United States Government Accountability Office

GAO

Testimony

Before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives

For Release on Delivery
Expected at 11:00 a.m. EDT
Wednesday, October 24, 2007

AVIATION AND THE ENVIRONMENT

Impact of Aviation Noise on Communities Presents Challenges for Airport Operations and Future Growth of the National Airspace System

Statement of Gerald L. Dillingham, Ph.D.
Director, Physical Infrastructure Issues

GAO
Accountability * Integrity * Reliability

GAO-08-216T

October 24, 2007

AVIATION AND THE ENVIRONMENT

Impact of Aviation Noise on Communities Presents Challenges for Airport Operations and Future Growth of the National Airspace System

GAO Accountability • Integrity • Reliability

Highlights

Highlights of GAO-08-216T, a testimony before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives

Why GAO Did This Study

To address projected increases in air traffic and current problems with aviation congestion and delays, the Joint Planning and Development Office (JPDO), an interagency organization within the Federal Aviation Administration (FAA), is working to plan and implement a new air traffic management system, known as the Next Generation Air Transportation System (NextGen). This effort involves implementing new technologies and air traffic control procedures, airspace redesign, and infrastructure developments, including new or expanded runways and airports. Community opposition is, however, a major challenge, largely because of concerns about aviation noise. As a result, according to JPDO, aviation noise will be a primary constraint on NextGen unless its effects can be managed and mitigated.

GAO's requested testimony addresses (1) the key factors that affect communities' level of exposure to aviation noise, (2) the status of efforts to address the impact of aviation noise, and (3) major challenges and next steps for reducing and mitigating the effects of aviation noise. The testimony is based on prior GAO work (including a 2000 survey of the nation's 50 largest airports), updated with reviews of recent literature, FAA data and forecasts, and interviews with officials from FAA and the National Aeronautics and Space Administration (NASA), industry and community representatives, and aviation experts.

To view the full product, including the scope and methodology, click on GAO-08-216T. For more information, contact Gerald L. Dillingham at (202) 512-2834 or dillinghamg@gao.gov.

What GAO Found

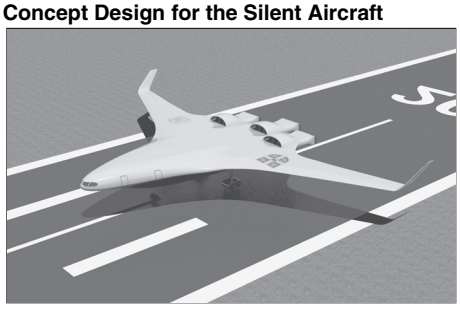
Key factors affecting the level of aviation noise that communities are exposed to include jet aircraft operations, land uses around airports, and aircraft flight paths. With more stringent regulatory standards for aviation noise, enabled by advances in technology, aircraft operations have become quieter, but aviation noise is still a problem when communities allow incompatible land uses, such as residences, schools, and hospitals, near airports. Aircraft flight paths also expose communities to aviation noise, and airspace redesign efforts, which are intended to improve aviation system safety and efficiency, may expose some previously unaffected communities to noise, raising concerns in those communities about higher noise levels.

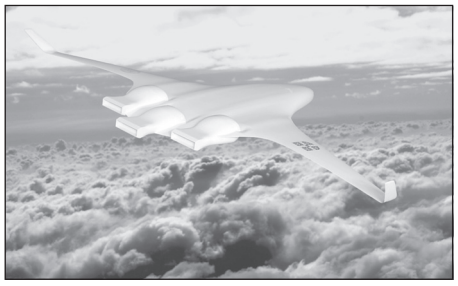
A number of efforts are underway or planned to address the impact of aviation noise on communities. More stringent noise standards for aircraft have been implemented, billions of federal dollars have been spent to soundproof buildings around airports, federal and private funding for research and development has advanced technologies to reduce aviation noise, NextGen technologies and procedures are being planned and will contribute to reducing communities' exposure to noise, some airports have imposed restrictions on the operation of certain aircraft, and airports are reaching out to communities to address their concerns about aviation noise and gain support for projects to increase airports' safety and efficiency.

Major challenges for reducing or mitigating the effects of aviation noise include continuing to make technological advances; obtaining substantial funding—from the federal government for NextGen in particular and from industry for equipping aircraft with new technologies—and cooperating on land-use issues. Next steps could include state and local actions to limit incompatible development, FAA's issuance of guidance related to the disposal of land acquired with federal funding for noise mitigation purposes, and the passage of legislative proposals that would address environmental issues, including the reduction of aviation noise.

FAA and NASA officials generally agreed with the information presented in this testimony and provided technical clarifications that GAO incorporated.

Concept Design for the Silent Aircraft





Source: Cambridge-MIT Institute.

Mr. Chairman and Members of the Subcommittee:

I appreciate the opportunity to testify before you today on the issue of aviation noise. As you know, air traffic has grown steadily over the past 5 years and is expected to continue growing, from 740 million air passengers in fiscal year 2006 to nearly 1 billion in 2015. With this growth has come a host of benefits and costs, from greater productivity and mobility for the nation as a whole to increased air traffic congestion, flight delays, and environmental issues, including aviation noise. To handle the forecasted growth, the Joint Planning and Development Office (JPDO), an interagency organization within the Department of Transportation's Federal Aviation Administration (FAA), is working to plan and implement a new air traffic management system, the Next Generation Air Transportation System (NextGen). Critical objectives for NextGen are to improve the overall safety and increase the efficiency of the National Airpspace System. Achieving these objectives for airports will involve the implementation of new technologies and air traffic control procedures, airspace redesigns, and infrastructure developments, including new or expanded runways and airports. Community opposition to these developments is, however, a major challenge, largely because of concerns about aviation noise. According to JPDO's 2007 Concept of Operations document, "current operational trends show that environmental impacts . . . will be the primary constraint on the capacity and flexibility of the NextGen unless these impacts are managed and mitigated." JDPO further states that noise has been and will continue to be a primary area of concern. Legislative proposals to reauthorize FAA[1] include a number of provisions designed to address aviation noise issues.

My testimony today addresses the following questions: (1) What are the key factors that affect the level of aviation noise exposure for communities? (2) What is the status of efforts to address the impact of aviation noise on communities? (3) What are the major challenges and next steps for reducing and mitigating the effects of aviation noise? My statement is based on our previous reports on aviation and the environment, one of which included a survey of the nation's 50 largest

[1]H.R. 2881 and S. 1300.

airports;[2] a synthesis of recent empirical literature; current FAA data and forecasts; published reports of selected airports' noise abatement initiatives and community-based aviation noise groups' efforts; and interviews with officials from FAA and the National Aeronautics and Space Administration (NASA), representatives of aviation industry groups and aircraft manufacturers, and selected aviation noise experts. We conducted our work from September to October 2007 in accordance with generally accepted government auditing standards.

Summary

Key factors affecting the level of aviation noise that communities are exposed to include jet aircraft operations, land uses around airports, and aircraft flight paths. Jet aircraft operations are the primary source of aviation noise, particularly during takeoffs and landings, and people's perceptions of aviation noise, which vary from one individual to another, can also influence communities' views on aviation noise. As a result, even comparatively low levels of noise exposure can create concerns in communities surrounding airports. More stringent standards for aviation noise—imposed through legislation and regulation and enabled by advances in technology—have, together with the airlines' response to the economic downturn following the terrorist attacks of September 11, 2001, led to the retirement or modification of older, noisier jet aircraft and their replacement with new, quieter jet aircraft. According to FAA, this change in the composition of the U.S. commercial fleet has been the most important factor in decreasing noise around airports. Local government decisions that allow communities to expand near airports may, however, erode the reductions in noise achieved through the introduction of quieter aircraft. FAA has issued guidance that discourages incompatible land uses, such as residences, schools, and hospitals, in areas with significant aviation noise, but communities face strong development pressures, and research suggests that federal land-use guidelines have had mixed results in deterring residential development in these areas. Finally, aircraft flight paths expose communities to aviation noise near airports, and changes in those flight paths may reduce or eliminate noise exposure in some communities and introduce or increase it in others. To date, FAA's

[2]See GAO, *Aviation and the Environment: Airport Operations and Future Growth Present Environmental Challenges,* GAO/RCED-00-153 (Washington, D.C.; Aug. 30, 2000). For this report GAO surveyed officials from the nation's 50 busiest commercial service airports to obtain their views on the key environmental concerns and challenges affecting airports' operations and future growth and to identify the efforts under way to address these concerns.

airspace redesign projects, which are intended to improve safety and efficiency while reducing congestion and delays, have generally involved changes in flight paths above 10,000 feet and have not greatly affected community noise levels. A planned project in the New York/New Jersey/Philadelphia area would, however, involve changes to flight paths at lower levels and has led to expressions of concern from communities that could experience higher noise levels.

A number of efforts are underway or planned to address the impact of aviation noise on communities. First, more stringent noise standards, which are significantly lower than the prior standards, are being implemented as new aircraft are being designed, built, and integrated into the U.S. commercial fleet. However, the implementation of these new standards may not have a significant impact on aviation noise levels because many aircraft in the current fleet met the new standards before they were required, the new aircraft will be integrated into the fleet over time, and increases in air traffic are likely to offset the reductions in noise levels attributable to quieter aircraft. Second, noise mitigation measures can reduce the impact of aviation noise on communities. These measures, which are typically carried out by airports and funded primarily through FAA's voluntary Part 150 Noise Compatibility program, include soundproofing buildings, acquiring noise-sensitive properties, and relocating people. Nearly 300 airports have participated in the Part 150 program and have both received and raised billions of dollars for mitigation measures. New FAA guidance, which is scheduled for release at the end of 2007, and the proposed FAA reauthorization legislation would respectively facilitate and expand airports' noise mitigation options. Third, research has led to the development of technologies that have reduced aviation noise, and this research is continuing, although declines in federal funding may have slowed the pace of government efforts. Both the National Aeronautics and Space Administration (NASA) and FAA have sponsored aviation noise research, often in collaboration with industry or academia. Such collaboration, for example, has contributed to the development of a Boeing aircraft that is expected to produce 60 percent less noise than its predecessor. Fourth, the planning for NextGen includes an environmental focus because concerns about aviation noise and emissions, which will grow with the expected increase in air traffic, will constrain efforts to expand system capacity. New technologies are being designed to control aircraft more precisely during approach and descent, thereby enabling the use of procedures that will reduce communities' exposure to aviation noise and emissions. Fifth, at an airport's request, FAA can impose restrictions on the operation of certain types of aircraft to reduce the impact of noise in surrounding communities. Generally,

however, airports and airports negotiate such restrictions without involving FAA. Finally, airports are using additional studies of aviation activity, supplemental measures of the effects of exposure to aviation noise, and community outreach and education to respond to community concerns about aviation noise and gain support for projects to increase airports' safety and efficiency.

