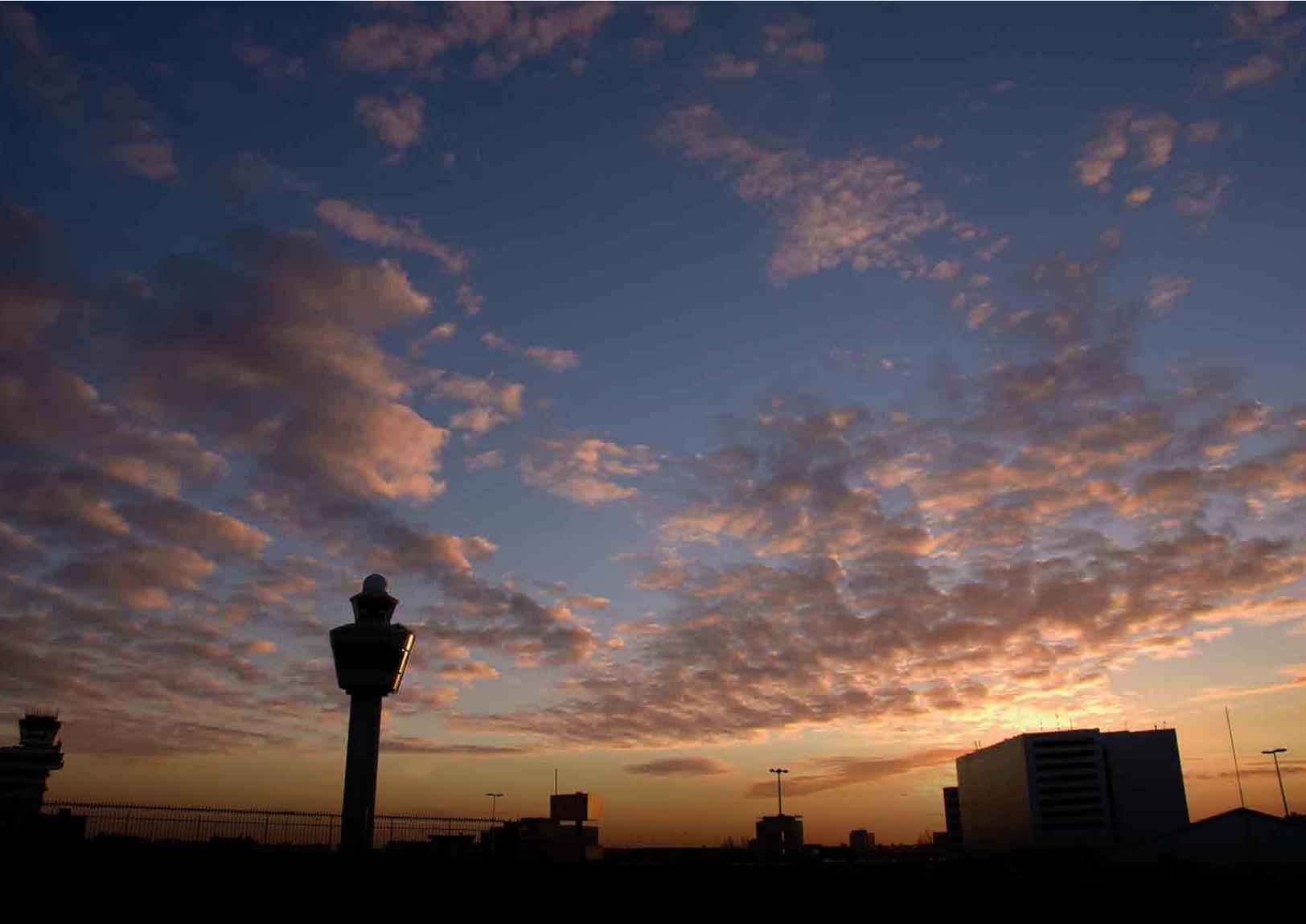


DEVELOPMENT AT U.S. AIRPORTS

A Summary Look at Future Trends and Opportunities



A SPECIAL REPORT BY ACC



ACC 

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CONTENTS

1 Introduction

1.1	Foreword	3
1.2	Acknowledgements	3
1.3	Executive Summary	4

2 Trends in U.S. Airport Development

2.1	Summary of Recent NPIAS Investment	6
2.2	Change in AIP Funding Over Time	7
2.3	Financing & Project Procurement	8
2.4	General Trends in U.S. Airport Development	11

3 2017 – 2021 Development Projects: Large & Medium Hubs

3.1	Research Methodology	15
3.2	Summary of Development at Large & Medium Hubs	19
3.3	Large & Medium Hub Investment Per NPIAS	21

4 2017 – 2021 Development Investment: Small Hub, Nonhub, and Nonprimary Airports

4.1	Research Methodology	23
4.2	Summary & Analysis of Development Investments	24

5 Conclusions

5.1	Conclusions	26
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APPENDIX

	APPENDIX A: Top 20 Major Projects	27
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1. Introduction

1.1 Foreword

The airport development environment in the United States is as dynamic as ever. ACC endeavored to develop a summary report to capture key trends in airport development in the U.S., and opportunities and implications for companies involved in all facets of airport development.

This report provides the industry important, high-level trends in future airport development, including funding, types of projects, required services, and procurement methods that will be utilized by airport owners/operators. Readers may find the comprehensive list of anticipated capital projects at over 50 large- and medium-hub airports that accompanies this report particularly valuable. It is available on the ACC website at www.ACConline.org.

ACC seeks feedback on the report and more importantly, what enhancements could be made in future editions. ACC is interested in what specific data companies would find useful. Please [go to this survey](#) and provide your input.

1.2 Acknowledgements

ACC would like to acknowledge the following individuals who helped contribute to this report.

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1.3 Executive Summary

This report is intended to inform the airport industry of trends in airport capital investment across the entire spectrum of U.S. airports, from large global-scale hubs to the smallest of General Aviation (GA) airports. Based on research of U.S. airport capital development projects over the next half decade to 2022, it highlights trends in types of projects, likely procurement models and funding, and associated consulting services required by airports. In addition, it examines the shift in airport development investment compared to that over the past five years. Priorities by project category are highlighted, along with a summary of the largest development projects expected over the next five years. The report’s objective is to provide a concise source of future projects and anticipated capital expenditures.



