industry, is at the heart of this pillar. We are also pursuing an aircraft CO₂ standard in collaboration with ICAO/CAEP. The outcomes we hope to achieve are aggressive efficiency improvements of at least 2% per year and carbon neutral growth by 2020 relative to 2005, and absolute reductions in all aircraft emissions by 2050. This five-pillar approach also broadly supports environment and energy goals of National Aeronautics Research and Development Plan.

The bottom line is the need to address the environment and energy challenges of aviation has not changed. The speed and robustness of our efforts to address these issues is what is in question. Under some reduced budget scenarios, CLEEN, ACCRI, and NextGen EMS among other efforts would go away. Our capacity to actively participate and contribute to the international work under ICAO CAEP will be diminished. Reduced resources are never fun, but if there is one silver lining it is that budget pressures may engender efficiencies and more creative solutions. Budgets have gone up and down before and they will again. But our efforts to address the complex issues associated with aviation's impact on the environment must continue if we are to ensure that our nation continues to enjoy the economic and social benefits afforded by the aviation enterprise.

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A New Focus on Criteria Pollutants

Over the last decade, much of the energy relating to aviation emissions has been directed towards cutting-edge issues relating to air toxics and greenhouse gases. Traditional criteria pollutants like ozone – for which the Environmental Protection Agency sets National Ambient Air Quality Standards (“NAAQS”) – have required work, creativity and mitigation to maintain airport project momentum, but have not caused fundamental roadblocks. At the same time, most nonattainment areas have made significant progress in meeting standards as onroad, nonroad and stationary source regulations reduced emissions.

The aviation industry will likely need to refocus on criteria pollutants over the next few years, especially ozone, nitrogen dioxide and particulate matter. The U.S. EPA has begun to ratchet down National Ambient Air Quality Standards on a more regular schedule and with more aggressive standards. Within the last year, EPA has revised nitrogen dioxide standards to include a new 1-hour maximum of 100 parts per billion (ppb) and is working to strengthen monitoring requirements and various other aspects of the NAAQS for both lead and particulate matter.

Perhaps most importantly, EPA is expected to issue a final rule in July 2011 that will significantly strengthen the NAAQS for ground-level ozone. Proposed in January 2010, EPA's new rule would further reduce the 8-hour primary ozone standard to a level within the range of 60-70 ppb. EPA last revised its primary standard for ozone in 2008 to 75 ppb from 85 ppb. However, the 75 ppb standard was challenged in court by both industry and environmental interests. During the first year of the Obama Administration, the EPA pledged to revisit the NAAQS to address some of the claims in that litigation.

The proposed standard between 60 and 70 ppb reflects a very significant revision of the existing criteria pollutant emissions standards and a profound challenge to air quality agencies tasked with meeting the standard. This challenge for the air agencies will, in turn, lead to significant changes for airports and the aviation industry in terms of increased nonattainment designations, tighter overall emissions budgets, and tougher state implementation plan (“SIP”) conformity requirements.

According to EPA, roughly 48 percent of all monitored counties across the country report ground-level ozone levels above the current standard of 75 ppb. Upon implementation of the new standard, EPA estimates that the number of these “nonattainment” counties will jump to between 76 - 96 percent, depending on where the standard is set between 60 to 70 ppb.

The degree of nonattainment is also expected to be much more extensive. For example, in 2009, the Denver Metropolitan area reported only 9 total days of ozone read-

ings above the current 75 ppb standard (and only one above the old 85 ppb standard), but had 18 total days above 70 ppb, 43 total days above 75 ppb and 80 total days with readings above 60 ppb, the toughest of EPA's proposed standards. Every 5 ppb of stringency reflects roughly a doubling of days in excess of the standards.

Denver-area modeling has also shown the scope of the challenge. Even with projected reductions in nitrogen oxide (NO_x) by more than a third by 2020 due to cleaner vehicles and other sources, modeling indicates that the area will exceed the range of the new standards. Modeling of a new rule to retire or retrofit all of the coal-fired power plants in the Denver area – reducing emissions by about 15,000 tons per year of NO_x – showed reductions of monitored values of only around 0.8 to 0.9 ppb. The scope of further needed emissions reductions will be great, even for the less stringent end of EPA's proposed range.