Major challenges and next steps for reducing or mitigating the effects of aviation noise include technological advances, substantial funding from government and the aviation industry, and cooperation on land-use issues. In the future, as in the past, technological advances through research and development will be the key to reducing aviation noise, but the timing of future advances is uncertain. Furthermore, additional federal funding for noise reduction research and development programs may be difficult to obtain without shifting funds from other federal noise reduction efforts, such as the Part 150 program. For the airlines, equipping new and existing aircraft with the NextGen technologies that will reduce communities' exposure to aviation noise will also be challenging. FAA estimates that the costs of equipping the fleet to take full advantage of NextGen will be about $14 billion. Yet even with quieter aircraft and quieter and more efficient NextGen procedures, aviation noise will persist around airports, and incompatible land uses will pose challenges for airports and FAA. State and local officials can help to address these challenges through land-use planning and regulations that limit incompatible development, and FAA can complete and issue proposed guidance that will clarify the options available for airports to dispose of adjacent land previously purchased with federal grants to buffer surrounding communities from aviation noise. The options, which would require passage of the pending FAA reauthorization legislation, include selling the land and using the sale proceeds for environmental projects. Cooperation on land-use issues among officials at all levels of government and aviation stakeholders will also be necessary to reduce or mitigate aviation noise sufficiently to obtain public buy-in for the capacity enhancement projects that are critical to a safe and efficient national air transportation system.

We provided a draft of this testimony to FAA and NASA for review and comment. The agencies generally agreed with the information presented and provided technical clarifications that we incorporated as appropriate.

Jet Aircraft Operations, Land Uses, and Aircraft Flight Paths Are Key Factors That Affect Communities' Level of Noise Exposure

Noise is one of the most significant environmental impacts of aviation. Although noise is present around virtually every airport in the country, the problem is greatest near busy commercial airports served by large jet aircraft. According to FAA, the retirement of older, louder aircraft and ground-based noise-mitigation efforts over the past 35 years have reduced by over 90 percent the number of people affected by significant aviation noise levels—defined as a 65-decibel[3] day night level (DNL 65 dB) or greater[4]—despite nationwide increases in population and air traffic. FAA's estimates indicate that from 2000 to 2006 alone, the number of people affected by these noise levels dropped by more than a third, from about 780,000 to about 500,000. [5] Nevertheless, these half million people are still exposed to significant aviation noise levels, and as communities expand near airports just outside the highly exposed areas and as air traffic increases, millions more are affected by lower levels of aviation noise. Changes in aircraft flight paths can also affect communities' exposure to aviation noise, redirecting air traffic over some communities that were not previously exposed and diverting it from others.

Aircraft Operations Are the Major Source of Aviation Noise

Both jet aircraft engines and jet airframes produce aviation noise during aircraft operations, particularly during takeoffs and landings. Moreover, certain types of aircraft contribute disproportionately to the level of noise around airports. In our 2000 report on environmental concerns and challenges for airports, we reported that the primary issue of concern identified by officials of the nation's 50 busiest airports was the noise generated by older jet aircraft. With the implementation of technologies to reduce aircraft engine noise, efforts to reduce noise from airframes will become more important.

[3]A decibel is a unit for expressing the relative intensity of sounds on a scale from zero for the average least perceptible sound to 130 for the average pain level.

[4]The impact of aviation noise is usually analyzed in terms of the extent to which this noise annoys people by interfering with their normal activities, such as sleep, relaxation, speech, television viewing, and school and business operations. The generally accepted model for assessing the effects of long-term noise exposure assigns additional weight to sounds occurring at night (between 10:00 p.m. and 7:00 a.m.), and when those sound levels exceed 65 decibels, individuals report a noticeable increase in annoyance.

[5]These estimates reflect a revision in FAA's method of estimating the number of people exposed to significant aircraft noise. FAA previously estimated that the number of people exposed to significant noise in 2000 was about 500,000.

As technologies for reducing aviation noise have advanced (see our discussion of some of these advances in the next section of this testimony), regulatory standards for jet aircraft noise have become more stringent. The Airport Noise and Capacity Act of 1990 authorized the Secretary of Transportation to reduce aviation noise through a program to phase out older, noisier aircraft – known as Stage 2 aircraft— by December 31, 1999. Aircraft owners could either retire Stage 2 aircraft weighing over 75,000 pounds or modify them with hushkits to sufficiently muffle the noise they generated to meet Stage 3 standards. FAA had adopted the Stage 3 standards in 1977, the year they were established by the International Civil Aviation Organization (ICAO), and all aircraft designed after that time were required to meet the Stage 3 standards, but previously certified aircraft designs were grandfathered until the 1990 act required that they be retired or modified.[6] However, the act exempted aircraft weighing less than 75,000 pounds, a category that includes older business class jets. Stage 2 aircraft that weigh less than 75,000 pounds and Stage 3 aircraft that have been recertified as such after being modified with hushkits are in compliance with current standards, although these aircraft tend to be louder than new aircraft in the same weight range.[7] Bills pending in both the House and the Senate[8] would require, with certain exceptions, that all existing aircraft meet Stage 3 standards, including those aircraft under 75,000 pounds that are currently exempted. In addition, in July 2005, FAA issued a Federal Aviation Regulation[9] requiring that all new jet aircraft designs be subject to the current, more stringent ICAO noise standards, known as Stage 4. Specifically, any new aircraft whose design was submitted to FAA for approval on or after January 1, 2006, must meet these standards, which are based on the Chapter 4 standards adopted by ICAO in 2001. The Stage 4 standards are 10 decibels

[6]ICAO is an advisory organization affiliated with the United Nations that aims to promote the establishment of international civil aviation standards and recommended practices and procedures. FAA is the U.S. representative to ICAO.

[7]Some older business class jets that do not meet Stage 3 standards are still in service. According to the Airports Council International-North America, these louder business jets pose a noise problem at some smaller airports.

[8]H.R. 2881 and S. 1300.

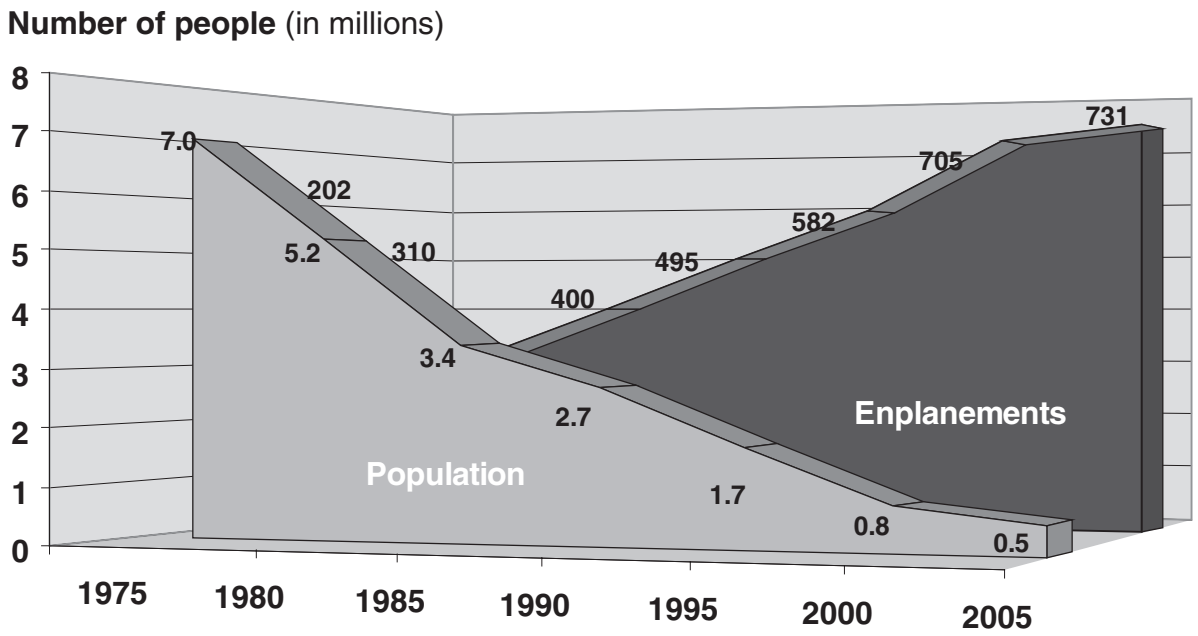
[9]14 CFR Parts 36 and 91.

lower on a cumulative basis[10] than the Stage 3 standards and represent a significant reduction in noise.

Since 2001, substantial progress has been made in retiring older, noisier aircraft. According to FAA, there has been a reduction of about 70 percent in the number of registered aircraft that have been modified with hushkits—mainly Boeing 727s and DC-9s. Today, there are 498 registered hushkitted aircraft, which make up about 8 percent of the U.S. commercial aircraft fleet. The replacement of these older aircraft with new, quieter aircraft has been the most important factor in decreasing noise around airports since the significant noise reductions achieved through the phaseout of Stage 2 commercial aircraft, according to FAA. Figure 1 indicates that the number of people exposed to significant noise levels has decreased even as the number of people flying has increased.