“Top 10” Headlines

- 1)** Greatest investment will be in terminals: new, expanded, and renovated, with the primary objective being capacity enhancement.
- 2)** Airfield pavement projects are ubiquitous but don't represent the largest investment category. Most are rehabilitative in nature, with few new runway projects planned.
- 3)** 2017 – 2021 National Plan of Integrated Airport Systems (NPIAS) includes an identified investment need of \$32.5 billion in projects eligible for federal funding. A new national initiative to improve nonstandard airfield geometry is beginning and should increase development costs in the next NPIAS report.
- 4)** Design-Build and Construction Manager at Risk models are gaining interest by airport sponsors where available.
- 5)** Public Private Partnerships (P3) for components of U.S. airports continue to increase in frequency, while airport-wide P3s continue to be rare.
- 6)** Airports, airlines and Federal agencies are increasing the use of technology to enhance passenger facilitation.
- 7)** Consolidated Rent-A-Car (CONRAC) facilities are becoming more common, popular and substantial in nature.
- 8)** Investments in the passenger experience are a way for airports to increase passenger spend.
- 9)** Transportation Network Companies (TNC) are noticeably evolving landside behavior, demand and challenges.
- 10)** Projects at GA airports tend towards upgrades of existing facilities and State of Good Repair (SOGR) initiatives.



2. Trends in U.S. Airport Development

2.1 Summary of Recent NPIAS Investment

Every two years, the Federal Aviation Administration (FAA) publishes a report outlining its estimates of the amount of Federal Airport Improvement Program (AIP) investment required to fund infrastructure development at 3,000+ airports identified in the National Plan of Integrated Airport Systems (NPIAS).¹ The estimated development investment needs are intended to upgrade airports to current design standards and to enhance capacity over the next five years. An important note that the NPIAS identifies only AIP-eligible projects and excludes projects that are privately-funded or funded with Passenger Facility Charges (PFCs). It also does not necessarily equate to actual spending. The authors analyzed the current NPIAS report (covering the years 2017-2021), using it as a consistent proxy for expected U.S. airport development investment during the next half decade. A summary of system-wide NPIAS investment is below.

The expected total investment needs in the current NPIAS (2017-2021) has declined slightly from estimates in previous reports. The 2017 NPIAS identifies a need for approximately \$32.5 billion of investment versus \$33.5 billion reported from 2015 to 2019, per the previous report. The FAA notes that a new national initiative to improve nonstandard surface geometry at U.S. airports is beginning and increased development costs will likely be reflected in the next NPIAS.

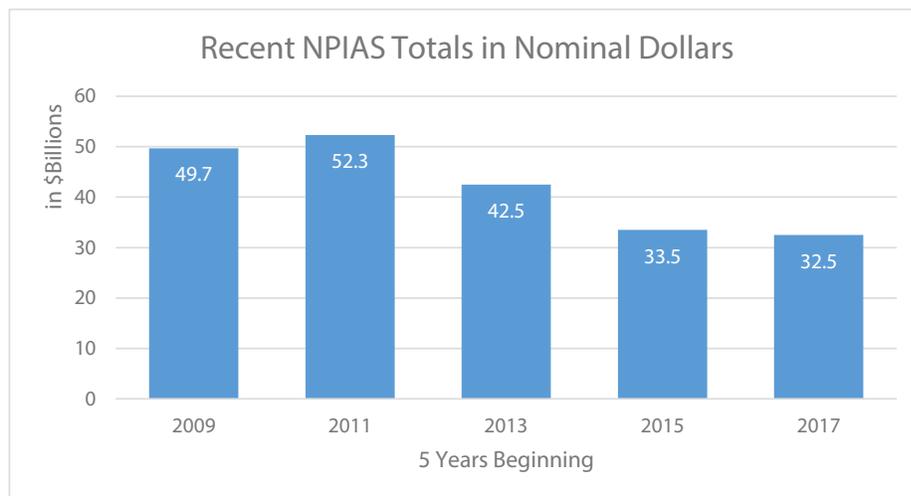


Figure 1: NPIAS funding 2009-2017²

¹https://www.faa.gov/airports/planning_capacity/npias/reports/

²https://www.faa.gov/airports/planning_capacity/npias/

2.2 Change in AIP Funding Over Time

From 2005 to 2011, AIP projects fell into four main categories: reconstruction, standards, capacity, and terminal. In the 2013 NPIAS report, terminal projects ceased being a major category, and the 2015 NPIAS reported that capacity projects had a deep decline. Today, only reconstruction and compliance with FAA standards are major categories, combining for 64 percent of projects between them.

The current NPIAS report (2017-2021) shows that reconstruction and standards both have slight increases compared to 2015. Capacity is now less than half of its 2013 peak, while terminal is only a third of its 2009 peak. These declines stem from the completion of specific major projects.

Overall, smaller airports have a larger share of Federal funding needs compared to their overall place in the national aviation system. Small and Non-hub airports have 13 percent of enplanements, but 49 percent of funding. Similarly, the 30 Large Hubs have 72 percent of enplanements, but only 35 percent of funding. This is expected, given the greater importance of AIP grants for smaller airports. There is also an element of “overhead” in airport funding, as Large Hubs have identified needs of \$12.35 per enplanement, Medium Hubs are \$26.62, and Small Hubs, \$64.11.

There are few notable outliers in terms of project distribution over the airport categories. For example, standards spending is weighted towards Non-primary airports by a 60/40 split, and Large Hubs take up two-thirds of capacity spending. Relative to their share of enplanements, capacity and noise projects are the largest needs at Large Hubs, while reconstruction is prevalent at Medium Hubs.

At Nonprimary airports, categories generally track with regard to funding versus Air Traffic Movements (ATMs). Reconstruction and standards projects make up 87 percent of spending. Relative to their share of ATMs, noise, safety, and security projects are over-represented at National airports, while environmental and terminal projects lag behind. At local and basic airports, terminal and security projects are overrepresented, while noise projects lag far behind.

...flat-lined levels of funding provided by Congress on a yearly basis require many airports to undertake sophisticated financing and project delivery vehicles

2.3 Financing & Project Procurement

While innovative methods of financing are growing more popular across the infrastructure industry, the flat-lined levels of funding provided by Congress on a yearly basis require many airports to undertake sophisticated financing and project delivery vehicles when upfront capital needs far outpace available revenue streams.

2.3.1 Financing for Airport Development

Each year, airports receive funding through AIP grants and revenues from PFC user fees. In FY16, combined AIP and PFC authority was approximately \$6.5 billion.

