



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

# Report to Congress National Plan of Integrated Airport Systems (NPIAS)

## 2017-2021



Cover Photographs (from left to right):

- 1) Leesburg Executive Airport, VA (JYO): Classified as a Regional
- 2) Runway lights at dusk
- 3) Cleveland Regional Jetport, TN (RZR): Replacement airport (Regional) opened in January 2013



**Federal Aviation Administration**  
U.S. Department of Transportation

# **Report to Congress**

## **National Plan of Integrated Airport Systems (NPIAS) 2017–2021**

Report of the Secretary of Transportation to the United States Congress  
Pursuant to Title 49 U.S. Code, Section 47103

The NPIAS 2017–2021 report will be available online at: [National Plan of Integrated Airport Systems \(NPIAS\) Report](#).



THE SECRETARY OF TRANSPORTATION  
WASHINGTON, DC 20590

SEP 30 2016

The Honorable Joseph R. Biden, Jr.  
President of the Senate  
Washington, DC 20510

Dear Mr. President:

I am pleased to transmit to you the National Plan of Integrated Airport Systems (NPIAS) 2017-2021.

The NPIAS report estimates the costs associated with establishing a system of airports that adequately meets the needs of civil aviation and supports the U.S. Department of Defense and the U.S. Postal Service. It draws selectively from local, regional, and State planning studies.

I have sent a similar letter to the Speaker of the U.S. House of Representatives.

Sincerely,

Anthony R. Foxx

Enclosure



THE SECRETARY OF TRANSPORTATION  
WASHINGTON, DC 20590

SEP 30 2016

The Honorable Paul D. Ryan  
Speaker of the House of Representatives  
Washington, DC 20515

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## EXECUTIVE SUMMARY

The National Plan of Integrated Airport Systems (NPIAS) report for Fiscal Years (FY) 2017 to 2021 is submitted to Congress in accordance with title 49 United States Code (U.S.C.), section 47103.

The NPIAS report identifies the airports included in the national airport system, the role they serve, and the amounts and types of airport development eligible for Federal funding under the Airport Improvement Program (AIP) over the next 5 years. The Federal Aviation Administration (FAA) has been publishing the NPIAS since 1984.

This edition identifies 3,340 public-use airports<sup>1</sup> (3,332 existing and 8 proposed) that are important to national air transportation and estimates a need for approximately \$32.5 billion in AIP-eligible airport projects between 2017 and 2021. This is a decrease of \$1 billion (3 percent) from the report issued 2 years ago.

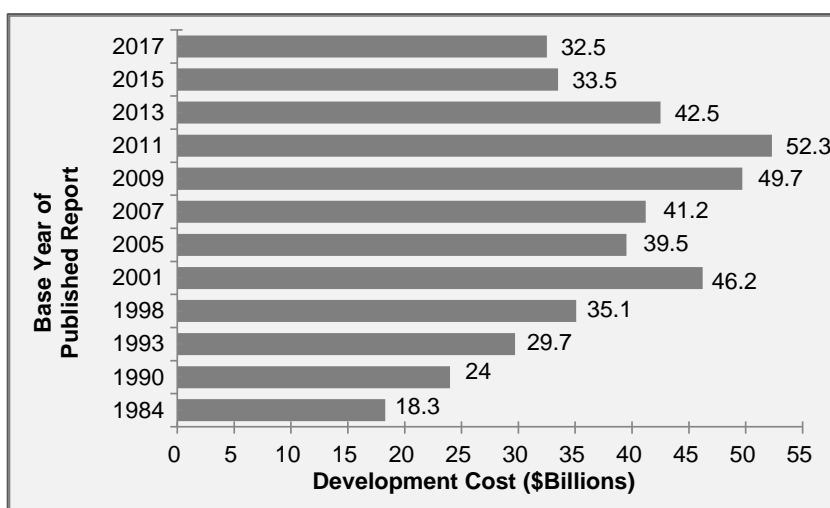
Figure 1 identifies the development costs at the time each report was prepared and does not reflect constant dollars.

Airport capital development needs are driven by current and forecasted traffic, use and age of facilities, and changing aircraft technology, which requires airports to update or replace equipment and infrastructure. AIP-eligible development is expected to decrease at large and medium

hubs, but development at small hubs is expected to increase, and development at all other airport categories remain flat. Capacity-related development continues to decrease while development to reconstruct pavement, bring an airport up to design standards, and expand or rehabilitate terminal buildings are projected to increase. While this report shows an increase in terminal projects, particularly at the small hubs, many of the large and medium hub airports have terminal projects planned. Since these are generally funded with Passenger Facility Charges (PFC), these costs tend not to be captured in the NPIAS report.

After more than a decade, major airport capacity projects and runway safety area (RSA) initiatives have successfully concluded. This included airport development to increase airport capacity, resulting in 23 major airports completing 27 airfield projects (new runways, runway extensions, or airfield reconfigurations) and to improve all the nonstandard RSAs at commercial service airports to meet dimensional standards or an equivalent level of safety. A new national initiative to improve

**Figure 1: Development Totals, 1984-2017**



<sup>1</sup> The word "airport," as identified in this report, includes landing areas developed for conventional fixed-wing aircraft, helicopters, and seaplanes.

nonstandard surface geometry is beginning, and it is anticipated that increased development costs will be captured in the next NPIAS report.

The FAA considers development included in the NPIAS in the Agency's Airports Capital Improvement Plan process. While all of these 5-year capital estimates are AIP-eligible, some may be funded by other sources, including PFCs or other airport revenue or financing. Funds for airport development are derived from a variety of sources, including Federal/State/local grants, bond proceeds, PFCs, airport-generated funds (landing and terminal fees, parking, aviation fuel, and concessions revenues), and tenant and third-party financing. The availability of funding sources and their adequacy to meet needs varies with type of airport and level of activity.

Cost estimates in the NPIAS are obtained primarily from airport master and State system plans prepared by planning and engineering firms for airport sponsors and local and State agencies. These plans are usually funded in part by FAA, are consistent with FAA forecasts of aeronautical activity, follow FAA guidelines, and have been reviewed and accepted by FAA planners who are familiar with local conditions. Efforts have been made to obtain realistic estimates of development needs that coincide with local and State capital improvement plans. The estimates only include development to be undertaken by airport sponsors (as opposed to projects that might be undertaken by airport tenants, such as airlines and air cargo operators). The development reflected in this report is based on planning documents available through 2015.

The NPIAS cost estimates are based upon planning estimates developed prior to design and full environmental evaluation, which may introduce additional mitigation costs. These development estimates do not include contingency costs (increases in cost based on changes in design or construction uncertainty) or normal price escalation due to inflation (annual increase in costs).

The NPIAS supports the strategic priorities and key initiatives identified in the FAA Administrator's Strategic Initiatives for safety, access, and global leadership by identifying airport improvements that will best meet those priorities. These priorities are identified in Chapter 2 of this report, which addresses the condition and performance of the national airport system, highlighting six topic areas: safety, capacity, environment, pavement condition, surface accessibility, and financial performance.

Overall, the findings are favorable, indicating the system is safe, convenient, well maintained, and that the majority of airport capital improvements are funded by nonfederal sources, such as rents, fees, taxes paid by users, and PFCs. The majority of airports in the national airport system have adequate airport capacity and few delays. However, there are airports that continue to experience consistent delays.

# CHAPTER 1: AIRPORT SYSTEM COMPOSITION

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## OVERVIEW

The national airport system, envisioned when civil aviation was in its infancy, has been developed and nurtured by close cooperation with airport sponsors and other local agencies, as well as Federal and State agencies. Airports are critical to the national transportation system and contribute to a productive national economy and international competitiveness. The enduring principles guiding Federal involvement in the national airport system were articulated more than 20 years ago and were subsequently reaffirmed by FAA and the aviation industry in 2011. To meet the demand for air transportation, airports and the national airport system should have the following attributes:

- Airports should be safe and efficient, located where people will use them, and developed and maintained to appropriate standards;
- Airports should be affordable to both users and the Government, relying primarily on producing self-sustaining revenue and placing minimal burden on the general revenues of the local, State, and Federal Governments;
- Airports should be flexible and expandable and able to meet increased demand and accommodate new aircraft types;
- Airports should be permanent with assurance that they will remain open for aeronautical use over the long term;
- Airports should be compatible with surrounding communities, maintaining a balance between the needs of aviation, the environment, and the requirements of residents;
- Airports should be developed in concert with improvements to the air traffic control system and technological advancement;
- The airport system should support a variety of critical national objectives, such as defense, emergency readiness, law enforcement, and postal delivery; and
- The airport system should be extensive, providing as many people as possible with convenient access to air transportation, typically by having most of the population within 20 miles of a NPIAS airport.

In addition to the above listed principles, a guiding principle for Federal infrastructure investment, as stated in Executive Order 12893,<sup>2</sup> is that Federal investments should be cost beneficial.<sup>3</sup>

While the Nation's airports have evolved differently over the past decades, they are an integral part of U.S. lifestyle and commerce. Some airports are large in size and have multiple runways. Others are relatively small and may only need a short, single runway to serve a critical purpose. The role of an airport is not necessarily directly related to its size or its facilities. Airports fulfill very diverse

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<sup>2</sup> Executive Order 12893, Principles for Federal Infrastructure Investments, was issued in the Federal Register on January 31, 1994, and has not been revoked. See <http://www.archives.gov/federal-register/executive-orders/pdf/12893.pdf>.

<sup>3</sup> The FAA implements these principles by using program guidance to ensure the effective use of Federal aid. A national priority system guides the distribution of funds, supplemented when necessary, by specific requirements for additional analysis or justification. Moreover, virtually all development projects must be justified based on existing or reasonably anticipated civil aeronautical activity levels.

roles—from moving people and cargo and serving agricultural needs, to providing community access and air ambulance services, to supporting private transportation using the smallest piston aircraft to the most sophisticated jets, and providing aeronautical access to manufacturers/assemblers and repair stations that support airlines and operators of all sizes in a global aerospace marketplace.

Approximately 590,039 pilots, 203,880 active general aviation aircraft, and 6,871 air carrier aircraft, utilize 19,536 landing areas consisting of 14,400 private-use (closed to the public) and 5,136 public-use (open to the public) facilities. Listed below (Table 1) is the breakout of private- and public-use landing areas in the United States by type of facility.

The FAA, in concert with State aviation agencies and local planning organizations, identifies public-use airports that are important to the system for inclusion in the NPIAS. About 65 percent (3,332) of the 5,136 public-use airports are included in the NPIAS. There are 1,804 existing public-use airports that generally are not included in the NPIAS because they do not meet the minimum entry criteria,<sup>4</sup> are located at inadequate sites, cannot be expanded and improved to provide a safe and efficient airport, or are located within 20 miles of another NPIAS airport.

**Table 1: Numbers and Types of Airports in the United States (as of February 2016)**

Type of Facility	Total U.S. Facilities	Private-Use Facilities	Public-Use Facilities	Existing NPIAS Facilities
Airport	13,168	8,321	4,847	3,284
Heliport	5,709	5,643	66	10
Seaplane Base	493	279	214	38
Balloonport	13	12	1	
Gliderport	35	30	5	
Ultralight	118	115	3	
<b>Total</b>	<b>19,536</b>	<b>14,400</b>	<b>5,136</b>	<b>3,332<sup>5</sup></b>

All commercial service airports<sup>6</sup> are included, and selected general aviation airports that meet requirements are included in the NPIAS. Ninety-eight percent of the facilities included in the NPIAS are airports. Throughout this report, the term “airport” includes landing areas developed for conventional fixed-wing aircraft, helicopters, and seaplanes.

The NPIAS report identifies for Congress and the public the airports included in the national airport system, the role they serve, and the amounts and types of airport development eligible for Federal funding under the AIP over the next 5 years. An airport must be included in the NPIAS to be eligible to receive a grant under the AIP. Airport development estimates included in the NPIAS may be funded by other funding sources, such as PFCs or other airport revenue or financing.

<sup>4</sup> The NPIAS entry criteria is contained in FAA Order 5090.3C, Field Formulation of the National Plan of Integrated Airport Systems (NPIAS), available online at: [http://www.faa.gov/regulations\\_policies/orders\\_notices/index.cfm/go/document.information/documentID/12754](http://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.information/documentID/12754).

<sup>5</sup> The eight proposed NPIAS airports are not included in this table.

<sup>6</sup> Privately owned airports with scheduled air carrier service are not eligible for designation as a commercial service airport (i.e., Branson Airport in Branson, Missouri).

## AIRPORTS IN THE NPIAS

The NPIAS contains 3,340 airports. This includes 3,332 existing and 8 proposed airports that are anticipated to open within the 5-year period covered by this report. The proposed airports are classified in the same categories as existing airports. Almost 98 percent (3,255) of the NPIAS airports are owned by public entities and 77 are privately owned.

Airports are grouped into two major categories: primary and nonprimary as shown in Figure 2 below. Primary airports are defined as public airports receiving scheduled air carrier service with 10,000 or more enplaned passengers per year. There are 382 primary airports based on calendar year (CY) 2014 data. Primary airports are grouped into four categories defined in statute: large, medium, small, and nonhub.

General aviation aircraft mainly use nonprimary airports. Included in the nonprimary category are nonprimary commercial service airports (public airports receiving scheduled passenger service and between 2,500 and 9,999 enplaned passengers per year), general aviation airports, and reliever airports. There are 2,950 nonprimary airports. These airports are further grouped into five categories: national, regional, local, basic, and unclassified. Appendix C of this report contains the airport definitions contained in both statute and policy that are used in this report.

**Figure 2: NPIAS Airports by Category and Role**

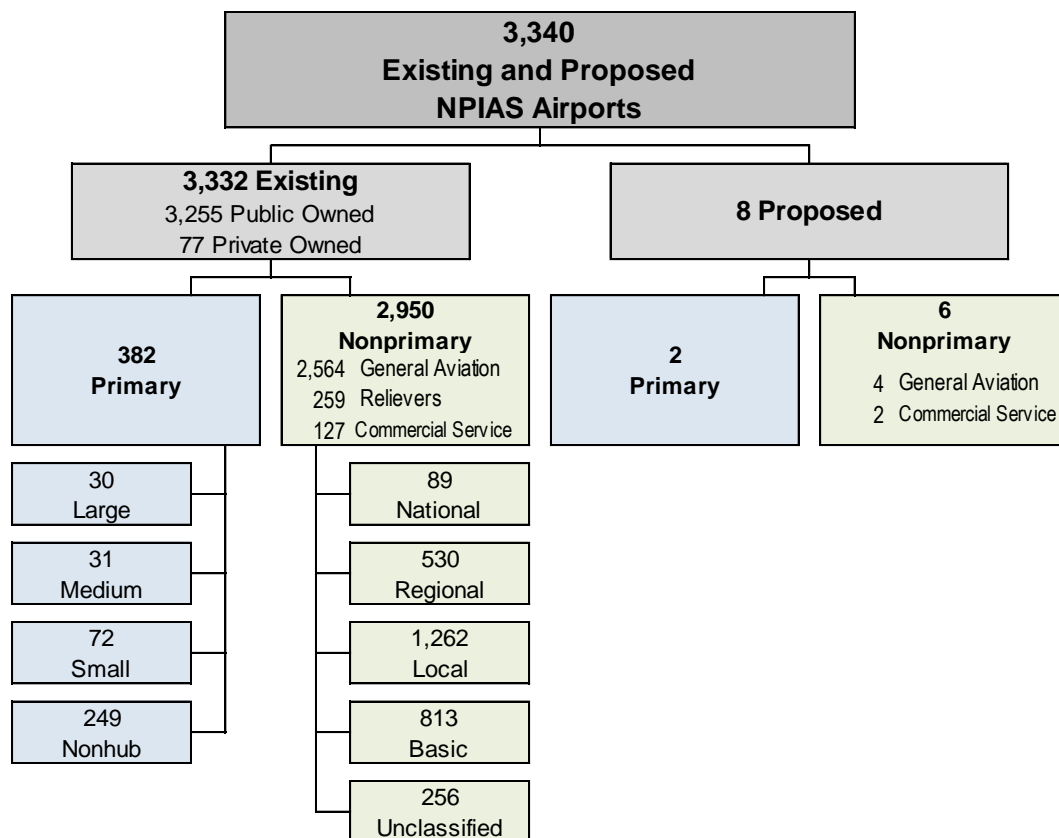


Table 2 reflects the number of existing NPIAS airports by category, as well as the percentage of enplanements, based aircraft, and percentage of total development.

**Table 2: Activity and Development at NPIAS Airports**

Number of Airports	Airport Category	Percentage of NPIAS Airports	Percentage of 2014 Total Enplanements <sup>1</sup>	Percentage of All Based Aircraft <sup>2</sup>	Percentage of NPIAS Cost <sup>3</sup>
30	Large Hub	1	72	0.7	20.9
31	Medium Hub	1	15	1.7	9.6
72	Small Hub	2	8	4.7	12.8
249	Nonhub	7	4	11.6	16.2
<b>382</b>	<b>Primary Subtotal</b>	<b>11</b>	<b>99</b>	<b>18.6</b>	<b>59.4</b>
89	National	3		11.5	5.4
531	Regional	16		25.6	12.2
1,261	Local	38		21.2	15.3
813	Basic	24		3.2	6.6
256	Unclassified	8		1.0	0.03
<b>2,950</b>	<b>Nonprimary Subtotal</b>	<b>89</b>		<b>62.6</b>	<b>39.5</b>
<b>3,332</b>	<b>Total NPIAS Airports</b>	<b>100</b>	<b>99</b>	<b>81.2</b>	<b>99.0</b>

<sup>1</sup>The remaining 1 percent of enplanements occurred at non-NPIAS airports.

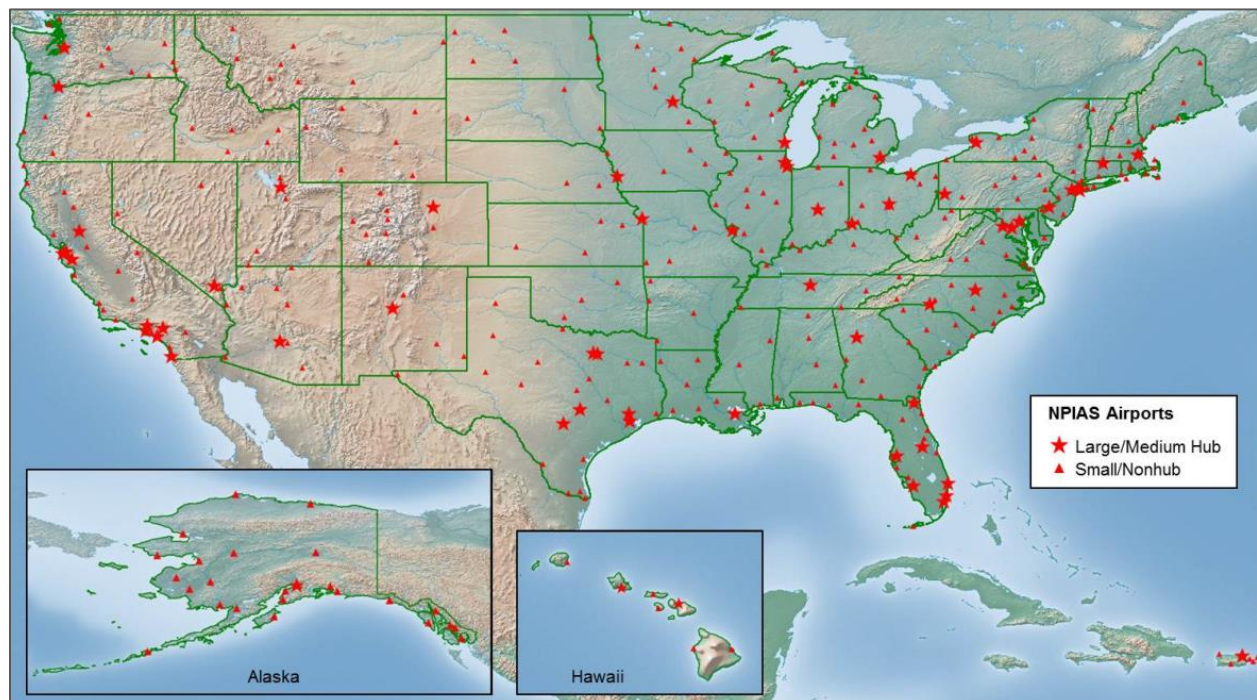
<sup>2</sup>Based on an active general aviation fleet of 203,880 aircraft in 2015.

<sup>3</sup>These costs are rounded and do not include the cost for new airports (1 percent).

## PRIMARY AIRPORTS

The 382 primary airports are grouped into four categories defined in statute: large, medium, small, and nonhub airports. Primary airports receive an annual apportionment with the amount determined by the number of enplaned passengers. CY 2014 enplanements determine FY 2016 service levels and passenger apportionments. Figure 3 below identifies the distribution of the primary airports.

**Figure 3: Primary Airports**



## **Large Hubs (30)**

Large hubs are those airports that each account for 1 percent or more of total U.S. passenger enplanements.<sup>7</sup> Some of these passengers originate in the local community, and some are connecting passengers transferring from one flight to another. Six large hub airports—San Diego International, LaGuardia, General Edward Lawrence Logan International, Ronald Reagan Washington National, Fort Lauderdale/Hollywood International, and Orlando International—primarily serve passengers that originate in the community or who are traveling specifically to those destinations. Many other large hub airports support higher percentages of passengers who are traveling through the airport to connect to another flight, rather than starting or ending their travel at these airports. Such connecting traffic can account for more than 65 percent of passenger activity at airports such as Charlotte/Douglas International and Hartsfield-Jackson Atlanta International. The 30 large hub airports account for 72 percent of all passenger enplanements.

Large hub airports tend to concentrate on airline and freight operations and have limited general aviation activity. Three large hub airports (Salt Lake City International, Honolulu International, and McCarran International) have an average of 226 based aircraft, but the other 27 large hubs have an average of 28 based aircraft. Thus, locally based general aviation plays a small role at most large hub airports.

The Nation's air traffic delay problems tend to be concentrated at certain large hub airports. Delays occur primarily during inclement weather conditions (i.e., reduced ceiling and visibility) or when runway capacity is reduced below that needed to accommodate traffic levels. Because of the number of connecting flights supported by these airports, delays among these busy large hub airports can quickly ripple throughout the system causing delays at smaller airports nationwide.

## **Medium Hubs (31)**

Medium hubs are defined in statute as airports that each account for between 0.25 percent and 1 percent of total U.S. passenger enplanements. The 31 medium hub airports account for 15 percent of all U.S. enplanements. Medium hub airports usually have sufficient capacity to accommodate air carrier operations and a substantial amount of general aviation activity. Four medium hub airports have an average of almost 300 based aircraft—John Wayne Airport-Orange County, Metropolitan Oakland International, Dallas Love Field, and William P. Hobby—while the other 27 medium hub airports have an average of 80 based aircraft.

## **Small Hubs (72)**

Small hubs are defined in statute as airports that enplane 0.05 percent to 0.25 percent of total U.S. passenger enplanements. There are 72 small hub airports that together account for almost 9 percent of all enplanements. Less than 25 percent of the runway capacity at small hub airports is used by airline operations so these airports can accommodate a great deal of general aviation activity, with an average of 126 based aircraft at each airport. Two small hubs—Fairbanks

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<sup>7</sup>The FAA's use of the term hub airport is slightly different than that of airlines, which use it to denote an airport with significant connecting traffic by one or more carriers. The hub categories used by FAA are defined in title 49 U.S.C., section 40102.



International and Long Beach/Daugherty Field—have an average of 468 based aircraft. These airports are typically uncongested and do not have significant air traffic delays.

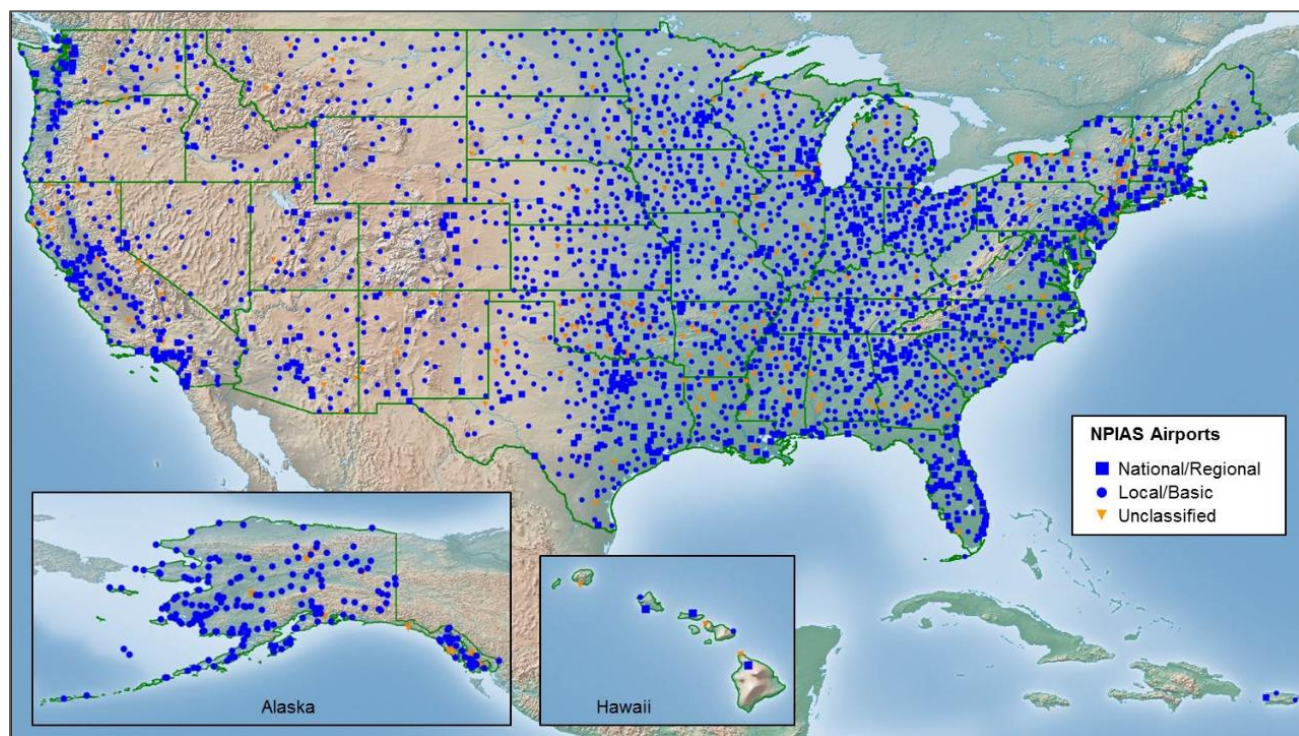
### Nonhub Primary (249)

Commercial service airports that enplane less than 0.05 percent of all commercial passenger enplanements but have more than 10,000 annual enplanements are categorized as nonhub primary airports. There are 249 nonhub primary airports that together account for almost 4 percent of all enplanements. These airports are also heavily used by general aviation aircraft with an average of 95 based aircraft.