[10]Under the Stage 4 standards, none of an aircraft's maximum noise levels at takeoff, flyover, and approach can exceed Stage 3 noise levels. Compliance with the standards is determined by subtracting an aircraft's maximum takeoff, flyover, and approach levels from the maximum permitted noise levels. The differences obtained are the noise limit margins, which are added together to determine what is termed the effective perceived noise (EPN). When the three margins are added together, the total must be 10 EPN dB or greater; and when any two of the margins are added together, the sum must be 2 EPN dB or greater.

Figure 1: Trends in Aviation Noise Exposure and Enplanements

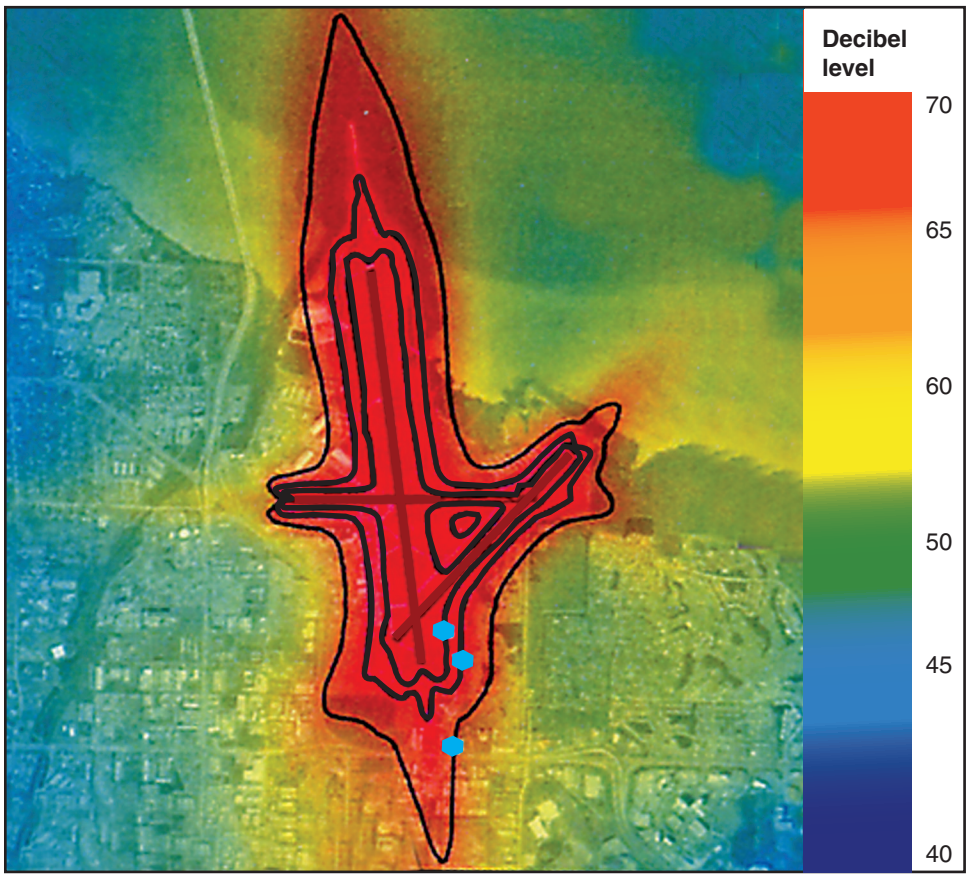


Source: FAA.

Incompatible Land Use Exposes Communities to Aviation Noise and Erodes Gains in Noise Control Achieved through More Stringent Standards and Advances in Technology

Decisions that allow communities to expand near airports may expose residences, schools, hospitals, and other uses to aviation noise. Such decisions are made primarily by local governments, but airports, which cannot control development in the communities that surround them, may nevertheless be held accountable by these communities for the effects of aviation noise. Although the areas around airports exposed to significant noise levels (DNL 65 dB or greater), known as noise contours (see fig. 2), have shrunk with the retirement of older aircraft, the incompatible use of land around airports remains a problem in dealing with the effects of aviation noise. Some stakeholders have said that the gains that have been made in noise attenuation through regulation and technology are being eroded or threatened by incompatible land use.

Figure 2: Aerial Photo Overlaid with Color-shaded DNL Contours



Source: Wyle Aviation Services.

FAA set the DNL 65 dB standard that is used to measure noise contours. This standard reflects the level of noise exposure over time that FAA has determined annoys people by interfering with normal activities such as sleep, relaxation, school, and business operations. FAA has also issued guidelines that identify land uses that would not be compatible with the noise generated by a nearby airport's operations, as well as land uses that could successfully be located close to an airport without interfering with their activity. Despite this guidance, however, strong pressure exists to develop residential areas around heavily used airports, and despite the steady decline in the number of people exposed to significant noise levels (DNL 65 dB and above), large numbers of people are still exposed to at least some noise around airports. And for FAA, population increases in areas around airports that are exposed to even moderate amounts of aviation noise pose a challenge because, given individuals' varying

sensitivity to noise, even comparatively low levels of exposure can generate community concerns. Population growth near airports also creates challenges for airports when planning expansion projects to meet the growing demand for air travel.

Any efforts to limit development have implications for the tax base of local communities. As a result, as FAA noted in a 2004 report to Congress on aviation and the environment,[11] there is a disconnect between federal aviation policy and local land-use decision-making. Until recently, evidence about trends in land use incompatible with airport activity was mostly anecdotal, but some empirical research is now available. For example research sponsored by FAA and NASA shows that for 92 commercial airports, between 1990 and 2000, "the effectiveness of existing federal land-use guidelines on reducing total noise exposure and deterring residential development inside the DNL 65 dB contours is mixed." Moreover, according to the research, "land-use planning has done little to address the increasing population aggregation on lands near existing noise footprints."[12]

Furthermore, according to FAA, incompatible land use is emerging as a problem around reliever airports, which predominantly service general aviation traffic that would otherwise go to nearby busy airports. These airports are located in quieter suburban and rural areas where aviation noise is more noticeable. Local governments with jurisdiction over land-use planning and development continue to permit building near airports, where developable land is comparatively plentiful. As a result, communities that did not exist when some airports were built are now opposing increases in aircraft operations and expansion at these airports.

[11]FAA, *Aviation and the Environment: A National Vision Statement, Framework for Goals and Recommended Actions* (Washington, D.C.: December 2004).

[12]Timothy F. LeDoux, *Airports and Their Cities: The Effectiveness of Mitigating Noise Exposure through Land Use Planning, 1990-2000*, Wyle Research Report WR 07-23, October 2007.

Airspace Redesign Initiatives May Change Some Communities' Exposure to Aviation Noise

The air traffic environment for the nation's airspace was designed and implemented in the 1960s and has undergone only minor changes over the years. However, the use of the airspace has changed significantly, with higher overall air traffic volumes and greater use of smaller and regional jet aircraft. As discussed later in this statement, FAA's airspace redesign initiatives have the potential to improve safety and efficiency by allowing the use of new arrival and departure procedures that can reduce the impact of noise and emissions on nearby communities. At the same time, though, they have led to concerns about aviation noise in some communities that were not previously exposed to it.

Airspace redesign projects usually involve changes in aircraft arrival and departure routes from airports. These changes may result in exposing some communities to less noise and others to more noise. FAA has completed over 30 airspace redesign projects, including projects around major airports such as those serving Las Vegas, Dallas-Fort Worth, Minneapolis, and Boston. According to FAA, between 2002 and 2007, airspace redesign projects have produced almost $700 million in customer benefits from reduced delays, more efficient routing, and reduced restrictions attributable to a more balanced air traffic control workload.

Until recently, most airspace redesign projects have involved changes in flight paths above 10,000 feet and have therefore not had a significant impact on noise levels in communities near airports. However, FAA has approved the most ambitious airspace redesign project to date, which involves flight path changes in the New York/New Jersey/Philadelphia airspace, including changes at levels below 10,000 feet. According to FAA, this airspace is some of the most complex and congested anywhere in the world, with about one third of the nation's commercial air traffic passing through it. Delays and congestion in this airspace or at area airports tend to ripple throughout the system. Airspace redesign projects have the potential to alleviate some of these problems at this critical chokepoint in the national airspace system.

Because the airspace redesign for the New York/New Jersey/Philadelphia area will make changes to arrival and departure routes, the noise contours in the area will also change, exposing some communities to less noise and others to more. According to FAA's analysis of the effect of the redesign, fewer people would be exposed to moderate to significant noise levels than is currently the case, but some people who live under the new flight paths would be exposed to higher though moderate levels of noise. On the basis of this analysis, the environmental impact statement prepared for the redesign project concludes that the project will not have a significant

environmental impact with respect to noise. However, the possible shift in noise contours has led to significant expressions of concern, including litigation in many of the communities that could experience higher though moderate levels of aviation noise. One of these communities, which has a large minority population, contends that the redesign would disproportionately affect minority neighborhoods. This contention could raise concerns about environmental justice.[13] We are currently reviewing the New York/New Jersey/Philadelphia airspace redesign at the request of this Subcommittee.

A Number of Efforts Are Underway or Planned to Reduce the Impact of Aviation Noise

To reduce the impact of aviation noise, FAA, in conjunction with NASA, aircraft and aircraft engine manufacturers, airlines, airports, and communities, follows what the International Civil Aviation Organization refers to as its "balanced approach." This approach recognizes that short-term opportunities to mitigate the impact of aviation noise on communities should be combined with longer-term efforts to reduce aviation noise. Efforts include reducing noise at the source through more stringent standards; implementing noise abatement programs in communities near airports; supporting research and development programs for new technologies to make aircraft quieter, developing and implementing NextGen technologies and procedures, and restricting aircraft operations . In addition, many airports address aviation noise issues through studies, supplemental analyses, and community outreach.