FAA reauthorization proposals introduced in the House and Senate in 2016 contained increases to AIP from the current annual \$3.35 billion level. There may be a chance that the AIP increases (up to \$3.75 billion proposed by the Senate in 2016, and an incremental increase to \$3.99 billion proposed in the House) could be included in the new FAA reauthorization bills to be considered in 2017.

While a previous push to increase the PFC from the current \$4.50 cap failed in Congress last year, proponents such as ACC, Airports Council International-North America, American Association of Airport Executives, and other stakeholders will lobby Capitol Hill to reconsider this in the upcoming session, though airlines are generally opposed to any increase. Without PFC increases, additional financing for some airports will come from the bond market, which could raise borrowing costs, potentially impacting overall bond ratings, and possibly increase costs to the airlines. Under the bond financing model, PFCs are often used to pay the debt service on the bonds. A number of airports have fully obligated their PFC entitlements for this purpose, some for years to come. It should also be noted that not all airports are able to access the bond market to finance projects.

The prevalence of private sector investment in U.S. airport development continues to lag that in other regions of the world, but it is starting to gain traction through Public-Private Partnerships (PPP or P3). Such private sector involved projects are typically only desirable where there is a

specific and predictable revenue stream attached, such as lease agreements in terminals. P3s are only widely authorized in 10 states (and the airport-less District of Columbia) at the moment, though certain governance structures can overcome these limitations. A prime example is the nearly 20-year-old P3 for JFK T4 (developed and managed by Schiphol USA), and the ongoing the Central Terminal Building replacement at LaGuardia. New York does not permit P3s, but the independent, bi-state Port Authority of New York & New Jersey is not subject to this restriction.

There has been limited acceptance of airport-wide P3s at some U.S. airports in recent years, though there is still some resistance from operators who are leery of involving private developers whose interests may not be in alignment with those of a publicly-owned and operated airport. The revenue demands of P3s may also result in higher costs for tenants that are then passed along to passengers and customers. The FAA's Airport Pilot Privatization Program has resulted in an airport-wide P3 at Luis Muñoz Marín International Airport in San Juan, Puerto Rico; however the only Large Hub to begin the process, Chicago-Midway, ceased the process after all but one bidder dropped out. There are two applications in process at Westchester County Airport, New York and Hendry County Airglades in Florida. Outside the pilot program, there have been (or will soon be) a number of facility-specific P3s at Austin (South Terminal), Orlando-Sanford, Denver (DEN) (Great Hall), and for components of the LAX Landside Access Modernization Program (LAMP). In addition, San Diego has announced a P3 for Terminal 1 to occur starting in 2017.

The U.S. airport P3 market is affected by the ability of airlines to finance tax-exempt and other debt for terminal developments through the airports where they hold a long-term lease on a terminal. Under current models of collaborative terminal development, airline-led initiatives can be considered as a "Soft" P3, with an airline funding and managing a project, with the contribution and support from the hosting airport authority. Airline investment in terminals is expected to continue to be a significant component of the U.S. P3 market, complementary to other forms of private investment.

Air cargo facility long-term leases have also been privately financed and can be considered forms of P3s. Another variety of P3 includes long-term

The prevalence of private sector investment in U.S. airport development continues to lag that in other regions of the world, but it is starting to gain traction



management contracts where airports or terminals are managed by private operators (such as AvPorts), under agreement with an airport authority. These tend to be limited to smaller air carrier or general aviation airports. Given recent P3 initiatives, it is likely that facility-specific P3s will increase in popularity and frequency. Consultants have much to offer airports during P3 projects, as some have the experience of being involved in multiple P3 projects, whereas it is likely that an airport's management team has limited or no experience.

At smaller airports, State economic development and other funding may be an alternative means of finance, though this requires airport authorities and their consultants to make a strong case for the benefits of individual projects.

2.3.2 Project Procurement Models

Traditional Design-Bid-Build (DBB) models are still being used by airports to procure development projects, but are starting to lose popularity according to airport leaders who were interviewed as part of the research effort. DBB continues to be utilized for smaller, less complex, and often airport-designed projects. For larger and more complex projects, airports are increasingly using Design-Build (DB) and Construction Manager at Risk (CM at Risk) to expedite schedules, reduce the risk to the airport, and to provide a better project at a lower cost.

Design-build projects engage a team consisting of a design firm and a general contractor and feature the owner interacting with both the design and construction segments of a project through a single contract and a single point of contact. Though the DB model has been increasing in prevalence, the varying levels of state adoption of DB has limited their widespread adoption for airport projects. Although only 16 states still have strict limits on DB transportation projects³, the relative unfamiliarity with the process even in authorized states has slowed its uptake.

The more common CM at Risk model has many of the benefits of DB, especially with regard to having known and fixed construction costs during design, though changes to the design are very expensive once works have started. CM at Risk keeps the owner at the table, and is generally accepted under every jurisdiction's regulations.

³http://www.dbia.org/advocacy/state/Documents/design_build_maps.pdf

San-Francisco (SFO) is pioneering an innovative variation of the DB model known as Progressive Design-Build, which they are using to procure two-thirds of its upcoming \$6 billion Capital Improvement Plan. PDB aims to improve project delivery by bringing stakeholders together at the beginning of the process to jointly agree on programming once the DB team has been selected, but before a final price and schedule has been agreed. The process also includes a 3D Virtual Design Construction Model to help align stakeholder expectations and fora for collaboration throughout.

2.4 General Trends in U.S. Airport Development

RUNWAYS & SAFETY

The Congressionally-mandated Runway Safety Area (RSA) program had a deadline of December 31, 2015, and most airports are now either in compliance or are in the final stages of construction. With the RSA improvement push having been completed, the next identified Federal airport safety initiative is known as Runway Incursion Mitigation (RIM). This will entail reconfiguring non-standard geometries in runway and taxiway networks in order to improve safety. The specific projects that will comprise RIM have not yet been chosen, and will begin to appear in the 2019 NPIAS. Consultants should be aware of airports' upcoming RIM airfield projects, as studies and projects are already underway.

With the exception of previously announced projects, new runway construction is not expected to be a major project driver. Seventeen of the 30 Large Hubs have added runways in the last 20 years, and among those which have not, most airports face physical constraints that would prohibit this type of major construction. Airport authorities still have in recent memory new runway construction projects at airports that were de-hubbed by their dominant carrier shortly after the completion of the runway, such as Saint Louis (STL). Given this, many airports with the ability to construct new runways are being patient and content to wait for the capacity upgrades brought by NextGen technology before embarking on a new round of pavement expansion. The system-wide nature and Federal control of NextGen is not reflected in per-airport spending trends.