Impact on Aviation

This will mean a number of things for aviation. First, a greater number of airports will find themselves within nonattainment areas, and therefore subject to requirements like general conformity (but also eligible for the Voluntary Airport Low Emissions (VALE) program). Under the Clean Air Act, any project involving federal funding, permitting, approval, or other form of federal support must be shown to be consistent with, or “conform” to, the specific requirements and allowable emissions thresholds of the area's applicable SIP. *De minimis* thresholds for the conformity rule may also be lower for some airports, because they depend on the nonattainment categorization of the area.

Tougher standards are likely to lead to tougher attainment designations and lower *de minimis* thresholds. Critically, the allowable level of total emissions for an area that will support attainment of the new standards will drop precipitously. This will make it much harder to put large airport-related budgets into SIPs, often the best strategy for addressing conformity for big projects. It will also invite more scrutiny of airport-related sources by air districts, as they scramble for control measures to meet the new standards. Offsets are going to be harder to find and more expensive to implement.

Looking ahead to when EPA's final ozone rule is scheduled this July (or later if the schedule slips again), it is important for airports to consider and prepare for the impacts of tougher regulation. This includes understanding the airport's emissions inventory, projecting development and growth, planning projects early, coordinating with regulators to understand applicable SIP requirements, and evaluating potential emissions mitigation strategies. The state and local air agencies will be generating new rounds of SIPs over the next few years and it will be both harder and more important to make sure airports and airport projects are properly included. Airports will also have to closely watch new particulate standards, as they are likely to become stricter and research continues to assess the contribution of turbines to ultrafine particulates.

Air toxics and greenhouse gas issues are not going away. However, they will likely need to make room on the aviation emissions front burner for the criteria pollutants.

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Critical Research Underway

Aviation has had a bruising opening decade in the new century – from the tragic events of 9/11 to the woes of global instability, pandemic outbreaks, fuel price volatility, and a historical financial crisis. The industry is adjusting to the market and global realities born out of the events of this past decade, albeit with painful losses. Yet, one of the challenges it must address, in a deliberate and purposeful way over the long run, is its impact on the environment. This is not only a cause for environmental protection, but also a business imperative to tackle a volatile energy market and achieve higher capacity and operational efficiency. It is, after all, an opportunity to demonstrate that aviation can lead the way in an era of transformational change and global challenge.

Air transportation is responsible for only 2 to 4 percent of global emissions depending on estimates used to account for climate forcing effects from non-CO₂ emissions. This is by all measures a smaller impact than other sectors of the global economy. However, this remains one of the few sectors that can still do so much for so many – from introducing breakthroughs in technology to implementing effectual change that can reverberate throughout the globe in a relatively short period of time. To be sure, the industry has made great strides in improving the environmental footprint of its aircraft fleet over the past decades. It has done so primarily out of competitive and market-considered reasons, but also in anticipation of policy mandates, as was the case with the Phase-out of Stage 2 aircraft at the turn of the 21st Century. Yet, as we move forward, more is needed: Environmental impacts constraining the expansion of the National Airspace System (NAS) will continue to require simultaneous progress on various fronts including research and technology development, system redesign and optimization, policy adaptation, and market-driven performance.

In the New Year, the research community will continue to enhance its understanding of aviation emissions, including climate-forcing effects in the upper atmosphere. The FAA is conducting important studies under the Aviation Climate Change Research Initiative (ACCRI) while the Airport Cooperative Research Program (ACRP) continues to be a valuable source of practical guidance for airports on environmental issues. In fact, we will soon be delivering guidance and technical documentation under ACRP Project 02-08 to help airports assess their contributions to local air quality.