Implementation of More Stringent Noise Standards May Not Noticeably Reduce Current Noise Levels

As aircraft whose design was approved on or after January 1, 2006, are integrated into the fleet, the new Stage 4 noise standards will be implemented. While these standards are more stringent than the prior Stage 3 standards and have been adopted internationally as well as domestically, their implementation may not have a significant impact on aviation noise levels. According to the Airports Council International-North America, which represents many of the nation's airports and other

[13]Environmental justice generally refers to efforts to identify and address the disproportionately high and adverse human health and environmental impacts on minority and low income populations. In 1994, President Clinton issued an executive order requiring all federal agencies to make environmental justice a priority. In accordance with the executive order, the U.S. Department of Transportation issued an Order on Environmental Justice upholding principles laid out in the National Environmental Policy Act and other federal statutes that ensure the social, economic and environmental welfare of low-income and minority communities, as well as their involvement in the environmental and transportation decision-making processes.

stakeholders, the Stage 4 standards were already being met by a significant proportion of the aircraft in production when ICAO adopted its identical Chapter 4 standards in 2001. Additionally, aircraft manufacturers' sales forecasts indicate that most of the new aircraft coming into service in the near future will be for the international market rather than for the U.S. market.

During the discussions leading up to the adoption of the ICAO Chapter 4 standards, the European Union argued that more stringent noise limits would push technology toward quieter aircraft. However, under the current ICAO system, a key criterion for the adoption of new standards is that they must be found to be "technologically feasible"—that is, demonstrably capable of being introduced across a sufficient range of the fleet, as shown by the commercial deployment or deployability of technologies that can meet the specified noise reductions.[14] Aviation industry representatives indicated that they considered the ICAO process rational for several reasons, including "not pushing the technology envelope," which could lead to a potential trade-off with aircraft performance. Additionally, industry representatives have stated that new product development programs are already complex and pose many business and schedule risks. As a result, they believe it is inadvisable to force more aggressive standards because they could lead to delays in new programs. More recently, ICAO has formed independent review committees under its Long Term Technology Goals initiatives to begin discussions with stakeholders on technologies that might be available 10 to 20 years from now. These committees are not charged with developing standards, but rather with involving stakeholders in these early discussions and preparing a report based on these efforts that is designed to stimulate further development of the most promising technologies and better inform ICAO when new standards may need to be considered.

[14]The other criteria for adopting new standards are that they must provide environmental benefits, be economically reasonable, and take the potential interrelationships between noise and emissions into account.

Noise Mitigation Programs Have Reduced Adverse Noise Effects, and Proposed Guidance and Proposed Legislation Would Support Further Noise Mitigation Efforts

Most airports are owned and operated by state governments and local municipalities. Therefore, the primary responsibility for addressing community concerns about noise resides with these entities. Nevertheless, airports can reduce the impact of noise on surrounding communities by undertaking measures to mitigate incompatible land use, such as acquiring noise-sensitive properties, relocating people, modifying structures to reduce noise, encouraging compatible zoning, and assisting in the sale of affected properties.

FAA supports airports' efforts to mitigate aviation noise through its voluntary noise compatibility program, known as the Part 150 Noise Compatibility Program, which provides guidance to airports on the types of land uses that are incompatible with certain levels of airport noise and encourages them to develop a noise compatibility program to reduce and prevent such uses. As part of the process, airports map the area affected by the noise and estimate the affected population. According to FAA, mitigation measures, such as soundproofing homes, have brought relief to tens of thousands of people in neighborhoods near long-established airports since the early 1980s.

Airports that participate in the Part 150 program can receive noise set-aside funds from the Airport Improvement Program (AIP),[15] which they must match to varying degrees, depending on their size.[16] According to FAA, nearly 300 airports have participated in the program. These funds can be used to, among other things, soundproof buildings and support relocation by acquiring homes in areas with significant noise. Thirty five percent of AIP discretionary funds are reserved for planning and implementing noise compatibility programs. In fiscal year 2006, FAA issued 90 noise-related AIP grants totaling $305 million.

Since the early 1980s, the federal government has issued grants or allowed airports to impose charges to mitigate noise around many airports. According to FAA, it has provided about $5 billion in AIP grants and

[15]The AIP program provides federal funds for development projects at the entire range of the nation's 3,400 airports – from small general aviation airports to the very largest airports that handle several million passengers per year.

[16]According to FAA, noise projects are eligible for 80 percent funding under AIP for large- and medium-hub airports and 95 percent funding at small, nonhub, general aviation, and reliever airports.

airports have used about $2.8 billion in passenger facilities charges (PFC)[17] for Part 150 noise mitigation studies and projects. In total, this funding amounts to nearly $8 billion (see table 1). FAA officials further noted that while the vast majority of airport noise mitigation projects use some AIP or PFC funding, airports may undertake projects with other financing.[18]

Table 1: AIP and PFC Investments for Noise-Related Purposes through Fiscal Year 2007

Dollars in millions	
AIP funds, fiscal years 1982-2007	**Funding**
Mitigation measures for residences	$1,903
Land acquisition	$2,170
Noise monitoring system	$170
Mitigation measures for public buildings	$703
Noise compatibility plan	$87
Total AIP funds	**$5,033**
PFC funds, fiscal years 1992-2007	
Multiphase	$1,283
Land acquisition	$481
Soundproofing	$1,018
Monitoring	$31
Planning	$15
Total PFC funds	**$2,828**
Grand total	**$7,861**

Source: FAA.

Although all airports are eligible to participate in the Part 150 program, some of the busiest commercial airports do not. Among these are New York's JFK International and La Guardia, Newark International, Houston's George Bush Intercontinental, Dallas-Fort Worth International, Boston-Logan International, Dulles International, O'Hare International, and Miami International (see app. I for a list of those airports among the 50 busiest that do not participate in the Part 150 program). According to FAA, some

[17]Passenger facility charges are fees airports can charge passengers to fund FAA-approved projects. Not all airports charge these fees.

[18] According to FAA, noise projects are 100 percent eligible under PFC and airports can use PFC funds for the required match for AIP funding.

airports have chosen not to participate in the Part 150 program for a variety of reasons. Some airport operators view the program as too complicated, costly, and difficult to implement. FAA officials note that some larger airports that have chosen not to participate in the program may have such a significant number of incompatible land uses that it would be financially prohibitive to implement mitigation measures in all areas significantly affected by noise and that the projects that were undertaken could take decades to complete. In addition, in some cases, neighborhoods are so clustered together that mitigation measures would have to be applied to a substantial number of homes outside significant noise contours in order to establish equitable neighborhood boundaries. FAA officials further note that an airport's nonparticipation in the Part 150 program does not mean that the airport does not have an airport noise mitigation program. For example, Boston Logan Airport has a noise program that predates the Part 150 program and qualifies for federal noise mitigation funding under the program through a grandfathering provision. Airports can also use AIP discretionary grant and PFC funds for noise mitigation without joining the Part 150 program. In addition, some soundproofing of schools and healthcare facilities is eligible for federal funding even if an airport does not participate in the Part 150 program.[19]

Besides providing funding for airports' noise mitigation efforts through the Part 150 program, FAA published draft guidance in June 2007 on the acquisition, management and disposal under AIP of noise land—that is, land that is exposed to significant noise levels. The guidance initiative was in part a response to the findings of an audit by the Department of Transportation Inspector General of 11 airports that disposed of land acquired for noise mitigation purposes.[20] The audit found that each of the 11 airports had noise land acquired with AIP funds, ranging from nominal acreage at several airports to hundreds of acres at others, that either was no longer required for noise compatibility purposes or did not have a documented need for airport development. The Inspector General concluded that with improved oversight of noise land and its disposal, FAA could recover an estimated $242 million for the Airport and Airways Trust Fund, which provides most of the funding for aviation programs, or

[19] 49 U.S.C. 47504 c (2) (D).

[20] U.S. Department of Transportation, Office of the Inspector General, *Audit of the Management of Land under Airport Noise Compatibility Programs* (Washington, D.C.: Sept. 30, 2005).

for other airport noise mitigation projects.[21] This finding was particularly important in light of the constrained resources that are available for all aviation programs. The final FAA guidance, which is scheduled for issuance by the end of calendar year 2007, explains the current options for reinvesting or transferring the proceeds from the sale of noise land acquired under AIP, giving preference to investment in airport noise compatibility projects. Provisions in the House[22] and Senate[23] reauthorization proposals would authorize these options. These provisions have the potential to help airports further mitigate the adverse effects of the incompatible land uses around airports and could provide additional resources for noise mitigation and other AIP-eligible investments.

The House reauthorization bill (H.R. 2881) also contains other provisions that, if enacted, could enhance FAA's and airports' efforts to mitigate the impact of noise on communities. Section 503 would allow FAA to accept funds from airport sponsors[24] to conduct special environmental studies to support approved noise compatibility measures for federally funded airport projects. In addition, Section 504 would allow FAA to accept funds, including AIP grants and PFC funds, from a sponsor in order to hire staff or obtain services to provide environmental reviews for new flight procedures that have been approved for airport noise compatibility purposes. Finally, Section 507 would authorize a new pilot program to allow FAA to fund six environmental mitigation demonstration projects at public-use airports to take previously laboratory-tested environmental research concepts into the airport environment in order to determine if they can measurably reduce or mitigate the environmental impacts of aviation noise or emissions.

[21]Under current law, an airport that disposes of noise land acquired with AIP grant funds is required either to return a proportional amount of the sale proceeds to the Trust Fund or to reinvest that amount in a noise compatibility project at the airport.

[22]FAA Reauthorization Act of 2007, House of Representatives Report 110-331, 110th Congress 1st Session, Section 132, pg. 9, September 17, 2007.

[23]Aviation Investment and Modernization Act of 2007, U.S. Senate, 110th Congress 1st Session, Section 203, pg. 30, May, 2007.

[24]An airport sponsor is the entity that owns the airport. For example, the City of Los Angeles is the sponsor for Los Angeles International Airport.

Past Research Has Significantly Advanced Noise Reduction Technologies, and Efforts Are Continuing, though Federal Funding Has Declined

Research and development of technologies for reducing aviation noise has led to advancements that have significantly reduced the amount of noise produced by aircraft, and this research continues, although further advancements will be challenging. NASA, FAA, academic institutions, and the aircraft and manufacturing industry are all involved in research and development projects aimed at reducing aviation noise and its impacts.