Consultants should be aware of airports' upcoming RIM airfield projects.



In order to meet this demand, airports cannot build their way out of congestion, but must find ways to use existing infrastructure more efficiently

PASSENGER FACILITATION

There are a number of innovation trends involving airports and passenger facilitation. The most prominent is a continued increase in global demand, with total passengers potentially doubling by 2030. In order to meet this demand, airports cannot build their way out of congestion, but must find ways to use existing infrastructure more efficiently. To do this, airports will need to realign two of the major processors located in terminals – baggage and security screening. By screening for intent, the physical space devoted to traditional hands-on security can be greatly reduced, and by taking advantage of innovations in autonomous mobility, baggage can be decoupled from the passenger journey. Terminal designers and developers should be aware of these trends to future-proof any major renovations or new construction that will result in terminal lifecycles stretching into this zone of innovation.

Within terminals themselves, there is renewed emphasis on enhancing the passenger experience, which is not always synonymous with new-build facilities. As existing facilities age and begin to require rehabilitation and SOGR needs, airports and their tenants can take the opportunity to add amenities and improve measures of sustainability and resiliency. A terminal rehabilitation is also an opportunity to refocus the building around operations and allow airports to spend less to realize greater efficiency. By flipping the standard process of terminal design to an “inside-out” model, focusing on remodeled concourses with high-quality passenger amenities rather than distinctive architecture, an airport can achieve the positive effect of increased passenger spend and airport revenue.

CHANGES IN FLEET MIX

The advent of efficient and lower cost widebodies such as the Boeing 787 and the Airbus A350 have opened new international routes to the tier of larger airports that have not previously had significant nonstop intercontinental connectivity, such as Boston, San Diego, Fort Lauderdale, or Oakland. The coming introduction of long-range narrow bodied aircraft such as the 737 MAX and the A320neo families will push this international route development and provide opportunities



for airlines to serve transatlantic routes from secondary airports. For example, Norwegian Air International (NAI) is planning transatlantic 737 MAX service from Providence, RI and from Stewart Airport near New York. This will require traditionally-domestic airports to upgrade terminals to include FIS and other facilities required to support international service.

Aircraft Design Group VI (Airbus A380 and Boeing 747-8) airfield and gate modifications and upgrades are largely finished, with the exception of Boston-Logan, which is wrapping up its upgrades as part of an overall expansion of international capability over the past 5 years. Orders for new A380s and 747-8s have stagnated and there is unlikely to be significant new demand for Group VI aircraft to serve destinations where they are not already present.

TRANSPORTATION NETWORK COMPANIES (TNC)

The sudden rise of TNC such as Uber and Lyft has created drastic shifts in mode share in only a few years, changing the volumes and characteristics of the vehicles placing demand on roadways and terminal curbs. This will cause many commercial airports to examine their landside operations with an eye towards re-accommodating and optimizing their space allocations. Airport leaders see this shift as presenting an opportunity for TNC consulting and for ground access planning activities.

2.4.1 General Aviation

While construction continues apace at large commercial airports, the picture is not as optimistic for GA.

The number of certificated pilots continues to decline, despite recent innovations like the Light Sport Aircraft category and the upcoming reforms to Third Class (non-commercial) Medicals. The number of commercial-rated (CPL/ATP) pilots is remaining steady, which means nearly all of this decline is in the private pilot (PPL) ranks. This trend is also seen in new student certificates issued, which has declined by 22 percent from 2006 to 2015. While some large GA airports, such as those in Florida and Arizona, retain a brisk business in flight instruction, many of these students come from overseas and never exercise their FAA license privileges in the United States once training is complete.

The GA fleet continues to shrink, though jet aircraft are gaining in popularity. Compared to 1980, the piston fleet is down 28 percent as of 2014, while business jets have quadrupled, portending a greater concentration of GA activity in the National and Regional categories, which serve more important cities and with better facilities. While Large Hubs will exist in cities that are big enough to have dedicated general aviation relievers, many business jet trips will involve the other categories of primary airports, and attracting GA will be a part of the business plans for those operators. Despite the increase in jets, total hours flown by GA are roughly half of their 1980 levels, and the average single-engine piston is now almost 45 years old. It is likely the piston fleet will shrink even further as the 2020 ADS-B mandate draws near and 100LL avgas continues to become scarcer and more expensive.

In addition to the decline in pilots, fleet size, and hours flown, GA airports around the country continue to be subject to outside pressures such as land development that may hinder airport operations or expansion, or in some cases result in closures entirely.



3 2017 – 2021 Development Projects: Large & Medium Hubs

3.1 Research Methodology

In addition to analyzing NPIAS data to understand airport development investment, detailed project-specific research and analysis for the majority of the top 60 airports (those in the Large Hub and Medium Hub categories) was conducted to understand specific development projects over the next five years. Approximately 50 airports are covered in this survey, as the remainder did not have comprehensive project data or plans publicly available. Sources of research data included airport Capital Improvement Programs (CIP) and other budget documents, various airport reports, lists of FAA grants, and other open-source articles. The research resulted in a detailed spreadsheet of the majority of Large and Medium Hub development projects. The project spreadsheet is available to ACC members and industry as a supplement to this report (refer to the [ACC website](#)).

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	A	B	C	D	E	F	G	H	I	J
1	Airport			2015 Annual						
2	Code	Name	Operator	Passengers	ATMs	FAA Hub Category (Select from Drop Down)	Project Name			
3	ABQ	Albuquerque Int'l Sunport	City of Albuquerque	4,745,256	124,174	Medium Hub	RW 8-26 Pavement Rehab			
4	ABQ	Albuquerque Int'l Sunport	City of Albuquerque	4,745,256	124,174	Medium Hub	TW E Reconstruction			
5	ABQ	Albuquerque Int'l Sunport	City of Albuquerque	4,745,256	124,174	Medium Hub	East (RON) Apron			
6	ABQ	Albuquerque Int'l Sunport	City of Albuquerque	4,745,256	124,174	Medium Hub	TW F7 New (RW 21 Exit TW) - Construct			
7	ABQ	Albuquerque Int'l Sunport	City of Albuquerque	4,745,256	124,174	Medium Hub	ARFF Equipment and Building			
8	ABQ	Albuquerque Int'l Sunport	City of Albuquerque	4,745,256	124,174	Medium Hub	Terminal Building Perimeter Concrete Reconstruction			
9	ABQ	Albuquerque Int'l Sunport	City of Albuquerque	4,745,256	124,174	Medium Hub	TW B Reconstruction			
10	ATL	Hartsfield-Jackson Atlanta Int'l Airport	City of Atlanta	101,491,106	882,497	Large Hub	Air Cargo Development			A phase of 100,000 square feet of area to be added to the existing terminal.
11	ATL	Hartsfield-Jackson Atlanta Int'l Airport	City of Atlanta	101,491,106	882,497	Large Hub	Hotel And Travel Plaza			A 4-story, 1.2 million square foot hotel and travel plaza.