This research project has used both innovative and reference methods to deliver insights to airport operators on how models and measurements can together be leveraged to quantify the overall impact of their operations on ambient air quality levels. Other ACRP projects scheduled to be completed in 2011 by other research teams include ACRP 02-03A and ACRP 02-07, which will respectively make a good contribution to existing knowledge on airport-related Hazardous Air Pollutants (HAP) and the costs and benefits of alternative aviation fuels.

In parallel, NASA is embarking this year on a technology research initiative that has the potential over time to achieve significant reductions in the environmental footprint of commercial aviation. The Environmentally-Responsible Aviation (ERA) Program has launched the first phase of its N+2 Advanced Vehicle Concepts project, which will seek advanced design alternatives for long-range aircraft with ambitious reductions in noise, fuel burn, and emissions – including a 75% reduction in LTO NO_x relative to CAEP-6, as well as reductions in cruise emissions, climate-forcing effects, and PM_{2.5} emissions. This project can serve as a catalyst for the introduction and demonstration of highly-innovative technologies such as advanced Laminar Flow Control and integrated propulsion-airframe concepts, leading to significant reductions in aircraft emissions per Revenue Passenger Mile (RPM).

What is more, the U.S. Department of Defense (DOD) is conducting critical research in both advanced aircraft design and alternative fuels; programs that are vitally important to the future environmental footprint of aviation. For instance, ongoing research by the Defense Advanced Research Projects Agency (DARPA) in third-generation biofuels has the potential to act as a game-changer for aviation; both in terms of climate effects, as well as the fuel price volatility that is plaguing the industry.

As technology development programs continue to move forward, it is equally important that the NAS be modernized and optimized so as to create an efficient operational system for new aircraft technology to deliver maximum environmental benefits. Herein lies the business case for the accelerated adoption of new aircraft technology should operators see an ROI [Return on Investment] benefit in using more efficient procedures that save fuel and reduce costs associated with delay and airspace access. Lowering NAS emissions while growing aviation traffic cannot be achieved without a market that is properly incentivized to make needed investments in advanced technology.

Finally, the policy community cannot lag behind awaiting resolution of current environmental constraints through technological innovation alone, or risking the progress that is being garnered by federal research in science and technology. Policy-makers, both at the federal and local levels, must recognize the pivotal role they must play for aviation to meet its environmental challenges while supporting the demands of a growing economy. First, while the focus of the U.S. Congress in the New Year may be on fiscal issues, it is important that

critical research programs that seek advanced solutions to aviation emissions and Air Quality impacts continue to be funded. This is not only in the interest of environmental mitigation, but also in the interest of the nation's competitive standing in science and technology. Second, as the debate on climate effects continues to evolve within the policy community, it is important to remember that regulatory action, applied correctly, is an important tool that can be used to steer stakeholders towards a common path. Deferring regulatory action on GHG and local Air Quality effects creates uncertainty, delays market response, and prolongs resistance to aviation growth. So, the earlier climate policy can be clarified, the faster the industry can move towards meeting its environmental obligations and by extension alleviating constraints on its ability to expand.

The effects of aviation operations on global climate and local air quality must be both understood and effectively addressed, despite the relatively small contributions of aviation to global emissions. On this issue, it is the proper role of government to invest in breakthrough research, balance stakeholder incentives, and promote a long-term strategy that serves the common good of the industry and the general public. The expansion of the air transportation system is an inevitable certainty. It is an economic imperative in this global economy, but it is also an opportunity for aviation to lead as a model industry. The challenge may, at times, seem unwieldy, but if history is any guide, no challenge of this kind has ever deterred the spirit of human ingenuity.

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Airports Being Innovative, Proactive

Airports have a long history of taking proactive, innovative measures to reduce their environmental impacts, including those associated with both local and global emissions. Recognizing that most aviation-related emissions result from activities outside an airport's ownership and control (e.g., aircraft, passenger vehicles), many measures airports have taken involve close cooperation with tenants, airlines, and others. I expect these types of initiatives to continue in the near future, with a focus on providing the most cost-effective environmental benefits in these times of close financial scrutiny and increasing regulatory burden.