Collaboration with Industry and Others Has Advanced Research on Aviation Noise

NASA, in partnership with the aircraft and aircraft engine manufacturing industry, has contributed to a number of advancements in aircraft engine and airframe technology that have substantially reduced the amount of noise produced by aircraft and may lead to further reductions in the future, depending on the extent to which current research leads to noise-reducing aircraft engine and airframe designs. For example, through partnerships with industry, NASA has conducted research on engine noise reduction technologies that have significantly reduced aviation noise. Research on the use of composites has also enabled reductions in the weight of aircraft, which affects the amount of noise the airframe produces. As a result of these and other advancements, the newest aircraft currently in production will produce substantially less noise than the models they will replace. For example, Boeing estimates that the 787 aircraft will produce 60 percent less noise than the 767 and the noise from the 747-800 will be 30 percent less than the 747-400 it is replacing. Similarly, Airbus says that its new A-380 jumbo jet will produce 46 percent less noise than the 747-400. However, industry representatives have indicated that returns are diminishing from these types of improvements.

FAA conducts a significant amount of its research on aviation noise issues, much of it through the Partnership for Air Transportation Noise and Emission Reduction (PARTNER), the Department of Transportation's Volpe National Transportation Systems Center, and other entities. PARTNER is a Center of Excellence that brings together experts from government, academia, and industry.[25] Sponsored by FAA, NASA and Transport Canada,[26] PARTNER includes 11 collaborating universities and

[25]FAA Centers of Excellence are FAA partnerships with universities and affiliated industry associations and businesses throughout the country that conduct aviation research in a number of areas including advanced materials, aircraft noise and emissions, and airworthiness.

[26]Transport Canada is the department within the government of Canada that is responsible for developing policies, regulations and services for the Canadian transportation system.

approximately 50 advisory board members who represent aerospace manufacturers, airlines, airports, state and local governments, and professional and community groups. The collaborating universities and organizations represented on the advisory board provide equal matches for federal funds for research and other activities. PARTNER projects related to aviation noise involve testing alternative descent patterns; identifying a means to reduce aircraft landing noise, fuel consumption, and emissions; assessing the human health and welfare risks of aviation noise; and developing online resources to better inform the public about aviation noise issues. According to FAA, in the last 10 years, it has spent about $42 million on research to characterize noise and improve prediction methods, including developing a capability to determine the trade-offs between noise and emissions and quantifying the costs and benefits of various mitigation strategies.

Federal Funding for Aviation Noise Research Has Declined

Federal funding for aviation noise research has declined over the past decade, particularly for NASA, which provides most of the federal funding for aeronautics research. NASA's budget for aeronautics research has dropped by about half over the past decade and is about $717 million for fiscal year 2007.[27] Partly to address this overall funding reduction, NASA has reorganized its aeronautical research portfolio to focus on what it calls "fundamental" research—a relatively early stage in the research and development process that is less costly than the later stages.[28] According to FAA, the combination of a dramatic decrease in NASA's funding and the reorganization of its aeronautical research portfolio to focus on fundamental research has left a gap in the near- and mid-term applied research and development that could produce technological solutions within the NextGen time frame.

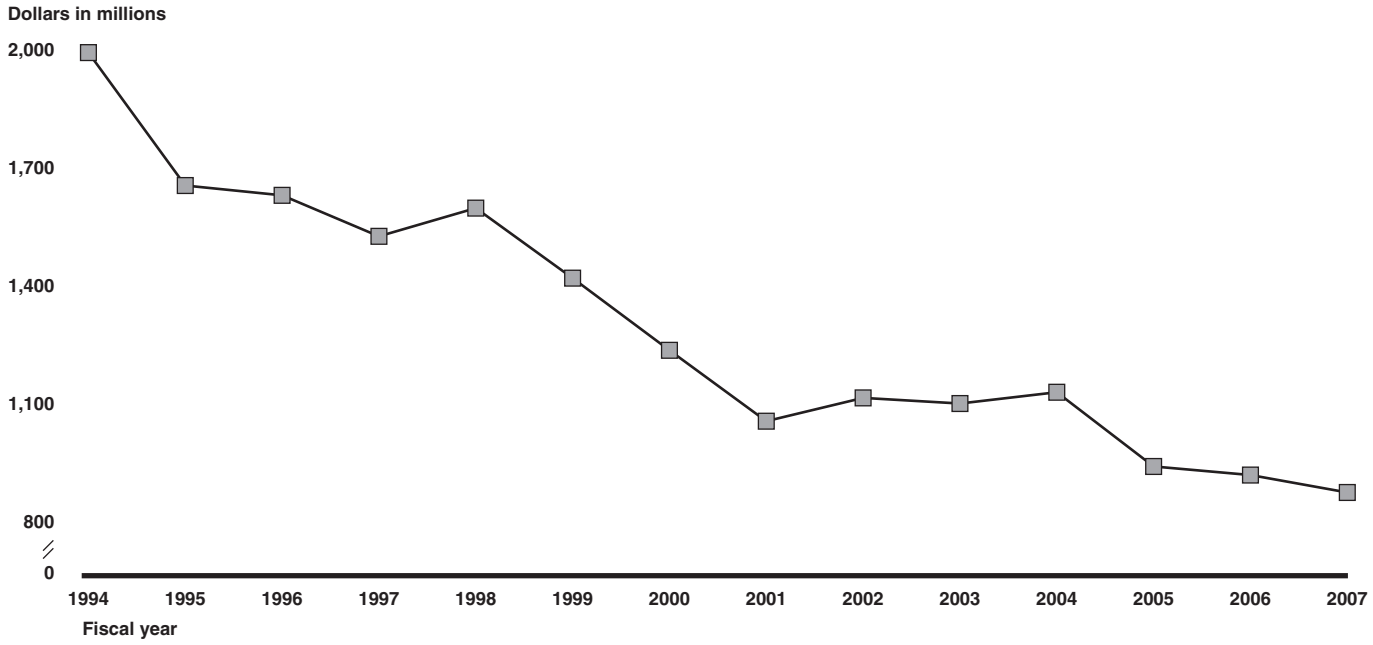
[27]According to NASA, about $58 million this budget goes toward noise-related research for subsonic fixed-wing aircraft.

[28]According to NASA. fundamental research includes(1) foundational research, which is the lowest level of the research pyramid on which advanced noise reduction technologies can be built; (2) discipline-level fundamental research, which includes the development of noise prediction methods that can be used to understand the potential for noise reduction of various concepts; (3) multidiscipline-level fundamental research, which includes studying the trade-offs between noise, emissions, and performance that must be understood in order the determine the performance characteristics of a new aircraft; and (4) system-level fundamental research, which includes explaining research issues when noise reduction technologies are integrated into a new aircraft and can include major wind tunnel tests.

According to FAA, most of the federal funding available for mitigating aviation noise is targeted to sound insulation projects for buildings around airports and relocation or acquisition programs. In a 2002 report on reducing the environmental impacts of aviation, the National Research Council's Committee on Aeronautics Research and Technology for Environmental Compatibility noted that the vast majority of federal expenditures on aviation noise are allocated to noise abatement at individual airports rather than to research on quieter aircraft and engines, which would ultimately reduce aviation noise nationally and internationally. The report concluded that the funding for federal research programs was too low to remove noise as an impediment to the growth of aviation—a conclusion that FAA reiterated in its 2004 report to Congress on aviation and the environment. An analysis prepared by the Aerospace Industries Association[29] indicates that NASA's aeronautics budget, which includes funding for noise reduction research, has been declining in constant dollars since the mid-1990s (see fig. 3).

[29]The Aerospace Industries Association represents the nation's leading manufacturers and suppliers of civil, military, and business aircraft, helicopters, unmanned aerial vehicles, space systems, aircraft engines, missiles, material, and related components, equipment, services, and information technology.

Figure 3: NASA Aeronautics Funding, Fiscal Years 1994-2007



Source: Aerospace Industries Association.

Legislative Proposals Would Increase Funding for Noise Reduction Technologies, and More Efficient Targeting Can Maximize Research Resources

FAA officials told us that both the Senate and the House reauthorization proposals for FAA include several provisions for funding programs that the authorizers believe will be critical to address the research gap. For example, the CLEEN[30] Engine and Airframe Technology Partnership would create a program for the development, maturation, and certification of engine and airframe technologies for aircraft over the next 10 years to reduce aviation noise and emissions. FAA said that the program is intended to provide some short-term advancement while NASA focuses on longer-term research on noise and emissions.

NASA officials told us the agency has become more effective in targeting its research resources to areas that have the most potential for success. In particular, these officials cited work on significant noise-reducing technologies that could be implemented in aircraft and engine designs as early as 2015, depending on whether manufacturers take over

[30]CLEEN stands for continuous lower energy, emissions and noise.