The findings are summarized below with a focus on understanding the leading project types, the most common motivators of projects, and a description of the categories of consulting services likely to be needed by airports to accomplish these projects. Each project was classified in terms of project category, motivator and types of consulting services required in order to perform this analysis.

3.1.1 Investments by Project Categories

The researched projects were coded according to the categories shown in the following pie chart, which were chosen to broadly align with the nine NPIAS categories. The pie chart depicts the share of total investment in the sample of Large and Medium hub airports by each project category.

...the leading project categories are Terminal (New) and Terminal (Expansion or Renovation), with a combined share of nearly 70 percent of total investment for the Large and Medium Hubs

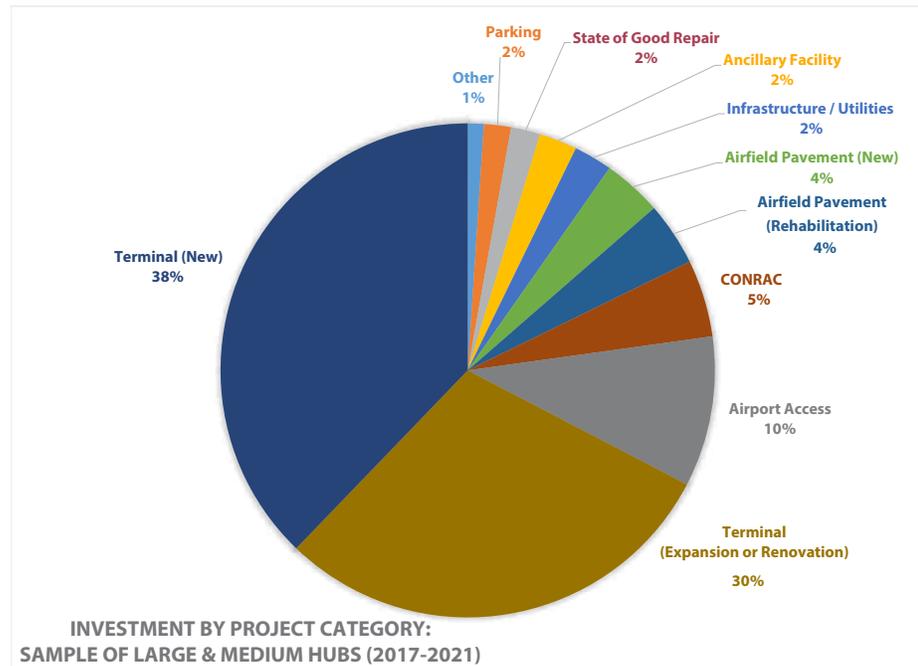


Figure 2: Large & Medium Hub investment by project category

The total sum identified across all capital projects was approximately \$70 billion. Given the complex and capital intensive nature of terminal development, it is not surprising that the leading project categories are Terminal (New) and Terminal (Expansion or Renovation), with a combined share of nearly 70 percent of total investment for the Large and Medium Hubs. Terminal projects include the range of sub-categories that terminal development entails, including security

screening and related projects. While stand-alone security initiatives appear to make up only a small amount of overall spending, the security-related components of new or redeveloped terminal projects are counted within these top two categories. The terminal category also includes the technological innovation and passenger experience programs that are inherent in construction or renovation, but are not broken out separately.

Multi-billion new terminal projects are underway or planned at LaGuardia (LGA) (\$8.5b), Salt Lake City (SLC) (\$2.9b), SFO (\$2.4b), Newark (EWR) (\$2.3b) and San Diego (SAN) (\$2.3b), with similarly significant renovations/expansions planned at Los Angeles (LAX), Atlanta (ATL), Portland (PDX) and elsewhere. Airport Access projects make up a tenth of the total investment of the sample (#3 of the categories), led by the \$2.7b Automated People Mover (APM) and associated projects planned for LAX. CONRAC facilities make up 5 percent of the total investment of the sample, as such facilities are becoming as sophisticated as airport terminal projects. LAX is planning a \$1b CONRAC, with the City of Chicago planning to invest nearly \$800m in one at ORD.

As expected, the research indicated that airfield pavement projects are underway consistently across the airports of the sample. While abundant, these less complicated projects tend to require less total investment, which is why they only reflect an 8 percent share, split evenly between new pavement and rehabilitation.



Airport authorities are pressing ahead with capacity enhancements

3.1.2 Project Motivators

Each researched project was coded according to one of the project motivator categories shown in the following pie chart. The project motivator is the primary reason the project was executed.