## NONPRIMARY AIRPORTS

Nonprimary airports are mainly used by general aviation aircraft and include 127 nonprimary commercial service, 259 relievers, and 2,564 general aviation airports. Nonprimary airports are divided into categories based on existing activity measures (e.g., the number and types of based aircraft and volume and types of flights). The 2,950 nonprimary airports were further grouped into five categories using existing activity, geographic factors, and public interest functions. These categories, illustrated in Figure 4, are national, regional, local, basic, and unclassified.

Figure 4: Nonprimary Airports



In preparation for the biennial report, FAA reexamined the roles of nonprimary airports in 2015 and coordinated with State aviation agencies and airport sponsors. We will continue to work with industry to identify users of these facilities and their associated role in the State and national airport system. As specialized functions emerge, we will work with industry to incorporate them into the



NPIAS categories. Each airport's category and role is reflected in Appendix A. The next review of airport roles will be in late 2017 in preparation for the NPIAS report due September 2018. Future development of nonprimary airports will continue to be based on eligible and justified needs and priorities consistent with the role of the airport in the national system.

### **National (89)**

National airports are located in metropolitan areas near major business centers and support flying throughout the Nation and the world. These airports provide pilots with attractive alternatives to the busy primary airports. In fact, FAA has designated 65 of these facilities as relievers for primary airports. National airports have very high levels of activity with many jets and multiengine propeller aircraft. Four national airports—Fort Lauderdale Executive, Phoenix Deer Valley, Centennial Airport in Denver, and Gillespie Field in San Diego—have more than 700 aircraft based at their airport. Two airports—Oakland County International in Pontiac, Michigan, and Morristown Municipal in Morristown, New Jersey—have limited air carrier service. National airports average about 250 total based aircraft, including 30 jets.

### **Regional (530)**

Regional airports are also in metropolitan areas and serve relatively large populations. These airports support regional economies with interstate and some long-distance flying and have high levels of activity, including some jets and multiengine propeller aircraft. About 50 of these airports have limited air carrier service, and FAA has designated 151 regional airports as relievers for primary airports. Six regional airports—Mesa Field in Phoenix, Arizona; Whiteman Airport in Los Angeles, California; Livermore Municipal Regional in Livermore, California; Montgomery Field in San Diego, California; Zamperini Field in Torrance, California; and Arlington Municipal in Arlington, Washington—have more than 400 based aircraft. Regional airports average about 100 total based aircraft, including 3 jets.

### **Local (1,261)**

Local airports are a critical component of our general aviation system, providing communities with access to local and regional markets. Typically, local airports are located near larger population centers but not necessarily in metropolitan areas. They also accommodate flight training and emergency services. These airports account for 38 percent of all NPIAS airports and have moderate levels of activity with some multiengine propeller aircraft. About 76 of these airports have limited air carrier service. Four local airports have more than 200 based aircraft—Nampa Municipal in Idaho; Birchwood Airport in Alaska; Corona Municipal in California; and Grants Pass in Oregon. Local airports average about 34 based propeller-driven aircraft and no jets.

### **Basic (813)**

Basic airports fulfill the principal role of a community airport providing a means for private general aviation flying, linking the community with the national airport system, and making other unique contributions. In some instances, the airport is the only way to access the community and provides emergency response access such as emergency medical or fire fighting and mail delivery. These airports have moderate levels of activity with an average of 10 propeller-driven aircraft and no jets.

## **Unclassified (256)**

These airports tend to have limited activity. Of the 199 public-owned unclassified airports, 122 have between 0 and 3 based aircraft and 78 have between 4 and 8 based aircraft. Thirty-five privately owned general aviation airports that have never received an AIP development grant are also unclassified. In addition, 22 privately owned reliever airports currently do not meet criteria for AIP funding.

## **NEW AIRPORTS (8)**

The NPIAS identifies eight proposed airports, two primary and six nonprimary, that are anticipated to be developed over the 5-year period covered by this report in Appendix A. One of the proposed new primary airports is to help meet the future demand for aviation in the Chicago area and is still in the planning stage with a Master Plan and Tier II Environmental Impact Statement (EIS) under development. The other new primary airport is to replace an existing airport in Williston, North Dakota, that is site constrained. The new airports are shown separately in Appendix A and are included in the list of airports by State in Appendix A. New airports are identified by a location identifier beginning with a plus symbol (i.e., +07W). Appendix A does not identify new airports (planning sites) expected to be under development beyond 2021.<sup>8</sup> Inclusion of a planning site in the NPIAS does not represent actual approval of the proposed airport (from planning, environmental or financial perspective), nor does it mean that the FAA has drawn a final conclusion about the need for (or technical or financial feasibility of) the proposed airport. Since the last report, six new airports opened (in 2014 and 2015), including five replacement airports (Tununak, Alaska; Colt, Arkansas; Conway, Arkansas; Bowman, North Dakota; and Thermopolis, Wyoming; and one new airport (Hardin, Montana)).

## **CONVERSION OF MILITARY AIRFIELDS AND USE OF MILITARY/CIVIL AIRFIELDS**

The Defense Base Realignment and Closure (BRAC) Commission has made many military airfields available for conversion to civil aviation use since 1989. About 32 surplus military airfields have been converted to civil use by local communities. Local communities have converted about 32 surplus military airfields to civil use (Roosevelt Roads Naval Air Station in Puerto Rico and Brunswick Naval Air Station in Maine). Most of these military airfields have long runways and associated facilities that can accommodate large civil aircraft. Fifteen of the surplus military airfields have become commercial service airports and four have significant cargo service (Sacramento Mather in California; Rickenbacker International in Ohio; Stewart International in New York; and Guam International in Guam). The remaining surplus airfields are in areas where additional general aviation airports are needed.

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<sup>8</sup> The FAA approved a planning site in April 2014 for a proposed replacement airport for Newtok, Alaska. At the time this Report was being prepared, the actual project was not anticipated to be completed within the FY 2017-2021 timeframe. However, as the Report goes to press, the FAA has recently been made aware that the State of Alaska and other agencies are actively reconsidering the timing of this project, which may need to be accelerated.

Even before the establishment of the BRAC, military officials have cooperated with local communities across the country to provide civilian access to military airport facilities. These local arrangements add capacity to the national airport system and maximize public investment dollars by eliminating the duplication of airport facilities in a community for military and civilian activities. There are approximately 21 military installations that also allow civilian aircraft activity. Many of the facilities are included in the NPIAS.

The U.S. Department of Defense (DOD) has found it advantageous to operate from civilian airfields. Similar to civilian uses on military airfields, military activity at civilian airfields reduces public investments in airport infrastructure by taking advantage of existing civilian airfield capabilities for military purposes. As specified in the National Guard Bureau Air National Guard Pamphlet 32-1001, Airport Joint Use Agreements for Military Use of Civilian Airfields, at airports where military units conduct a significant level of activity, DOD entered into an agreement with the local community to pay for costs related to the military use of the airfield. As of 2015, the military has agreements in place with approximately 90 civilian airports.

## **AIRPORT PRIVATIZATION**

Public-use airports in the United States owned and operated by a public agency or a government entity such as a county, city, or State government are eligible to participate in the Airport Privatization Pilot Program. Congress established the pilot program (title 49 U.S.C., section 47134) in 1996 to determine if, once certain economic and legal impediments were removed, privatization could produce alternative sources of capital for airport development and provide benefits. The FAA's Modernization and Reform Act of 2012, expanded the pilot program from 5 to 10 airports, but left the requirement that the pilot program can include no more than one large hub airport and at least one general aviation airport unchanged. Public-owned general aviation airports can be leased or sold; public-owned air carrier airports can only be leased. In February 2013, under the pilot program, FAA approved a 40-year lease of Luis Muñoz Marín International Airport in San Juan, Puerto Rico, from the Puerto Rico Ports Authority (the public sponsor) to Aerostar (a private operator). Currently, Hendry County's Airglades Airport in Clewiston, Florida, has an application under active FAA consideration. Eight pilot program slots (including one for a large hub airport) are available.

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## CHAPTER 2: SYSTEM OBJECTIVES AND PERFORMANCE

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### OVERVIEW

This chapter describes DOT's goals and FAA objectives for the national air transportation system. We highlight the performance of the airport system in six key areas: safety, capacity, environmental sustainability, runway pavement condition, surface accessibility, and airport financial performance. This chapter also includes major FAA initiatives that will improve the performance of the national air transportation system in these key areas.

### SUPPORTING NATIONAL AIR TRANSPORTATION SYSTEM OBJECTIVES

The NPIAS supports DOT and FAA objectives for the air transportation system, as shown below. The DOT objectives are contained in the Strategic Plan for FYs 2014 through 2018.<sup>9</sup>

#### U.S. Department of Transportation

The DOT's Strategic Plan, "Transportation for a New Generation," sets the direction for DOT to provide safe, efficient, convenient, and sustainable transportation choices through five strategic goals that are supported by a wide-ranging management goal to make DOT a high-performance, outcome-driven Agency. Each of the five strategic goals below is reflected in the next section (Factors Indicating System Performance).

1. **Safety:** Improve public health and safety by reducing transportation-related fatalities, injuries, and crashes;
2. **State of Good Repair:** Ensure the United States proactively maintains its critical transportation infrastructure in a state of good repair;
3. **Economic Competitiveness:** Promote transportation policies and investments that bring lasting equitable and economic benefits to the Nation and its citizens;
4. **Quality of Life in Communities:** Foster quality of life in communities by integrating transportation policies, plans, and investments with coordinated housing and economic development policies to increase transportation choices and access to transportation services for all users; and
5. **Environmental Sustainability:** Advance environmentally sustainable policies and investments that reduce carbon and other harmful emissions from transportation sources.

#### Federal Aviation Administration

The FAA supports DOT strategic goals with four mission-based strategic initiatives listed below. The specific objectives within each goal are available online.<sup>10</sup>

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<sup>9</sup>DOT's FY 2014–18 Strategic Plan is available at: <https://www.transportation.gov/administrations/office-policy/fy-2014-2018-strategic-plan>.

<sup>10</sup> FAA Strategic Initiatives are available online at: [http://www.faa.gov/about/plans\\_reports/media/FAA\\_Strategic\\_Initiatives\\_Summary.pdf](http://www.faa.gov/about/plans_reports/media/FAA_Strategic_Initiatives_Summary.pdf).

1. **Make Aviation Safer and Smarter:** Build on safety management principles to proactively address emerging safety risks by using consistent, data-informed approaches to make smarter, system-level, risk-based decisions.
2. **Deliver Benefits Through Technology/Infrastructure:** Lay the foundation for the National Airspace System (NAS) of the future by achieving prioritized Next Generation Air Transportation System (NextGen) benefits, integrating new user entrants, and delivering more efficient, streamlined services.
3. **Enhance Global Leadership:** Improve safety, air traffic efficiency, and environmental sustainability across the globe through an integrated, data-driven approach that shapes global standards, enhances collaboration and harmonization, and better targets FAA resources and efforts.
4. **Empower and Innovate With the FAA's People:** Prepare FAA's human capital for the future by identifying, recruiting, and training a workforce with the leadership, technical, and functional skills to ensure the United States has the world's safest and most productive aviation sector.

### FAA's Office of the Associate Administrator for Airports

Each organization within FAA sets annual performance goals in support of FAA and DOT strategic goals. The Office of Airports is responsible for preparing the NPIAS and administering the AIP, as well as other programs that improve the safety, efficiency, and condition of the airport system. In carrying out these functions and implementing the FAA's Office of Airports' Business Plan, the organization contributes substantially to achieving the FAA's strategic goals.

## FACTORS INDICATING SYSTEM PERFORMANCE

For the last 25 years, six key factors have been used in NPIAS reports to indicate the performance of the airport system: safety, capacity, environmental performance, runway pavement condition, surface transportation accessibility, and financial performance. These six airport performance factors align with the five strategic goals contained in the DOT's Strategic Plan; the alignment is indicated in parentheses where it may not immediately be clear.

However, the six factors are not all related in the same way to capital improvements, and increased investment in airport infrastructure is not the only way to improve performance. For example, Federal aid to airports can be useful when focusing on specific issues, such as the provision of airport rescue and fire fighting (ARFF) equipment, development of safety areas around runways, removal of obstructions in runway approach paths, and planning and implementing noise compatibility measures. By contrast, however, there are also a number of operational and other measures (not involving construction) that airports can take to improve safety, accessibility, efficiency, financial, and environmental performance.

## SAFETY

The United States has not only the largest and most complex aviation system in the world, but also one of the safest as demonstrated by the low accident rate. Airport facilities and operations are an important contributor to the resulting safety record. Although the airport is rarely determined to be a cause of an aircraft accident, it may be cited as a contributing factor that impacts the severity of an

accident, and in many cases, airport facility and operational improvements supported by FAA either mitigate or prevent accidents.

The FAA and industry has begun implementing Safety Management Systems (SMS), which are designed to identify hazards, assess the risks from those hazards, and put measures in place to mitigate those risks. This is the core of the FAA's risk-based decisionmaking initiative. The risk-based decisionmaking initiative serves as the basis for the compliance philosophy.

The compliance philosophy is the latest step in the evolution of how FAA works with regulated entities. It focuses on the most fundamental goal: find problems in the NAS before they result in an incident or accident, use the most appropriate tools to fix those problems, and monitor the situation to ensure that they stay fixed.

The compliance philosophy recognizes that all parties want to comply with aviation's high safety standards. It recognizes that most operators voluntarily comply with both the rules and the core principles of an SMS. It also recognizes that in today's complex aviation environment; even the best operators make honest mistakes. However, even unintentional errors can have a serious adverse impact on aviation safety so the problems must be fixed. There is zero tolerance for intentional reckless behavior or inappropriate risk taking. Enforcement is, and always will be, one of the FAA's tools to ensure compliance in the case of willful or flagrant violations or for refusal to cooperate in corrective action.

The success of our risk-based decisionmaking initiative, which includes SMSs and now the compliance philosophy, requires both FAA and the aviation community to evolve how we do business and how we interact with one another.

## **Runway Safety**

To operate safely and efficiently, the aviation system relies on communication and coordination among air traffic controllers, pilots, airports, airport vehicle operators, and pedestrians. Their actions impact runway safety.

The International Civil Aviation Organization (ICAO) defines a runway incursion as any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft. Each incursion is classified into one of four categories based on the severity of the incident. Category A, the most severe, is where a collision was narrowly avoided. Category B is an incident in which separation decreases and there is a significant potential for collision. Category C is an incident characterized by ample time and/or distance to avoid a collision. Category D, the least severe, is where there was no collision hazard. In 2008, the United States implemented ICAO's definition of a runway incursion, and incidents formerly classified as surface incidents<sup>11</sup> are now classified as runway incursions.

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<sup>11</sup> Previously, an incident without an aircraft in potential conflict, such as an unauthorized aircraft crossing an empty runway, was defined as a surface incident and not a runway incursion.

Additional methods of preventing runway incursions include recommending that airports improve how they provide information on rapidly changing runway and taxiway construction and closings.

The Runway Safety Call to Action (C2A) convened in June 2015 with 108 representatives from industry, labor, and government. The C2A was summoned by FAA and was a followup to the 2007 Call to Action Safety Summit. At that summit, industry and government representatives established a five-point, short-term call to action plan, now completed, as well as mid- and long-term call to action plans involving technology improvements, which are either complete or now in their final stages of deployment. The campaign, which steadily achieved its goal of reducing every type of runway incursion, focused on pilot training, technology, airport signage, and communications to meet its outlined objectives.

In the months following the C2A meeting, FAA points of contact were identified and assigned a corrective action recommendation by their line of business. The points of contact developed a corresponding implementation plan for each of the corrective actions. In some cases, corrective actions were combined where there was significant overlap of purpose. Three areas were identified (visual recognition, communications, and procedures and awareness), and short-, mid-, and long-term corrective action recommendations were developed. Implementation plans have been developed and actions are being taken to reduce the number and severity of surface events.<sup>12</sup>

The FAA uses AIP funds to enhance airport safety and support the Agency's goal of reducing accidents, fatalities, and runway incursions. With the help of the AIP, airports can reconfigure runways and taxiways to optimize both safety and efficiency. Airport operators can build perimeter roads around the airfield so vehicles do not have to be driven across runways and taxiways. The AIP funds are also used to meet updated standards for runway marking and signs, and eliminating confusion on airfields. These updates have included changing the airfield marking standard for taxiway centerlines at certificated airports (based on enplanements) to require special markings that will alert pilots when they are approaching hold short lines and working with airport operators to install stop bars<sup>13</sup> at certain runway/taxiway intersections. The FAA also has a Facility and Equipment (F&E) Program that focuses on runway safety, including Airport Surface Detection Equipment, Model X (ASDE-X), Airport Surface Surveillance Capability (ASSC), and Runway Status Lights (RWSL).<sup>14</sup>

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<sup>12</sup> For more information on FAA runway safety initiatives, visit: [http://www.faa.gov/airports/runway\\_safety/](http://www.faa.gov/airports/runway_safety/).

<sup>13</sup> A stop bar is a series of in-pavement and elevated red lights that indicate to pilots that they may not cross.

<sup>14</sup> More information on these programs can be found in the FAA's Capital Investment Plan at: [http://www.faa.gov/air\\_traffic/publications/cip/](http://www.faa.gov/air_traffic/publications/cip/).



## Maintaining Safe Airport Conditions

The FAA helps airports maintain safe conditions by developing airport design standards based on airport design categories that apply to facilities throughout the system. The FAA airport design standards have developed over time and provide the necessary dimensions to accommodate aircraft operations, as well as an extra margin of safety such as with the standards for RSAs discussed in the next section. Airports agree to meet these FAA design standards when they accept AIP funds for capital improvements to their facilities. The FAA standards address physical layout characteristics such as runway length and width, runway/taxiway/taxilane separation, RSAs, lighting, signs, and markings. The standards also address material characteristics (e.g., pavement, wiring, and luminance of lights) and issues, such as ARFF equipment, training and operations, snow removal plans and supporting equipment, and wildlife hazard management.

In another effort to promote safety, the Office of Airports has focused contract and staff resources on updating standards contained in advisory circulars (ACs). Many AIP-funded projects must comply with the safety standards contained in the ACs.

The Office of Airports continues efforts on two research programs: Airport Technology Research and the Airport Cooperative Research Program (ACRP). The President's FY 2015 budget submission included a request for \$29.5 million in funding for Airport Technology Research. This research is conducted at the FAA's Technical Center in Atlantic City, New Jersey, in the areas of airport planning and design, airport lighting and marking, runway safety, wildlife hazard mitigation near airports, ARFF, and pavement design and construction. The results of the research are used to update ACs and equipment specifications to provide guidance to airport sponsors and consultants.

The ACRP is a national resource for the airport industry, fulfilling the vital needs of airport practitioners by providing industry-driven research to airports of all sizes across the country and beyond at no cost. After 10 years in operation, the ACRP has engaged thousands of public- and private-sector airport practitioners, academicians, consultants, advocates, and students to identify the airport industry's most pressing challenges and fund research to document, mitigate, and create tools to help address those challenges.

Since its establishment in 2003, the ACRP has authorized more than \$106 million for 469 projects to generate nearly 400 research products in the form of reports, digests, syntheses, compact discs, and web documents addressing problems in every area of an airport's organization. The ACRP has convened hundreds of panels with thousands of industry experts to obtain research ideas and ensure that each research product is guided by a relevant yet diverse set of perspectives. A complete listing of all ACRP research projects and research results is available free of charge on the Transportation Research Board's ACRP Web site.<sup>15</sup>

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<sup>15</sup> The Transportation Research Board's ACRP Web site is located at: <http://www.trb.org/acrp/>.

## Runway Safety Areas (RSAs)

The standards for RSAs are designed to minimize damage to aircraft and injuries to occupants when an aircraft unintentionally strays from or overruns the runway during an operation. The standards provide for graded areas contiguous to the runway edges that are free of ruts, humps, and other surface irregularities. Only objects required to be there because of their function, such as runway lights or signs, can be in the RSA. These objects must be frangible by being mounted so they break away if struck by an aircraft. Adherence to design standards ensures the consequences of incidents are less likely to be severe.

As aircraft became larger, faster, and more demanding, the required RSA dimensions increased. As a result, many RSAs at commercial service airports (many of which were built decades ago) did not meet current FAA standards before the RSA program began in 2000. The FAA accelerated the improvement of RSAs that did not meet Agency design standards and worked with airport sponsors and local communities to improve the remaining nonstandard RSAs. At the end of CY 2015, all of the nonstandard RSAs were improved to meet dimensional standards or an equivalent level of safety, to the extent practicable, with the help of both AIP and PFC funds, as well as local investments. In addition, of the RSAs that also needed FAA-owned navigational aid and equipment to be removed or relocated, approximately 73 percent (422 of 576) have been improved, to the extent practicable, as of September 2015.

For some airports, it is not possible to acquire sufficient land to meet RSA standards through full physical compliance. For those cases, FAA, in partnership with industry and airport sponsors, conducted research to develop a soft-ground arrestor system to quickly stop aircraft that overrun the end of a runway. Based on that research, FAA issued a specification for Engineered Materials Arresting Systems (EMAS). An EMAS is designed to stop an overrunning aircraft by exerting predictable deceleration forces on its landing gear as the EMAS material deforms. The EMAS have been installed at more than 105 runway ends at 62 airports, and there are plans under contract to install or replace 4 EMAS at 3 additional U.S. airports over the next several years.

**Figure 5: EMAS on the Approach End of Runway 16 at Chicago Executive Airport, IL**



## Runway Incursion Mitigation (RIM)

Runway incursions occur because of human error by a pilot, an air traffic controller, or a vehicle operator. The FAA tracks runway incursions to help understand runway safety issues and develop strategies to mitigate the risk. In an effort to understand the root causes of runway incursions, FAA analyzed more than 6 years of national runway incursion data for 2007 through 2013. This effort was the first step in the FAA's risk-based approach to identify runway incursion locations. Using a

geographical information system, FAA then developed a preliminary inventory of airport locations where runway incursions have occurred.

The RIM is a new, comprehensive, multiyear program introduced in FY 2015 to identify, prioritize, and implement mitigation projects to address the runway incursion risks at these locations. Mitigation alternatives focus on improving existing geometry issues but may also include improved marking and lighting, airfield signage, operational solutions, or other developing technologies. Many solutions may consist of a combination of two or more of these alternatives. As these projects are further developed, their development costs will be refined and included in the next NPIAS report.

### **Safety Management System (SMS)**

In 2001, ICAO adopted an amendment to Annex 14, Aerodromes of the Convention on International Civil Aviation, requiring all member states to establish SMS initiatives for certificated international airports. The ICAO defines a SMS as a “systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures.”<sup>16</sup> The SMS provides an organization’s management with a set of decisionmaking tools that can be used to plan, organize, direct, and control its business activities in a manner that enhances safety and ensures compliance with regulatory standards. The FAA supports conformity of U.S. aviation safety regulations with ICAO standards and recommended practices.

#### ***SMS Pilot Studies***

The FAA is developing SMS standards for certificated airports under title 14 Code of Federal Regulations (CFR), part 139. Since 2007, FAA has initiated numerous pilot studies to evaluate the development of SMSs at a variety of certificated airports.<sup>17</sup> More than 30 certificated airports of varying sizes and operations have participated in the studies. Participating airports reviewed existing safety standards to determine if they met the intent of typical SMS requirements. They then developed SMS manuals and implementation plans based in part on their findings.

To continue the analysis into the next phase of SMS, FAA launched another study in FY 2010 aimed at implementing the SMS at a small number of airports. The study provided funding for participating airports to implement certain processes developed under the original pilot studies. It required the airports to conduct safety risk analyses to proactively identify hazards and mitigate risks in their operations and development. In addition, airports conducted audits and inspections of their SMS programs to gain lessons learned from implementation and review the effectiveness of their SMS in proactively identifying safety issues on the airport. To participate, the airports had to have participated in the earlier studies. Thirteen airports participated in this implementation study, which ended in February 2012. The FAA compiled the results of the study and included them in AC 150/5200-37A, Safety Management Systems for Airports, released June 29, 2012.

The pilot studies allowed airports and FAA to gain experience establishing airport-specific SMSs that are tailored for the individual airport. Additionally, this experience provided best practices and lessons learned that FAA is using as it considers how to incorporate SMS standards into part 139.

<sup>16</sup> See ICAO Safety Management Manual (SMM), Definitions section, ICAO Doc. 9859-AN/474 (Third Edition-2013).