Airport initiatives to reduce emissions include such actions as converting to low emission airport vehicles and shuttles, installing fuel hydrant systems, designating cell phone waiting lots, offering employee trip reduction programs, improving both airside and landside operational efficiency, providing power and pre-conditioned air for aircraft, consolidating rental car facilities, exploring renewable energy

generation, and increasing facility energy efficiency.

To get a truer picture of the breadth and depth of the environmental initiatives in place at our member airports, Airports Council International-North America (ACI-NA) conducted an environmental benchmarking survey in 2008. The survey was the first of its kind, and it addressed a wide range of environmental issues, including air quality, climate, and energy efficiency. The results were not a surprise – a broad range of measures were in place at airports across the U.S. and Canada to measure and address emissions from both airport and non-airport owned sources. However, we determined that, given the right information, tools, and policies, more could be done. As a result, in February 2009, the ACI-NA Board of Directors adopted a slate of ambitious, yet achievable environmental goals, including seven air quality/climate/energy goals. The goals aim to encourage more airports to undertake environmental initiatives that have been proven successful at other airports.

Last summer, ACI-NA conducted an updated environmental benchmarking survey, revised specifically to measure our members' progress in achieving the Board-adopted environmental goals, along with a variety of other environmental measures. While recognizing that the survey results may not necessarily be representative of all airports, we were happy to see significant progress in a number of areas. Importantly, however, additional work is needed in other areas.

As an example, in 2008, 15 out of 74 airports responding to our survey had prepared greenhouse gas (GHG) emissions inventories. By 2010, GHG inventories were completed or under development at 36 out of 59 responding airports. The corresponding ACI-NA goal aims for half of our members to have conducted such inventories by 2015. This significant uptick is likely a result of new airport-specific GHG emission inventory guidance released in 2009 by the Airport Cooperative Research Program (ACRP). Airports were also driven by new federal GHG emissions reporting regulations that apply to sources emitting 25,000 metric tons or more per year. Airports unsure of their GHG emission level needed to prepare an inventory to determine their potential reporting requirements. Having this inventory in hand now provides airports with information they can use to establish GHG emission reduction goals and develop more detailed climate action plans that address specific emission sources. These kinds of activities are likely to continue, given industry's overall dedication to reducing its climate impacts.

In comparison, the number of responding airports that provide low emission vehicle infrastructure only increased from 34 to 35 over that two year period. Progress in this area fell victim to the financial challenges faced by airports from reduced airline operations and decreased passenger traffic. However, the goal remains important, and our Board is encouraging half of our members to have such infrastructure in place by 2019.

The economic downturn has the entire airport community looking closely at every dollar spent. Fewer resources and a focus on reducing costs have made it even more difficult for

many airports to begin new projects, including those involving tenant and airline partners. Balancing environmental programs with competing priorities such as safety, security, and capacity often leads to difficult decisions. Meeting new and more stringent regulatory requirements adds even further pressure to the bottom line.

To help assess and balance varying priorities, many airports are incorporating sustainability concepts into their decision-making, simultaneously considering the environmental, economic, and social impacts of their actions. Fortunately, many initiatives that reduce emissions have the added benefit of cost savings, usually through the consumption of less energy or fuel. Airports are also taking a different approach by assessing an initiative's cost-benefits over its life-cycle, rather than focusing solely on the upfront costs. For example, while a low emission vehicle may have a higher purchase price than a conventional vehicle, the fuel savings over the life of the vehicle are expected to more than make up for that difference in cost.

Airports are also ensuring measures that reduce emissions are incorporated early into broader project and planning efforts. Through a new Sustainable Master Plan Pilot Program administered by the FAA, a number of airports are developing sustainable master plans or building sustainable concepts into existing master plans, thus making an early commitment to reduce environmental impacts as the airport grows and changes to meet future activity demands.

These sustainable approaches are generally becoming more commonplace amongst airports, especially as new tools such as the Sustainable Aviation Guidance Alliance database are available and undergoing enhancements over the next couple years through ACRP. Sustainability metrics and a ratings concept are also part of a new ACRP project. The Global Reporting Initiative's Airport Operators Sector Supplement will also be released this year, providing a sustainability reporting framework specific to the airport industry.