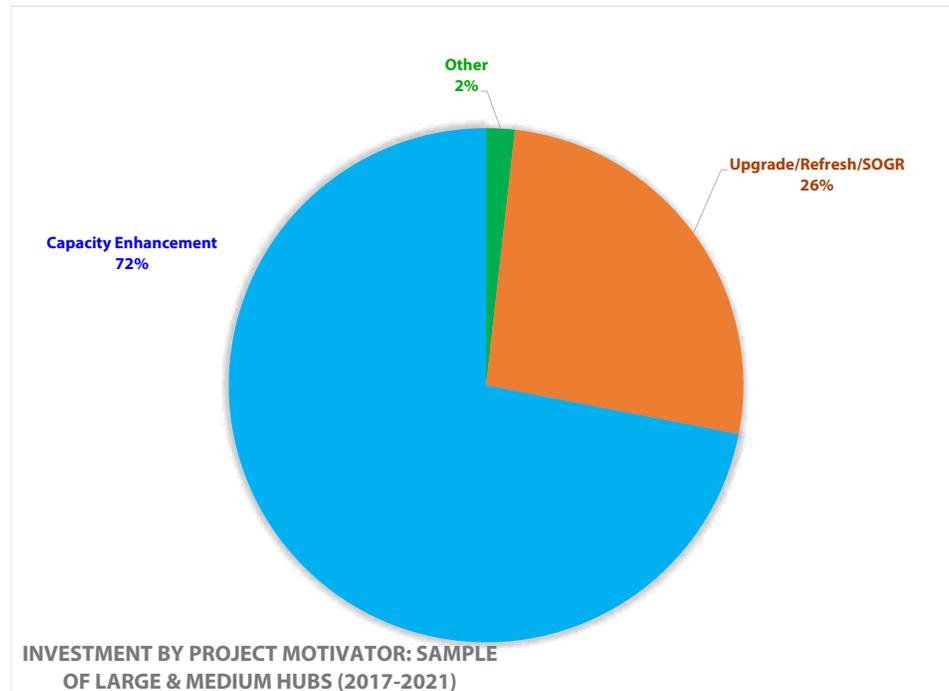


Figure 3: Large & Medium Hub investment by project motivator

Airport authorities are pressing ahead with capacity enhancements. Projects in this category make up 72 percent of overall spending, with upgrades and state of good repair projects comprising 26 percent. The remainder are projects that involve safety, security, or are intended to meet regulatory requirements, though elements of these are contained within many of the capacity enhancement projects. As seen in the previous section, the majority of the capacity enhancements projects involve terminals rather than pavement work.



3.1.3 Consulting Services Required

Each project was assessed for the consulting services likely to be needed by the airport or other project sponsor in order to plan, design, build, and successfully deliver the project. The consulting service categories are shown in the following table. Required consulting services were identified for each project type and the percentage of total investment requiring each service type is shown in the table.

Table 1: Services required by project value

DISCIPLINE	# OF PROJECTS REQUIRING	TOTAL PROJECT SPEND (\$M)	PERCENTAGE OF SPEND
Engineering	512	\$68,783	98%
Construction	498	\$66,266	95%
Planning	400	\$58,046	83%
Architecture	146	\$48,156	69%
IT	78	\$34,402	49%
Security	82	\$33,411	48%
Baggage	33	\$15,613	22%
Environmental	99	\$10,338	15%
Rail/APM	15	\$6,093	9%
Financial	8	\$3,669	5%
TOTAL	534	\$69,848	

Some consulting services such as engineering and construction are quite universal, required in nearly all projects in one form or another (as measured by project investment). Planning services are required in more than 80 percent of projects, while architectural services are needed in approximately 70 percent of projects (typically terminal and other buildings projects). Further details are available in the development projects spreadsheet available on the [ACC website](#).

3.2 Summary of Development at Large & Medium Hubs

According to the project-specific research, airports are pressing ahead with capacity enhancements. Such projects make up 72 percent of overall spending, with upgrades and state of good repair projects making up 26 percent. The remainder are safety/security projects and those that achieve regulatory requirements.

Capacity enhancements are dominated by terminal construction. Major terminal projects are underway or planned at Columbus (CMH), EWR, Houston (IAH), LAX, LGA, New Orleans (MSY), Orlando (MCO), Philadelphia (PHL), San Antonio (SAT), SFO, and SLC.

These terminal projects make up two-thirds of all spending at Large and Medium Hub Airports, with an estimated total expenditure of \$47 billion out of the roughly \$70 billion in overall projects in the sample. Spending on new terminals slightly outpaces that of renovations, \$26.4 billion to \$20.6 billion.

The final new runway of the ORD Modernization Program has been approved and is in design, and Charlotte (CLT) is currently in the Environmental Impact Statement (EIS) process for a planned fourth parallel runway. Among other high-profile recent runway proposals, the planned new runway at PHL is currently on hold, and there is no firm commitment or timeline for the next runway approved and included in DEN's master plan.

Airfield pavement projects make up \$5.6 billion, or 8 percent of total expenditures. These are split roughly equally between new pavement and rehabilitation of existing installations.

Airport access projects are a strong segment of spending, at \$6.8 billion, or almost 10 percent of the total. This is driven by the \$4.1 billion LAMP project at LAX, which includes an APM, an intermodal transport facility, and roadway improvements. Other notable APM projects are found at ATL, MCO, Phoenix (PHX), SFO, and Tampa (TPA). Significant roadway projects are expected at BOS, CLT, Ft. Lauderdale (FLL), and PDX.

CONRAC facilities make up \$3.5 billion, or 5 percent of expected expenditures. The largest of these is at LAX, with Hartford (BDL), Maui (OGG), Minneapolis-St. Paul (MSP), ORD, PDX, and TPA all above \$250 million each.

3.3 Large & Medium Hub Investment per NPIAS

In addition to the project-specific analysis as described above, 2017-2021 NPIAS data was used to evaluate estimated NPIAS investment versus annual enplanements. Each Large and Medium Hub was plotted individually with NPIAS investment on the Y axis and annual enplanements on the X axis. A trendline was fitted in order to determine airports expected to have above-average investment over the next half decade compared to peers of similar passenger volume. A separate chart was prepared for the Large Hubs and for the Medium Hubs, as shown below.

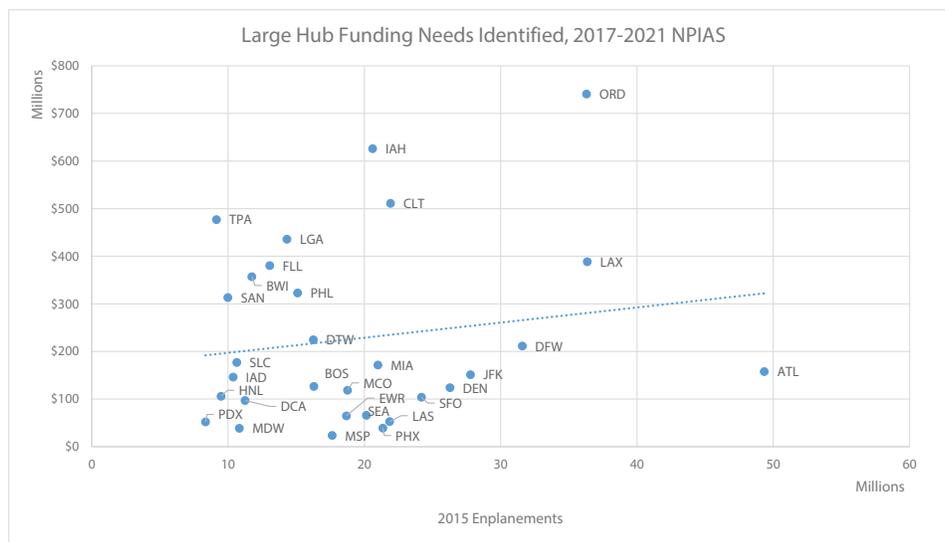


Figure 4: NPIAS investment estimates at Large Hubs

The leading airports are typically ones with specific large projects in the pipeline. Among Large Hubs, according to NPIAS the top five investment airports are CLT, IAH, LGA, ORD, and TPA, shown significantly above the trendline for Large Hubs.