<sup>17</sup> A list of participating airports is available online at:  
[http://www.faa.gov/airports/airport\\_safety/safety\\_management\\_systems/](http://www.faa.gov/airports/airport_safety/safety_management_systems/).

On July 12, 2016, FAA published a Supplemental Notice of Proposed Rulemaking (SNPRM) that would require airport operators to institute the SMS at their airports. This action is necessary to improve safety through conformance with best practices in risk management and promote international harmonization with ICAO standards. The proposed rule is intended to facilitate integration of formal risk management processes within the airport's day-to-day operations.

### ***Safety Risk Management (SRM)***

The Office of Airports implemented an SMS within its own organization in August 2010. Certain documentation, such as airport layout plans, modification to standards, or construction safety phasing plans, submitted for approval from large, medium, and small hub airports, must undergo a safety risk management assessment. Each action must incorporate proactive risk assessment aimed at considering safety issues throughout the entire project development cycle from planning to construction. These safety risk assessments provide FAA additional decisionmaking and coordination tools to ensure future projects and actions incorporate appropriate safety controls prior to approval.

### **Wildlife Hazard Mitigation**

The FAA has overseen a wildlife management program for more than 50 years in an effort to keep airports safe by making them less attractive to all types of wildlife. The FAA has continued a multifaceted approach for mitigating wildlife strikes. This includes continuing a robust research program, making improvements to the National Wildlife Strike Database and outreach, incorporating new technology to increase and simplify strike reporting, and providing AIP funding to airports to conduct Wildlife Hazard Assessments (WHAs) and develop Wildlife Hazard Management Plans (WHMPs).

The number of strikes annually reported to FAA increased from 1,851 in 1990 to a record 13,668 in 2014. The 2014 total was an increase of 2,267 strikes (20 percent) compared to the 11,401 strikes reported in 2013. Between 1990 and 2014, 156,114 strikes were reported. As of December 2015, all 544 part 139 certificated airports completed a WHA, initiated a WHA, or used an existing Bird/Wildlife Aircraft Strike Hazard (BASH) Plan at joint-use facilities that are predominantly military. The AIP funds are also available for follow-on WHMPs, as needed.

A number of wildlife hazard management initiatives have been implemented and are underway, including:

- Systematic strike data collection started in 1990 for use by the Office of Airports and the aviation industry as a means of improving airport safety and reducing wildlife hazards. The Web site [wildlife.faa.gov](http://wildlife.faa.gov) has search fields that enable users to find data on specific airports, airlines, and engine types, as well as by date and State without having to download the entire database. The Web site is updated continuously to add more data and resources. Further, a comprehensive annual report, "Wildlife Strikes to Civil Aircraft in the United States, 1990-2014," has been available to the public since 1995.
- The FAA identified gaps among certificated airports, air carriers, and general aviation airports in reporting wildlife strikes. Overall strike reporting has steadily increased while damaging strikes within the airport environment decreased or remained stable. The increased reporting of strikes is due, in part, to the FAA's efforts to improve strike reporting by stakeholders across the

country, as well as improving the public's ability to report wildlife strikes through Web sites and smartphone applications. The reduction in damaging strikes is due to professionally run wildlife hazard programs by airports and increased airport awareness to the hazards posed by certain wildlife. The FAA is conducting outreach to the aviation community to further close the reporting gaps.<sup>18</sup> One such outreach activity includes printing posters that promote strike reporting. Over the past 4 years, FAA has distributed 36,000 posters to more than 4,000 part 139 airports, general aviation airports, aviation flight schools, and the aviation industry.

- The FAA continued evaluating the performance of low-cost portable bird radars and other automated detection and monitoring systems capable of detecting and tracking birds on or near airports. Bird radar systems were deployed at Seattle-Tacoma International, Chicago O'Hare International, John F. Kennedy International, and Dallas/Fort Worth International. These evaluations are being performed through a multiyear agreement with the U.S. Department of Agriculture (USDA), the National Wildlife Research Center, the National Center of Atmospheric Research, and Indiana State University.

For the last 15 years, FAA and USDA have conducted a research program to make airports safer by reducing the risks of aircraft-wildlife collisions. The research efforts designed to improve wildlife management techniques and practices on and near airports include:

- Methods for making airport habitats less attractive to species that are the most dangerous in terms of aircraft collisions. This is accomplished by studying which species use the airport property, how they behave in that environment, and why they are attracted.
- Techniques for controlling species by restricting access to attractive features, such as stormwater ponds.
- Technologies for harassing and deterring hazardous species.
- The types of grasses and agricultural crops that attract the least amount of hazardous wildlife.
- Cooperative research efforts between USDA and FAA, including techniques employed on aircraft to deter collisions with wildlife. A new study aims to quantify the sensory capabilities of targeted hazardous avian species and evaluate the effect of modifying onboard aircraft lighting systems. The goal is to develop a novel onboard aircraft lighting system that will enhance detection and avoidance of aircraft by birds and ultimately reduce strikes.

## **CAPACITY (RELATES TO DOT'S ECONOMIC COMPETITIVENESS GOAL)**

The ability of the United States to effectively compete in a global economy requires air transportation services that operate efficiently and reliably to sustain economic opportunity throughout the Nation. The capacity of the airport system is affected by many factors, including the layout of individual airports, the manner in which airspace is organized and used, airport operating procedures, weather conditions, the aircraft type using the system, and the application of technology. The majority of airports in our NAS have adequate airport capacity and little or no consistent delays. However, at a small number of airports where consistent capacity constraints and delays regularly occur, they frequently impact the entire air transportation system. The FAA seeks to enhance capacity where the benefits of additional capacity exceed the costs.

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<sup>18</sup> A copy of the report can be found online at: [http://www.faa.gov/airports/airport\\_safety/wildlife/](http://www.faa.gov/airports/airport_safety/wildlife/).



A major concern in airport planning is the adequacy of the runways and taxiways to handle anticipated aircraft operations safely and efficiently. A single runway with a parallel taxiway can normally accommodate approximately 200,000 annual aircraft operations. The FAA provides guidance to help airport sponsors decide when they should consider airfield capacity improvements. Current FAA guidance recommends that capacity planning start when aircraft activity reaches 60 to 75 percent of an airport's airfield capacity. With major airfield improvements often taking 10 or more years from concept to completion, this recommendation allows adequate lead for improvements to be implemented before the congestion problem becomes critical.

Before a new runway or runway extension can be built, FAA must assess potential environmental impacts that may result from airport development projects. The FAA's authorizing statute requires FAA to implement a process for expedited and coordinated environmental reviews of certain airport capacity, safety, and security projects. In addition, FAA is continuing to work closely with the busiest airports to ensure environmental studies for major runway projects or airfield reconfigurations are completed on schedule. The FAA establishes environmental impact analysis teams, maximizes the use of available staff and consultant resources, and uses recommended best practices for accomplishing its environmental work in a timely manner. The FAA works with other Federal and State environmental resource agencies to achieve concurrent reviews, analyses, and permit approvals to the greatest extent possible. Schedules are established with key milestones and monitored and a process is created to elevate and resolve disputes or disagreements between parties.

Since 2000, infrastructure projects at 23 major airports have provided the capability to accommodate more than 2 million additional operations each year. This is a significant accomplishment. Moving forward, new airport infrastructure will continue to play a vital role in increasing capacity. This is true even with the capacity and efficiency benefits that are being realized with the NextGen program to modernize the NAS<sup>19</sup>.

NextGen benefits airports by providing new "tools in the toolbox," such as precision flight procedures and surface management, which complements traditional airport planning and development initiatives. Where substantial new capacity is needed, new or expanded airfield infrastructure will generally represent the most viable means of achieving significant capacity increases. NextGen will often be a critical enabler for a new runway, for example, by maximizing the capacity that can be achieved by using of performance-based navigation (PBN) procedures or approaches to closely spaced parallel runways. Going forward, both new runways and NextGen improvements are needed to improve efficiency at capacity-constrained airports. For more information, see section on Alternative Capacity Enhancement Methods.

## **Congestion and Delay**

The concentration of aircraft arrivals and departures at an airport can result in congestion and delay. Consistent delays are an indicator that activity levels are approaching or exceeding throughput capacity levels. The impacts of delays can be measured in many ways and include:

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<sup>19</sup> Additional information about the Next Generation Air Transportation System, see: <http://www.faa.gov/nextgen/>.

- Direct costs, such as increased fuel use and crew time;
- Indirect costs, such as the extra travel time for passengers;
- Missed connections (resulting in delays on other airlines and their passengers); and
- Increased air emissions.

Delay is expressed in different metrics. For example, DOT tracks the on-time performance of airlines and reasons for flights arriving after their scheduled arrival times. Other delay statistics are collected and used for specific purposes. For example, air traffic controllers identify instances where aircraft are delayed 15 minutes or more in a given flight segment. The FAA uses this information to monitor the day-to-day operations of the air traffic control system. Airport planners and designers use the average delay per aircraft operation as a measure of congestion, which is related to the balance of demand versus capacity. This statistic can be forecasted and translated into a dollar cost of delay.

### **Air Carrier On-Time Performance**

The DOT defines a delayed operation as an aircraft arriving at or departing from a gate 15 minutes or more after its scheduled time. The number of arrivals and departures that are delayed 15 minutes or more is compiled by DOT for busy airports and is reported monthly. In 2015, the 14 carriers reporting on-time performance recorded an overall on-time arrival rate of 79.9 percent with 1.5 percent of the flights canceled.<sup>20</sup>

Of the 18.9 percent of flights delayed in 2015,<sup>21</sup> 7 percent were delayed because the aircraft arrived late (previous flight with same aircraft arrived late, causing the present flight to depart late);

- 6 percent were delayed due to air carrier delay (circumstances within the airline’s control, such as maintenance or crew problems, aircraft cleaning, baggage loading, and fueling);
- 5 percent were delayed due to national aviation system delays (such as significant aviation weather constraints, runway closures, heavy traffic volume, and air traffic control);
- 0.6 percent were delayed due to extreme meteorological events that, in the judgment of the carrier, delayed or prevented the operation of a flight, such as tornado, blizzard, or hurricane; and
- 0.3 percent of the delays were attributed to diverted flights.

### **Delay Indicators**

The FAA monitors the day-to-day operations of the air traffic control system. Airport planners and designers use the average delay per aircraft operation as a measure of congestion. Through the Aviation System Performance Metrics (ASPM) system, FAA tracks delay indicators at the 30 busiest airports, referred to as “core airports,”<sup>22</sup> using reporting from participating airlines. Delays can be measured against the scheduled flight time or against the flight plan. For purposes of this analysis, FAA used flight plan data.

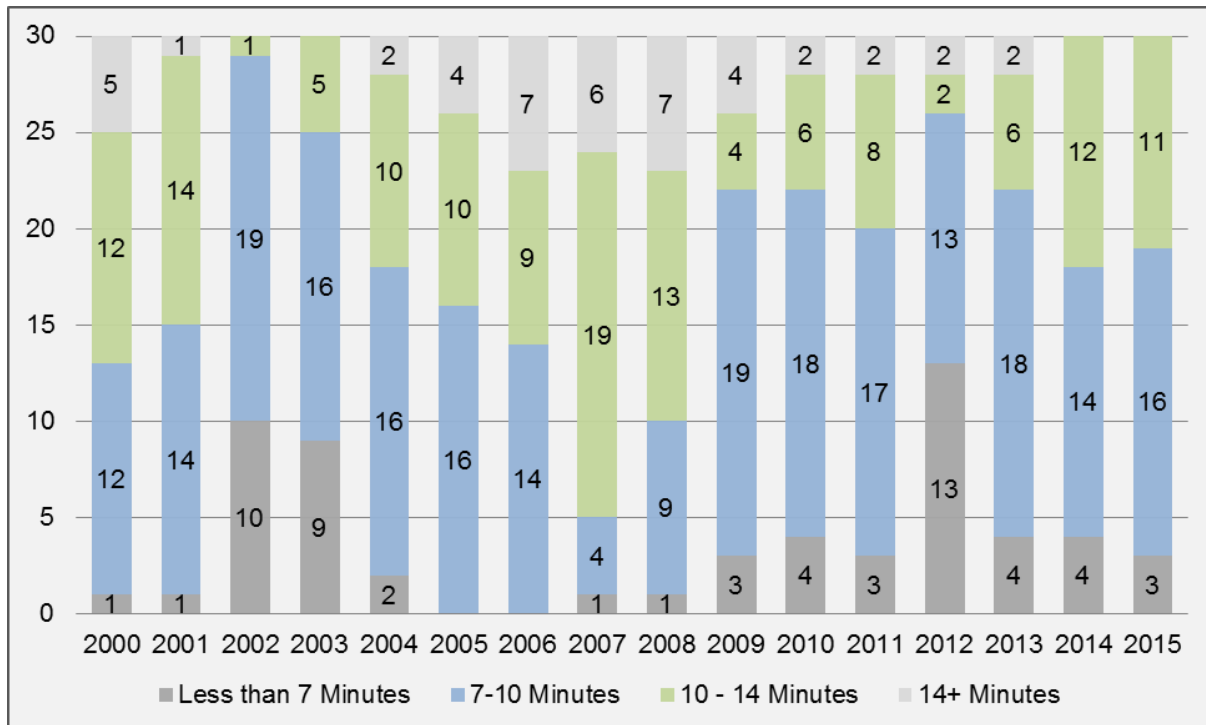
<sup>20</sup>Data available at: <http://www.transtats.bts.gov/HomeDrillChart.asp>. Beginning in 2014, only 14 air carriers will be required to report airline on-time data to the Bureau of Transportation Statistics.

<sup>21</sup>Data available at: [http://www.transtats.bts.gov/OT\\_Delay/OT\\_DelayCause1.asp?pn=1](http://www.transtats.bts.gov/OT_Delay/OT_DelayCause1.asp?pn=1).

<sup>22</sup>The FAA has identified those airports with the greatest impact on system performance as “core airports.” These core airports have more than 1 percent of passenger enplanements or 0.75 percent or more of the total nonmilitary itinerant operations.

Grouping the core 30 airports according to average arrival delay per operation, Figure 6 shows there were 17 airports experiencing more than 10 minutes of delay per arrival (e.g., 12 airports with 10 to 14 minutes and 5 with more than 14 minutes) in 2000. In 2007, the number of airports with an average arrival delay of more than 10 minutes increased to 25. In 2015, the number of airports with more than 10 minutes of delay decreased to 11. No airport had more than 14 minutes of arrival delay in 2014 or 2015.

**Figure 6: Average Arrival Delays for 30 Core Airports**

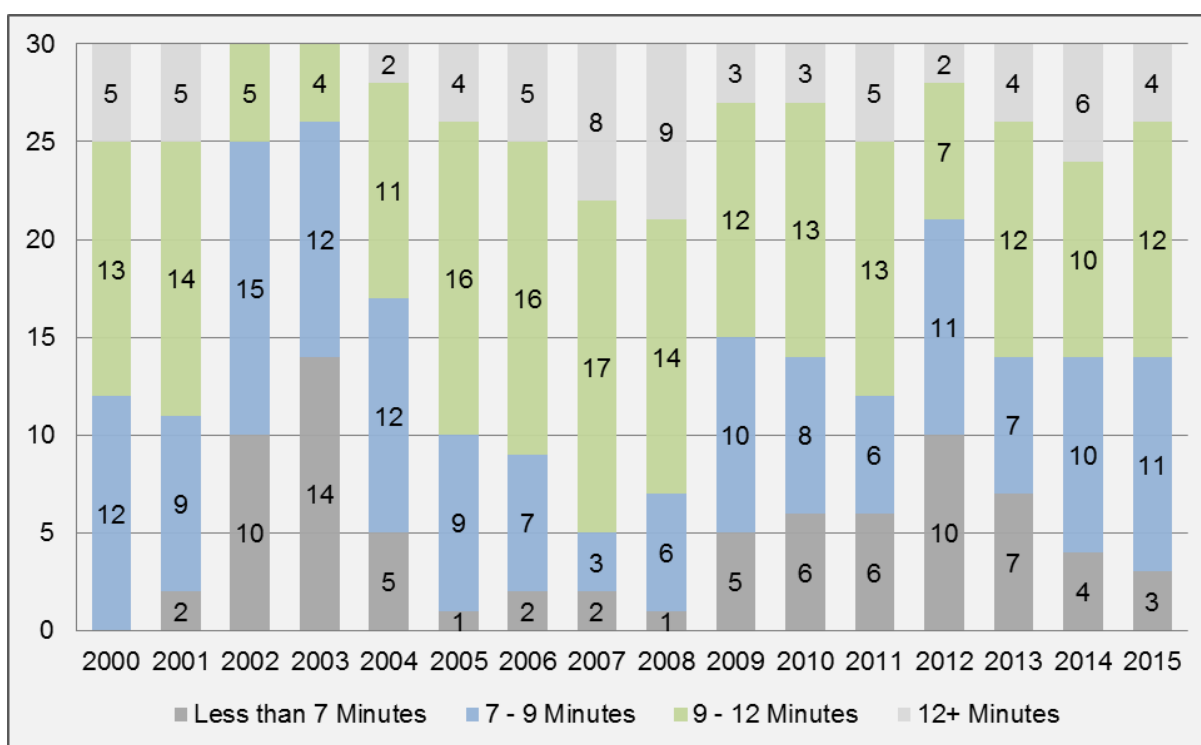


Source: ASPM. Data available at: <https://aspm.faa.gov/aspm/entryASPM.asp>.

Grouping the core 30 airports according to average departure delay per operation, as shown in Figure 7, shows that in 2000 there were 18 airports with more than 9 minutes of delay per departure. In 2007, the number of airports with an average departure delay of more than 9 minutes increased to 25. In 2015, the number of airports with more than 9 minutes of delay decreased to 16.



**Figure 7: Average Departure Delays for 30 Core Airports**



Source: ASPM. Data available at: <https://aspm.faa.gov/aspm/entryASPM.asp>.

## Airport Capacity—A National Look

In recognition of delays and congestion detailed above, FAA has developed an ongoing series of reports, known as the Future Airport Capacity Task (FACT), to assess the future capacity of the Nation's airports and metropolitan areas. The first FACT report was published in 2004, and an update, FACT2, was published in 2007. The bookend report, FACT3, was published in 2015.<sup>23</sup>

As a series, the FACT reports have identified airports that are at risk for significant delays and congestion in future years. In the case of FACT3, the report identifies capacity constrained airports through 2020 and 2030. The report shows that new runways have helped to improve capacity at many formerly congested airports. For the rest of this decade, much of the U.S. hub airport system has sufficient capacity – except for several high-demand airports that have consistent delays: New York City area airports, Hartsfield-Jackson Atlanta International Airport, Philadelphia International Airport, and San Francisco International Airport.

The systemwide analyses conducted in the FACT are intended to determine which airports have the greatest need for additional capacity primarily in terms of runway development. This information helps inform FAA strategies about the timing and need for infrastructure improvements at the national level for Agency planning purposes.

<sup>23</sup> The FACT3 report is available online at: [http://www.faa.gov/airports/planning\\_capacity/](http://www.faa.gov/airports/planning_capacity/).

With advances in modeling capabilities, the FACT3 report included surface and gate constraints in addition to runway and airspace operations. The capacity benefits from anticipated airfield capacity improvements and NextGen procedures and technologies were also assessed. Finally, updated delay and performance criteria were used to identify congested airports.

Notably, all of the airports identified in FACT3 as capacity constrained are large hub, core airports. Although the FACT3 study evaluated some smaller commercial service or general aviation airports, none of these evaluated airports were identified as capacity constrained. This reflects the continued concentration of air traffic growth at major hubs. While NextGen will reduce growth in average delays, steady traffic growth as forecasted will nonetheless result in severe congestion at eight of the nine capacity-constrained airports by 2030, affecting air travel nationwide. Figure 8 contains a comparative summary of all three FACT reports.

Given the evolving trends and shifts in the aviation industry, there is considerable uncertainty about any projection out to 2030. Uncertainty results from variations in traffic growth, how quickly the airlines add larger aircraft to their fleet to replace smaller aircraft, demographic and socioeconomic shifts, and the impact of capacity improvements from NAS modernization initiatives. However, with several consecutive years of sustained traffic growth at any of the core airports, the long-term delay concerns will become much more tangible. As a result, it remains crucial for these airports to continue their efforts to devise long-term planning solutions to address capacity constraints. Going forward, both new runways and NextGen improvements are needed to improve efficiency at capacity-constrained airports.

Another ongoing series of reports issued by FAA examines the capacity of the major U.S. airports. The Airport Capacity Profiles, formerly known as the Airport Capacity Benchmark Report, was updated in 2014.<sup>24</sup> Capacity for the purpose of this report is defined as the hourly throughput of arrivals and departures that an airport's runways are able to sustain during periods of high demand. Information is provided on the facility's layout, annual weather conditions, current operations, and recent and future improvements. Both air traffic control facility "called rates" and model-estimated hourly throughput rates are shown for the highest capacity configuration that is commonly used during visual, marginal, and instrument conditions. Updated airport profiles are published annually to the Web site for selected airports that have either seen enhancements to runway infrastructure or updated air traffic control procedures. The model used for this report is also used for FACT3, as well as for the NextGen systems analysis evaluations, and is available for use by airports in the United States.<sup>25</sup>

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<sup>24</sup> These reports are available online at: [http://www.faa.gov/airports/planning\\_capacity/profiles/](http://www.faa.gov/airports/planning_capacity/profiles/).

<sup>25</sup> Model information is available at: [http://www.faa.gov/airports/planning\\_capacity/runwaysimulator/](http://www.faa.gov/airports/planning_capacity/runwaysimulator/).

Figure 8: Comparative Summary of all Three FACT Reports

Airport	FACT 1			FACT 2			FACT 3		
	2004	2013	2020	2007	2015	2025	2011	2020	2030
ABQ		●	●						
ATL	●	○	●			●	●	●	●
BDL			●						
BHM			●						
BOS			○			○			
BUR		●	●						
BWI		○	○						
CLT		○	○		○	○			●
CVG		○	○						
DCA			○						
DEN			○						
DFW			○						
DTW			○						
EWR	●	●	●	●	●	●	●	●	●
FLL		●	○	●	○	●			○
HOU		●	●		○	○			
IAD			○			○			
IAH		○	○		○	○			●
ISP			●						
JFK		●	○			●	●	●	●
LAS		○	●			●			●
LAX		○	○			○			
LGA	●	●	●	●	●	●	●	●	●
LGB		●	●		●	●			
MDW		○	●		○	●			
MEM			○						
MIA			○						
MSP		○	○			○			
OAK		●	●		●	●			
ONT			●						
ORD	●	●	○	●	○	○			○
PBI		●	○		○	○			
PHL	●	●	○		●	●	●	●	○
PHX		○	○			●			●
PVD			●		○	○			
SAN						●			
SAT		●	●		○	○			
SEA			○			○			
SFO						●		○	●
SLC			○						
SNA		●	●		●	●			
STL		○	○						
TUS		●	●		○	○			

**Comparative Summary Results Across All Three FACT Reports**

Legend:

- Constrained in reference case, but unconstrained if planned improvements are implemented
- Constrained even after all planned improvements are implemented; additional capacity enhancement is needed; or constrained in base year.

No symbol indicates not capacity constrained

Note: This table lists only the airports that were identified as capacity-constrained in one of the FACT reports. It does not list other airports that were analyzed in the FACT reports, but not identified as capacity-constrained.

Source: FACT3: Airport Capacity Needs in the NAS. Available at: [http://www.faa.gov/airports/planning\\_capacity/](http://www.faa.gov/airports/planning_capacity/).

## Alternative Capacity Enhancement Methods

While the construction of new runways and runway extensions can provide substantial improvements to capacity, new technology can also benefit some airports by reducing delays and increasing operational efficiency without substantial capital investment. Incorporating new technologies in the modernization of the NAS is a key component to the FAA's NextGen program.

Delays can be reduced or more proactively managed, in part, by modifying air traffic control procedures or introducing new technologies to improve the flow of airborne aircraft. Changes in air traffic and flight procedures may also improve the efficiency of traffic flows or alleviate capacity constraints. Airspace design changes, for example, can establish more effective airspace structures and provide better access and improved use of available runways.

NextGen improvements are benefiting airports today. For example, Data Communications (Data Comm) is improving departure efficiency and reducing departure delays by using speedy datalinks to deliver departure clearances and clearance revisions to aircraft. The increased use of PBN avionics and routes in the NAS is improving access to general aviation airports and improving the airspace efficiency of busy, complex hub airports. Along with FAA, airports and airlines are investing in surface surveillance systems and data sharing to comprehensively track surface movements in order to enhance safety and traffic flow, as well as to improve collaborative decisionmaking. Updated closely spaced parallel runway standards published in 2015 allow for increasing capacity on some existing runways while providing options to build new runways with reduced lateral spacing and less real estate. Comprehensive information is available in the FAA's annual NextGen Update, which is available online at:

[http://www.faa.gov/nextgen/update/operator\\_investments\\_and\\_airports/airport\\_enhancements/](http://www.faa.gov/nextgen/update/operator_investments_and_airports/airport_enhancements/).

### **Congestion Management**

Congestion management is a broad term that includes a number of imposed administrative measures (e.g., slots, which limit the number of flights that may be scheduled) to reduce congestion and delay and allocate constrained capacity. Airport operators may seek to reduce congestion through revenue neutral peak-hour pricing to encourage airlines to move operations to a less congested time or secondary airport.<sup>26</sup> Another congestion management technique is using the International Air Transport Association (IATA) guidelines for schedule facilitated airports in accordance with the Worldwide Scheduling Guidelines. An IATA Level 2 designation enables FAA to request all United States and foreign air carriers to report to FAA their proposed scheduled operations for the schedule facilitated airport, which allows the Agency to closely monitor the traffic levels and prevent excessive scheduling and delays at that facility. This is not a common practice in the United States and has only been utilized at a small number of U.S. airports. However, FAA has successfully implemented this congestion management technique when warranted by congestion concerns at selected airports (e.g., San Francisco International and Chicago O'Hare International).