New ACRP reports focused on emission-reducing measures are providing airports with additional needed guidance in this area. Projects on quantifying the contribution of airport emissions to local air quality, identifying practical airport GHG emission reduction strategies, and measuring airport construction emissions, amongst others, will be released within the next couple years.

In spite of the many financial and regulatory hurdles airports are facing, airports are finding creative ways to work with their industry partners to adopt and enhance emission reducing initiatives, including the ACI-NA environmental goals. To help airports overcome those hurdles, ACI-NA is identifying and developing information sharing initiatives, education opportunities, new research, and policy changes necessary to provide more guidance for airports looking to improve their environmental stewardship. Focusing on these plans over the next couple years, we hope to assist our members as they continue to progress on their path of sustainability, providing benefits to communities, the environment, and the bottom line.

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Adaptation Will Be a Major Focus in Future

When members of the AER Editorial Advisory Board were invited to write an opinion piece predicting our outlook for the field, I immediately wondered how to keep it brief when there are so many things happening and how to avoid sounding like chicken-little saying the sky is falling. I think most of us will agree that the air quality/emissions field will remain complex and very active for the foreseeable future, requiring a substantial investment of time and energy to track progress, as well as new and emerging issues. I will jump in on three issues:

Greenhouse Gases/Climate Change and Adaptation

Probably the question I get most often about the future is regarding greenhouse gas/climate change. This includes emissions as well as adaptation.

With the November 2010 elections, the political winds seem to have shifted at a least temporarily away from Congress enacting a national program to control greenhouse gas emissions. Early Congressional proposals seem designed to signal to USEPA that the new Congress is displeased with the recent endangerment finding and other climate change-based policies. I doubt much will happen in Congress during 2011. Relative to aviation emissions controls, the US relies on ICAO which is considering CO₂ metrics. I suspect that because many carriers are voluntarily striving to achieve a 20-30% reduction in fuel efficiency by 2020, no serious global aircraft-related controls will be promulgated in the near-term by ICAO.

That leaves control in the United States to the individual states, counties, and cities, which so far have stepped into the Congressional vacuum and enacted priorities for energy conservation and renewable energy development and/or established greenhouse gas emission targets. According to the Pew Climate Center, so far only 14 states do not have renewable or alternative energy portfolio standards which specify the amount of electricity to be generated using renewable or alternative sources. Greenhouse gas emissions targets have been adopted by 23 states. A greenhouse gas emission target is where the state plans, for example, to reduce emissions to 1990 levels by 2020, and to 50 percent below 1990 levels by 2050. Pew Climate Center also indicates that 38 states have adopted Climate Action Plans which will likely morph into the greenhouse gas equivalent of a State Implementation Plan (SIP). Many airports are preparing greenhouse gas inventories and Climate Action Plans to understand their status relative to their state or local targets.

During the next year, USEPA plans to continue to "tailor" the Clean Air Act regulatory regime to encompass green-

house gas emissions. In March 2011, those airports that are required to report their emissions under the mandatory reporting rule, will submit their first reports. This rule was designed to enable USEPA to better understand the sources and location of emissions. Later in 2011, EPA is expected to promulgate New Source Performance Standards. The efforts in 2011 are expected to address power plants and refineries, and it is unclear as to how far USEPA will go to regulate existing plants and refineries. It is also unclear when and how these programs will migrate to other sources.

By design, the current national mandatory reporting rule only applies to the largest emitters. I feel certain that in the future, a national program will cast that net even wider. It is probable that mid and smaller emitters will be required to report within the next decade, and probably will catch up to airports. However, this is likely to only require Scope 1 emissions, which are from sources owned and controlled by the entity. For airports, that means fleet vehicles and stationary sources but not electricity, which falls under Scope 2.

The airport industry is just now beginning to study how climate change will affect airports. I think that adaptation will be a big focus in upcoming years as we learn to adapt to the new climatic conditions.