Table 2: Largest projects of Top 5 NPIAS investment airports (Large Hubs)

AIRPORT	LARGEST PROJECT	COST (\$M)
ORD	CONRAC	782
IAH	New Terminal D (Mickey Leland International Terminal)	1,518
CLT	Concourse C Expansion	463
TPA	APM	417
LGA	Terminal C/D Redevelopment	4,500

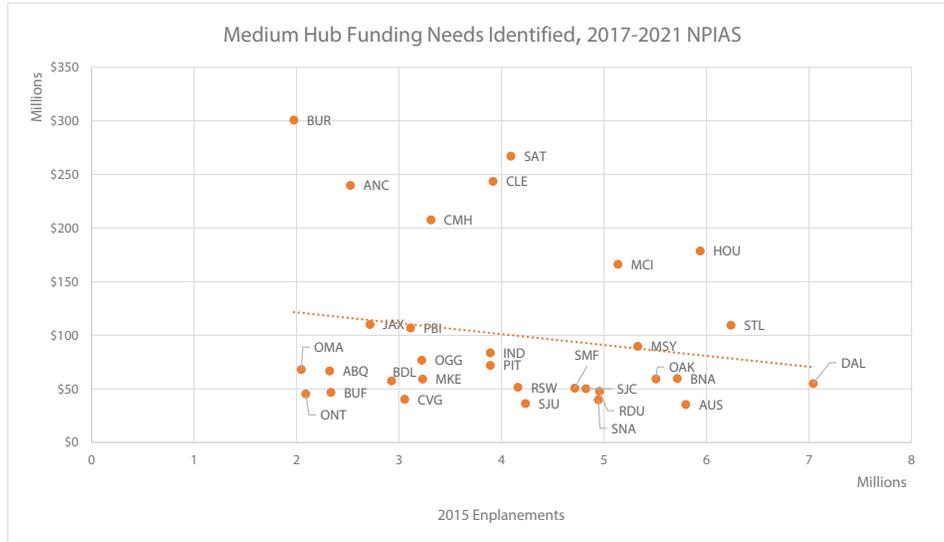


Figure 5: NPIAS Investment Estimates at Medium Hubs

Among Medium Hubs, the top five investment from an investment perspective are Anchorage-International (ANC), Burbank (BUR), Cleveland-Hopkins (CLE), Columbus (CMH) and SAT.

Table 3: Largest projects of Top 5 NPIAS investment airports (Medium Hubs)

AIRPORT	LARGEST PROJECT	VALUE (\$M)
BUR	New Terminal	400
SAT	New Terminal C	335
CLE	Runway Rehabilitation	34
ANC	Runway widening	89
CMH	New Terminal	1,300



4 2017 – 2021 Development Investment: Small Hub, Nonhub, and Nonprimary Airports

4.1 Research Methodology

Benchmarking was conducted for Small Hub, Nonhub and Nonprimary airports using 2017 – 2021 NPIAS investment data versus annual enplanements and ATMs. The data was plotted on various scatterplots by airport category and region, and trendlines were established. Development projects at airports which plotted well above the trend line were investigated and are presented.

For General Aviation (GA) airports, select State System Plans were used to research development projects at a subset of representative airports in each of the nine FAA regions that qualify under the FAA’s rubric of national, regional, local, or basic. The State plans were used as a starting point to ensure that reliable data is available for each representative airport. The sample airports were then projected to represent the universe of GA airports across the nation and their similar projects.

Projects at GA airports tend towards upgrades of existing facilities and SOGR initiatives to return airports to their original functionality

Table 4: Airports researched for Nonprimary analysis

REGION	NATIONAL	REGIONAL	LOCAL	BASIC
Alaska	N/A		Talkeetna/TKA	Willow/UUO
Central	N/A	Ankeny/IKV	Columbia-Mari- on County/ORO	
Eastern	Philadelphia Northeast/PNE	Winchester/ OKV	New Castle/UCP	
Great Lakes	St. Paul/STP	Airlake/LVN	Lake Elmo/21D	Ashland County/3G4
New England	Norwood/OWD	Plymouth/PYM	Orange/ORE	
Northwest	Everett-Paine/PAE	Heber City/36U	Arlington/AWO	Wilbur/2S8
Southern	Boca Raton/BCT	Stuart/SUA	Apalachicola/AAF	Belle Glade/X10
Southwest	Houston-Ellington/EPD	Hobbs/HOB	Los Alamos/LAM	Santa Rosa/SXU
Western-Pacific	San Diego-Gillespie/ SEE	Salinas/SAC	Banning/BNG	Sequoia/D86

4.2 Summary & Analysis of Development Investments

Using the same NPIAS investment versus enplanements approach that was used for the Large and Medium Hubs, the Small Hubs located significantly above the trendline include Des Moines (DSM), Greensboro (GSO), Little Rock (LIT), Memphis (MEM), and Providence (PVD), as depicted in the following graph.