The FAA recognizes the importance of airports specifically and the aviation industry generally as a major economic engine at the local, regional, and national level. Airports need to be both

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<sup>26</sup> DOT's Policy Regarding Airport Rates and Charges, 73 Federal Register 40434 (July 14, 2008); see also *Air Transport Association of America v. U.S. Department of Transportation*, 613 F.3d 206 (D.C. Cir. July 13, 2010) (denying petition for review of policy).

environmentally and economically sustainable. However, there are a small number of airports where demand consistently exceeds capacity and causes delays for the entire system and where it is not immediately clear whether capacity increases are readily achievable. In such locations, other short- and long-term solutions may be needed to address congestion by managing and allocating access in a fair and competitive manner.

### ***New York Metropolitan Area***

With persistent demand for New York area airspace and airports and the limited ability to expand capacity, FAA is presented with a challenge of how best to allocate scarce runway capacity. For decades, FAA managed congestion at LaGuardia and John F. Kennedy International airports through the High Density Traffic Airports Rule (HDR). However, Congress mandated the expiration of the HDR at both airports on January 1, 2007. To minimize congestion at LaGuardia, John F. Kennedy International, and Newark Liberty International after the expiration of the HDR, FAA put temporary orders in place at all three New York metropolitan airports that cap scheduled operations. The orders for John F. Kennedy International and LaGuardia have been extended until October 27, 2018. Beginning with the winter 2016 scheduling season (which is effective October 30, 2016), FAA will change the designation at Newark Liberty International under the IATA Worldwide Slot Guidelines from Level 3 slot controls to Level 2 schedule facilitation.

The New York Area Program Integration Office was established to integrate the implementation of delay-reduction initiatives in the New York metropolitan area. It leads a matrix team with representatives from the FAA's Air Traffic, Aviation Safety, Airports, Policy, International Affairs and Environment offices. The team has developed an Integrated Master Schedule and Delay Reduction Plan with all delay reduction initiatives and supporting projects.

The Port Authority of New York and New Jersey has a number of ongoing and planned projects to better serve passengers and improve operational efficiency at its system of airports. The Port Authority operates LaGuardia, John F. Kennedy International, Newark Liberty International, Stewart International, Teterboro, and Atlantic City International airports. The Port Authority also continues to evaluate ways to accommodate future demand for air travel in the New York metropolitan area. An ongoing study is analyzing a range of alternatives and will identify a subset of alternatives for further evaluation.

### ***Chicago O'Hare International Airport***

The FAA also continues to monitor congestion and delay at Chicago O'Hare International, although the airport is no longer operating under a regulatory limit on scheduled operations. The previous congestion management rule expired on October 31, 2008, in conjunction with the opening of the first new O'Hare Modernization Program runway in November 2008. However, in order to monitor traffic and delay levels, FAA has maintained Chicago O'Hare International as an IATA Level 2 schedule facilitated airport. As a Level 2 airport, FAA obtains advance schedule information from U.S. and foreign air carriers, which enables the Agency to identify and work with the carriers to voluntarily mitigate excessive scheduling and delays.

### ***San Francisco International Airport***

In 2011, FAA designated San Francisco International as an IATA Level 2 airport in order to mitigate existing congestion and expected increased congestion due to RSA construction work. Under the

IATA Level 2 process beginning with the summer 2012 scheduling season, airlines operating or planning to operate flights submit planned schedules for the upcoming season. The FAA continues to review the aggregate of planned schedules and determines whether they may cause significant congestion and delays in light of operational constraints and works with airlines to voluntarily adjust schedules to mitigate congestion and delay impact, as necessary. The FAA determined that the demand and capacity balance at San Francisco International Airport warranted continuation of the IATA Level 2 designation following completion of RSA construction at the airport.

### ***Los Angeles International Airport***

In 2015, FAA designated Los Angeles International Airport as an IATA Level 2 airport due to the potential for congestion during the phases of the multiyear runway construction work because of forecasted schedule growth by multiple carriers.

## **ENVIRONMENTAL (RELATES TO DOT'S QUALITY OF LIFE IN COMMUNITIES AND ENVIRONMENTAL SUSTAINABILITY GOAL)**

Community concern about environmental issues can impact both expansion and operation of existing airports. Environmental constraints also increase the difficulty of developing new airports. The problem is particularly serious in metropolitan areas where there is high aviation demand and strong pressure to develop residential and other incompatible land uses near airports. In addition, airports in large metropolitan areas are frequently located in air quality nonattainment areas. Historically, communities have been concerned about noise levels, but they are also concerned about air quality, water pollution, and, most recently, climate change.

The FAA has a commitment to inform and involve the public and give meaningful consideration to community concerns and views as FAA makes aviation decisions that affect them. In September 2016, FAA released an updated Community Involvement Manual that provides guidance for FAA employees who are involved in planning, conducting, or approving aviation actions that may raise concerns within a community. Special consideration needs to be given to provide meaningful public involvement by minority and low income populations. The FAA has developed a new capability to help identify these environmental justice populations.

As it evolves, NextGen capabilities will help reduce levels of carbon dioxide emissions by enabling more efficient movement of aircraft on the airport surface. New airframe and engine technologies and development of renewable sustainable fuels will also improve noise, air quality, and greenhouse emissions. The introduction of PBN to the NAS introduces both opportunities and challenges for controlling noise exposure to communities. The highly configurable nature of PBN procedures allows for the potential to design routes away from population centers; however, safely maintaining the narrower flight corridors and allowing for increased efficiency may in some cases lead to higher noise levels directly under the consolidated flight paths. The FAA continues to refine its ability to model environmental impacts associated with PBN, including noise, air quality, and climate change. The FAA takes into consideration the potential impacts and the populations that could be impacted, including environmental justice populations, prior to implementing FAA actions.

To address the potential impacts of climate change, FAA has been developing, in accordance with Executive Orders, the data and review of resources required to assist the ability of the national

airport system to withstand and/or recover from anticipated severe weather events and rising sea levels. The resources required for this purpose are not yet contained within the current 5-year development costs.

## **Air Quality**

Many of the Nation's airports are located in air quality nonattainment or maintenance areas. Air quality improvements in these areas are accomplished through State implementation plans, which provide controls and measures to meet health-based National Ambient Air Quality Standards under the Clean Air Act. The FAA provides financial support for airport air quality mitigation through the AIP and PFC Program.

The FAA encourages early airport actions to reduce local emissions through the Voluntary Airport Low Emissions (VALE) Program. The goal of the VALE Program is to reduce air pollutants at commercial service airports in areas that do not meet air quality standards. It is designed to provide airport sponsors with financial and regulatory incentives to invest in proven low-emission airport technologies, including alternative fuel vehicles, and low-emission infrastructure, such as refueling and recharging stations and electrical power for aircraft at the gate. The VALE Program was established in FY 2005 and, to date, FAA has invested approximately \$173 million in AIP funds in 87 VALE projects at 44 commercial service airports.

The FAA Modernization and Reform Act of 2012, Pub. L. 112-95, authorized FAA to establish a new emission-reduction pilot program. The Zero-Emission Airport Vehicles (ZEV) and Infrastructure Pilot Program allows FAA to award AIP funds for the acquisition and operation of zero-emission vehicles and supporting infrastructure at commercial service and general aviation airports.

Public-use airports in the NPIAS are eligible to receive consideration for AIP funding to procure ZEVs under the ZEV Pilot Program. All AIP procurement requirements must be met, and per the statute, priority will be given to airports located in the U.S. Environmental Protection Agency (EPA) designated air quality nonattainment areas. To meet ZEV standards, the vehicle must produce zero exhaust of any criteria pollutant (or pollutant precursor).

## **Water Quality**

Many of the Nation's airports are found near waterways and wetlands because when airports were originally built, the best available land suitable for an airport (flat and inexpensive) was found near water. Today, activities at these airports have the potential to cause adverse water quality impacts if they are not properly designed and managed. In particular, airport construction activities, fire fighting activities, and seasonal aircraft and runway anti-icing/deicing operations are major concerns. Airport construction activities could cause sediment-laden runoff to enter waterways. Chemicals in the aqueous film forming foams (AFFF) are now being regulated in some states because of their potential toxicity and persistence issues. Biological and chemical breakdown of aircraft and runway deicing chemicals in airport runoff can reduce oxygen in receiving waters. Additives in deicing chemicals may be toxic to aquatic life, and the industry has taken steps to eliminate such additives.

The FAA continues to work with EPA, airport operators, airlines, and industry groups to address various water quality issues. The FAA consulted with EPA during the rulemaking process that established reasonable effluent limit guidelines for airport deicing activities, namely aircraft and runway de/anti-icing. The final rule was published in the Federal Register on May 16, 2012. The FAA continues to work with airport operators and airlines in the search for alternatives to earlier generation runway deicing chemicals, methods to deice aircraft, and the use of centralized aircraft deicing facilities. Currently, industry groups are working on a voluntary pollution reduction program for aircraft deicing fluids that was developed during the rulemaking process.

The voluntary pollution reduction program is a 5-year effort (2012–2017) with a phase 1 report published on March 31, 2015. This report addressed information exchange and outreach, technology development and deployment, pollution reduction goals, and the environmental benefits of pollution reduction, as well as next steps.

The FAA is also working with airport sponsors, industry associations, and other Federal agencies to ensure water quality mitigation activities do not create safety concerns by attracting wildlife, notably large mammals or birds hazardous to aviation.

The FAA continues to participate in ACRP projects administered by the Transportation Research Board (TRB):

- ACRP 02-75, Benefit-Cost Analyses Guidebook for Airport Stormwater;
- ACRP 02-71, Guidebook and Decision Tool for Managing Airport Stormwater Containing Deicers;
- ACRP 02-70, Wetland Mitigation – A Guidebook for Airports;
- ACRP 02-62, Green Stormwater Infrastructure Strategies for Airports;
- ACRP 02-61, Airport Stormwater Management Electronic Resource Library and Training Materials;
- ACRP 02-60, Use and Potential Impacts of AFFF Containing Per- and Polyfluoroalkyl Substances (PFASs) at Airports;
- ACRP Report 115, Understanding Microbial Biofilms in Receiving Waters Impacted by Airport Deicing Activities (published 2014);
- ACRP Report 125, Balancing Airport Stormwater and Bird Hazard Management (published 2015); and
- ACRP Report 134, Applying Whole Effluent Toxicity Testing to Aircraft Deicing Runoff (published 2015).

### **Airport Sustainability Efforts**

The FAA continues to work closely with aviation stakeholders to promote sustainable airport development. Airport sustainability efforts include:



- Airport Sustainability Planning – The FAA continues to support airports that are preparing comprehensive airport sustainability plans.<sup>27</sup>
- Cooperative Research – The FAA continues to work with ACRP on sustainability research. Ongoing research includes the development of a sustainability decision tool and enhancements to the Sustainable Aviation Guidance Alliance (SAGA) database. The SAGA database was created by industry stakeholders to provide information on airport sustainability practices. Research includes ACRP Synthesis Report 66, Lessons Learned from Airport Sustainability Plans, a study on the effectiveness and lessons learned from comprehensive airport sustainability plans.

## Environmental Streamlining

The FAA continues to address airport-related impacts on noise, air quality, and other environmental concerns. In doing so, it complies with many Federal laws, Executive orders, and regulations. The FAA’s authorizing statute requires FAA to streamline (i.e., improve efficiency and effectiveness) its environmental review of capacity projects at congested airports. The statute also requires FAA to conduct streamlined environmental reviews for Administrator-designated safety or security projects at any airport.

The FAA will also implement Executive Order 13604, Improving Performance of Federal Permitting and Review of Infrastructure Projects, which calls for the execution of Federal permitting and review processes, including environmental review processes, with maximum efficiency and effectiveness.

## Environmental Research

The FAA-funded ACRP is examining areas of airport-related environmental concerns and advancing the science and technology necessary for creating an environmentally friendly airport system. The FAA’s ACRP efforts are focusing on:

- Airport-related hazardous air pollutants and greenhouse gasses;
- The impact of airports on climate change and community noise;
- Developing alternative aviation fuels;
- Developing advanced noise and air emissions models;
- Promoting airport sustainability;
- Land use compatibility;
- Environmental management systems; and
- Integrating airport development and environmental review processes.

Since 2005, FAA has allocated \$106 million toward an array of aviation design, construction, operation, and environmental research projects. In each fiscal year from 2010 through 2016, \$15 million was provided for ACRP research, including \$5 million specifically for environmental research.

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<sup>27</sup> For further information, visit the Web site: <http://www.faa.gov/airports/environmental/sustainability>. Airport sustainability planning, along with all other planning costs, are not included in this report.

The FAA's Office of Environment and Energy has a research and development program that supports science and technology necessary for creating an environmentally friendly airport system. The program helps to:

- Reduce the number of people exposed to significant noise around the U.S. airports;
- Reduce significant air quality impacts attributable to aviation;
- Achieve carbon neutral growth by 2020 relative to a 2005 baseline; and
- Develop and deploy sustainable alternative aviation fuels.

The program is following a five-pillar approach that is focused on improved scientific knowledge and integrated modeling, new aircraft technologies, sustainable alternative aviation fuels, air traffic management modernization and operational improvements, and policies, environmental standards, and market based measures.

## **Environmental Management Systems at Airports**

AC 150/5050-8, Environmental Management Systems for Airport Sponsors, provides guidance to airport sponsors wanting to develop Environmental Management Systems (EMS).<sup>28</sup> It also provides guidance to airport sponsors on the components needed for an EMS. An EMS is a management framework based on the Plan-Do-Check-Act model. It helps organizations that adopt an EMS to balance environmental performance with business objectives through a process of continual improvement. It has resulted in significant savings and cost avoidance for many organizations, including airport sponsors. Airport sponsors of large or medium hub airports can obtain AIP funding to assist in developing an EMS.<sup>29</sup>

## **Livable Communities**

The DOT's Livability Initiative, similar to Ladders of Opportunity, is intended to improve the quality of life in communities where coordinated transportation, housing, and commercial development give people access to affordable and environmentally sustainable transportation. This initiative is intended to show how DOT will pursue coordinated, place-based policies and investments that increase transportation choices and access to public transportation services for all Americans. There are two strategic objectives for livable communities:

- Expand convenient, safe, and affordable transportation choices for all users by directing Federal investments in infrastructure toward projects that more efficiently meet transportation, land use, and economic development goals developed through integrated planning approaches.
- Ensure Federal transportation investments benefit all users by emphasizing greater public engagement, fairness, equity, and accessibility in transportation investment plans, policy guidance, and programs.

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<sup>28</sup> AC 150/5050-8 is available online at:

[http://www.faa.gov/airports/resources/advisory\\_circulars/index.cfm/go/%20document.current/documentNumber/150\\_5050-8](http://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/%20document.current/documentNumber/150_5050-8).

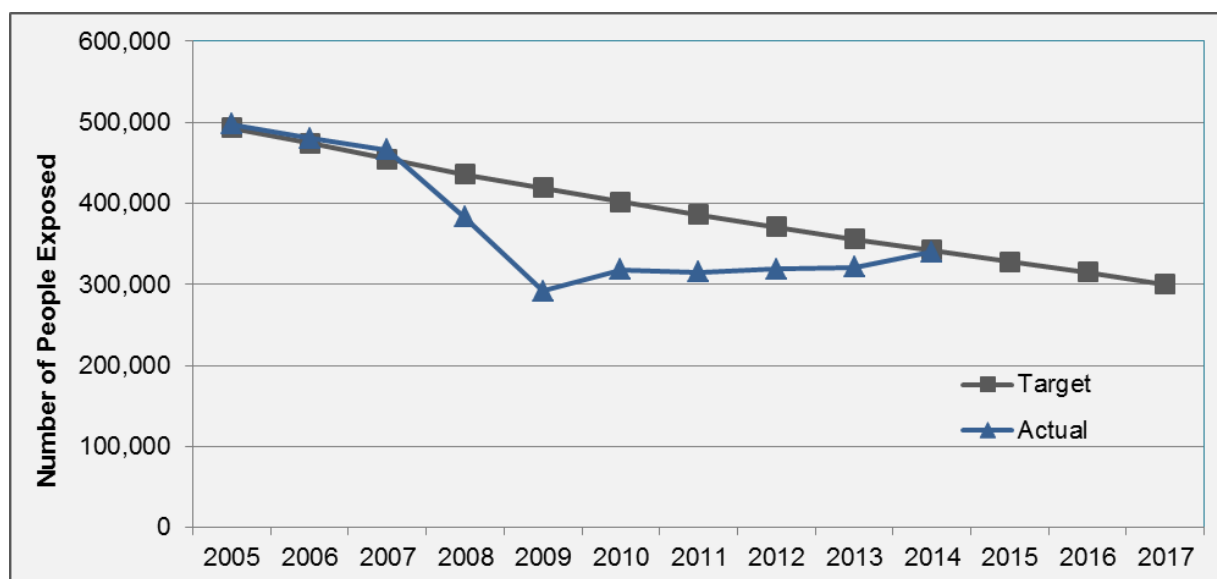
<sup>29</sup> See AIP handbook online at: [http://www.faa.gov/airports/aip/aip\\_handbook/](http://www.faa.gov/airports/aip/aip_handbook/). Only the initial development of the environmental management program (not keeping the document current) is eligible.

The FAA supports this initiative through the many environmental and sustainability programs described above. The FAA also encourages the review of ground access in master planning and expansion of public transit connections to airports. Public transit connections to airports are discussed later in the Surface Accessibility section.

## Noise

The noise situation around airports has changed dramatically since 1976.<sup>30</sup> At that time, an estimated seven million people living near airports in the United States were exposed to significant levels of aircraft noise.<sup>31</sup> That number decreased over time. It is estimated that the number of people in the United States living in areas adjacent to airports with noise levels above the day-night average sound level (DNL) of 65 decibels (dB) decreased from approximately 498,000 in CY 2005 to 340,000 in CY 2014, as shown in Figure 9.

**Figure 9: Number of People Exposed to Aircraft Noise (2005-2017)**



This reduction of aircraft noise levels for people living near or around airports who are exposed to aircraft noise is primarily due to reductions in aircraft source noise and the phase out of older Stage 1 and 2 aircraft. In February 2013, the ICAO Committee on Aviation Environmental Protection agreed on a new noise standard for subsonic jet airplanes. This new noise standard ensures the latest available noise reduction technology is incorporated into new aircraft designs after that date. To help ensure continued noise reductions, FAA and stakeholders are developing and implementing operational procedures that could reduce noise from today's fleet, as well as to develop quieter

<sup>30</sup> In 1976, DOT published its Aviation Noise Abatement Policy, which provided a course of action for reducing aviation noise impact. The principles contained in that document and subsequent legislative and regulatory action have resulted in a dramatic reduction in the number of Americans adversely exposed to aviation noise. An excerpt of that policy is available online at: [http://www.faa.gov/about/office\\_org/headquarters\\_offices/apl/noise\\_emissions/planning\\_toolkit/](http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/planning_toolkit/).

<sup>31</sup> Defined as DNL of 65 dB or higher in title 14 CFR, part 150, section 7, and Appendix A (Table 1) for residential land uses.

aircraft technology through the FAA's Continuous Lower Emissions, Energy, and Noise Program, which could lower the noise from tomorrow's fleet of aircraft.

The FAA established a noise exposure performance target in 1997 to reduce aircraft noise levels for people living near or around airports who are exposed to aircraft noise by 1 percent per year. This target was updated in 2007 to reduce the number of people living in areas incompatible with aircraft noise by 4 percent per year. In 2010, FAA established the 2005 baseline of 500,000 as the number of people exposed to aircraft noise against which to measure FAA's noise reduction goal. In 2011, FAA set an additional target to reduce the number of people living in areas of significant aircraft noise to 300,000 by 2018. This target is aligned with the 4-percent reduction per year that FAA has been working toward. The FAA is currently exceeding the per annum performance targets and is expected to stay below the 2011 target in the near term, but steps may be needed in the future if FAA is to reach the 2018 target. These steps may include new aircraft and engine technology and operational improvements.

The FAA's part 150 program,<sup>32</sup> established under the Aviation Safety and Noise Abatement Act of 1979 (title 49 U.S.C., section 47501, *et. seq.*), helps airport operators develop comprehensive noise and land use compatibility programs. Entrance into the part 150 program is voluntary for airport operators and includes development of noise exposure maps (NEMs), which identify land uses that are incompatible with airport noise, and Noise Compatibility Programs (NCP), which develops measures to reduce airport-related noise impacts in the community. The NEMs are also required for an airport that enters the part 150 program. The airport operator uses NEMs to evaluate current noise impacts and future incompatible development. The FAA determines whether the airport operator has prepared NEMs in accordance with part 150. After active and direct participation of affected parties, the airport operator can then submit an NCP outlining mitigation measures to improve noise and land use compatibility. Once an airport has entered the part 150 program, there are requirements to keep the NEMs and NCPs up to date related to the impact of noise on incompatible land uses.

At the end of FY 2015, there were 276 airports participating in the part 150 program, and 257 had NCPs approved by FAA. In addition to first-time NCP approvals, FAA has approved 147 updates to these programs. An FAA-approved NCP allows an airport to seek Federal aid from the AIP noise set-aside for noise mitigation projects.<sup>33</sup> Since 1982, 256 airports have received grants for part 150 studies, and over \$6.19 billion has been granted for airport noise compatibility projects. Besides AIP funding, airports have collected and used PFCs for noise mitigation totaling nearly \$4.30 billion.

Considerable effort has been expended over the past 37 years to provide relief to noise-impacted areas by funding noise mitigation projects under the AIP. Noise mitigation projects include residential and public building sound insulation, land acquisition, and relocating residents from noise-impacted areas. Noise compatibility efforts also promote preventive measures, such as comprehensive planning, zoning, subdivision ordinances, building codes, and real estate disclosure.

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<sup>32</sup> Title 14 CFR, part 150, Airport Noise Compatibility Planning.

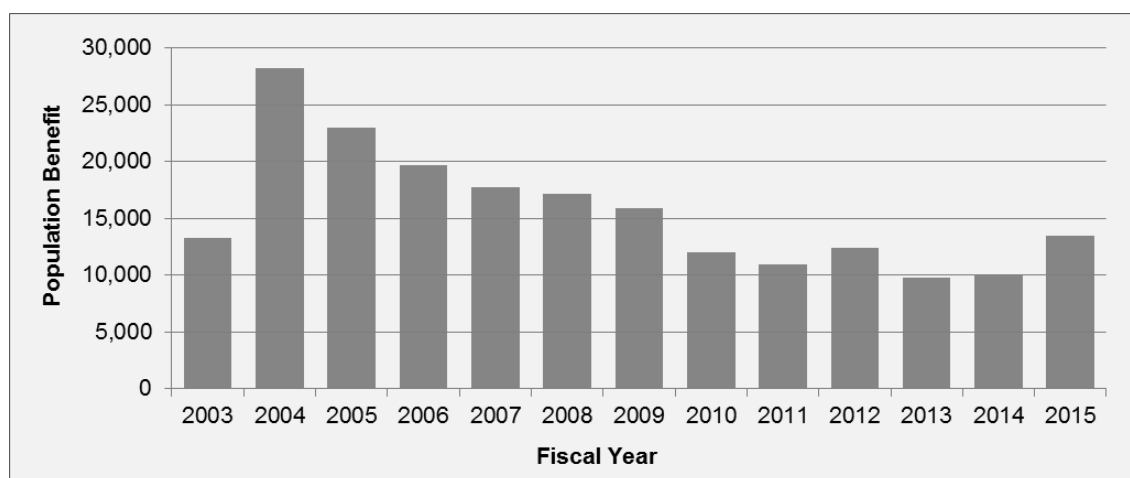
<sup>33</sup> Certain noise projects to benefit schools and medical facilities and mitigations in an approved Final Environmental Impact Statement can be federally funded without an approved NCP.

In addition, airports have acquired noise-monitoring equipment and installed noise barriers to reduce ground run-up noise.

The FAA's objective is to reduce the population exposed to significant levels (DNL of 65 dB or greater) of aircraft noise. In FY 2003 and FY 2004 studies, FAA tracked only resident population benefiting from noise funding. In FY 2005, this was expanded to include student populations.

Resident benefits are tracked when the airport provides funding (with AIP assistance) for either sound insulation or relocation from the areas of significant airport noise. Student benefits are tracked when the airport provides funding (with AIP assistance) for noise insulation of schools or school relocation. More than 23,000 residents and students have benefitted from noise funding in FYs 2014 and 2015. See Figure 10 for a yearly breakdown.