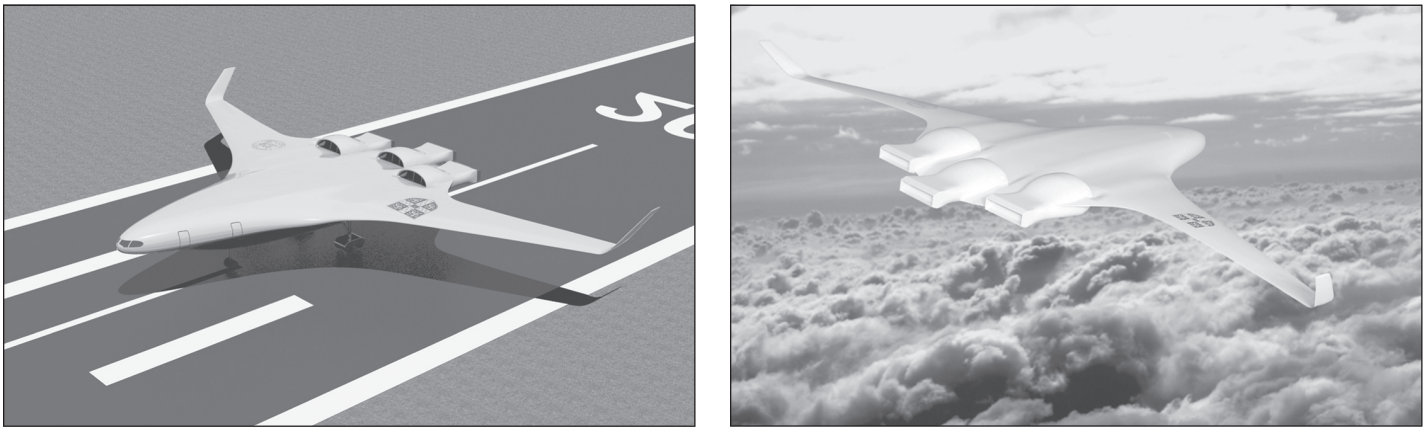
responsibility for integrating the new technologies into production-ready aircraft. NASA has set goals for developing technologies that could reduce what is known as effective perceived noise (EPN) by 42 EPN dB[31] below Stage 3 standards and that could be implemented in the next generation of aircraft,[32] which NASA refers to as N+1, by 2015 (N is the current generation of advanced twin-engine aircraft). For the longer term (2020), NASA is focusing on the development of tools and technologies that can be used in the design of advanced hybrid wing body aircraft (N+2) and that would achieve even greater noise reductions, in the range of 52 EPN dB below Stage 3 standards.[33] According to NASA, both of these research efforts are also aimed at reducing emissions and fuel burn, which in combination with noise reductions would help mitigate the environmental effects of future increases in air traffic. NASA officials stress that because NASA's research ends at a relatively early stage of development, aircraft and engine manufacturers would need to take over responsibility for integrating the noise reduction improvements into aircraft and engine designs, and their assumption of this responsibility is not guaranteed. NASA and others in the aeronautics research community are working on similar advanced designs, such as the "silent aircraft" concept that involves researchers from Cambridge University in Great Britain and the Massachusetts Institute of Technology (see fig. 4).

[31]See footnote 10.

[32]The reductions would occur in aircraft that would replace such current aircraft as the Boeing 737 and Airbus A320. Reductions would be different for larger aircraft and regional jets.

[33]The noise reductions NASA predicts would be achieved through the technologies it is researching would be achieved if noise reduction is the only goal. However, when other factors are considered, such as the need to reduce pollutants like nitrogen oxides, the noise reductions may be lower.

Figure 4: Concept Design for the Silent Aircraft



Source: Cambridge-MIT Institute.

Planning for NextGen Includes an Environmental Focus, and Technologies and Procedures Are Being Developed to Reduce Noise as well as Improve Efficiency

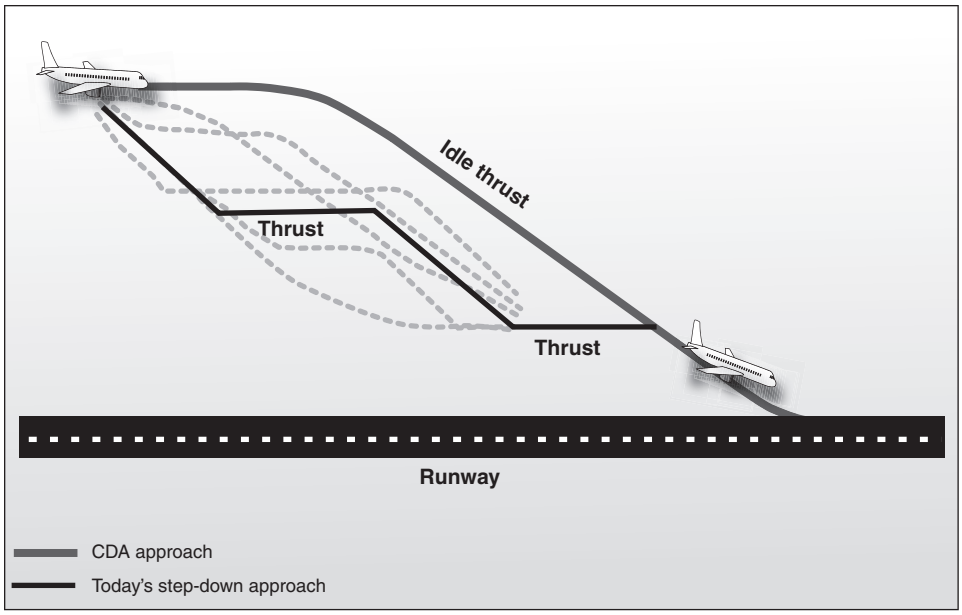
Part of the planning for NextGen includes reducing the environmental impact of aviation because concerns about aviation noise and emissions, which will increase with the expected growth in air traffic, are strong constraints on system capacity. A preliminary JPDO[34] analysis shows that noise and emissions could increase between 140 and 200 percent over the next 20 years as a result of increased flights, which would become a significant constraint on planned capacity improvements.

Technologies and procedures that are being developed as part of NextGen to improve the efficiency of flight operations are also expected to help reduce the impact of noise. One such technology, considered a centerpiece of the NextGen system, is the Automatic Dependent Surveillance–Broadcast (ADS-B) satellite aircraft navigational system. ADS-B is designed, along with other navigation technologies, to provide for more precise control of aircraft during approach and descent. This improved control will facilitate the use of various air traffic control procedures that will reduce communities' exposure to aviation noise and emissions. For example, the Continuous Descent Arrivals (CDA) procedure (see fig. 5) is expected to allow aircraft to remain at cruise

[34]As noted, JPDO is the interagency office housed within FAA that is responsible for planning NextGen and coordinating the transition to this new system. A JPDO task team is responsible for researching, developing, implementing, and maintaining an environmental protection strategy for NextGen.

altitudes longer as they approach destination airports, use lower power levels, and thereby lower noise and emissions during landings. Under current landing procedures, aircraft make step-down approaches that alternate short descents and forward thrusts, which produce more noise than a continuous descent. The PARTNER Center of Excellence has designed and flight-tested a nighttime CDA procedure for the Louisville International Airport, which United Parcel Service plans to begin using for its hub operations in the near future. [35]

Figure 5: Comparison of CDA and Current Step-Down Approach



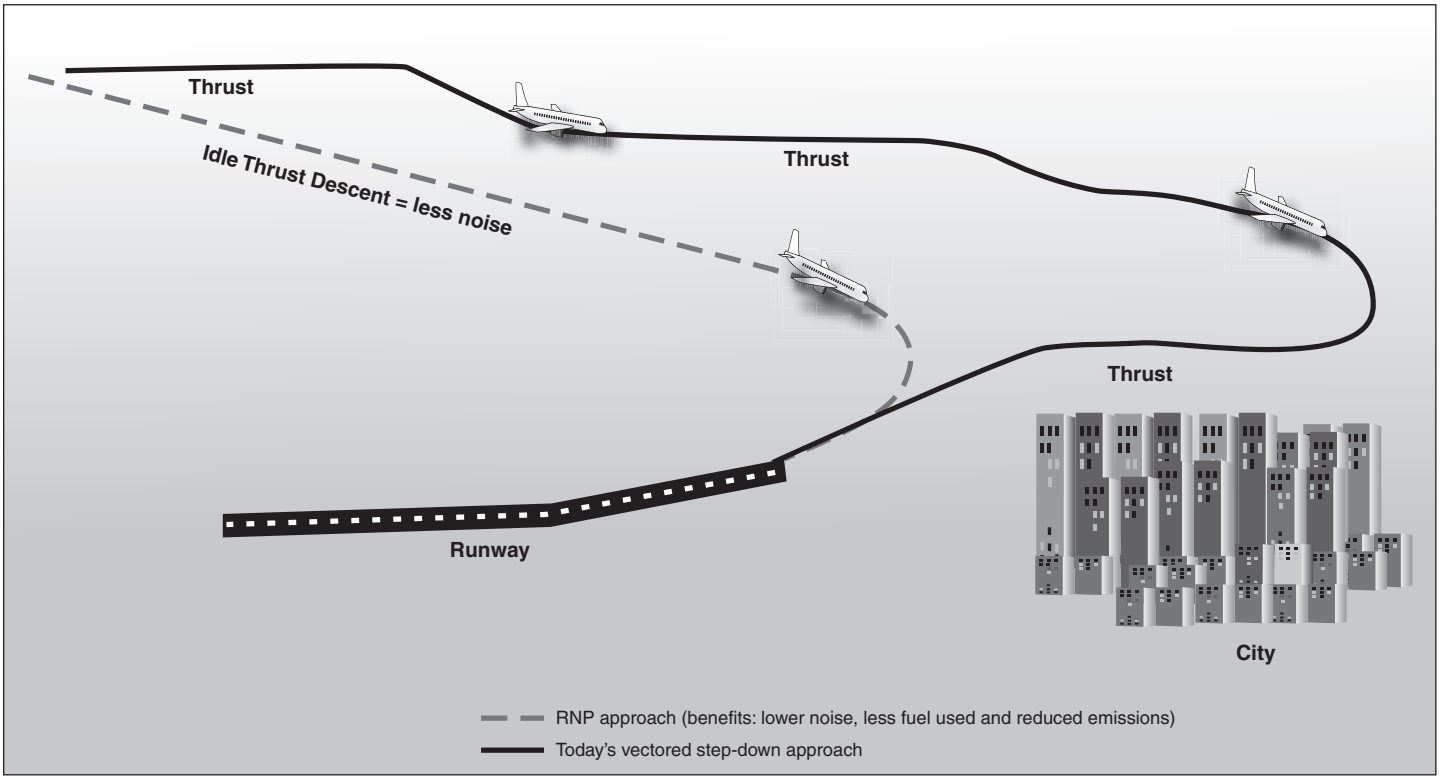
Sources: Naverus and AVTECH; and Art Explosion (clip art).