In the future, airport planning will likely include methodologies designed to aid with understanding unique adaptation issues at each individual airport. These will likely address: 1) what are the likely weather changes over time; 2) the probability/frequency of those conditions and what the conditions mean to existing and future infrastructure; and 3) how to embrace infrastructure and operations risk analyses into capital project planning and operations planning.

Contingency plans and irregular operations plans will likely be needed due to more frequent, erratic, climate change-related weather. As radical as it sounds now, I think these issues will likely become part of our normal planning process, as it seems inevitable. As an industry, we are just beginning to consider the effects of climate change on the air travel system as it is today, and what it will look like with implementation of NextGen.

Energy and/or Sustainability

Energy represents a current issue that will likely remain another leading issue facing the industry probably for the future. This challenge also represents tremendous opportunities for innovation and cost savings.

Of concern is the cost of fuel and its availability. While the US Department of Energy believes fuel will remain below \$100 per barrel through 2012, various other organizations do not share that prediction. Some indicate that the cost of fuel will reach and possibly exceed \$100 per barrel in 2011 and \$120 per barrel in 2012 (returning to and possibly exceeding the highs of the summer of 2008). Unexpected events affecting production, coupled with continued skyrocketing demand in China, could certainly make this earlier rather than later.

Airlines are actively exploring alternative jet fuels, while airports will continue to support airline alternative fuel initia-

tives and explore renewable facility power like solar and geothermal. Fortunately, those airports that are undertaking sustainability planning are capturing the energy costs and benefits of their actions.

The FAA's VALE program has grown substantially in the last few years. I would anticipate that VALE's popularity will continue to grow as more and more airports voluntarily reduce emissions. I think that these FAA discretionary funds will ultimately be broadened to also fund voluntary greenhouse gas emission reduction actions, which VALE only does indirectly now. I only hope that an emission reduction credit program is retained and applied to greenhouse gases. I encourage airports and airlines to take time to understand, document, and be transparent about their emission reduction actions. Such a philosophy will aid the industry in the future when regulations concerning energy efficiency or greenhouse gases are promulgated.

Criteria Pollutants

For the traditional pollutants, it is expected that the standards for pollutants like ozone and particulate matter will be strengthened in the future and new pollutants subject to standards. USEPA planned to issue a new ozone standard late last year, and with emphasis on health consequences of particles, an ultra fine particulate standard is likely on the horizon.

Airports projects not currently subject to the conformity regulations would then need to have conformance shown with the SIP for those occurring in areas not attaining these standards. For those subject to tightened standards, conformity may become more difficult to demonstrate. In both cases, we continue to urge airports to actively work with their state agency to capture current and future airport-related emissions in the SIP. Difficulties with conformity can also be alleviated with emission reduction credits, which can only occur by documenting the emission reduction benefits of early actions.

Conclusion

So what does all of this mean for the aviation community and airports in particular? I believe that air quality will remain an issue that requires careful attention for many years to come. Many in the industry have spent a lot of time following these issues. I suspect that a substantial amount of time will continue to be required to stay abreast of the changes relative to greenhouse gas, energy, and emissions and their consequences.

Nancy N. Young, Esq. Vice President, Environmental Affairs Air Transport Association

Setting the Future of Aviation Emissions Policy in 2011

There is a tremendous amount of focus on the big events of 2012. In the grander scheme, the U.S. Presidential election and the end of the world prophecies come to mind. Even for aviation emissions there is focus on that year – from the beginning of the trading obligation for airlines covered by the European Emissions Trading Scheme (EU ETS) (although my money is on the success of the Air Transport Association legal challenge to change that) to the expiration of the terms of the Kyoto Protocol. But if we look forward at 2012 too much, we may lose sight of the opportunities and events of 2011, which could be foundational for aviation emissions policy in years to come.