**Figure 10: Number of People Benefitting from Sound Insulation (2003-2015)**



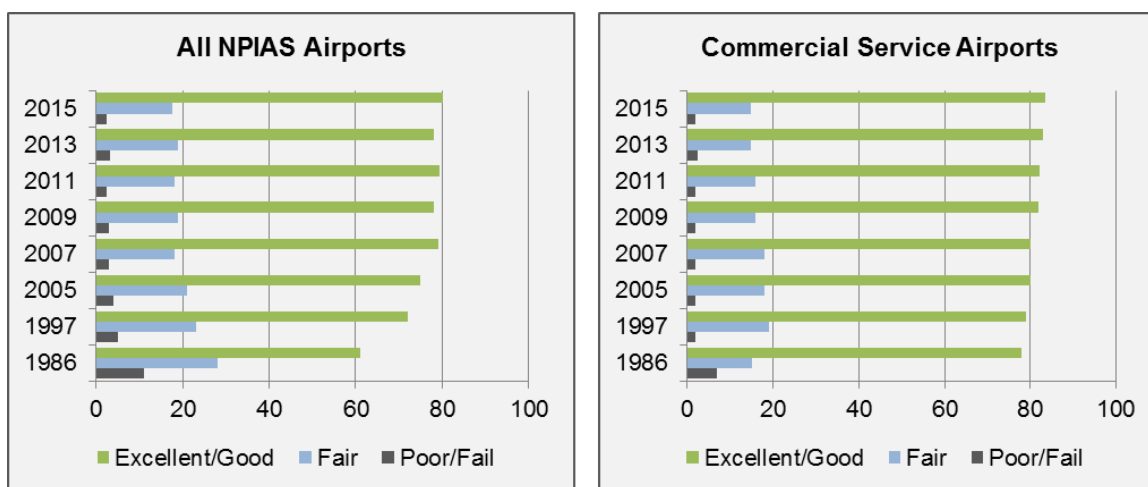
## **RUNWAY PAVEMENT CONDITION (RELATES TO DOT'S STATE OF GOOD REPAIR GOAL)**

Airfield pavement needs regular preventive maintenance to seal cracks and repair damage, increasing the time between major rehabilitation cycles. Preventive maintenance (e.g., seal coat surface treatment) or more significant rehabilitation may be needed on a 4- to 7-year cycle or a 15- to 25-year cycle, respectively, to remedy the effects of age, use, and exposure. Runway pavement in a state of good maintenance minimizes damage to aircraft and avoids unnecessary higher costs for major rehabilitation (e.g., full-depth reconstruction).

As part of airport inspections, FAA updates airport master records for public-use airports and reports the results through the Airport Safety Data Program. Runway pavement conditions are classified as excellent (no visible deterioration); good (e.g., all cracks and joints sealed); fair (e.g., mild surface cracking, unsealed joints, some slab edge spalling); poor (e.g., large open cracks, slab surface and edge spalling, vegetation growing through cracks and joints); or failed (e.g., widespread, severe cracking with raveling and deterioration).

The FAA’s goal is to ensure that not less than 93 percent of runways at airports in the NPIAS are maintained in excellent, good, or fair condition. Data for FY 2015 indicates that 97.7 percent of runways at NPIAS airports are rated excellent, good, or fair. Pavements at commercial service airports are better, with 98.2 percent of the runways rated excellent, good, or fair. Figure 11 shows the percentage of runways reported in excellent/good, fair, and poor/failed condition at NPIAS and commercial service airports since 1986.

**Figure 11: Runway Pavement Condition (1986-2015)**



In an effort to ensure that pavement receives the optimum level of maintenance, Congress authorized FAA to permit the use of AIP grants for routine pavement maintenance at nonhub airports.<sup>34</sup> In order for an eligible sponsor to receive an AIP grant for pavement maintenance, the airport sponsor must be unable to fund maintenance with its own resources and must implement an effective pavement maintenance management program.

## Pavement Research

Research has been integral to the FAA’s ability to achieve performance goals for runway pavement conditions. Several concentrated pavement-related research programs help address the continued need to improve FAA airport design, construction, and maintenance standards. The majority of pavement research is conducted at the FAA’s William J. Hughes Technical Center (Tech Center) in Atlantic City, New Jersey. The Tech Center houses the National Airport Pavement Test Facility (NAPTF), a 1,200-foot building with 900 feet of full-scale airport test pavement. The NAPTF allows FAA and industry to validate new design standards for existing and proposed multiple wheel landing gear configurations.

To augment the research being performed inside the NAPTF, FAA completed construction of the National Airport Pavement and Materials Research Center (NAPMRC) in 2015. The facility houses the newly acquired Heavy Vehicle Simulator–Airport Model (HVS-A) to provide increased capacity for performing full-scale accelerated pavement tests.

<sup>34</sup> Congress authorized pavement maintenance at nonhub airports under title 49 U.S.C., sections 47102(3)(H) and 47105(e).

The NAPMRC will be used for full-scale accelerated pavement tests to study the effects of high tire pressures on the performance of pavement surface layers and test the performance of greener/sustainable technologies, such as warm mix asphalt (WMA) and recycled asphalt pavement (RAP) at high pavement temperatures. The HVS-A is capable of applying a maximum wheel load of 100,000 pounds. The results will be used to develop FAA standards and specifications.

AC 150/5320-6E, Airport Pavement Design and Evaluation, is the FAA standard for airport pavement structural design and has found application worldwide.<sup>35</sup> The AC includes state-of-the-art interactive pavement design software, incorporating results from full-scale tests conducted at the NAPTF, as well as other industry research. Enhancements to the design software continue. In FY 2016, FAA updated the AC and accompanying software to include updated design models for asphalt and concrete pavement types based on the most recent series of full-scale tests, advances in computational models, and updates to aircraft libraries.

Significant ongoing research based at the Tech Center is aimed at increasing pavement life for large-hub runways from the current 20-year standard to 40 years' useful life. This research and development effort recognizes that extending pavement useful life is a complex problem combining improved, more durable pavement materials, rational pavement maintenance strategies, and better performance prediction models based on collection and analysis of real airport pavement performance data. The goal of this research is to increase the useful pavement life minimizing the amount of time that the runways are not available for use due to major pavement rehabilitation. By extending the time between major rehabilitation of runways, this will reduce the amount of associated aviation system delays and contribute to long-term cost savings.

Other research is conducted through FAA-funded Centers of Excellence located throughout the United States.<sup>36</sup>

## **SURFACE ACCESSIBILITY (RELATES TO DOT'S QUALITY OF LIFE IN COMMUNITIES AND ECONOMIC COMPETITIVENESS)**

Airports are generally located to make air transportation as convenient and accessible as possible. The 2010 Census, extrapolated to 2015, reveals that 72 percent of the current U.S. population of 319.4 million people lives within 20 miles of a primary airport. When general aviation airports are also included, 98.5 percent of the population lives within 20 miles of a NPIAS airport.

An important component of DOT's Quality of Life in Communities Initiative is to enhance transportation choices for users. Providing public transportation to airports is a means of meeting this goal. Statistics for major airports in the United States indicate an important, but limited, role of public transportation in airport access. The Intermodal Passenger Connectivity Database<sup>37</sup> includes

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<sup>35</sup> The AC and access to design programs are available online at:

[http://www.faa.gov/airports/resources/advisory\\_circulars/index.cfm/go/document.current/documentnumber/150\\_5320-6](http://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.current/documentnumber/150_5320-6).

<sup>36</sup> More information is available at: <http://www.faa.gov/go/coe>.

<sup>37</sup> Research and Innovative Technology Administration, Bureau of Transportation Statistics, Intermodal Passenger Connectivity Database at: [http://www.transtats.bts.gov/DatabaseInfo.asp?DB\\_ID=640&Link=0](http://www.transtats.bts.gov/DatabaseInfo.asp?DB_ID=640&Link=0).

information on more than 7,000 passenger transportation terminals and available intermodal connections.

Data collected from 2007 to mid-2012 indicates that on average 29 percent of commercial service airports are served by another scheduled public transportation mode, predominately transit bus (city-wide or metropolitan area buses). However, when looked at by airport hub type, the airports with higher passenger traffic were more likely to have two or more other transport modes. Every large hub airport has at least one transportation mode other than driving a private vehicle. Ninety-four percent of the medium hubs, 45 percent of the small hubs, and 14 percent of the nonhubs and commercial service airports have at least one public transportation mode service the airport.

An increasingly popular transportation mode has been the addition of linking commercial service airports with public rail transit services. Table 3 provides a list of these U.S. airports and the type of rail service. Nationwide, air and rail transits are linked at 28 busy airports, including 5 airports served by more than one rail mode. Current plans include the extension of rail to Denver International (April 2016 opening), Washington-Dulles International (late 2019 opening), and Honolulu International (entire 20-mile system to open in 2019). This will reduce travel time by providing direct links to the airport and reduce traffic delays incurred by automobiles and buses. Airports are eligible to fund the dedicated on-airport (and airport-owned) portions of transit links through PFCs.

The link between the airport and surface/ground transportation modes is important. Airports must always be considered critical elements of the total transportation system. The ACRP reports listed below contain information to assist airport sponsors in planning and developing effective surface transportation to airports including public transportation.

- ACRP Report 25, Airport Passenger Terminal Planning and Design (issued in 2010), comprises a guidebook, spreadsheet models, and a User's Guide in two volumes and a CD-ROM to provide guidance in planning and developing airport passenger terminals and assist users in analyzing common issues related to airport terminal planning and design.
- ACRP Report 40, Airport Curbside and Terminal Area Roadway Operations (issued in 2010), provides modeling tools to assist airports in planning for terminal curb and access roadway capacity enhancements based upon a level of service concept.
- ACRP Report 118, Integrating Aviation and Passenger Rail Planning (issued in 2015), examined data and tools to help policy makers make good decisions about the potential for air systems and rail systems to be planned and implemented together. The project examined experiences in the United States and Europe in which rail systems interact with air systems in order to identify the quality of tools and methods. The report identifies planning process options, funding challenges, and potential actions to improve integration of rail services with airports, particularly in congested corridors. A CD-ROM accompanies the report and contains an Air/Rail Diversion Model, a sketch planning tool capable of supporting the evaluation of a range of policy actions that affect choice of air or rail for long distance travel. A User's Guide provides direction in applying the model to evaluate different scenarios and a Technical Appendix provides supplemental information for the model.
- ACRP Report 146, Commercial Ground Transportation at Airports: Best Practices (issued in 2015), covers best management practices to ensure the provision of safe, comfortable, easy-to-



use, and efficient commercial ground transportation service. Commercial ground transportation services include taxicabs, limousines, shared-ride services, transportation network companies, courtesy vehicles, buses, and vans. The guidebook reviews the ground transportation industry, potential solutions to challenges airport operators frequently face, how to select a solution, and how to implement the selected best practice.

**Table 3: Airports Served by Rail\***

<b>City</b>	<b>Airport</b>	<b>Service</b>
Anchorage	Ted Stevens Anchorage Int'l	Intercity (Alaska Railroad)
Atlanta	Hartsfield-Jackson Atlanta Int'l	Heavy Rail
Boston	General Edward Lawrence Logan Int'l	Heavy Rail
Chicago	Chicago O'Hare Int'l	Commuter and Heavy Rail
Chicago	Chicago Midway Int'l	Heavy Rail
Cleveland	Cleveland-Hopkins Int'l	Heavy Rail
Dallas-Ft. Worth	Dallas-Ft. Worth Int'l	Commuter Rail
Dallas	Dallas Love Field	Commuter Rail
Denver	Denver Int'l	Commuter Rail (April 2016)
Ft. Lauderdale	Ft. Lauderdale/Hollywood Int'l	Commuter Rail
Los Angeles	Los Angeles Int'l	Light Rail
Burbank-Glendale-Pasadena	Bob Hope Airport	Intercity and Commuter Rail
Miami	Miami Int'l	Commuter and Heavy Rail
Minneapolis-St. Paul	Minneapolis-St. Paul Int'l	Light Rail
Milwaukee	General Mitchell Int'l	Intercity (Amtrak)
New York City	JFK Int'l	Heavy Rail
New York City	Newark Liberty Int'l	Intercity and Commuter
Philadelphia	Philadelphia Int'l	Commuter Rail
Phoenix	Phoenix Sky Harbor Int'l	Light Rail
Portland	Portland Int'l	Light Rail
Providence	Theodore Francis Green State Airport	Commuter Rail
San Francisco	San Francisco Int'l	Heavy Rail
Oakland	Metropolitan Oakland Int'l	Intercity and Heavy Rail
Salt Lake City	Salt Lake City Int'l	Light Rail
Seattle	Seattle-Tacoma Int'l	Light Rail
South Bend	South Bend Airport	Commuter Rail
St. Louis	St. Louis Lambert Int'l	Light Rail
Baltimore	Baltimore/Washington Int'l Thurgood Marshall	Intercity, Commuter, and Light Rail
Washington	Ronald Reagan Washington National	Heavy Rail

\*Some direct rail connections require a bus, people mover, or other connection to the airport.

Note: Rail service to Anchorage is seasonal.

## FINANCIAL PERFORMANCE (RELATES TO ECONOMIC COMPETITIVENESS)

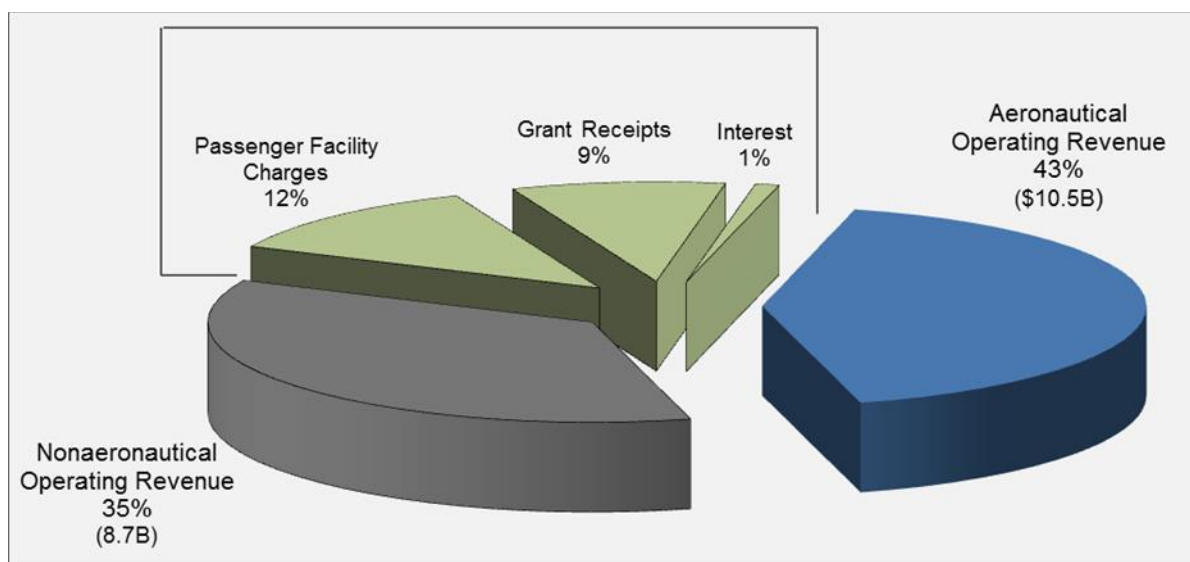
The NPIAS airports are owned and operated by thousands of State and local agencies and a few private owners. This makes compiling comprehensive data on the financial operations of all 3,332 existing NPIAS airports difficult. However, FAA requires commercial service airports, currently 509 of the NPIAS airports, to report financial data annually, including revenue and expense information. Since the remaining 2,811 NPIAS airports, mostly general aviation, are not required to report financial information, there is limited financial data available for general aviation airports.

The FAA uses data provided by commercial service airports from FAA Form 5100-127, Operating and Financial Summary, for each fiscal year to evaluate the financial performance of the airports. Data collected in these forms includes the following:

- Aeronautical and nonaeronautical revenues;
- Operating and nonoperating expenses;
- Beginning and ending balances for net assets; and
- Operating statistics.

Total airport revenues for 509 commercial service airports<sup>38</sup> were reported to be nearly \$25 billion in 2014. Total airport operating revenue, which includes both aeronautical and nonaeronautical revenue, totaled \$19.2 billion (78 percent). Figure 12 shows the revenue by type at commercial service airports. Aeronautical operating revenue includes revenue from landing fees; rent from terminals, hangars, and tie downs; fuel sales; and other fees; it accounted for \$10.5 billion (43 percent). Nonaeronautical operating revenue includes fees from parking and rental car operations, concessions, and retail operations; it accounted for \$8.7 billion (35 percent). Nonoperating revenue from interest, grants, and passenger facility fees totaled \$5.5 billion (22 percent), which includes \$2.9 billion from PFCs, \$2.2 billion from grants, and \$280 million in interest income. The PFC revenue is approximately 17 percent of large hub airport revenue, 12 percent of medium hub airport revenue, and 9 percent of revenues at small hub airports. See Figure 12 for a display of airport revenue by type.

**Figure 12: 2014 Revenue at Commercial Service Airports by Type**



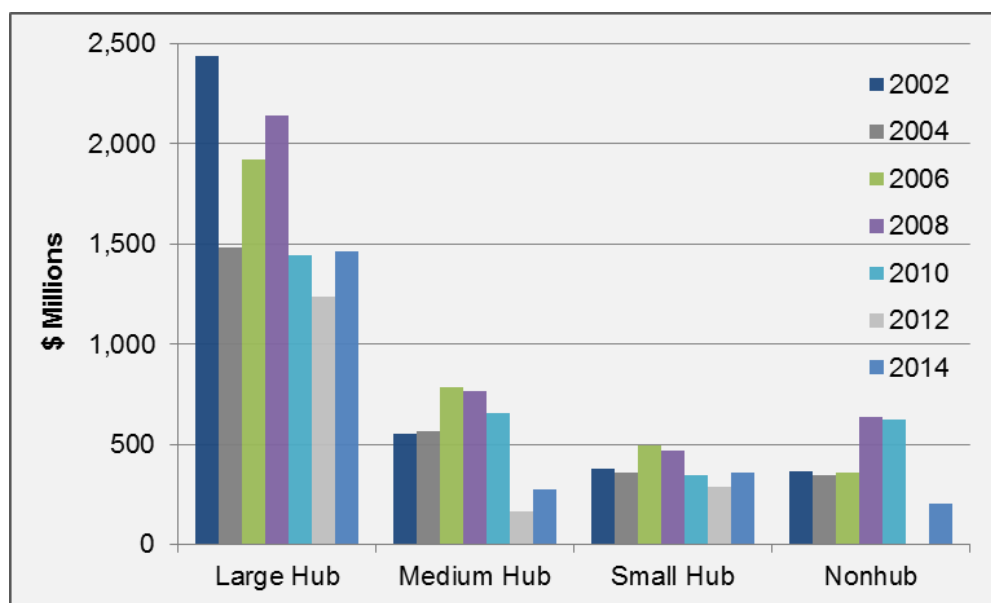
The costs of airport operations and maintenance are a function of the age of the facilities and the nature of airline activity and other operations. Total operating expenses from personnel compensation and benefits, communications and utilities, supplies and materials, contractual

<sup>38</sup> Airport classification for fiscal year financial filing is based on the passenger activity in the preceding calendar year; i.e., an airport classified as commercial service in CY 2013 must file a report for its 2014 fiscal year.

services, insurance, and other totaled \$12.3 billion (77 percent). Total nonoperating expenses from interest expense totaled \$3.6 billion (23 percent).

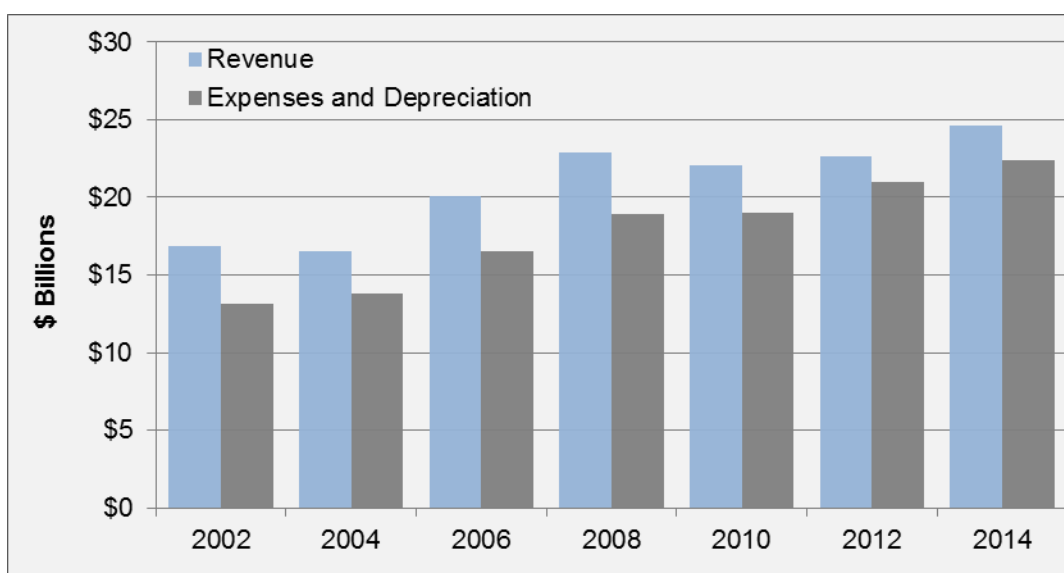
There is a considerable variation in net income by hub type and year, as shown in Figure 13, with large hubs accounting for 64 percent of the net income reported in 2014. There is also a variation in revenue sources and expenditures among airports. For example, concessions, rental car, and parking revenues are 26 percent of total revenues for large hub airports, 34 percent of revenues for medium hub airports, 30 percent for small hub airports, and 13 percent for nonhub primary and nonprimary commercial service airports. Table 4 provides a summary of 2014 revenue and expenses by hub type.

**Figure 13: Net Income by Year and Hub Type**



The financial status of the Nation's air carrier airports is stable with airports carefully managing operating, financing, and capital expenses. Airports are moving to shorter-term airline lease agreements in order to more efficiently control their assets and provide opportunities for competitive airline service. Airline lease agreements provide a measure of service and revenue stability. Airports have the ability to diversify and maximize revenue from concessions and other assets allowing greater revenue diversity and growth. Between 2002 and 2014, the total airport revenue and expenses reported for commercial service airports increased (see Figure 14). In 2002, the total revenue at commercial service airports was \$4.73 billion more than total expenses (including depreciation). In 2014, the total revenue at commercial service airports was \$2.3 billion more than total expenses (including depreciation). Expenses are increasing faster than revenues, a situation that has led airports in every category to seek opportunities to increase nonaeronautical revenues.

**Figure 14: Revenue and Expenses Plus Depreciation by Year**



Commercial service airports have several sources to fund airport development projects, including bond proceeds, PFCs, airport-generated funds (landing and terminal fees and parking, aviation fuel, and concessions revenues), and tenant and third-party financing, as well as Federal, State, and local grants. A majority of the development projects at major U.S. airports are funded through the capital markets, most commonly through airport revenue bonds. Bond ratings range from B at the low end to AA at the high end. Airports with more economic and financial strength and diversity tend to achieve higher ratings, while smaller airports tend to be rated lower.

Capital markets evaluate the creditworthiness of an airport based on several factors. These factors include the demand for air service in the region, the type of passenger demand (originating versus transferring), the number of commercial airports in the region, and the quantity and quality of service provided by the airlines. The overall creditworthiness of U.S. airports as a group remains strong. However, continuing fuel price volatility could force airlines to further reduce capacity, which affects airports indirectly. Large and medium hub airports typically have had strong credit ratings, and this is not expected to change in the study timeframe. Nonhub primary and nonprimary commercial service airports have more limited incomes and generally do not have such robust operating surpluses to repay borrowed funds. As a result, smaller airports tend to rely more heavily on grants than larger airports to finance capital improvements.

**Table 4: Airport Operating and Financial Summary 2014 (\$ Millions)**

Category	30	31	72	388	521
	Large Hub	Medium Hub	Small Hub	Nonhub	Total
<b>Aeronautical Operating Revenue</b>					
<b>Aeronautical Operating Revenue</b>					
Landing Fees	\$2,664	\$545	\$251	\$95	\$3,555
Terminal Rents	3,700	657	293	101	4,751
Cargo and Hangar Rentals	396	65	74	78	613
Fixed-Base Operator Revenue	103	44	35	60	242
Apron Charges/Tie Downs	79	49	25	8	161
Fuel Sales and Taxes	178	40	37	102	357
Other Aeronautical Fees	655	62	58	72	847
<b>Total Aeronautical Operating Revenue</b>	<b>\$7,775</b>	<b>\$1,462</b>	<b>\$773</b>	<b>\$516</b>	<b>\$10,526</b>
<b>Nonaeronautical Operating Revenue</b>					
Parking and Rental Car	\$3,206	\$1,061	\$676	\$241	\$5,184
Concessions	1,074	194	81	18	1,367
Terminal Rents	342	43	35	10	430
Land Rental and Nonterminal	344	84	104	131	663
Other Nonaeronautical Fees	765	109	89	49	1,012
<b>Total Nonaeronautical Operating Revenue</b>	<b>\$5,731</b>	<b>\$1,491</b>	<b>\$985</b>	<b>\$449</b>	<b>\$8,656</b>
<b>Nonoperating Revenue (Expenses) and Capital</b>					
Passenger Facility Charges	\$2,103	\$434	\$230	\$87	\$2,854
Grant Receipts	754	227	455	768	2,204
Interest	227	26	18	9	280
Other	-168	97	94	94	117
<b>Total Nonoperating Revenue</b>	<b>\$2,916</b>	<b>\$784</b>	<b>\$797</b>	<b>\$958</b>	<b>\$5,455</b>
<b>TOTAL REVENUE</b>	<b>\$16,422</b>	<b>\$3,737</b>	<b>\$2,555</b>	<b>\$1,923</b>	<b>\$24,637</b>
<b>Operating Expenses</b>					
Personnel Compensation and Benefits	\$3,060	\$743	\$579	\$436	\$4,818
Contractual Services	2,963	620	283	225	4,091
Communications and Utilities	715	176	122	86	1,099
Supplies and Materials	381	109	95	90	675
Insurance, Claims, and Settlements	160	41	28	29	258
Other	914	196	120	145	1,375
<b>Total Operating Expenses</b>	<b>\$8,193</b>	<b>\$1,885</b>	<b>\$1,227</b>	<b>\$1,011</b>	<b>\$12,316</b>
<b>Nonoperating Expenses</b>					
Interest Expense	\$2,755	\$520	\$202	\$75	\$3,552
Other	0	0	0	0	0
<b>Total Nonoperating Expenses</b>	<b>\$2,755</b>	<b>\$520</b>	<b>\$202</b>	<b>\$75</b>	<b>\$3,552</b>
<b>TOTAL EXPENSES</b>	<b>\$10,948</b>	<b>\$2,405</b>	<b>\$1,429</b>	<b>\$1,086</b>	<b>\$15,868</b>
<b>Depreciation</b>	<b>\$ 4,010</b>	<b>\$1,059</b>	<b>\$765</b>	<b>\$632</b>	<b>\$6,466</b>
<b>NET INCOME</b>	<b>\$ 1,464</b>	<b>\$ 273</b>	<b>\$ 361</b>	<b>\$ 205</b>	<b>\$ 2,303</b>
<b>Other Information</b>					
Capital Expenditures	\$ 5,723	\$ 971	\$1,049	\$1,098	\$ 8,841
Bond Proceeds	4,505	288	612	74	5,479
Sale of Property, Contributed Capital, Other	975	16	85	3	1,079
Reporting Year Debt Payments	7,193	1,901	665	147	9,906
Indebtedness at End of Year	\$68,483	\$11,494	\$3,603	\$1,612	\$85,192

**Source:** Data collected by FAA on FAA Form 5100-127 (Operating and Financial Summary) for fiscal years ending in 2014 (as of January 2016). Compliance Activity Tracking System, <http://cats.airports.faa.gov/>. Numbers may not add exactly due to rounding.