Note: Continuous Descent Arrivals keep aircraft higher for longer and then have them descend at near-idle power to touchdown. Optimal profiles are not always possible, especially at busy airports.

[35]See John-Paul Clarke, et al., *Partnership for Air Transportation and Emissions Reduction Development, Design, and Flight Test Evaluation of a Continuous Descent Approach Procedure for Nighttime Operation at Louisville International Airport* (Cambridge, MA: Jan. 9, 2006).

Similarly, Area Navigation/Required Navigation Performance (RNP) procedures[36] will permit aircraft to descend on a precise route that will allow them to avoid populated areas. FAA notes, however, that the new procedures will not always be usable when traffic is heavy at busy airports (see fig. 6).

Figure 6: Comparison of RNP and Current Step-down Approach



Sources: Naverus and AVTECH; Art Explosion (clip art).

Note: An RNP approach path allows for idle-thrust, continuous descent instead of today's step-down approaches with vectors. RNP precision and curved-approach flexibility can shift flight paths to avoid populated areas.

[36]Area Navigation/Required Navigation Performance procedures provide enhanced navigational capability to the pilot. Area Navigation equipment can compute the airplane's position, actual track, and ground speed, and then provide meaningful information relative to the route of flight selected by the pilot. A critical component of Required Navigation Performance is the ability of the navigation system to monitor the aircraft navigation system to monitor its achieved navigation performance and to identify for the pilot if an operational requirement is or is not being met during an operation.

Airport Restrictions on Aircraft Operations Offer Limited Relief from Aviation Noise

Airports can seek restrictions on the operations of certain types of aircraft to reduce the impact of noise on surrounding communities. FAA implements a national program for reviewing airport noise and access restrictions, known as Part 161. Through this program, FAA reviews airports' requests to limit the operations of louder aircraft. According to FAA, the Part 161 process has rarely been used since 2000. Only a few airports have drafted Part 161 studies to support requests for restrictions, and only one—Naples Airport in Florida—has fully completed the Part 161 process. Los Angeles International Airport and Bob Hope Airport in Burbank, California, have indicated to FAA that they will be submitting Part 161 studies to FAA to restrict the operations of certain aircraft that meet the Stage 3 noise standards. FAA's approval will be required for the restrictions these airports are seeking. Because the Part 161 process demands that airports submit studies showing, among other things, the benefits of restricting aircraft operations, airport operators generally choose to negotiate informal agreements with airlines rather than seek mandatory restrictions. Airports have also imposed curfews on aircraft operations in order to reduce the impact of noise in the early morning and late evening. For example, at Reagan National Airport and San Diego International Airport, louder aircraft are not allowed to land or take off in the late evening and early morning.

Airports Are Using Additional Studies, Supplemental Noise Metrics, and Community Outreach to Address Community Concerns about Aviation Noise

According to FAA, communities are increasingly aware of efforts to plan for and mitigate aviation noise, and complaints about noise are coming increasingly from outside the DNL contours, along with demands for action to address noise in areas outside significant noise contours. Some community groups and the Environmental Protection Agency (EPA) have questioned whether the DNL standard adequately captures the impact of noise on people. FAA officials note that the Federal Interagency Committee on Aviation Noise[37] supports the use of the DNL measure and that the use of the metric to measure noise near airports has been upheld in court decisions. However, a number of airports have undertaken additional measures, such as special noise studies, to respond to community concerns about aviation noise.

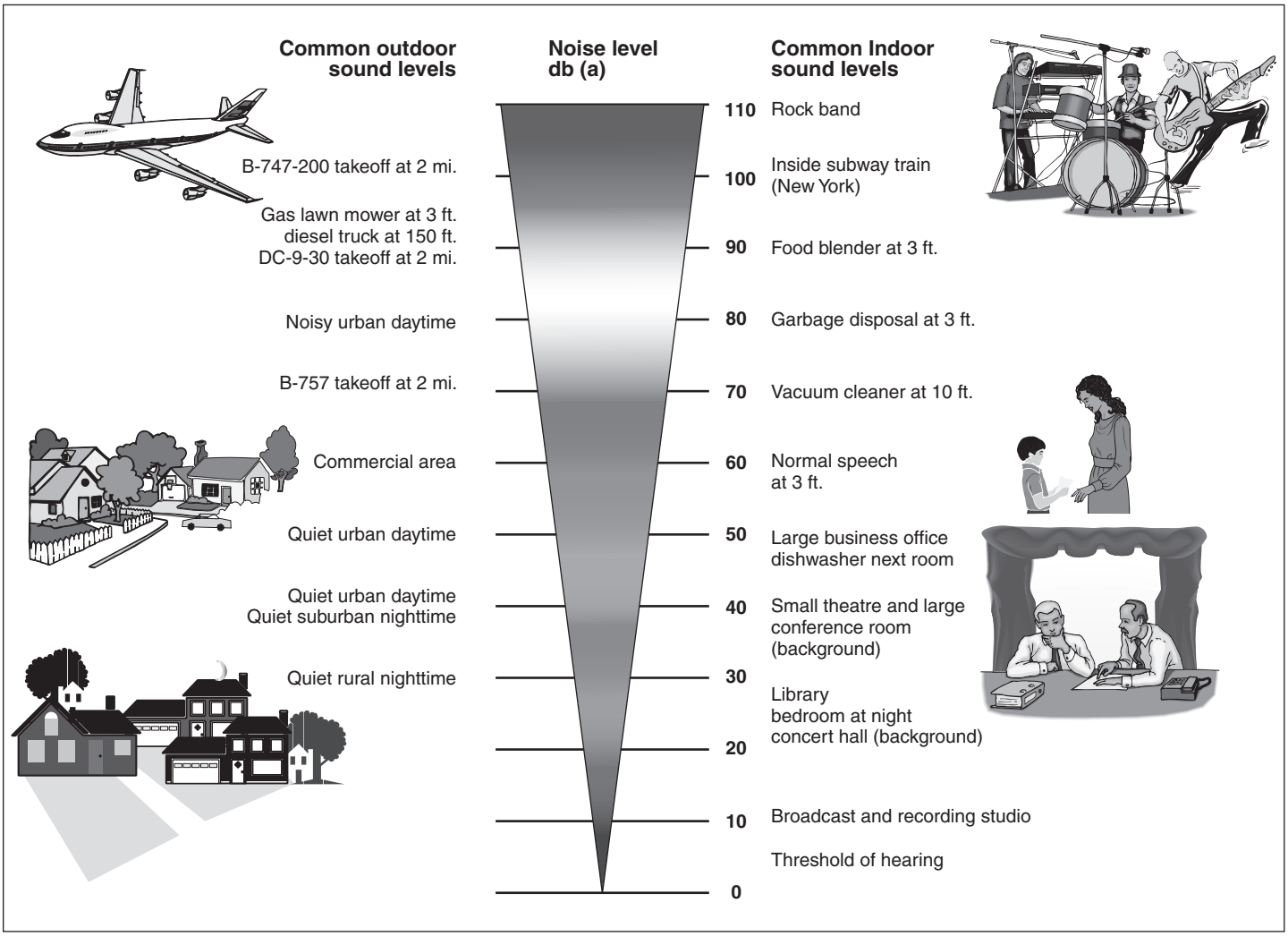
[37]The Federal Interagency Committee on Aviation Noise serves as a forum for debate over future research needs to better understand, predict, and control the effects of aviation noise, and to encourage new technical developments in these areas. Federal agencies represented on the committee include the Departments of Defense, Housing and Urban Development, the Interior, and Transportation; the U.S. Environmental Protection Agency; and NASA.

According to some noise experts, the typical airport noise study presents results only in terms of DNL contours on a background map, but very rarely quantifies noise exposure with DNL or any other metric at specified geographic locations in the study area. While DNL contours are used effectively to establish land-use guidelines and define noise mitigation program boundaries, they do not provide residents with practical information about the aviation noise they will experience in their homes. By contrast, the special noise studies not only enable residents to locate their homes on a map that is overlaid with DNL contours, but they also indicate how often airplanes fly overhead, at what time of day flights occur, or how those flights may interfere with activities such as sleeping, speaking, or watching television. According to the experts we spoke with, the public has responded very positively to receiving this detailed information about noise exposure.

With growing complaints about noise from outside the DNL contours, airports are also contracting for analyses based on alternative noise metrics to supplement the DNL noise analysis. Although the Federal Interagency Committee on Noise[38] in 1992 recommended continuing the use of the DNL noise metric as the principal means of describing airport noise exposure, it also recommended supplementing this description with noise analyses based on alternative metrics. According to a leading engineering firm that specializes in performing noise analyses, two supplemental metrics are thought to define exposure in ways that the general public can understand more readily than the DNL metric. One of these metrics, the Number Above—which counts how many times noise exceeds a selected threshold level in a given time period—has emerged as the most useful supplemental metric, while another metric, Time Above—the total time that noise exceeds the threshold during the time period—is also being used with increasing frequency. According to FAA officials, FAA supports the use of supplemental metrics, noting that they may be useful in evaluating some specific noise impacts, such as interference with speech, sleep, and learning (see fig. 7).

[38] The Federal Interagency Committee on Noise was the predecessor of the Federal Interagency Committee on Aviation Noise.

Figure 7: Levels of Noise Associated with Various Activities



Sources: FAA, Art Explosion, and © Corel Draw.