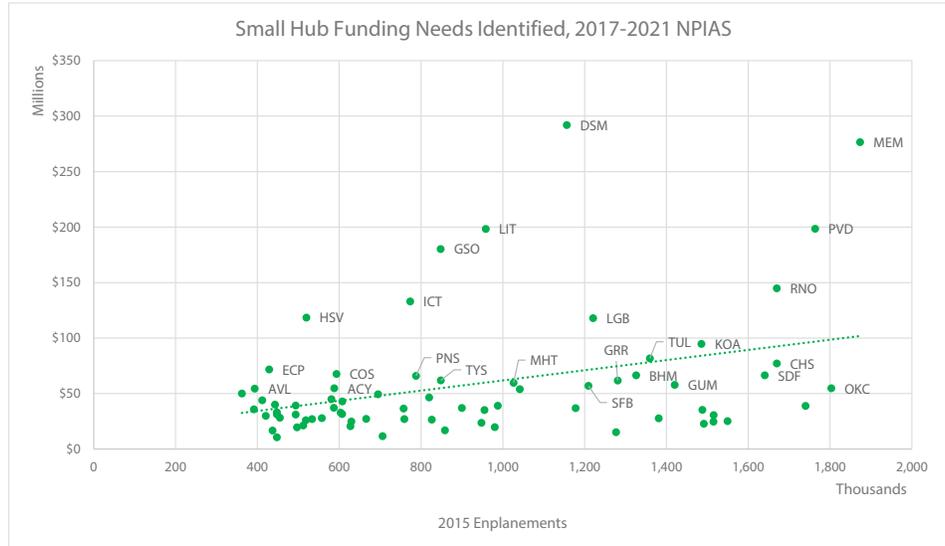


Figure 6: NPIAS Investment Estimates at Small Hubs

GA airports were plotted with NPIAS funding against total annual ATMs. Eight airports have over \$50 million in identified needs. Most of the entrants in this category are among the larger GA-only airports in the nation, including Teterboro; Van Nuys; Kansas City-Downtown; Palwaukee, DuPage, and Kankakee, all in the Chicago suburbs, and Fort Lauderdale-Executive. The only airport that does not fit this mold is Quonset Airport in Rhode Island, which is a joint-use Military/Civilian airfield. The main project driving the need for investment at Quonset is the repair of nearly 9,000 feet of seawall. Each of these airports are classified as Nonprimary National, with the exception of Kankakee and Quonset, which are both Regional.

Projects at GA airports are typically upgrades of existing facilities and SOGR initiatives to return airports to their original functionality. There is also a demand for ancillary facilities such as hangars and fuel farms, which can themselves generate revenue for the airport. A number of the SOGR

projects include runway and taxiway reconstruction, as these are items with time-limited lifespans and require periodic rebuilding.

Two-thirds of all spending at GA airports is for pavement projects, split 60/40 in favor of pavement rehabilitations over new pavement. An additional 11 percent of funding is dedicated to ancillary facilities, and 7 percent to infrastructure or utility projects. At the larger National category airports, pavement makes up 48 percent of spending, while for the other three GA airport categories pavement averages 75 percent of spending. The National category airports instead have greater investment emphasis on ancillary facilities (18 percent), SOGR (13 percent), and infrastructure/utility (11 percent).

Smaller airports often have limited or no engineering staff, and must acquire engineering and other consultant services to accomplish a wide range of projects, including extensions of staff during major capital program planning and implementation.

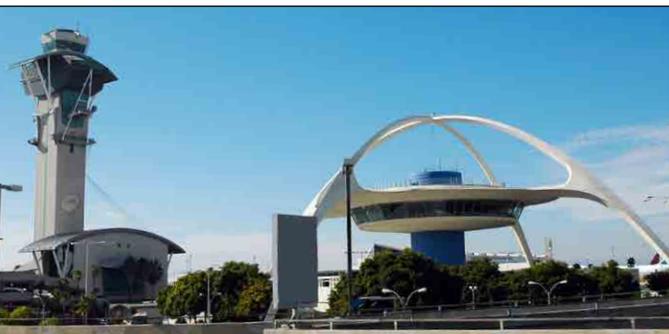


5 Conclusions

Capital needs and opportunities within the national airport system are substantial, as airports seek to invest in constant improvements with an eye towards more efficient operations, happier passengers, and increased revenue generation. The vast majority of spending at commercial airports remains in passenger-facing applications, such as new or upgraded terminals, CONRAC facilities, and ground access projects. Airfield pavement projects including rehabilitation programs are included in most airports' capital improvement programs, but the total cost of such projects is low compared to more significant terminal, access, and other projects.

At GA airports, projects tend towards the physical plant of the airfield itself, with maintenance and upkeep of existing runways, taxiways, and apron areas, which are often large undertakings that may stretch the capacity of airport staff. Much like commercial airports, larger GA airports are looking to add amenities such as additional hangar space and upgraded facilities to allow more operations by more types of aircraft in an effort to gain regional competitive advantages.

One unknown factor is the new Trump Administration, which has made robust infrastructure investment a keystone of its policy agenda. The details of the infrastructure funding package, its potential impact on airports, and the role of the private sector in ultimately financing and delivering projects remains to be seen. Overall, a number of airports across the country are undertaking aggressive and substantial capital expansion and redevelopment programs in the next five years, which will present many new opportunities for airport development companies.



Appendix

Appendix A: Top 20 Major Projects (2012 – 2016)

In examining expected airport development projects over the next half decade, it is beneficial to consider projects completed during the past five years. The following table summarizes the 20 most significant projects ranked by project cost.

Table 5: Major projects completed 2012 – 2016

AIRPORT	PROJECT	COST (\$M)	DESCRIPTION
LAS	Terminal 3	2,400	New 14 gate terminal, garage, and roadways. Upgrade airport baggage system
DFW	Enhance Terminals A, B, C, E, and garages	2,300	Comprehensive refresh and upgrade of passenger-facing facilities
LAX	Tom Bradley Int'l Term (TBIT) Expansion	1,900	18 additional international gates, facility modernization
PHX	SkyTrain	1,600	Automated People Mover (APM) connecting terminals to garages and light rail
JFK	T4 Expansion	1,400	20 additional international gates for Delta
ATL	New International Terminal	1,400	New 12-gate international terminal with processor. Extend APM, new garage, new roadways
SAN	T2 West Expansion	1,000	470,000 sq ft expansion to 1998-completed T2, additional passenger amenities
FLL	New Runway (10R-28L)	791	Lengthen runway to 8,000' and improve taxiway system
DEN	Hotel and Transit Center	719	519-key hotel, open air plaza, public transit center
ORD	New Runway (10R/28L)	516	New 7,500' runway. This phase of the O'Hare Modernization Program also included a new \$41M South Control Tower
MIA	AirportLink Metrorail	506	2.4 mile extension of Metrorail (heavy rail) to the Miami Airport Station
DAL	Terminal Modernization	500	New 20-gate terminal on existing terminal site, apron, and roadways
OAK	Bay Area Rapid Transit (BART) Connector	484	APM connecting airport terminals to BART (heavy rail) system
SEA	CONRAC	419	New 2.1M sq ft CONRAC
JFK	Reconstruct Runway 4L/22R	400	Reconstruct and widen 11,351' runway with new 728' extension, runway safety area (RSA) improvements, add rapid exit taxiways (RET)
JFK	JetBlue T5i	200	Add 3 international gates, Federal Inspection Services (FIS), and 2 baggage carousels
PHL	Terminal F Renovation/Expansion	152	Expand, renovate, connect to other terminals
CMH	New Runway (10R/28L)	140	New 10,113' runway. Taxiway renovations
SFO	T3 East Redevelopment	138	Renovate to upgrade passenger experience, sustainability, capacity
LGB	New Concourse	45	New 11 gate walk-out concourse



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