At the close of 2010, the Future of Aviation Advisory Committee (FAAC) convened by U.S. Department of Transportation Secretary LaHood issued a set of recommendations for ensuring the competitiveness of the U.S. commercial aviation industry, which provides the safest aviation system in the world. Significantly, four of the recommendations involved continuing and extending aviation's strong environmental record, particularly in the area of emissions savings. And all four of those highlighted the public-private partnership in technology, operations and infrastructure research, development and deployment as critical to success, both in terms of continued emissions savings and in terms of the competitiveness of this vital U.S. industry.

Indeed, recognizing that jet fuel costs and price volatility pose significant financial challenges to the aviation industry, and that fuel savings equate to emissions savings, the FAAC honed in on "win-win" propositions. The result is a roadmap (or flight plan) for aviation emissions policy in 2011 and beyond, focusing on the aircraft itself, the fuel we use to power it, the air traffic management system in which it operates and the regulatory framework that can support – or undermine – our progress. Here's a brief look at the four environmental recommendations, and key opportunities for implementing them in the coming year.¹

Aircraft Engine and Airframe Technology

Although it has long been recognized that foundational breakthroughs in airframe and engine technology require a public-private partnership, the National Academy of Sciences and a special report to Congress have documented tremendous decreases in U.S. government investment in this area. Recognizing that this has threatened the aviation environmental technology pipeline, the FAAC recommended the acceleration of "aircraft technology development with more robust research and development by government and industry." Specific recommendations in this regard included "significant

increases in funding to programs such as the FAA's Continuous Lower Energy, Emissions and Noise (CLEEN) technology program," permanent "extension of industry research and development tax credits," and "close coordination with National Aeronautics and Space Agency (NASA) aeronautical research programs."

Arguably, these are exactly the types of programs that President Obama was speaking to when he repeated in his 2011 State of the Union address that we need "to reach a level of research and development we haven't seen since the height of the Space Race." The President said that his soon-to-be-released budget would focus on investment, "especially clean energy technology – an investment that will strengthen our security, protect our planet, and create countless new jobs for our people." Given that the FAAC Environment Subcommittee documented that "[a]viation-related research and development investments are vital for a high technology economy and also the enablers of solutions that can decrease emissions, create good jobs, increase U.S. competitiveness, and provide substantial enhancements to mobility - benefiting the general public," the President's budget should place significant investment here. Moreover, Congress should recognize that this is not an area where they should be stingy, as the return on investment for the country undoubtedly will be significant.

Sustainable Alternative Aviation Fuel

Since the founding of the Commercial Aviation Alternative Fuels Initiative (CAAFI) by the Air Transport Association (ATA), FAA, Aerospace Industries Association and Airports Council International-North America in 2006, U.S. commercial aviation stakeholders and the U.S. military have made tremendous strides toward the deployment of sustainable alternative aviation fuels. From rig tests, to test flights, to a revision of the jet fuel specification to allow for synthetic fuels and to pre-purchase contracts for such fuels, the airlines and military are closing in on making alternative aviation fuels a reality.

Why is this important? Such fuels show promise for significant reductions in GHGs and emissions with local air quality effects over the lifecycle of the fuels. Also, they offer a strategically important alternative to petroleum-based fuels, which often must be imported from politically unstable regions and are prone to significant price volatility that threatens the viability of U.S. aviation.

Seeing these opportunities, the FAAC has recommended that the U.S. Department of Transportation demonstrate "strong national leadership to promote and showcase U.S. aviation as a first user of sustainable alternative fuels." To accomplish this, the FAAC recommends "increased coordination and enhancement of the concerted efforts of government and industry to pool resources, overcome key challenges, and take concrete actions to promote deployment of alternative aviation fuels."