Besides additional studies and supplemental noise metrics, airports are using community outreach and education to address some of the impacts of aviation noise. Representatives of airports and local governments we spoke with emphasized that effective community outreach programs are essential for addressing noise issues that arise when airports are planning to expand or change their operations. One of these representatives noted that early and continuous open communication between the airport, local governments, and the affected communities is a key to gaining support for projects to increase airport capacity. They pointed out that airports should

have ongoing efforts to seek stakeholder involvement on airport-related issues and not wait until potential noise problems arise, such as when airport expansion projects are being planned. For example, the San Francisco International Airport has been bringing community representatives and aviation officials together since 1981 to discuss and attempt to resolve airport-related issues through the San Francisco Roundtable—a voluntary body created by the airport that includes representatives from 45 Bay Area jurisdictions, FAA officials, airline advisers, air traffic managers, and the airport director. In addition, according to a San Francisco International Airport official, the airport reaches out to the community through its Managed Noise Mitigation program, which encourages communities affected by airport noise to determine their noise mitigation priorities and manage their distribution of noise mitigation funds in accordance with their priorities. Other airports have also made community outreach an important component of their efforts to deal with the impacts of aviation noise. For instance, Chicago established the O'Hare Noise Compatibility Commission in 1996 to begin constructive dialogue on aircraft noise issues with the 40 communities surrounding O'Hare International Airport. The commission's community outreach efforts include a Web site on aircraft noise issues; a community outreach vehicle that travels to schools, libraries, and community events and provides aircraft noise and noise-monitoring demonstrations; and a quarterly newsletter that highlights the work of the commission and its work to reduce noise at O'Hare.

To support airports' community outreach efforts, the Transportation Research Board (TRB) is undertaking a project that is intended to result in guidance for airports on best practices in community outreach. According to TRB, the project will identify the jurisdictions with authority over various aspects of aviation noise and the obstacles to airport operations and development that can occur because of surrounding communities' negative perceptions about local aviation noise. The study will result in a guidebook about local aviation noise that will allow airport decision makers to manage expectations related to aviation noise within the community. The study also includes alternative ways to communicate noise issues and suggests other improvements that can help ease concerns about aviation noise issues.

Reducing the Impact of Aviation Noise Poses Challenges Involving Technology, Funding, and Cooperation on Land-use Issues

Reducing aviation noise requires technological advances, substantial funding from government and the aviation industry, and cooperation among stakeholders and communities on land-use issues. Fulfilling these requirements will be challenging because the pace of improvement in existing technologies may have slowed, government and industry resources are constrained, and land use involves strong competing interests. While most of these challenges will take years to fully address, steps can be taken now to help mitigate the impact of noise on communities and reduce the constraints that noise can have on transforming the air traffic system.

Technological Advances through Research and Development Are Key to Future Aviation Noise Reduction

The first challenge will be to continue reducing the amount of noise from aircraft engines and airframes. NASA's, FAA's, and manufacturers' past research and development efforts have led to advances that have significantly lowered aviation noise, but the timing of the next leaps in technologies is uncertain. While NASA is conducting work on technologies that it believes could, with industry support, lead to significant noise reductions by 2015, FAA and aircraft industry representatives maintain that, for some time, reductions in aircraft noise are likely to be incremental. In addition, it may be technologically challenging to improve the environment by reducing aviation noise without adversely affecting the environment in other ways. As we reported in 2003,[39] designing aircraft engines to minimize noise could increase fuel burn, which would release more carbon dioxide and other greenhouse gases into the atmosphere.

Providing Funding for Research and Development and for Equipping the Fleet with NextGen Technologies Poses Challenges for Government and Industry

Funding noise reduction research and development programs poses a challenge for federal agencies. Given the federal government's long-term structural fiscal imbalance, additional funding for such programs may not be available without shifting funds from other aviation noise reduction efforts, such as programs to mitigate the impact of noise on communities. Currently, most of the federal funding for reducing aviation noise goes to soundproofing programs. Although funding for noise mitigation programs may not generate the highest return on investments, reducing such funding could make it more difficult to obtain community approval of airport expansion projects necessary to increase system safety and efficiency. Provisions in the Senate and House reauthorizations bills such as the

[39]See GAO, *Aviation and the Environment: Strategic Framework Needed to Address Challenges Posed by Aircraft Emissions*, GAO-03-252 (Washington, D.C.: Feb. 28, 2003)

CLEEN proposal could help to address the challenges in this area, and industry funding will continue to play an important role.

Implementing new noise reduction technologies, whether by integrating new, quieter aircraft into the fleet or by retrofitting aircraft, poses financial challenges for the aviation industry. Aircraft have an average lifespan of about 30 years, and it can take almost that entire period for airlines to pay for an aircraft. The current fleet is, on average, about half as many years old—11 years for wide-body aircraft and 14 years for narrow-body aircraft—and is therefore expected to be in operation for many years to come. Additionally, the financial pressures facing many airlines make it difficult for them to upgrade their fleets with new, quieter aircraft. Currently, for example, U.S. carriers have placed a small proportion of the over 700 orders (40, or less than 6 percent) that Boeing officials say the company has received for its new state-of-the-art 787. These financial pressures also have implications for airlines' ability to equip new and existing aircraft with NextGen technologies such as ADS-B that can enable more efficient, quieter approaches and descents. FAA estimates that it will cost the industry about $14 billion to equip aircraft to take full advantage of NextGen. Congress and FAA may want to consider how to incentivize the airlines to train their pilots and to equip and retrofit the fleet with the technologies necessary to operate in NextGen as soon as possible.

Managing Land Use for Compatibility with the Airport Environment Requires Cooperation among Stakeholders and Communities

Even with the introduction of quieter aircraft and the implementation of NextGen technologies and procedures that will enable quieter aircraft approaches and landings, there will still be some noise around airports. Additionally, these reductions in aviation noise are likely to be eroded by the public's increasing awareness of and sensitivity to even moderate amounts of aviation noise and to predicted increases in the number of aircraft flying overhead. Hence, incompatible land use will continue to present obstacles to airport expansion projects. However, since most airports are owned and managed by state or local authorities, it is incumbent upon those authorities to work in good faith with FAA to minimize incompatible land use in their jurisdictions (see fig. 8).

Figure 8: Residential Exposure to Aviation Noise

Source: Nova Development (clip art).

State and local authorities can take action, through land-use planning and development, zoning, and housing regulation, to limit the use of land near airports to purposes compatible with airport operations. State and local governments could require, for example, that appropriate notice of airport noise exposure be provided to purchasers of real estate and to prospective residents near airports to ensure awareness of aviation noise issues. In addition, FAA can make it easier for airports to dispose of AIP noise land by completing and issuing its draft guidance on this process. Passing the related provisions in the Senate and House FAA reauthorization bills will also be important steps.

Thank you, Mr. Chairman and Members of the Subcommittee, this concludes my prepared statement. I will be glad to answer any questions that you may have at this time.

Contact and Acknowledgments

For further information on this testimony, please contact Dr. Gerald L. Dillingham at (202) 512-2834 or dillinghamg@gao.gov. Individuals making key contributions to this testimony include Ed Laughlin, Lauren Calhoun, Bess Eisenstadt, Jim Geibel, David Hooper, Rosa Leung, Maureen Luna-Long, Josh Ormond, Jena Sinkfield, and Larry Thomas.

Appendix I: U.S. Airports That Are among the Nation's 50 Busiest and Do Not Have a Part 150 Noise Mitigation Program

Airport
Boston-Logan International
Chicago-O'Hare International
Dallas-Fort Worth International
Dallas Love Field
Denver International
Gillespie Field (San Diego, CA)
Houston-David Wayne Hooks
Houston-George Bush Intercontinental
John F. Kennedy International (New York, NY)
John Wayne-Orange County
Miami International
Newark International
New York La Guardia
Phoenix Deer Valley
Phoenix Mesa Gateway
Van Nuys (Van Nuys, CA)
Washington Dulles International

Source: FAA.

Related GAO Products

Airport Finance: Observations on Planned Airport Development Costs and Funding Levels and the Administration's Proposed Changes in the Airport Improvement Program. GAO-07-885. Washington, D.C.: June 29, 2007.

Reagan National Airport: Update on Capacity to Handle Additional Flights and Impact on Other Area Airports. GAO-07-352. Washington, D.C.: February 28, 2007.

Aviation and the Environment: Strategic Framework Needed to Address Challenges Posed by Aircraft Emissions. GAO-03-252. Washington, D.C.: February, 28, 2003.

Aviation Infrastructure: Challenges Related to Building Runways and Actions to Address Them. GAO-03-164. Washington, D.C.: January 30, 2003.

Aviation and the Environment: Airport Operations and Future Growth Present Environmental Challenges. GAO/RCED-00-153, Washington, D.C.: August 30, 2000.

Aviation and the Environment: Results from a Survey of the Nation's 50 Busiest Commercial Service Airports. GAO/RCED-00-222. Washington, D.C.: August 30, 2000.

Aviation and the Environment: FAA's Role in Major Airport Noise Programs. GAO/RCED-00-98. Washington, D.C.: April 28, 2000.

Reagan National Airport: Limited Opportunities to Improve Airlines' Compliance with Noise Abatement Procedures. GAO/RCED-00-74. Washington, D.C.: June 29, 2000.

This is a work of the U.S. government and is not subject to copyright protection in the United States. The published product may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.

GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's Web site (www.gao.gov). Each weekday, GAO posts newly released reports, testimony, and correspondence on its Web site. To have GAO e-mail you a list of newly posted products every afternoon, go to www.gao.gov and select "E-mail Updates."

Order by Mail or Phone

The first copy of each printed report is free. Additional copies are $2 each. A check or money order should be made out to the Superintendent of Documents. GAO also accepts VISA and Mastercard. Orders for 100 or more copies mailed to a single address are discounted 25 percent. Orders should be sent to:

U.S. Government Accountability Office
441 G Street NW, Room LM
Washington, DC 20548

To order by Phone: Voice: (202) 512-6000
TDD: (202) 512-2537
Fax: (202) 512-6061

To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Web site: www.gao.gov/fraudnet/fraudnet.htm
E-mail: fraudnet@gao.gov
Automated answering system: (800) 424-5454 or (202) 512-7470

Congressional Relations

Gloria Jarmon, Managing Director, jarmong@gao.gov, (202) 512-4400
U.S. Government Accountability Office, 441 G Street NW, Room 7125
Washington, DC 20548

Public Affairs

Susan Becker, Acting Manager, beckers@gao.gov, (202) 512-4800
U.S. Government Accountability Office, 441 G Street NW, Room 7149
Washington, DC 20548

PRINTED ON RECYCLED PAPER