**Note:** Beginning in 2012, approximately 77 airports in the State of Alaska were consolidated into one reporting entity and are captured on the FAA Form 5100 data as a nonhub airport.

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## CHAPTER 3: USE OF THE AIRPORT SYSTEM

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### OVERVIEW

There are several factors that impact airport development requirements. The largest factors affecting airport facility requirements and capital investment are the current type and level of operations and future demand for air transportation.

The FAA uses a comprehensive process to guide airfield development. It includes airport master planning, FAA airspace studies, environmental analysis and documentation, airfield modeling, and delay analysis, as well as benefit-cost analyses for larger capacity projects. Airfield simulation models are employed to estimate the level of delay associated with current and forecast operations for both the existing airfield and for planned improvements.

Forecasts of future levels of aviation activity, which typically are part of an airport master plan, are the basis for airport planning decisions. These projections are used to determine the need and timing for new or expanded facilities at individual airports.

The FAA issues an annual aerospace forecast that is a top-down forecast for aviation activity in the United States for the next 20 years. The national forecast<sup>39</sup> examines current commercial operations (passenger and cargo) and general aviation, as well as emerging aircraft operations (e.g., very light jets, light-sport aircraft, and unmanned aircraft systems) and projects future activity. The FAA also develops a bottom-up forecast, known as the Terminal Area Forecast (TAF).<sup>40</sup> The TAF is the FAA's forecast of aviation activity by airport for all the existing NPIAS airports. These forecasts are prepared to meet the budget and planning needs of FAA and to provide information that may be useful for State and local authorities, the aviation industry, and other stakeholders.

### COMMERCIAL AIRLINE SERVICE

The national airport system is a reflection of the types of aircraft using the airports and subsequent economic activity. Of the 3,332 airports contained in the NPIAS, approximately 509 of these airports are commercial service airports. Commercial airline service represents the most widely known aspect of the aviation industry and includes the carriage of passengers on aircraft.

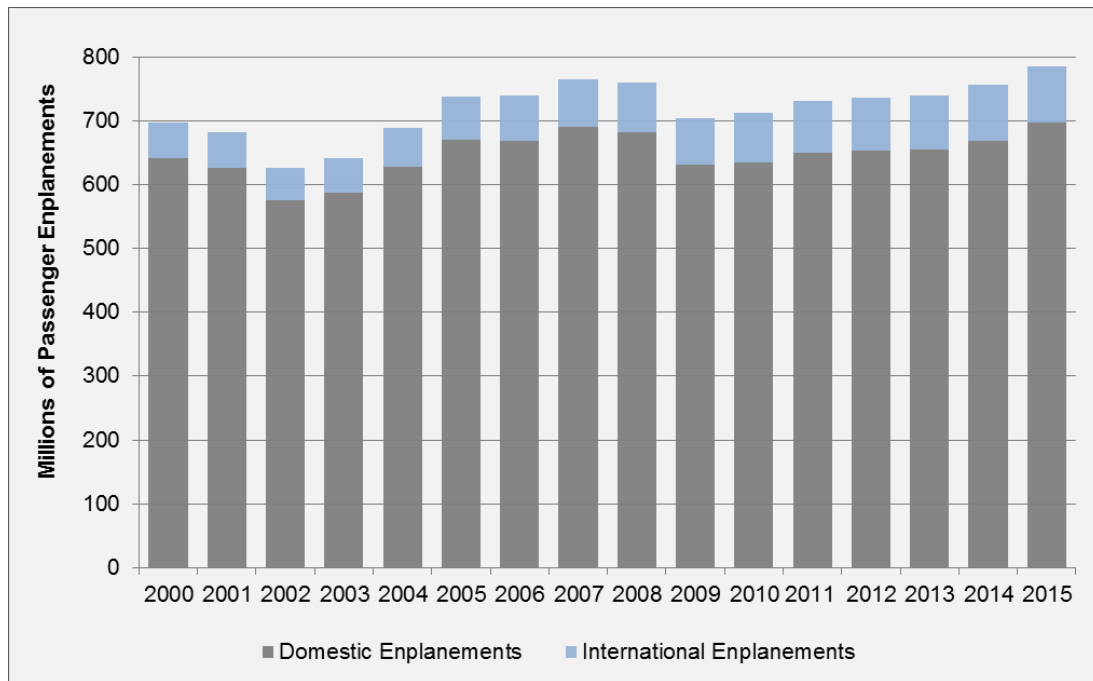
The last 15 years have been turbulent for U.S. commercial air carriers, resulting in variations in annual passenger boardings at U.S. and foreign airports as shown in Figure 15. In FY 15, total enplanements reached an all-time high of 785 million, with international enplanements of 89 million and domestic enplanements of 696 million. Domestic enplanements represent approximately 87 percent of total U.S. passenger traffic at commercial service airports.

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<sup>39</sup> FAA Aerospace Forecast, FY 2016-2036, is available online at: [http://www.faa.gov/data\\_research/aviation/](http://www.faa.gov/data_research/aviation/).

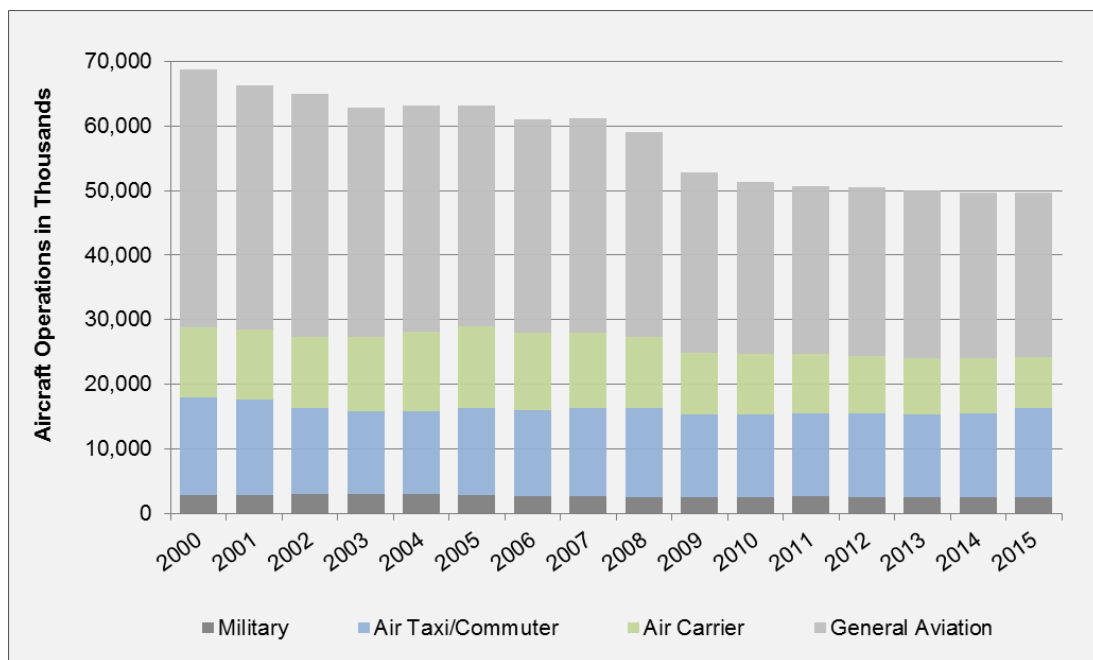
<sup>40</sup> The TAF is available online at: <http://taf.faa.gov/>.

**Figure 15: Domestic and International Enplanements (2000–2015)**



There have been changes in aircraft operations as measured at the airports with airport traffic control towers in the last 15 years as shown in Figure 16. Currently, 517 airport traffic control towers report traffic counts. In 2015, air carrier operations were down 9 percent from the peak experienced in 2000. Air taxi/commuter operations as well were down 37 percent in 2015 from their 2005 high.

**Figure 16: Aircraft Operations at Airports with FAA and Contract Control Towers**





The reductions in aircraft operations reflect air carriers' capacity restraint in better matching available seats with demand, the retirement of older and less efficient aircraft, the shifting of larger aircraft to international services, and the growing use of 70- to 90-seat regional jet aircraft in place of smaller 50-seat regional jets. Air taxi/commuter operations grew annually through 2005 when operations peaked as the major air carriers shifted flights to their regional partners. The combined activities of air carrier and air taxi/commuter operations account for 43 percent of total operations at airports with airport traffic control towers. Total operations by military aircraft at commercial service airports have decreased to the lowest levels in the past 15 years. General aviation operations at airports with airport traffic control towers have decreased 36 percent in the past 15 years. Many of these operations have shifted to the surrounding nonprimary airports.

## Forecast for Commercial Aviation

The FAA forecasts that aviation traffic will continue to slowly grow over the long term, averaging 2.2 percent growth per year. Air carriers fine-tuned their business models to minimize financial losses by lowering operating costs, eliminating unprofitable routes, and grounding older, less fuel-efficient aircraft. To increase operating revenues, air carriers initiated new services that customers are willing to purchase. Air carriers also charge separately for services that were historically bundled in the price of a ticket. In the last 5 years, four major airline mergers have occurred leaving four dominant airlines in the United States—American, Delta, Southwest, and United Airlines. These changes, along with capacity discipline, have resulted in a fifth consecutive year of profitability for the industry in 2015. Going into the next decade, there is optimism that the industry has moved from a boom-to-bust model to one of sustainable profits.

## CARGO

Air cargo (domestic and international freight air/express and mail) is moved in the bellies of passenger aircraft and in dedicated all-cargo aircraft. Air cargo carriers face price competition from alternative shipping modes, such as trucks, container ships, and rail cars. Air transportation is the preferred mode for the shipment of high-value, lightweight, and perishable goods.<sup>41</sup> In 2015, 29 percent of exports and 25 percent of imports measured by value in 2015 were shipped by air.<sup>42</sup> In 2013, 11 of the 50 busiest international freight gateways (seaports, land ports, and airports) by value of shipment were airports.<sup>43</sup> Lower shipping costs and more frequent service have made air cargo a major factor in the way global business is conducted.

Air cargo is generally concentrated at busy commercial service airports. The majority of air cargo flights usually occurs during off-peak periods and do not substantially contribute to airport congestion and delay problems. The principal need for airport development to support cargo

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<sup>41</sup> Air cargo accounts for less than 1 percent of imports and exports by weight.

<sup>42</sup> Source for air, water, and total – U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade, FT920: Exhibit 1, U.S. Exports and Exhibit 4, December 2015. Available at: <http://www.census.gov/foreign-trade/Press-Release/2015pr/12/ft920/index.html>. Source for truck, rail, and pipeline:

<sup>43</sup> Source – U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Table 1-51, available at: [http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national\\_transportation\\_statistics/html/table\\_01\\_51.html](http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_01_51.html) as of July 2015.

operations is related to cargo sorting and transfer facilities developed by the package express carriers. These airports must have high-capacity, all-weather runway systems to support reliable operations.

The President established the National Export Initiative<sup>44</sup> in 2010 to enhance and coordinate Federal efforts to facilitate the creation of jobs in the United States through the promotion of exports. The goal of this initiative is to improve conditions that directly affect the private sector's ability to export by working to remove trade barriers abroad by:

- helping firms overcome the hurdles to entering new export markets;
- assisting with financing; and
- pursuing a Governmentwide approach to export advocacy abroad.

Additional information on this important national initiative, which brings together resources from across the U.S. Government to assist American businesses in planning their international sales strategies and succeed in today's global marketplace, can be found at: <http://export.gov/>.

## Forecast for Cargo

Factors that affect air cargo growth are Gross Domestic Product, fuel prices, real yields, and globalization. The fleet of cargo aircraft is expected to increase from 781 in 2015 to 1,114 in 2036. Revenue Ton Miles are expected to increase at an average annual rate of 3.6 percent over the next 20 years.

## GENERAL AVIATION

Eighty-eight percent of NPIAS airports are classified as nonprimary airports and serve mainly general aviation activity. General aviation activity, as measured by total operations at airports with control towers, has decreased 36 percent since 2000. Much of the decline in the later parts of the decade can be attributed to economic conditions, high fuel prices, and other factors.

The term “general aviation” encompasses a diverse range of commercial, governmental, and recreational uses. While it is often easier to consider what general aviation does not include—scheduled airline and military activity—this does not sufficiently define general aviation activity. To better understand this segment of the industry and the resulting requirements for the airport and air traffic system, each year FAA surveys the general aviation community through general aviation and title 14 CFR, part 135,<sup>45</sup> activity surveys. These surveys ask respondents to indicate the types of uses of their aircraft and the number of hours flown, as well as the type of aircraft flown, flying conditions, fuel consumption, and aircraft age.

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<sup>44</sup> Executive Order 13534, National Export Initiative, was issued on March 11, 2010. See: <http://www.archives.gov/federal-register/executive-orders/2010.html>.

<sup>45</sup> Title 14 CFR, part 135, Operating Requirements: Commuter and On Demand Operations and Rules Governing Persons On Board Such Aircraft.

Table 5 summarizes the results of the CY 2012 and CY 2014 surveys by types of uses. The percentages are based on the number of actual hours flown. While personal use of general aviation aircraft (29.5 percent) is the single largest use category, the combined nonpersonal uses of general aviation aircraft represent the majority (54.8 percent) of all general aviation activity. It is notable that instructional uses comprise the second largest use category. For 20 years, the majority of commercial airline pilots have been trained through civilian training systems rather than through the military. Instructional training for all pilots, whether pursuing flying recreationally or as a career, is best conducted away from commercial service airports to preserve commercial service airport capacity and enhance reliability for airline schedules. For these reasons, instructional training is currently focused at general aviation airports.

**Table 5: General Aviation and CFR Part 135 Activity Survey, Actual Hours Flown by Use, CY 2012 and CY 2014**

Category	Percent of Total	
	CY 2012	CY 2014
<b>General Aviation Use</b>		
Personal Use <sup>46</sup>	33.5%	29.5%
Instructional	15.3%	16.4%
Corporate/Executive	9.7%	12.2%
Business	8.7%	7.5%
Aerial Observation	5.4%	6.4%
Other <sup>47</sup>	5.2%	4.5%
Aerial Application	3.9%	4.0%
Other Work Use	1.1%	1.1%
External Load (Rotorcraft)	0.9%	0.7%
Aerial Other	0.8%	0.7%
Sightseeing	0.7%	0.8%
Air Medical	0.4%	0.5%
<b>Subtotal</b>	<b>85.6%</b>	<b>84.3%</b>
<b>On-Demand Title 14 CFR Part 135 Use</b>		
Air Taxi and Air Tours	11.4%	12.6%
Part 135 Air Medical	3.0%	3.1%
<b>Subtotal Part 135 Use</b>	<b>14.4%</b>	<b>15.7%</b>
<b>Total All Uses</b>	<b>100.0%</b>	<b>100%</b>

Source: General Aviation and 14 CFR Part 135 Activity Surveys – CY 2014.

The results of the survey demonstrate the role general aviation plays in accommodating commerce throughout the United States. It is estimated that thousands of passengers are carried on business and corporate aircraft each year. Business and corporate aircraft also move airfreight,<sup>48</sup> ensuring overnight delivery of high-priority business documents and providing just-in-time delivery of parts to manufacturing plants.

<sup>46</sup> “Personal Use” includes recreational flying, family use, and tourism, but also includes flying in order to stay current with license requirements.

<sup>47</sup> “Other” is defined as positioning flights, proficiency flights, training, ferrying, sales demonstrations, etc.

<sup>48</sup> Large transport aircraft carrying air cargo are included with the air carrier counts, as many of these operators operate under similar regulations to commercial airlines carrying passengers.

On-demand air taxi services provide air access to communities not served by commercial airlines and additional access to communities with airline service. Air medical services provide rapid access to emergency medical services that cannot be provided on scheduled airline aircraft and in many rural parts of the country, which may not be served by scheduled airline activity. Aerial application includes activities, such as fertilizing for agricultural purposes or fighting forest fires. Aerial observations include patrolling pipelines or the electrical grid infrastructure to ensure safety and reliability of these energy systems, identifying forest fires early in their development, or surveying wildlife and natural habitats.

General aviation also encompasses public aircraft operations within these use categories. Examples include the use of general aviation, which provides nearly all inland search and rescue services, or homeland security, law enforcement, and disaster relief activities by other nonmilitary government agencies. These activities are not identified separately, but are included within each use category. In 2014, public-use aircraft flew 8.5 percent of the total general aviation hours. General aviation also includes the humanitarian services, such as transporting patients to medical centers or delivering relief supplies to areas following natural disasters.

As evidenced by the diverse range of activities, general aviation has various land use, airspace, and air traffic requirements that are much different from the requirements for commercial air service. This necessitates a system of airports that is flexible in design and construction to accommodate these uses. General aviation airports are included in the NPIAS because they have the capacity to accommodate these varied uses and roles.

### **Forecast for General Aviation**

The FAA forecasts the fleet<sup>49</sup> and hours flown for single-engine piston aircraft, multiengine piston, turboprops, turbojets, piston and turbine-powered rotorcraft, experimental and sport aircraft, and “other” (which consists of gliders and lighter than air vehicles).

The U.S. general aviation manufacturing sector experienced its first decline in deliveries since 2010. The single engine piston aircraft deliveries continue to grow and business jet deliveries showed a very modest increase, but turboprop deliveries declined by 10 percent. Based on figures released by the General Aviation Manufacturers Association (GAMA),<sup>50</sup> U.S. manufacturers of general aviation aircraft delivered an estimated 1,581 aircraft in CY 2015, 3.1 percent less than in CY 2014.

The long-term outlook for general aviation driven by turbine aircraft activity remains favorable. The active general aviation fleet is projected to increase at an average annual rate of 0.2 percent over the next 20 years. The more expensive and sophisticated turbine-powered fleet is projected to grow at an average annual rate of 2.1 percent with the turbine jet portion increasing at 2.5 percent a year. Fixed-wing piston aircraft, the largest segment of the general fleet, is predicted to shrink over the forecast period by 19,280 aircraft (at an average annual rate of 0.7 percent). Created in 2005, the light-sport aircraft category is the smallest segment of the fleet but forecasted to grow by 4.5 percent annually, adding about 3,700 new aircraft by 2036.

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<sup>49</sup> The FAA forecasts active aircraft only. An active aircraft is one that flies at least 1 hour during the year.

<sup>50</sup> GAMA data is available online at: <https://www.gama.aero/media-center/industry-facts-and-statistics>.

## UNMANNED AIRCRAFT SYSTEMS

Unmanned aircraft systems (UAS) have historically supported military and security operations. However, interest in civil uses (e.g., aerial mapping, crop monitoring, communications, and commercial photography) is growing, as is interest in recreational uses.

The UAS come in a variety of shapes and sizes and serve diverse purposes. They may have a wingspan as large as a Boeing 737 or be smaller than a radio-controlled model airplane. Regardless of size, the responsibility to fly safely applies equally to manned and unmanned aircraft operations.

The FAA first authorized use of unmanned aircraft in the NAS in 1990 and has made provisions to allow certain specific operations in the NAS, just like any existing manned aircraft flight. Congress confirmed in Public Law 112-95, FAA Modernization and Reform Act of 2012, that UAS are aircraft consistent with the statutory definition of an aircraft as set forth in title 49, U.S.C, section 40102(a)(6). This means that UAS operators can utilize the NAS as long as the operator of the UAS meets all applicable laws and regulations and operates the UAS in a safe manner.

Other than operations for hobby or recreational purposes, there are presently three methods of gaining FAA approval for flying civil (nongovernmental) UASs:

- 1) Special Airworthiness Certificates – Experimental Category (SAC-EC) for civil aircraft to perform research and development, crew training, and market surveys.
- 2) Obtain a UAS type and airworthiness certificate in the Restricted Category (title 14 CFR, section 21.25(a)(2) and section 21.185) for a special purpose or a type certificate for production of the UAS under title 14 CFR, section 21.25(a)(1) or section 21.17.
- 3) Petition for Exemption with a civil Certificate of Waiver or Authorization (COA). Public (governmental) UAS operations must go through the public COA process. For these, FAA issues a COA that permits public agencies and organizations to operate a particular aircraft for a particular purpose in a particular area. The COA allows an operator to use a defined block of airspace and includes special safety provisions unique to the proposed operation. The COAs usually are issued for a specific period – up to 2 years in many cases.

The FAA's goal is to safely integrate the UAS into the NAS. Safety of the NAS is enhanced when the operator of a UAS and the airport operator coordinate prior to a UAS flight on or near an airport. This coordination enhances integration into the NAS by:

- Allowing the airport operator to help the operator of the UAS aircraft by advising to ensure understanding of patterns, routes, and procedures utilized by manned aircraft on and near the airport to reduce the potential for conflicts between UAS aircraft and manned aircraft flights.
- Allowing the airport operator to understand the proposed parameters of the UAS aircraft flight for situational awareness and coordination with airport tenants and users as necessary.
- Allowing the airport operator to understand where UAS flights on or near the airport are occurring.

In June 2014, FAA published a Federal Register notice on its interpretation of the statutory special rules for model aircraft in the FAA Modernization and Reform Act of 2012. The law is clear that FAA may take enforcement action against model aircraft operators who operate their aircraft in a manner that endangers the safety of the NAS. In the notice, FAA explains that this enforcement authority is designed to protect users of the airspace, as well as people and property on the ground.

Section 333 of Public Law 112-95 grants the Secretary of Transportation authority to allow certain UASs to operate in the NAS, which otherwise would be prohibited from operating under title 14 CFR, part 107. Essentially, the grant of exemption permits the Secretary to determine whether certain UASs may operate in the NAS without the UAS meeting all regulatory and statutory requirements for small UAS in title 14 CFR, part 107, or, for other types of UAS, the requirements for manned aircraft, such as aircraft certification. The FAA issues an exemption to facilitate this decisionmaking process for future UAS rulemakings and provide relief from current FAA rules where appropriate. Specifically, section 333 allows the Secretary to determine which proposed UAS operations, because of the UAS size, weight, speed, operational capability, proximity to airports and populated areas, and proposed operation, do not pose a safety or national security hazard and whether an airworthiness certificate or certificate of authorization is required for operation. Additionally, section 333 grant of exemption is required for any civil UAS operation that is not for hobby or recreational purposes; academic and educational institutions are exempt from the small UAS rule.

All UASs used to conduct (nonmilitary) public or civil operations using UAS weighing in excess of 55 pounds must be registered with FAA in accordance with title 14 CFR, part 47. Since December 2015, operators who fly small UASs weighing between .55 and 55 pounds, including model aircraft and remote-controlled aircraft flown for hobby or recreational purposes, must register under either title 14 CFR, part 47 or part 48. In order to assist UAS operators, FAA developed a mobile application (app) called B4UFLY. Within two taps, users know if it is safe to fly at their current location. The app provides a status indicator that tells users: —Proceed with Caution,|| —Warning – Action Required,|| or —Flight Prohibited.|| The app also features a planner mode that allows users to select a different time and location for an upcoming flight and determine if there are any restrictions at that place and time. On August 29, 2016, the FAA issued new rules for non-hobbyist small UAS operations – Part 107 of the Federal Aviation Regulations – covering a broad spectrum of commercial uses for drones weighing less than 55 pounds.<sup>51</sup>

By law, hobbyists who want to fly within 5 miles of an airport must notify the airport operator and the air traffic control tower (when an air traffic facility is located at the airport) prior to flying. For now, B4UFLY will ask users who are required by law to notify the airport before flying for voluntary information about their planned flight. This will not meet the statutory requirement to notify the airport and air traffic control facility, but the data will help the Agency make informed policy decisions related to notification.

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<sup>51</sup> For further information, please see [www.faa.gov/uas/](http://www.faa.gov/uas/).

## COMMERCIAL SPACE LAUNCH SITES

The FAA's Office of Commercial Space Transportation (AST) licenses and regulates U.S. commercial space launches and reentries and the operation of commercial space launch and reentry sites.<sup>52</sup> The AST's mission is to ensure protection of the public, property, the national security, and foreign policy interests of the United States during commercial launch or reentry activities and to encourage, facilitate, and promote U.S. commercial space transportation.

Commercial space transportation generally consists of the launch of payloads or space flight participants into orbit for either commercial or government customers by private, nongovernment entities called launch service providers. Commercial space transportation also covers suborbital launches, where a vehicle containing a payload or space flight participants is launched on a trajectory that briefly goes into space but returns to Earth without going into orbit. The AST also regulates the planned reentry of reentry vehicles from space to Earth.

Vehicles are launched from licensed launch sites, referred to as commercial spaceports. There were seven FAA-licensed or permitted launches in 2015 and 12 licensed or permitted launches in 2014. In May 2013, FAA and the AST Advisory Committee published their annual global forecast for commercial launch demand, the 2013 Commercial Space Transportation Forecasts. An average of 31.2 worldwide commercial space launches is forecast each year through 2022.