Based on the hard work of an array of aviation stakeholders, particularly members of the CAAFI Certification &

Qualification Team, we expect to see a second revision to the jet fuel specification in 2011 – this one for hydrotreated renewable jet fuel (HRJ), which is a biofuel derived from plant oils. The CAAFI Environment Team also is poised to further confirm the methodologies and protocols for demonstrating the lifecycle emissions performance of alternative aviation fuels. In addition to its work within CAAFI, ATA has teamed with the U.S. Department of Agriculture and Boeing on a "Farm to Fly" initiative, to connect the agricultural supply chain with the aviation alternative fuel demand in a sustainable way. We also have a Strategic Alliance with the procurement arm of the military, the Defense Logistics Agency, to share information and efficiently pool resources toward deployment. But we are peering over what Bill Harrison, Technical Advisor for Fuels and Energy at the U.S. Air Force Research Laboratory, has called the "valley of death." While we know "how" to do aviation alternative fuels, whether we can largely depends on scaling up supply and making alternative aviation fuels cost-competitive. Support is needed from the federal government to ensure this promising alternative literally gets off the ground.

Again, this should be a priority in the President's upcoming budget, in Congress and in the federal agencies, as the investment is a sound one. Indeed, as the FAAC recognized, "[a]viation is well-suited for rapid deployment of alternative fuels because airports present concentrated nodes of demand, with a relatively small number of airport fueling stations compared to ground transport's substantially higher numbers of fueling stations and vehicles. Further, the aviation industry has positioned itself so the alternative fuels are capable of being 'dropped in' to existing aircraft engines and storage and distribution infrastructure." As the FAAC recognized, "[d]evelopment of commercially available alternative fuels will not only benefit civil aviation, but will also support green jobs, provide benefits to U.S. military aviation, support the farming sector that grows the bio-fuel feedstocks, and be the impetus for innovative alternative fuel development and deployment for other transportation modes and industry sectors."

Accelerating High Yield Efficiency Gains in a Modernized Air Traffic Management System

It is well-recognized that this nation needs to transition to the Next Generation Air Transportation System, or "NextGen." This was underscored by the FAAC, when two of its subcommittees developed recommendations regarding its implementation. That one of those was the Environment Subcommittee was telling. In making its recommendation for "substantial additional targeted investment to accelerate equipage elements of NextGen that will have significant near term benefits and increase likelihood of successful deployment," the Environment Subcommittee noted substantial savings in fuel burn and resulting emissions.

The FAAC recognized that enhanced aircraft equipage, like the ground and satellite technology needed for a modern-

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ized air traffic management system, is a critical national infrastructure investment. Among the specific recommendations was prioritizing the high-yield opportunities and accelerating their implementation over the next four years. As the new Congress again takes up FAA Reauthorization and looks at ideas championed by the President and both houses of Congress for U.S. infrastructure investment, the FAAC's recommendations in this regard should be heeded.

A Supportive Regulatory Framework

In its final environmental recommendation, the FAAC recognized that to have effective technology, alternative fuels and air traffic management infrastructure investment, national policy must be aligned to make it happen. While this primarily means that federal research and development, deployment and infrastructure programs should support public-private initiatives and investments, it also means that federal regulatory policy must not serve to undercut those initiatives and investments. Accordingly, the FAAC called for U.S. leadership domestically and internationally to support a "rationalized, harmonized approach to aviation GHG emissions, in lieu of a myriad of often counterproductive proposals – particularly involving emissions taxes, charges and trading."

There are significant opportunities for U.S. leadership in this regard in 2011. First, the U.S. can follow through on the first three environmental recommendations of the FAAC. Second, the U.S. can continue to work within the 190-member United Nations body charged with setting international aviation's emissions standards, recommended practices and policy, the International Civil Aviation, in implementing the global framework for aviation and climate change agreed in October 2010 and filling in the remaining gaps. And finally, the U.S. can and should stop seeing the airlines as a funding source for all manner of taxes, charges and other economic measures. The industry has made significant commitments to continuing its strong environmental record. To be able to do so, it must be able to invest in its future.

¹ The environmental recommendations are the first four in the FAAC package, available on the FAAC web site at http://www.dot.gov/faac/FAAC_Recommendations.pdf.

AVIATION EMISSIONS REPORT

Anne H. Kohut, Publisher

Published 22 times a year at 43978 Urbancrest Ct., Ashburn, Va. 20147; Phone: (703) 729-4867; FAX: (703) 729-4528.
e-mail: editor@aviationemissionsreport.com; Price \$550.

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