The FAA has granted launch site operator licenses to 10 commercial space launch sites located in the following seven states: Alaska, California, New Mexico, Oklahoma, Virginia, Texas, and Florida. At this time, five licensed launch sites are collocated with public-use NPIAS airports that accommodate both aviation and space operations. The collocated licensed launch sites are listed below:

- Mojave Air and Spaceport – Mojave, California;
- Clinton-Sherman Airport– Clinton, Oklahoma;
- Midland International Air and Space Port – Midland, Texas;
- Houston Spaceport at Ellington Airport – Houston, Texas; and
- Cecil Airport – Cecil, Florida.

## OTHER FACTORS IMPACTING AIRPORTS

Capacity is affected not only by the volume of air transportation but also by the way in which airlines and other users operate. The FAA anticipates that airlines will continue to concentrate their schedules at their primary hubs where large numbers of flights converge in short periods of time to maximize the opportunity for passenger transfers. No new airline hubs are expected to arise within the next 5 years.

Low-cost carriers frequently serve major metropolitan areas by using less-congested, secondary commercial service airports where existing facilities are underutilized. In the past, this occurred in

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<sup>52</sup> Authorized by Executive Order 12465 and title 51 U.S.C., subtitle V, chapter 509, the Commercial Space Launch Act of 1984, as amended.

communities where a legacy carrier served the major hub airport. More recently, however, secondary airports are becoming a focus where the major hub airport is nearing capacity and is served by low-cost carriers. This trend, in part, reflects a shift by airport operators toward practices that facilitate airline competition, such as preferential-use (versus exclusive-use) gate leases, short-term (versus long-term) lease and use agreements, adherence to competitive access assurances that are required when an airport uses PFCs to finance airline gates, and other airport business practices reflected in airport competition plans filed with the Office of the Secretary of Transportation and FAA by medium and large hub airports that are dominated by one or two airlines.

The globalization of the airline industry, the rapid growth of air transportation in other parts of the world, and the increased range and flexibility in the size of international aircraft will combine to bring international passenger service to more U.S. airports. Low cost carriers (both U.S. and European) are branching into international service. For example, European discount carriers are now serving Providence, Rhode Island, and Portland, Oregon. Spirit Airlines is now flying to the Caribbean and South America and Southwest Airlines is now offering flights to the Caribbean, South America, and Mexico. The effects will vary but may include requirements for longer runways, terminal building expansion, and provision of Federal inspection facilities for immigration, customs, and agriculture at airports where international traffic was previously limited but is now increasing. The increased number of jet aircraft in the general aviation fleet will result in a demand for longer runways at certain general aviation airports, particularly those with substantial use (500 or more annual operations) by business and corporate aircraft.

### **New Large Aircraft**

Airports in the United States are continuing to plan and develop new facilities for the next generation of large aircraft. The Airbus A380 and the Boeing 747-8 require special consideration due to their fuselage length, wingspan, and weight. For example, the Airbus 380's 262-foot wingspan is 37 feet wider than the next largest aircraft, the 80-foot tail height is 16 feet taller than the next tallest aircraft, and the maximum takeoff weight of approximately 1.3 million pounds is 300,000 pounds heavier than the next heaviest aircraft in the fleet. The Boeing 747-8, at 250 feet in length, is 18 feet longer than the Airbus A380. The current distance between parallel taxiways and their runways, the configuration of taxiway systems, and the layout of terminal buildings are affected by the larger wingspans (A380) and fuselage length (Boeing 747-8). Underlying structures, such as bridges and culverts, will require either reinforcement to accommodate the aircraft's heavier weight or taxiing routes to avoid these structures.

Currently, the A380 is being operated by foreign air carriers into several U.S. airports, such as: Los Angeles International, John F. Kennedy International, Washington Dulles International, George Bush Houston Intercontinental, Hartsfield-Jackson Atlanta International, Miami International, and San Francisco International, and they are expected to fly into Chicago O'Hare International in the near future. A few other airports have received approval to accommodate passenger A380s. Air freight carriers determined that at this time the A380 freighter version is not feasible to operate; therefore, this type of service is not anticipated. The other in service new large airplane, the Boeing 747-8 (both passenger and freighter versions), has a smaller wingspan than the A380 at 225 feet. This airplane was previously projected to operate at slightly over 24 U.S. airports. In preparation, 24 U.S. airports, also one in Puerto Rico, have received approval to accommodate the



Boeing 747-8. The FAA continues working with Boeing to ensure these airports and others will be able to accommodate the aircraft.

Several airports are undertaking large modernization projects to improve airfield safety and efficiency and to prepare for projected increases in airplane size and passenger activity. Because airports are continuously upgrading terminals and airfields for a variety of reasons, it is difficult to determine exactly how much of those costs are solely attributable to accommodating the new large aircraft. Airports planning to receive service by new large aircraft started their preparations and financial planning for necessary improvements several years ago. Until all improvements can be made, FAA has and will continue to work on a series of procedures and design processes, already in use by Airbus and Boeing, to safely accommodate these aircraft at existing airports.

## Industrial Aviation

Many airports have activities more industrial in nature, ranging from maintenance, repair, and overhaul (MRO) (which occurs nationwide)<sup>53</sup>, to specialized aviation services, such as paint and interior completion, to aircraft assembly, fabrication, and manufacturing. A number of airports that support industrial activities have a military history due, in part, to the infrastructure developed by the military, the presence of a trained workforce, and the availability of large hangars and specialized facilities indicative of industrial aviation requirements. While the landside facilities supporting this type of activity are generally not AIP-eligible, FAA continues to work with industry stakeholders to determine how industrial activities might be used in determining an airport's role in the national airport system as described in Chapter 1. Airports with industrial aviation tend to be primary airports or very busy nonprimary airports. A few examples of airports with industrial aviation components are listed below:

- Boeing Field/King County International Airport in Seattle, Washington (primary)
- Charleston Air Force Base/International Airport in Charleston, South Carolina (primary)
- Savannah/Hilton Head International Airport in Savannah, Georgia (primary)
- Pensacola International Airport in Pensacola, Florida (primary)
- Snohomish County (Paine Field) in Everett, Washington (nonprimary)
- Cecil Airport in Jacksonville, Florida (nonprimary and commercial space launch site)
- Kelly Field in San Antonio, Texas (nonprimary)

Many of the associated facilities are large in scale and require substantial land, as well as varying levels of access to the airfield, depending upon the specific functions involved. Because of the commercial nature of the facilities, effective planning for such functions requires extensive early coordination with the FAA's planning, environmental, and compliance specialists.

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<sup>53</sup> Source: 2016-2026 Global Fleet and MRO Market Economic Assessment. See: <http://arsa.org/news-media/economic-data/>.

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## CHAPTER 4: DEVELOPMENT REQUIREMENTS

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### CAPITAL PLANNING OVERVIEW

The development needed to provide an adequate national airport system, as shown in this report, is derived from locally prepared airport master plans, airport system plans<sup>54</sup>, capital improvement plans, and airport inspections. These airport planning documents consider all significant aviation requirements and are tied to the current use and condition of each airport and the forecast increase in activity. Typically, operators of individual airports prepare airport master plans, usually with the assistance of consultants. The FAA field offices review these plans, which follow a standard outline contained in ACs that link development to current and forecast activity. Plans for major development, such as new runways or runway extensions, tend to be controversial, and the planning process provides interested parties with the opportunity to learn about the project through public outreach.

Development that is not eligible for Federal AIP funding or not justified by the aviation activity forecast over the next 5 years is screened by FAA planners and is not entered into the NPIAS database. The combination of a planning process that links development to activity, an FAA review that culls out unnecessary and ineligible development, and the discussion of controversial proposals at public outreach sessions results in reasonable and well-documented estimates of future airport project requirements. However, the actual timing and cost of development may vary from the airport master plan. For instance, projects may be deferred or developed in phases in order to reduce immediate costs or, conversely, an unexpected rapid increase in activity may justify accelerating certain development.

State system plans are also used as a data source for the NPIAS. The State system plan includes airport locations considered important to State air transportation objectives, as well as those that are of sufficient national interest to be included in the NPIAS. These plans play a part in the development of the airport role and conditions and performance information. However, aviation system plan recommendations on capital development at individual airports or for a state aviation system plan are usually secondary to airport master plan information. In these cases, the State or regional system plan identifies broad needs or priorities within its jurisdiction.

The FAA encourages airports to consult with airlines and other user groups about major airport investment programs. Airlines have questioned the scope and timing of specific development proposals, including major new airports, ground access projects, and certain terminal and airfield improvements. The NPIAS generally reflects the airport operator's viewpoint about the scope and schedule for proposed development. If proposals are downsized, rescheduled, or accomplished in phases, development costs could be lower or more protracted.

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<sup>54</sup> An airport master plan is a detailed, long-term development plan for an individual airport. Airport system plans (regional and State) study the performance and interaction of an entire aviation system to understand the interrelationships among and between individual airports.

All development projects identified in the NPIAS are eligible for AIP funding; however, the planned development consistently exceeds the funding available from the AIP each year. While all of these 5-year capital estimates are AIP-eligible, some may be funded by other sources, including PFCs or other airport revenue or financing. In allocating AIP funds, FAA must select projects that advance statutory goals, as well as DOT and FAA objectives and enhance the national airport system.

Investment decisions are made using structured selection criteria that help identify critical annual development needs within associated AIP funding levels. This annual internal process, known as the Airports Capital Improvement Plan (ACIP), is used by FAA to select projects for AIP funding. The ACIP allows FAA to determine and fund the most critical airport development needs within AIP funding limits set by Congress through the appropriation process. This is accomplished by establishing a process that, among other things, considers factors, such as an airport's service level, national priority rating, activity level, and hub status; type of project; and the Agency's goals for safety, capacity, efficiency, security, and infrastructure preservation.

Using this process, FAA is able to distribute funding made available under the AIP. The AIP funding falls into two basic categories: apportioned funds (also known as entitlements) and discretionary funds. Entitlement funds (roughly 70 percent of the funding available for grants) are apportioned by formulas contained in statute each year to specific airport sponsors, types of airports, or States. The remaining amount of AIP funding (30 percent) is discretionary funding. Of that amount, approximately two-thirds is designated for specific projects or airport types, such as airports in the Military Airport Program, noise mitigation, and environmental projects.

Benefit-cost analyses (BCAs) are required to demonstrate the merit of capacity projects exceeding \$10 million in discretionary funds over the life of the project and for projects requesting a letter of intent (LOI)—a multiyear commitment of Federal AIP support for airfield project. Executive Order 12893, Principles for Federal Infrastructure Investments, provided the impetus for the Office of Airports to develop its benefit-cost evaluation criteria. The BCA process is not used as a basis for allocating AIP funds or noncapacity projects undertaken for the objective of safety, security, noise mitigation, and conformance with FAA standards. The authorizing statute exempts these projects from the BCA process, as the underlying value of the type of project has already been subject to economic evaluations required through FAA regulations and ACs.

The assessment of aviation benefits at airports is challenging due to the variation in operational scope between airport types. Large air carrier airports with substantial activity that frequently experience delays can be evaluated based on the benefits to passengers and aircraft operations of reducing or removing these delays. Standard methodologies and values are readily available for use in these assessments. The FAA has also developed a methodology to capture downstream benefits of delay reduction associated with capacity AIP projects at 100 commercial service airports. However, only a small number of airports experience significant levels of congestion and delay.

For the majority of airports, other economic benefits must also be assessed. Typically, this is done by assessing the operations of a new aircraft or aircraft class that would be able to use the airport because of the project. While a project may be justified operationally by relatively few operations of a new aircraft or class of aircraft, quantifying the associated benefit of these operations is a

challenge. In addition, BCAs do not consider the mere shift of passengers or operations from one airport to another as a benefit to the system because it is done from a national perspective; such transfers between regions are considered to have a neutral overall impact on the national economy. Many benefits will not be realized until a project is completed and commissioned, which may be years after the BCA was completed. In addition, the benefits may be realized over a 20-year period and may vary from forecast results in the BCA unrelated to the quality of the BCA itself.

While FAA relies on BCA results, among other considerations, in making discretionary funding decisions for capacity projects, the Agency does not generally use BCA results to determine a project's ranking on the FAA's list of reviewed projects that are eligible for discretionary funds in a given year, referred to as the "discretionary candidate list." Governing legislation for the AIP identifies a number of other factors, such as safety, congestion relief, intermodal connections, quality of the environment, and capacity, for priority consideration. The FAA is exploring the development of methodologies for quantifying these factors in the future. In addition, other projects included in the discretionary candidate list are not subject to the BCA requirement.

When required, the airport sponsor conducts a BCA using requirements developed by FAA. The airport sponsor then submits its BCA and supporting documentation to FAA for review and acceptance. Sometimes it is possible for an airport sponsor to conduct a BCA in conjunction with the development of the airport master plan or environmental study. More typically, the airport sponsor conducts a BCA and submits it to FAA prior to requesting AIP discretionary funds for the project.

In general, a BCA must demonstrate the project's benefits outweigh its costs before FAA will consider the project eligible for discretionary funding. This BCA requirement does not apply to reconstruction projects that do not change the operating characteristics of the airport. In addition to providing a BCA, airport sponsors seeking an LOI must meet additional requirements.

While projects requiring a BCA cannot be funded until FAA accepts the BCA, FAA can still include the project in the ACIP for planning purposes. Since the ACIP is a multiyear planning tool, it is possible for a project needing a BCA to be included in the ACIP for future-year funding consideration.

During FYs 2014 and 2015, the Office of Airports continued efforts to improve the BCA process. The FAA received a BCA for proposed capacity improvements for a runway extension in Morgantown, West Virginia. In addition, FAA was asked to review airport planning documents, which included proposed BCA methodologies for proposed capacity improvements for:

- a new air cargo complex in Hendry County, Florida;
- a runway reconstruction and extension project in Kahului, Hawaii;
- a proposed new runway in Norfolk, Virginia; and
- a proposed new airport in Pahrump, Nevada.

Finally, FAA completed the review for a runway extension at Orlando-Sanford, Florida, and found the benefits were less than the costs; therefore, FAA concluded the BCA does not support Federal funding for the project.

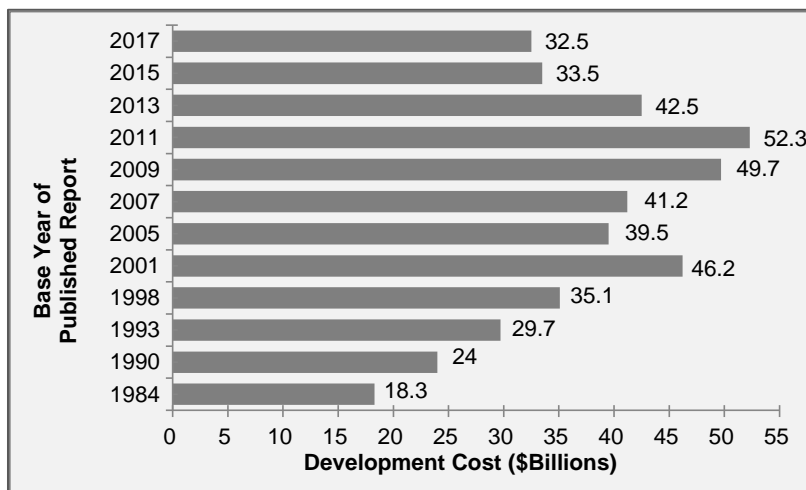
The Office of Airports has also utilized BCA models that were recently developed to assess navigational aids, improved approach minima, and weather observing equipment. In FY 2014 and FY 2015, FAA completed reviews for 11 Automated Weather Observing System proposals and two approach lighting proposals.

The Office of Airports collaborated with the Office of Policy, International Affairs and Environment on new BCA-related research through ACRP: ACRP 03-19, Passenger Value of Time, Benefit-Cost Analysis, and Airport Capital Investment Decisions. In May 2015, this research resulted in the publication, Passenger Value of Time, Benefit-Cost Analysis, and Airport Capital Investment Decisions<sup>55</sup>. The FAA currently uses the values of time included in DOT guidance<sup>56</sup>, which includes a single value of time for the traveler for the entire airport trip. Volume 1 of ACRP research, Guidebook for Valuing User Time Savings in Airport Capital Investment Decisions, provides travel time values that are specific to various segments of an airport trip, such as ground access and egress time, terminal access time, security processing time, gate time, and flight time.<sup>57</sup> These values of times may be more beneficial when considering investments in and around the terminal infrastructure. The guidebook includes processes that decision makers can utilize that use the more detailed values of time in estimating the relative benefit or cost of proposed capital improvements. At this time, FAA will keep using the DOT's travel time guidance for airport capacity projects; however, the Agency may consider incorporating the new research in future guidance.

## DEVELOPMENT COSTS

This report reflects the costs associated with capital development projects needed between 2017 through 2021 that are AIP eligible and do not have funding sources identified. The 5-year estimates contained in this report (\$32.5 billion) are 3 percent lower than those found in the 2015 edition. These estimates were largely compiled in FY 2015 and validated in FY 2016. Since the last report was prepared 2 years ago, construction costs have increased 1.9 percent.<sup>58</sup>

**Figure 17: Development Needs (1984-2017)**



<sup>55</sup> Information about this research project is available at: <http://www.trb.org/Main/Blurbs/172472.aspx>.

<sup>56</sup> Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis can be found at: <http://www.transportation.gov/administrations/office-policy/2015-value-travel-time-guidance>.

<sup>57</sup> For official purposes, FAA currently uses the values of time outlined in the Department of Transportation Guidance, Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis.

<sup>58</sup> Source: Civil Works Construction Cost Index System calculated by the U.S. Army Corps of Engineers, September 30, 2015. Comparing construction costs for FY 2013 and FY 2014.

A review of all the development projects resulted in some AIP-eligible projects being deferred beyond the 5-year timeframe of this report. This is due to slower growth in activity levels that would have warranted the projects or financial constraints or other financial priorities. Also, since terminal projects (rehabilitation or expansion) at the large and medium hub airports are generally funded with PFCs, these costs tend not to be captured in this report. In the last 2 years, the top 15 PFC-approved projects (in terms of total cost) were all terminal related. Many of the largest projects are terminal construction or reconstruction and only a small portion of those costs are AIP eligible. The larger airports appear to be preserving their future PFC collections for large future projects.

After more than a decade, major airport capacity projects and RSA initiatives have successfully concluded. This included airport development focused on increasing airport capacity resulting in 23 major airports completing 27 airfield projects (new runways, runway extensions, or airfield reconfigurations) and improving all of the nonstandard RSAs at commercial service airports to meet dimensional standards or an equivalent level of safety. The RIM program, a new national initiative to improve nonstandard surface geometry, is beginning (see discussion above), and it is anticipated that increased development costs will be captured in the next NPIAS report.

Capital projects are categorized by type of airport and the principal purpose of the development. There are 11 development purposes and 9 airport types. Development totals by airport type and purpose are shown below in Table 6.

**Table 6: 2017–2021 NPIAS Cost by Airport and Development Category (2015 \$ Millions)**

Development Category	Large	Medium	Small	Nonhub	National	Regional	Local	Basic	Unclassified	Proposed Airport	Total	Percent
Safety	\$ 250	\$ 105	\$ 140	\$ 313	\$ 68	\$ 68	\$ 72	\$ 38	\$0	\$ 0	\$ 1,052	3.23%
Security	50	20	25	53	67	61	127	72	\$0	0	475	1.46%
Reconstruction	2,180	1,403	1,426	1,920	683	1,531	1,649	703	\$6	0	11,502	35.34%
Standards	892	675	922	1,803	728	1,894	2,744	1,181	\$2	0	10,841	33.31%
Environmental	64	56	182	55	2	17	16	13	\$0	0	406	1.25%
Noise	416	83	82	91	44	17	2	0	\$0	0	735	2.26%
Capacity	2,379	337	245	176	109	207	175	67	\$0	0	3,696	11.36%
Terminal	401	368	1,084	661	2	39	56	25	\$0	0	2,636	8.10%
Access	176	74	60	175	42	105	93	32	\$0	0	758	2.33%
Other	0	2	1	13	3	29	48	26	\$0	0	122	0.38%
New Airport	0	0	0	0	0	0	0	0	\$0	321	321	0.99%
<b>Total</b>	<b>\$6,807</b>	<b>\$3,123</b>	<b>\$4,168</b>	<b>\$5,260</b>	<b>\$1,747</b>	<b>\$3,968</b>	<b>\$4,984</b>	<b>\$2,157</b>	<b>\$8</b>	<b>\$321</b>	<b>\$32,544</b>	<b>100%</b>
<b>Percentage</b>	<b>20.9%</b>	<b>9.6%</b>	<b>12.8%</b>	<b>16.2%</b>	<b>5.4%</b>	<b>12.2%</b>	<b>15.3%</b>	<b>6.6%</b>	<b>0.03%</b>	<b>1%</b>	<b>100%</b>	

Costs associated with planning (master, regional, and State system plans and environmental studies) are not reflected in Tables 6 and 7 or in Appendix A. For the 5-year period covered by this report, planning costs total \$380.5 million with nonprimary airports accounting for 52 percent (22 percent at local airports) and primary airports accounting for 48 percent (17 percent at large hubs).

For comparison purposes, the development requirements contained in the previous edition of the NPIAS (2015–2019) are shown below in Table 7.

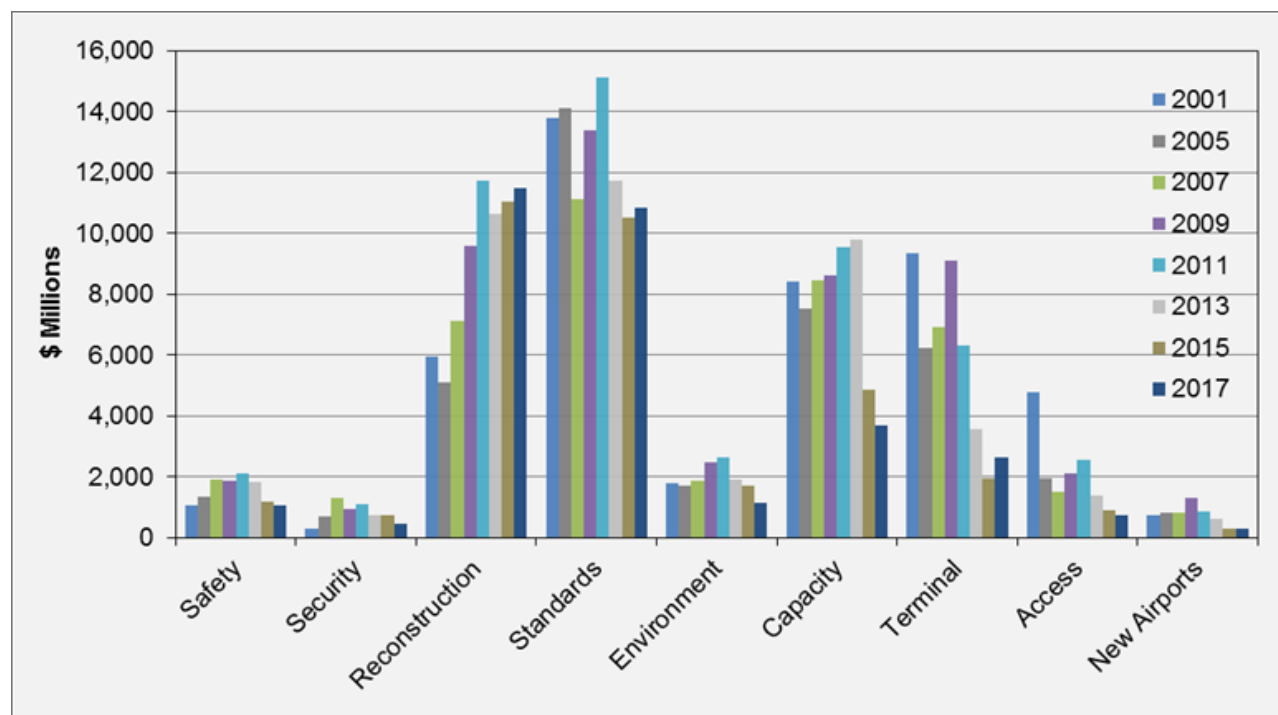
**Table 7: 2015–2019 NPIAS Cost by Airport and Development Category (2013 \$ Millions)**

Development Category	Large	Medium	Small	Nonhub	National	Regional	Local	Basic	Unclassified	Proposed Airport	Total	Percent
Safety	\$ 299	\$ 122	\$ 179	\$ 323	\$ 76	\$ 74	\$ 86	\$ 30	\$0	\$ 0	\$ 1,189	3.50%
Security	311	36	29	57	67	63	115	76	\$0	0	755	2.30%
Reconstruction	2,283	1,573	1,160	1,907	572	1,333	1,578	650	\$1	0	11,058	33.00%
Standards	525	698	893	1,729	769	1,880	2,740	1,277	\$2	0	10,513	31.40%
Environmental	166	208	100	44	7	11	22	11	\$0	0	569	1.70%
Noise	657	213	125	70	40	23	4	0	\$0	0	1,133	3.40%
Capacity	3,427	396	272	170	150	218	180	73	\$0	0	4,886	14.60%
Terminal	352	249	624	575	30	44	63	19	\$0	0	1,954	5.80%
Access	281	96	80	193	36	105	88	30	\$0	0	909	2.70%
Other	54	26	8	40	4	29	59	37	\$0	0	257	0.80%
New Airport	0	0	0	0	0	0	0	0	\$0	295	295	0.90%
<b>Total</b>	<b>\$8,355</b>	<b>\$3,617</b>	<b>\$3,471</b>	<b>\$5,106</b>	<b>\$1,752</b>	<b>\$3,781</b>	<b>\$4,935</b>	<b>\$2,204</b>	<b>\$3</b>	<b>\$295</b>	<b>\$33,517</b>	<b>100%</b>
<b>Percentage</b>	<b>25%</b>	<b>11%</b>	<b>10%</b>	<b>15%</b>	<b>5%</b>	<b>11%</b>	<b>15%</b>	<b>7%</b>	<b>0%</b>	<b>1%</b>	<b>100%</b>	<b>100%</b>

## DEVELOPMENT BY TYPE

All AIP-eligible projects are categorized based on the principal purpose of the development. Figure 18 compares the type of development identified in the current report to the seven previous reports. Increases in reconstruction, standards, terminal, and new airport projects are anticipated over the next 5 years. Decreases in safety, security, environment, and capacity projects are anticipated through 2021.

**Figure 18: 5-Year AIP-Eligible Development Costs by Category, FYs 2001–2015**





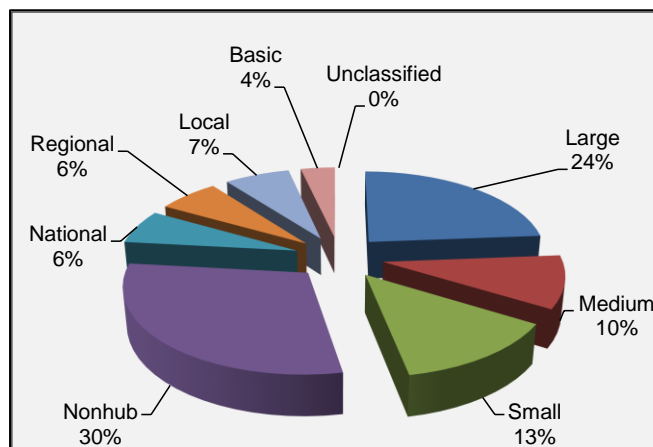
Listed on the following pages are the development categories, a short description of each, charts illustrating the percentage of development by airport category, and other relevant information.

## Safety and Security

Safety and security projects include development that is required by Federal regulation, airport certification procedures, or design standards and are intended primarily for the protection of human life. These two categories account for about 5 percent (\$1.5 billion) of the funding needs identified in the NPIAS. The FAA gives safety and security development the highest priority to ensure rapid implementation and to achieve the highest possible levels of safety and security.

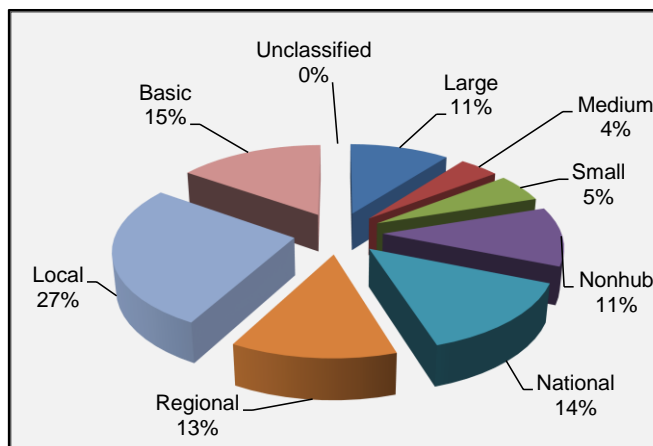
Projects included in the safety category include obstruction lighting and removal, acquisition of ARFF equipment required by part 139, construction or expansion of ARFF buildings, and improvements to RSAs. Safety development totals \$1 billion, a decrease of \$137 million from the last report, largely reflecting the fact that many significant RSA improvements have now been funded and implemented. The 382 primary airports account for 77 percent of the safety projects with nonhub airports accounting for 30 percent. The 2,950 nonprimary airports account for 23 percent of these projects.

**Figure 19: Safety**



Security projects include security fencing, access control from aircraft movement areas to the terminal, and other security enhancements required by the title 14 CFR, part 1542, regulation. Security development totals \$475 million, a decrease of \$280 million from the last report. Primary airports have identified access control systems and other security improvement projects totaling \$148 million (31 percent). Nonprimary airports have identified approximately \$327 million (68 percent) in perimeter fencing.

**Figure 20: Security**

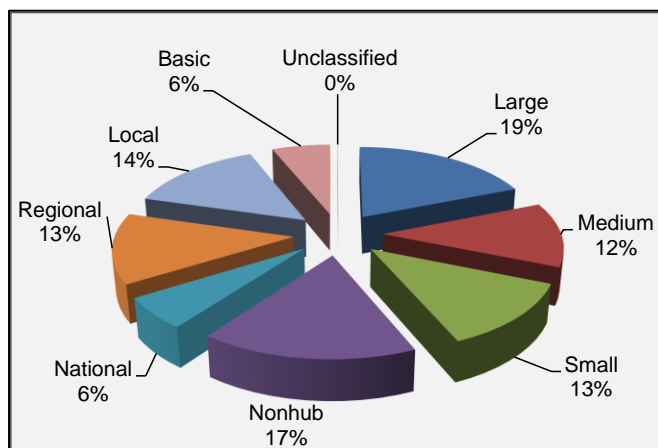


## Reconstruction

Reconstruction includes development to replace or rehabilitate airport facilities, primarily runway, taxiway, and apron pavement and lighting systems that have deteriorated due to weather or use and that have reached the end of their useful lives. Failure to replace deteriorating pavement increases airport maintenance costs and can result in damage to aircraft propellers and engines, pooling water, and ice deposits that can jeopardize braking and directional control, and eventually cause potholes that can damage landing gear. Airfield lighting cables and fixtures deteriorate with age, resulting in dim and unreliable lighting if they are not replaced. Reconstruction is included in the NPIAS when normal maintenance procedures are no longer economical and effective.

This category is the largest development category, accounting for about 35 percent (\$11.5 billion) of NPIAS funding needs and includes the rehabilitation of pavement on a 15- to 20-year cycle. This category of development increased by 3.1 percent and reflects an increase in reconstruction costs by every type of NPIAS airport. The primary airports account for 61 percent of this development with large hub airports accounting for 19 percent. The nonprimary airports account for 39 percent of this development.

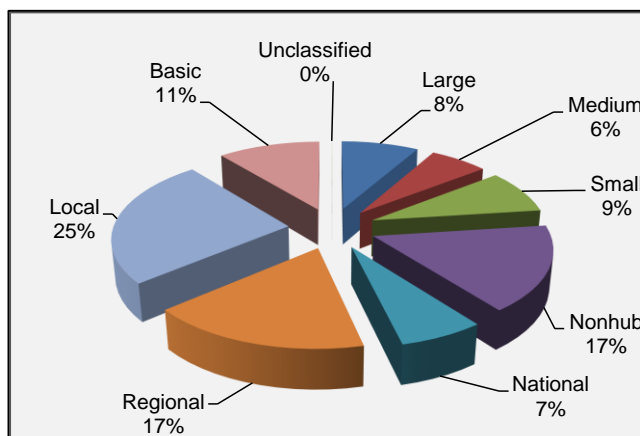
**Figure 21: Reconstruction**



## Standards

Many airports were designed and built more than 50 years ago to serve relatively small and slow aircraft. They now serve larger and faster turboprop and jet aircraft. As a result, runways and taxiways must be relocated to provide greater clearance for aircraft with larger wingspans, taxiway geometry must be improved to correct confusing layouts, and aircraft parking areas must be adapted to accommodate larger aircraft. Standards development at general aviation and reliever airports is generally justified to accommodate a substantial number of operations by a “critical” aircraft with sizes and operating characteristics that were not foreseen at the time of original construction. If this work is not undertaken, aircraft may be required to limit fuel or passenger loads because of inadequate runway length. The FAA usually requires proof that an aircraft type will account for at least 500 annual itinerant operations at an airport before the development to accommodate it is included in the NPIAS.

**Figure 22: Standards**



Standards projects include development that is needed to bring an existing airport up to design criteria recommended by FAA. It also includes development that is needed to comply with FAA technical and operational specifications. Examples of these projects include strengthening, widening, relocating or extending runways and taxiways and associated lighting; expansion of existing or construction of new aprons; acquiring equipment (e.g., snow removal, deicing, weather reporting, and approach lighting and guidance systems); and buildings for equipment (snow removal) or aircraft (hangars).

This development category accounts for 33 percent (\$10.8 billion) of the NPIAS funding needs, an increase of \$328 million from the last report. Nonprimary airports account for 60 percent of this development and primary airports account for 40 percent.

## Environment

The environment category includes projects designed to achieve an acceptable balance between airport operational requirements and environmental requirements. These projects include replacing impacted wetlands, removing wildlife attractants, constructing deicing containment facilities, acquiring energy efficient equipment, and purchasing specialized equipment or infrastructure to support the VALE Program for reducing airport air emissions. This accounts for 1.2 percent (\$405 million) of the NPIAS costs with small hub airports accounting for 45 percent.

Fifty-five percent of these environmental projects are for constructing deicing containment and treatment facilities.

## Noise

Development in this category includes projects to meet the expectations of residents of the surrounding area for a quiet and clean environment. This development supplements the noise reductions that have been achieved by quieter aircraft and the use of noise abatement flight procedures. This category accounts for 2 percent (\$735 million) of NPIAS costs with 57 percent of the development costs at large hubs. Costs are concentrated at airports with frequent flights by jet aircraft and include the relocation of households and sound insulation of residences and public buildings in noise impacted areas underlying aircraft approach and departure paths. This development is part of an extensive Federal and industry program involving land use planning, quieter aircraft, and noise abatement procedures that have reduced the estimated number of people exposed to significant noise. Development in this category includes projects to mitigate noise for residences or public buildings, noise monitoring systems, and compensation to property owners for overflights.

Figure 23: Environment

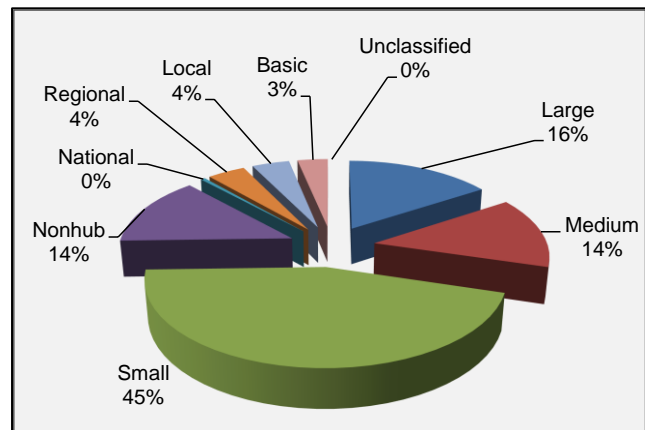
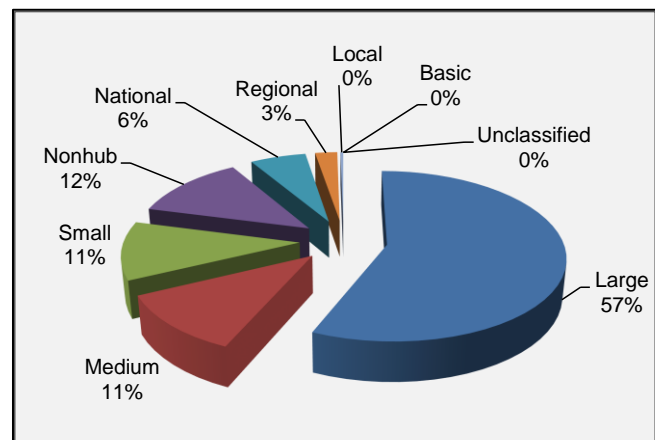


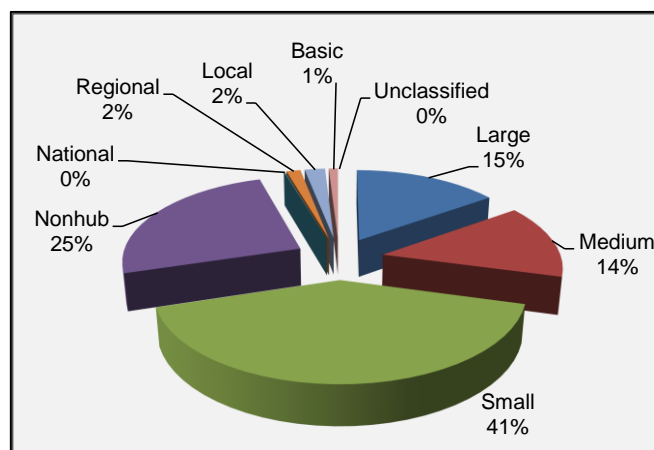
Figure 24: Noise



## Terminal Building

Terminal building costs are incurred for development to accommodate more passengers and different aircraft (small regional jets and new large aircraft). This is the fourth largest development category, accounting for 8 percent (\$2.6 billion) of the NPIAS costs. Terminal costs had decreased over the last 6 years, but this report reflects an increase in terminal costs for all the hub airports, especially the small hubs, which increased 73 percent from 2015. The NPIAS only includes the public-use portion of terminals that are AIP eligible (about 50 to 60 percent) and excludes revenue-generating areas<sup>59</sup>, such as areas that are leased by a single tenant or used by concessions, such as gift shops and restaurants.

**Figure 25: Terminal Building**

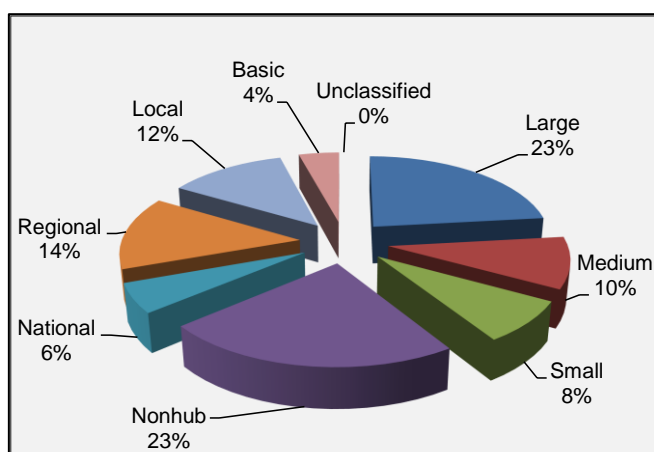


Terminal development is concentrated at the busiest commercial service airports. Funding of terminal projects, especially large and medium hubs, tends to be accomplished through PFCs.

## Surface Access

Access includes the portion of airport ground access (highways and transit) that is within the airport property line and eligible for grants under the AIP. Surface access currently accounts for 2 percent (\$758 million) of the NPIAS costs, down 17 percent from the last report. The large hub airports account for 23 percent (down from \$281 million in 2015 to \$176 million) and nonhub airports account for 23 percent of the access development needs (\$175 million). In the last 2 years, several research projects have been completed through the ACRP that provide useful information for airports as they examine ground transportation improvements. This includes curbside improvements and improving passenger access to the airport terminal from surface transportation facilities. The FAA encourages airport sponsors and State and local officials to develop airport master plans and airport system plans that consider passenger convenience, airport ground access, and access to airport facilities.

**Figure 26: Surface Access**



As new airport master planning begins to explore and analyze these aspects of the airport, the decreasing trend in access projects may reverse as new and innovative surface projects are identified.

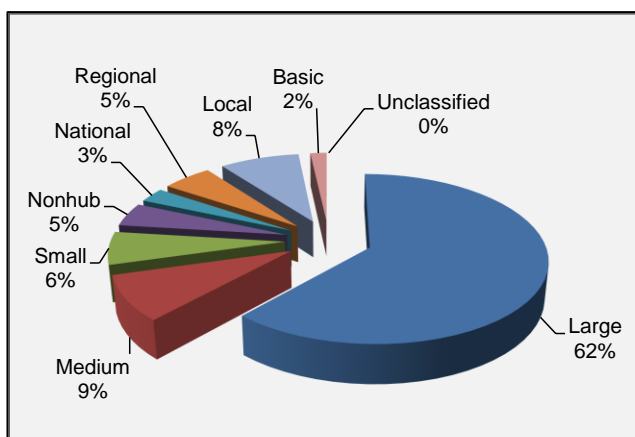
<sup>59</sup> Some smaller public-use airports, such as nonhub primary airports, can use AIP funds for public-use areas of a terminal that are revenue producing.

## Airport Capacity

Airport capacity is development that will improve an airport for the primary purpose of reducing delay and/or accommodating more passengers, cargo, aircraft operations, or based aircraft. This is the third largest development category, accounting for 11 percent (\$3.9 billion) of the NPIAS, and includes new runway, taxiway, and apron construction and extensions. Large hub airports account for 64 percent of the development to improve capacity or reduce delay.

Development to improve airfield capacity decreased 24 percent from the last report. This decrease may be due to the completion of major runway extensions or new runways in the last several years. The remaining airfield capacity development included in this 5-year plan will help to reduce congestion. However, problems will remain in certain large metropolitan areas, such as New York and Los Angeles. The FAA will continue to focus on the need for additional capacity and increased efficiency at those locations.

Figure 27: Airport Capacity



## New Airports

New airports and helipads are proposed in the NPIAS for communities that generate a substantial demand for air transportation and either do not have an airport or have an airport that cannot be improved to meet minimum standards of safety and efficiency. In addition, new commercial service and general aviation airports are recommended for communities where existing airports are congested and cannot be expanded to meet the forecast demand for air transportation. During the next 5 years, four general aviation airports, two nonprimary commercial service airports, and two primary airports are anticipated to open or be under development. New airport costs account for 1 percent (\$321 million) of all NPIAS development. Development costs in this category increased by 9 percent from the last report. This category also includes continuing AIP-eligible capital costs for new airports that recently opened.

## Other

This category of development accounts for about 0.4 percent (\$122 million) of the total development in the NPIAS. It includes fuel farms, utilities, and construction and rehabilitation of parking lots. National, regional, local, and basic nonprimary airports account for 84 percent of this development.

## DEVELOPMENT BY AIRPORT HUB AND ROLE

Figure 28 highlights the change in total AIP-eligible development by airport category from the last report. The AIP-eligible development needs decreased at large and medium hub airports, 18 percent and 14 percent, respectively. Small and nonhub airports reflect an increase in needs, 20 percent and 3 percent, respectively. Development at the nonprimary airports remained flat.

The \$1.5 billion decrease in AIP-eligible development at the large hub airports reflects the completion of major airside capacity expansion programs and a focus on reconstruction. Also, several large hubs have terminal rehabilitation or expansion projects planned, and while a small portion is AIP eligible, they are typically funded with PFCs and are generally not captured in the NPIAS.

**Figure 28: 5-Year AIP-Eligible Development Costs by Airport Type  
2015 and 2017 Reports (\$ Millions)**

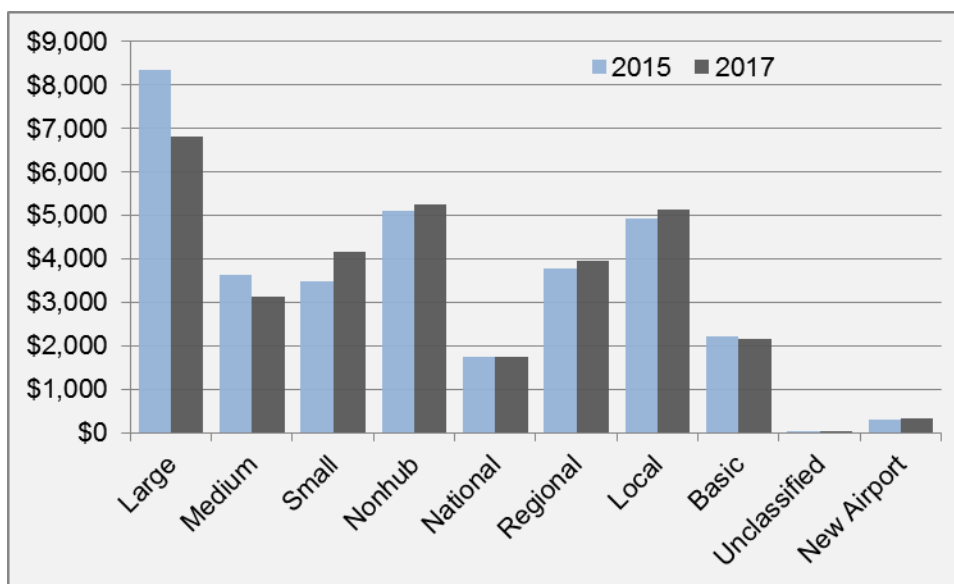
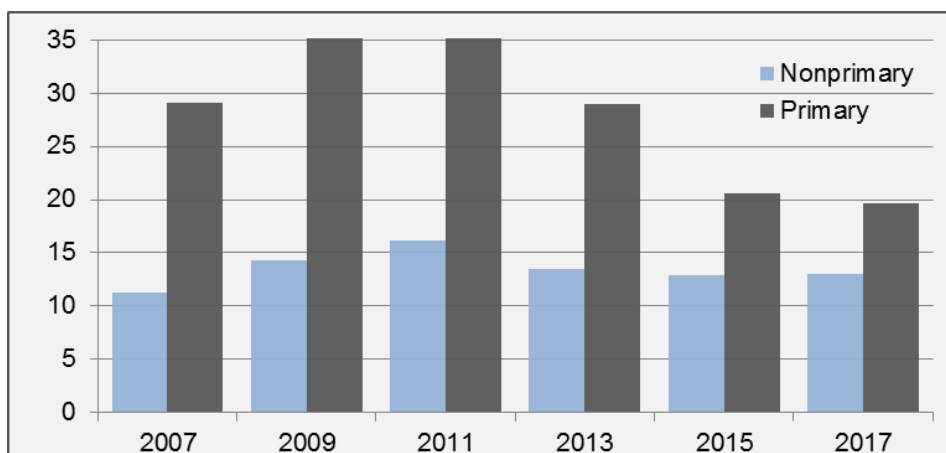


Figure 29 highlights the total development for primary and nonprimary airports over the last decade. In 2007, primary airports accounted for 73 percent (\$29 billion) of the NPIAS 5-year development, and in 2017, primary airports will account for 60 percent (about \$20 billion). In 2007, nonprimary airports accounted for 27 percent (\$11.3 billion) of the development, and in 2017, nonprimary airports will account for \$13 billion or 40 percent of the total 5-year development costs.

**Figure 29: NPIAS Development—Primary and Nonprimary Airports, 2007-2017 (\$ Billions)**



Development to replace or rehabilitate airport pavement and lighting systems is the largest category for primary airports. The second largest development category is to bring the airport up to current design standards recommended by FAA, followed by development to increase capacity. Development to bring an airport up to current design standards recommended by FAA is the largest category for nonprimary airports. The second largest development category is replacing or rehabilitating airport pavement and lighting systems, followed by development to increase capacity.

## **ANTICIPATED SOURCES OF FUNDING**

There are four major sources of funds used to finance airport capital development: airport cash flow, bond proceeds, Federal/State/local grants, and PFCs. Access to these sources of financing varies widely among airports with some large airports able to generate and apply significant cash flow to capital projects and the small commercial service and general aviation airports often requiring subsidies from local and State governments to fund operating expenses and finance modest improvements.

Over the last 15 years, AIP grants have exceeded \$3 billion annually. For the last 12 years, PFC collections have exceeded \$2 billion annually (in many cases leveraged to pay debt service or much larger bond issues). Approximately \$5.5 billion in airport bonds were issued in 2014.<sup>60</sup> In 2014, the commercial service airports reported on FAA Form 5100-27 grant receipts totaling \$2.2 billion and PFC collections totaling \$2.85 billion. These same airports reported total expenditures of \$8.8 billion in capital expenditures and construction for airport development projects, including projects eligible for AIP grants and projects ineligible for AIP grants, like automobile parking garages and hangars.<sup>61</sup>

The AIP serves as an effective investment tool to fund safety, security, and airfield projects that rank highest in national priority. The PFC Program has broader eligibility than the AIP, particularly for terminal projects, noise compatibility measures, and costs associated with debt financing, and is available in significant and generally predictable amounts to large and medium hub airports. As a result, airports, especially large and medium hubs, have been directing the majority of their PFC revenues to landside projects, such as terminal development, ground access systems, noise mitigation, and the financing costs of these projects. The majority of nonhub primary airports use PFC revenues as the local “match” funds for AIP grants.

## **ADDITIONAL COSTS NOT INCLUDED IN THE NPIAS**

The NPIAS only includes development that is eligible to receive Federal grants under the AIP. It does not include ineligible airport development, such as automobile parking structures, hangars, air cargo buildings, or the revenue-producing portion of large passenger terminal buildings.<sup>62</sup> It also does not include:

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<sup>60</sup> This is the proceeds from the sale of bonds (refinancing, as well as new bonds) reported by commercial service airports for 2014 on FAA Form 5100-127.

<sup>61</sup> FAA Form 5100-127, Operating and Financial Summary.

<sup>62</sup> The authorizing legislation allows nonprimary entitlement funds to be used for hangars, provided FAA believes the airport has an adequate plan for financing all airside needs.

- Development eligible under the PFC Program but ineligible under the AIP, such as leased gates and related areas;
- Improvements to assist airports to withstand or recover from severe weather events and rising sea levels anticipated as a consequence of global warming;
- Improvements to highway and transit systems beyond the airport property line;
- Improvements to air traffic control and navigation aids that may be funded by the FAA's F&E Program, including most equipment for NextGen;
- Costs associated with modifying terminals to accommodate explosive detection systems. The FAA is prohibited from funding these projects with AIP funding. However, these projects remain eligible under the PFC Program and under the Transportation Security Administration's grant program;
- Development needed to address capacity shortfalls where no clear solution has yet emerged; and
- Costs associated with planning (master plans, regional and State system plans, and environmental studies). Between 2017 and 2021, total costs for airport planning (airport master plans, regional and State system plans, and environmental studies) are estimated at \$381 million.